KARPAGAM ACADEMY OF HIGHER EDUCATION

(Established under Section 3 of UGC Act 1956)
Pollachi Main Road, Eacharani Post, Coimbatore-641 021
DEPARTMENT OF COMPUTER SCIENCE, CA & IT

Subject : **VISUAL PROGRAMMING**	SEMESTER: **V**	**L T P C**
SUBJECT CODE: **15CSU501**	CLASS : **III B.Sc.CS**	**4 1 0 5**

PROGRAM OUTCOME:

This course enables to understand the visual platform and apply the power of .Net technologies in programming. No explicit prerequisite course work is required, but students are expected to have a fundamental understanding of Language Basics, Programming Fundamental and OOP's Concepts

PROGRAM LEARNING OUTCOMES:

A student who successfully completes this course should, at a minimum, be able to:

- Grasp the fundamentals of a programming language and know the basic differences between programming languages
- Apply the processes involved in Software Development
- Program logics and different platforms to build effective software
- Choose the architecture based on the problem to be solved
- Apply the power of .Net technologies and reason why it is popular today
- Differentiate between the types of applications supported by .Net
- Build, compile, and execute a VB.NET program
- Apply techniques to develop error-free software

UNIT-I

Getting Started With VB.NET: The Integrated Development Environment-IDE Components-Visual Basic: The Language -Variables-Constants-Arrays – Variables as Objects-Flow Control Statements- Writing and Using Procedures: Module Coding – Arguments-Working with Forms: Appearance of Forms- Loading and Showing Forms.

UNIT-II

Basic Windows Controls: Textbox Control- ListBox, CheckedListBox-Scrollbar and TrackBar Controls. More Windows Control: The common Dialog Controls-The Rich TextBox Control.The TreeView and ListView Controls -Designing Menus. Multiple Document Interface

UNIT- III

Handling Strings, characters and Dates: Handling Strings and Characters – Handling Dates. Working with Folders and Files: Accessing Folders and Files – Accessing Files. Drawing and Painting with Visual Basic: Displaying Images – Drawing with GDI –
Co-ordinate Transformation – Bitmaps.

UNIT-IV

Web forms and ASP.NET: Web forms, web controls-ASP.NET Configuration, Scope and state- ASP.NET and state-The Application Object-ASP sessions-The Session object-ASP.NET objects and components-Active server components and controls.

UNIT-V

Web server and ASP.NET-ASP.NET and SQL server-Using SQL server, using database in ASP.NET applications, ActiveX data objects-The ADO.NET objects model.

TEXT BOOK

1. Jeffrey R. Shapiro. 2008. The Complete Reference Visual Basic.Net, 1st Edition, Tata -McGraw-Hill Edition, New Delhi.
2. Evangelos Petroutsos. 2014. Mastering Vb. Net, SYBEX Inc., USA.
3. Dave Mercer. 2015. ASP.NET – Beginner's Guide. 2nd Edition, New Delhi: MCGraw Hill.

REFERENCES

1. Richard Bowman. 2002. Visual Basic.Net, Hungry Minds Inc. Publication, Canada
2. Bill Evjen, Scott Hanselman, Farhan Mohammed, Srinivasa Siva Kumar and Devin Rader. 2012. Asp.Net 2.0, Wiley Publication, USA.
3. Greg BucZek. Asp.Net Tips and Techniques, 1st Edition, New Delhi: Tata McGraw Hill Publications 2014.

WEB SITES

1. http://visualbasic.w3computing.com/vb2008/
2. http://www.tutorialspoint.com/vb.net/vb.net_environment_setup.htm
3. http://www.msdotnet.co.in
4. http://www.w3schools.com/

ESE MARKS ALLOCATION

1	**Section A** 20 X 1 = 20 Online Examination	**20**
2	**Section B** 5 X 8 = 40 Either '**A**' OR '**B**' Choice	**40**
3	Total	**60**

KARPAGAM ACADEMY OF HIGHER EDUCATION

Pollachi Main Road, Eacharani Post, Coimbatore-641 021

Enable | Enlighten | Enrich
(Deemed to be University)
(Under Section 3 of UGC Act 1956)

DEPARTMENT OF COMPUTER SCIENCE, CA & IT

STAFF NAME : K.YUVARAJ & S.MANJUPRIYA
SUBJECT NAME : VISUAL PROGRAMMING
SUBJECT CODE : 15CSU501
SEMESTER : V
CLASS & SECTION : III B.Sc. (CS)

S.NO	Lecture Duration (Hour)	Topics To Be Covered	Support Materials/ Pg. No
		UNIT I	
1.	1	Introduction	W1
2.	1	**GETTING STARTED WITH VB.NET** Integrated Development Environment Start Page, Project Types	**T1:** 3 – 12
3.	1	**IDE Component** IDE Menu, Toolbox, Window, Solution Explorer, Properties Window, Output Window, Command Window, Task List Window.	**T1 :** 19 – 30 W2
4.	1	**VISUAL BASIC : THE LANGUAGE** - **Variables** Declaring Variables, Types of Variables, Converting Variable Types, User-Defined Data Types, A Variable's Scope, The Lifetime of a Variable.	**T1 :** 80 – 119 W3
5.	1	- **Constants** - **Arrays** Declaring, initializing arrays, Array limits, Multidimensional arrays, dynamic arrays, arrays of arrays.	**T1 :**120- 129
6.	1	**Tutorial**	
7.	1	- **Variables as Objects** What is an object?, Formatting numbers and dates	**T1 :**130-135
8.	1	- **Flow Control Statement** Test structures, loops, nested control, exit statements.	**T1 : 136- 148** **W2**
9.	1	**Writing and Using Procedures** - **Module Coding** subroutines, functions, Calling functions and subroutines	**T1:**151 - 159

10.	1	- **Arguments** Argument-Passing mechanisms, Event Handler Arguments, Passing an Unknown number of arguments	**T1:**160 - 169
11.	1	Named Arguments, More types of function return values, Overloading functions	**T1:** 170 – 180 W4
12.	1	**Tutorials**	
13.	1	**Working with Forms** - **Appearance of Forms** Properties, Placing controls, setting the tab order,	**T1:** 185 - 193
14.	1	VB.NET at work Anchoring And Docking, form event's	**T1:** 194 - 206
15.	1	- **Loading and Showing Forms** startup, controlling forms, Forms Vs Dialog boxes, multiple forms	**T1:** 207 - 217
16.	1	**Recapitulation and Discussion of Important Questions**	
Total No of Hours Planned for Unit I : 16			
Text Book		**T1: Evangelos Petroutsos, 2014. Mastering Vb. Net, SYBEX Inc., USA**	
Websites		**W1 : http://howtostartprogramming.com/vb-net/** **W2 : http://visualbasic.w3computing.com/vb2008/1/vb-2008** **W3 : http://www.tutorialspoint.com/vb.net/vb.net_variables.htm** **W4 : http://www.dotnetperls.com**	
UNIT II			
1.	1	**Basic Windows Controls** **Textbox Control** Basic properties, Text-manipulation properties, Text-selection properties and methods, capturing keystrokes	**W5** **T1:** 241 - 262
2.	1	**Tutorials**	

3.	1	**ListBox, CheckedListBox** Properties, items collection,	**T1:** 263 - 270
4.	1	Scrollbar Controls Track Bar Controls	**T1:** 279 - 286
5.	1	**More Windows Control** The common Dialog Controls Color Dialog, Font Dialog,	W2 **T1:** 289 - 296
6.	1	Open Dialog, Save As Dialog, Print Dialog	**T1:**297 – 304
7.	1	The Rich TextBox Control RTF language, properties, Methods, cutting, pasting, searching	**T1:** 307 - 317
8.	1	**Tutorials**	
9.	1	The Tree view Control - Add new item at design time and at run time	**T1:** 746 – 767 W6
10.	1	The List View Control - Column Collection, List Item Object, item collection	**T1:** 768 - 783
11.	1	**Designing Menus** menu editor, menu item object properties, manipulating menus at runtime, iterating a menu's items	**T1:** 219 - 230
12.	1	**Multiple Document Interface** MDI applications-basics, building an MDI, built-in capabilities,	**T1:** 837
13.	1	Accessing child forms, ending an MDI applications.	W7
14.	1	**Recapitulation and Discussion of Important Questions**	
15.	1	**Tutorials**	
Total No of Hours Planned for Unit II : 15			
Text Book		**T1: Evangelos Petroutsos, 2014. Mastering Vb. Net, SYBEX Inc., USA**	

Websites		**W2 : http://visualbasic.w3computing.com/vb2008/1/vb-2008** **W5 : http://www.vb6.us/tutorials/** **W6 : http://vb.net-informations.com** **W7 : https://msdn.microsoft.com/**	
UNIT - III			
1.	1	**HANDLING STRINGS, CHARACTERS AND DATES** **Handling Strings and Characters** char, String	**T1:** 530-534 W8
2.	1	String Builder	**T1:** 534-544
3.	1	**Handling Dates** DateTime, TimeSpan	**T1:** 552-567
4.	1	**WORKING WITH FOLDERS AND FILES** **- Accessing Folders and Files** Directory class, File Class	**T1:** 570-578
5.	1	Directory Info Class, File Info Class, Path Class	**T1:** 584-587
6.	1	**Tutorial**	
7.	1	**- Accessing Files** File Stream, Stream Writer, Stream Reader Object	**T1:** 594-601
8.	1	Sending Data to a file, Binary Writer, Binary Reader Object	**T1:** 602- 607
9.	1	**DRAWING AND PAINTING WITH VB** **Displaying Images** Image object, exchanging images through the clipboard	**T1:** 620-630 W2
10.	1	**Drawing with GDI+** Basic Drawing Object, Drawing Shapes	**T1:** 632-633 W9
11.	1	Drawing Methods Gradients, Clipping	**T1:** 642-665
12.	1	**Tutorials**	
13.	1	**Coordinate Transformations** Specifying Transformations	**T1:** 668-675
14.	1	**Bitmaps** Specifying Colors Defining Colors Processing Bitmaps	W10 **T1:** 681-697

15.	1	**Recapitulation and Discussion of Important Questions**	
Total No of Hours Planned for Unit III : 15			
Text Book		**T1: Evangelos Petroutsos, 2014. Mastering Vb. Net, SYBEX Inc., USA**	
Websites		**W2 : http://visualbasic.w3computing.com/vb2008/1/vb-2008** **W8 : http://www.go4expert.com** **W9 : www.dotnetheaven.com** **W10: http://www.yevol.com/en/vb/applicationdesign/lesson09.html**	
Unit - IV			
1.	1	**Web Forms And ASP.NET** - Web Forms	**T2:** 155 - 161
2.	1	**Tutorials**	
3.	1	- Web Forms (Cont..)	**T2:** 162 - 170
4.	1	- Web Controls	W11
5.	1	- Web Controls (Cont…)	W11
6.	1	**ASP.Net Configuration, Scope and State** - ASP.Net And Configuration	**T2:** 183 - 191
7.	1	- ASP.Net and State Visitor status and state State Maintenance in ASP.Net	**T2:** 192 -198
8.	1	Tutorials	
9.	1	- The Application Object Scope, Events, Collections, Methods	**T2:** 206 – 210

10.	1	- ASP Sessions Sessions in Asp.Net Enabling and Disabling ASP Sessions	**T2:** 212 -213 W12
11.	1	- The Session Object Event handler, properties, Collections and Methods	**T2:** 213 – 219
12.	1	**ASP.NE Objects And Components** - Active Server Components and Controls Creating Server Components with ASP	**T2:** 278 – 283
13.	1	The Ad Rotator Component The ASP.NET Ad Rotator Server Control	W3
14.	1	Tutorials	
15.	1	**Recapitulation and Discussion of Important Questions**	
Total No of Hours Planned for Unit IV : 15			
Text Book		**T2: Dave Mercer.2015.ASP.NET – Beginner's Guide. 2nd Edition, New Delhi: McGraw Hill.**	
Websites		**W3 : http://www.tutorialspoint.com/vb.net/vb.net_variables.htm** **W11: http://www.slideshare.net** **W12: http://asp.net-tutorials.com/**	
UNIT - V			
1.	1	**Web Services and ASP.NET** - Web Services Development - What is XML?	**T2:** 311 – 316
2.	1	- WSDL and SOAP	**T2:** 322 – 325 **W13**
3.	1	Tutorials	
4.	1	ASP.NET and SQL Server - Microsoft Enterprise Servers	**T2:** 339-342
5.	1	Using SQL Server - Setting Up SQL Server	**T2:** 343 – 344

6.	1	Using Database in ASP.NET Applications - Database Design - Relational Database	**T2:** 344- 360
7.	1	Building Database Tables	W14
8.	1	ActiveX data objects - Data consumers and data providers - The ADO Object Model	**T2:** 361 – 364
9.	1	Tutorials	
10.	1	The ADO.Net Object Model	**T2:** 365 **W15**
11.	1	**Recapitulation and Discussion of Important Questions**	
12.	1	**Discussion of previous year ESE Question Paper**	
13.	1	**Discussion of previous year ESE Question Paper**	
14.	1	**Discussion of previous year ESE Question Paper**	
Total No of Hours Planned for Unit V : 14			
Text Book	**T2: Dave Mercer.2015. ASP.NET – Beginner's Guide. 2nd Edition, New Delhi: McGraw Hill.**		
Websites	**W13: https://www.w3.org/** **W14: http://www.tutorialspoint.com/listtutorial/** **W15: http://www.w3schools.com/asp/ado_intro.asp**		
Total No of Hours Planned for this course: 75			

UNIT-I
SYLLABUS

Getting Started With VB.NET: The Integrated Development Environment-IDE Components-Visual Basic: The Language -Variables-Constants-Arrays – Variables as Objects-Flow Control Statements- Writing and Using Procedures: Module Coding – Arguments-Working with Forms: Appearance of Forms- Loading and Showing Forms.

Integrated Development Environment

The Start Page

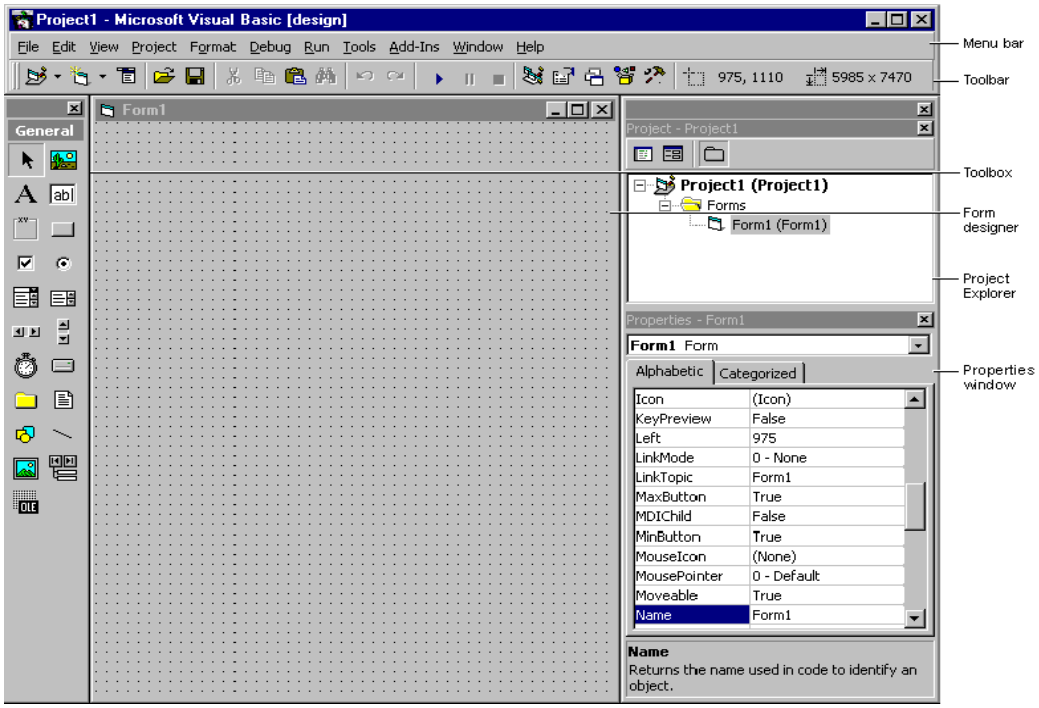
When you run the Visual Basic Setup program, it allows you to place the program items in an existing program group or create a new program group and new program items for Visual Basic in Windows. You are then ready to start Visual Basic from Windows.

To start Visual Basic from Windows

1. Click **Start** on the Task bar.
2. Select Programs, Visual Studio and then Microsoft Visual Basic 6.0.–or–
   Click **Start** on the Task bar.
   Select **Programs**.
   Use the **Windows Explorer** to find the Visual Basic executable file.
3. Double-click the Visual Basic icon.

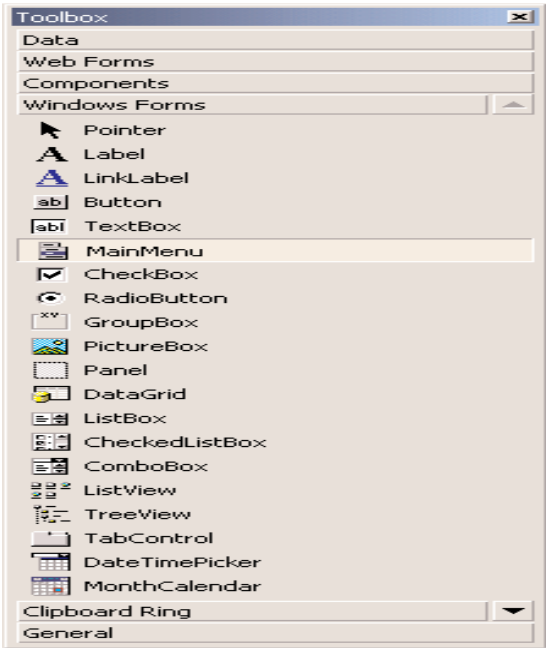
You can also create a shortcut to Visual Basic, and double-click the shortcut.
When you first start Visual Basic, you see the interface of the integrated development environment, as shown in Figure 2.1.

Figure 2.1 The Visual Basic integrated development environment



Using the Windows Form Designer

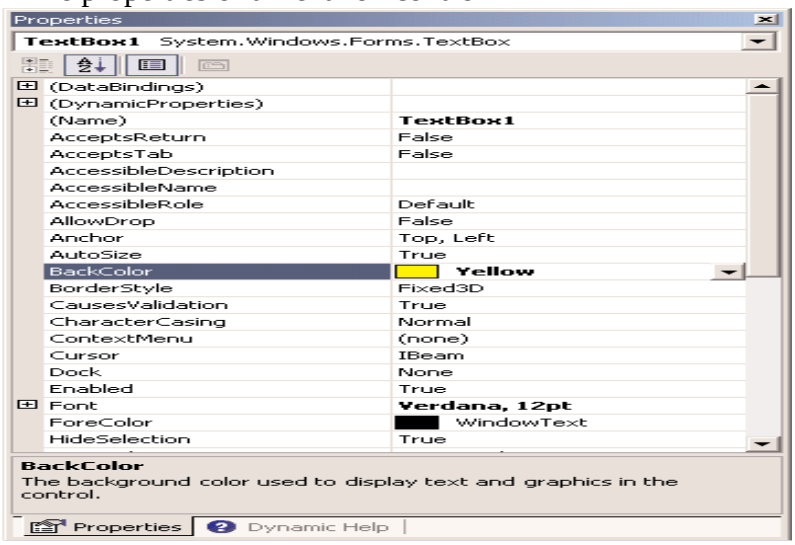
Figure The Windows Forms Toolbox of the Visual Studio IDE



The control's properties will be displayed in the Properties window This window, at the far left edge of the IDE, displays the properties of the selected control on the form. If the

Properties window is not visible, select View ➢Properties Window, or press F4. If no control is selected, the properties of the selected item in the Solution Explorer will be displayed. Place another TextBox control on the form. The new control will be placed almost on top of the previous one. Reposition the two controls on the form with the mouse. Then right-click one of them and, from the context menu, select Properties.

Figure - The properties of a TextBox control



In the Properties window, also known as the Property Browser, you see the properties that determine the appearance of the control, and in some cases, its function. Locate the TextBox control's Text property and set it to "My TextBox Control" by entering the string (without the quotes) into the box next to property name. Select the current setting, which is TextBox1, and type a new string. The control's Text property is the string that appears in the control.

Then locate its BackColor property and select it with the mouse. A button with an arrow will appear next to the current setting of the property. Click this button and you will see a dialog box with three tabs (Custom, Web, and System), as shown in Figure 1.6. On this dialog box, you can select the color, from any of the three tabs, that will fill the control's background. Set the control's background color to yellow and notice that the control's appearance will change on the form..

Figure - Setting a color property in the Properties dialog box

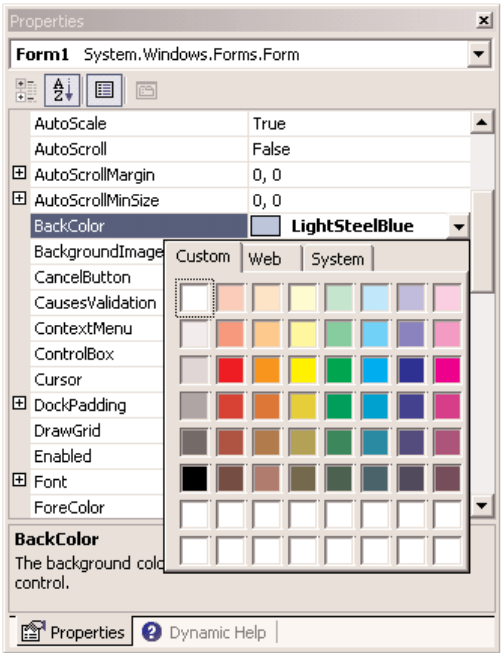
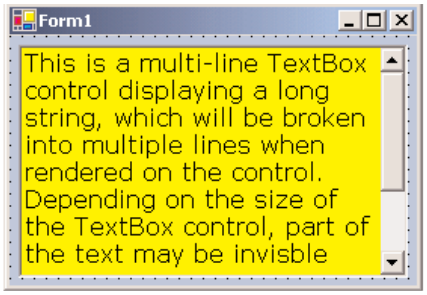
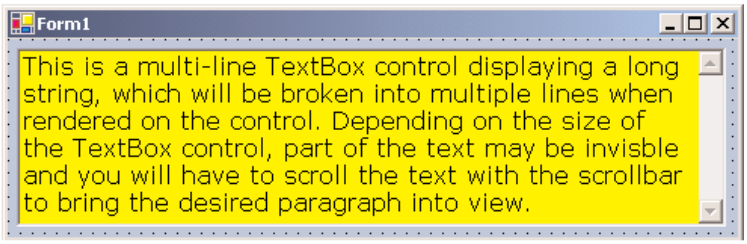


Figure - The appearance of a TextBox control displaying multiple text lines





Project Types

All the project types supported by Visual Studio are displayed on the New Project dialog box, and they're the following:

Class library A class library is a basic code-building component, which has no visible interface and adds specific functionality to your project. Simply put, a class is a collection of functions that will be used in other projects beyond the current one.

Windows control library A Windows control (or simply *control*), such as a TextBox or Button, is a basic element of the user interface. If the controls that come with Visual Basic (the ones that appear in the Toolbox by default) don't provide the functionality you need, you can build your own custom controls.

Console application A Console application is an application with a very limited user interface. This type of application displays its output on a Command Prompt window and receives input from the same window.

Windows service A Windows service is a new name for the old NT services, and they're longrunning applications that don't have a visible interface. These services can be started automatically when the computer is turned on, paused, and restarted. An application that monitors and reacts to changes in the file system is a prime candidate for implementing as a Windows service.

ASP.NET Web application Web applications are among the most exciting new features of Visual Studio. A Web application is an app that resides on a Web server and services requests made through a browser. An online bookstore, for example, is a Web application. The application that runs on the Web server must accept requests made by a client (a remote computer with a browser) and return its responses to the requests in the form of HTML pages.

ASP.NET Web service A Web service is not the equivalent of a Windows service. A Web service is a program that resides on a Web server and services requests, just like a Web application, but it doesn't return an HTML page. Instead, it returns the result of a calculation or a database lookup. Requests to Web services are usually made by another server, which is responsible for processing the data

Web control library Just as you can build custom Windows controls to use with your Windows forms, you can create custom Web controls to use with your Web pages.

The IDE Components

The IDE of Visual Studio.NET contains numerous components, and it will take you a while to explore them. It's practically impossible to explain what each tool, each window, and each menu does.

The IDE Menu

The IDE main menu provides the following commands, which lead to submenus. Notice that most menus can also be displayed as toolbars. Also, not all options are available at all times. The options that cannot possibly apply to the current state of the IDE are either invisible or disabled. The Edit menu is a typical example.

File Menu

The File menu contains commands for opening and saving projects, or project items, as well as the commands for adding new or existing items to the current project.

Edit Menu

The Edit menu contains the usual editing commands. Among the commands of the Edit menu are the Advanced command and the IntelliSense command.

Advanced Submenu

The more interesting options of the Edit ➢Advanced submenu are the following. Notice that the Advanced submenu is invisible while you design a form visually and appears when you switch to the code editor.

View White Space Space characters (necessary to indent lines of code and make it easy to read) are replaced by periods.

Word Wrap When a code line's length exceeds the length of the code window, it's automatically wrapped.

Comment Selection/Uncomment Selection Comments are lines you insert between your code's statements to document your application. Sometimes, we want to disable a few lines from our code, but not delete them (because we want to be able to restore them).

IntelliSense Submenu

The Edit ➢IntelliSense menu item leads to a submenu with four options, which are described next. IntelliSense is a feature of the editor (and of other Microsoft applications) that displays as much information as possible, whenever possible.

List Members When this option is on, the editor lists all the members (properties, methods, **events, and argument list) in a drop-down list.**

TextBox1.

a list with the members of the TextBox control will appear (as seen in Figure). Select the Text property and then type the equal sign, followed by a string in quotes like the following:

TextBox1.Text = "Your User Name"

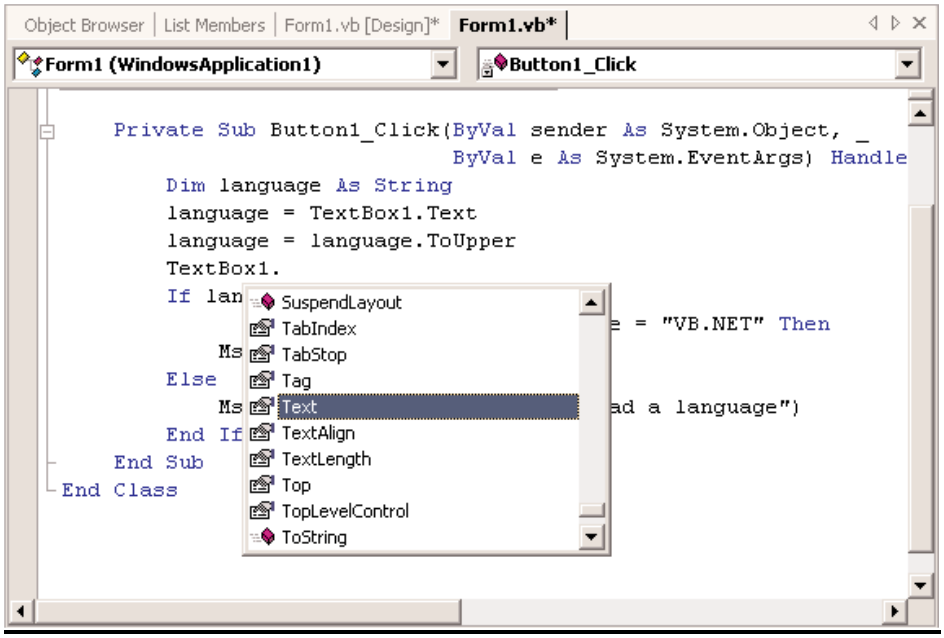
If you select a property that can accept a limited number of settings, you will see the names of the appropriate constants in a drop-down list. If you enter the following statement:

TextBox1.TextAlign =

you will see the constants you can assign to the property (as shown in Figure, they are the values HorizontalAlignment.Center, HorizontalAlignment.Right, and HorizontalAlignment.Left).

Parameter Info While editing code, you can move the pointer over a variable, method, or property and see its declaration in a yellow tooltip.

Figure - Viewing the members of a control in an IntelliSense dropdown list



Quick Info This is another IntelliSense feature that displays information about commands and functions. When you type the opening parenthesis following the name of a function, for example, the function's arguments will be displayed in a tooltip box (a yellow horizontal box).

View Menu

This menu contains commands to display any toolbar or window of the IDE. You have already seen the Toolbars menu (earlier, under "Starting a New Project"). The Other Windows command leads to submenu with the names of some standard windows, including the Output and Command windows.

The Output window is the console of the application. The compiler's messages, for example, are displayed in the Output window. The Command window allows you to enter and execute statements. When you debug an application, you can stop it and enter VB statements in the Command window.

Project Menu

This menu contains commands for adding items to the current project (an item can be a form, a file, a component, even another project). The last option in this menu is the Set As StartUp Project command, which lets you specify which of the projects in a multiproject solution is the startup project (the one that will run when you press F5).

Build Menu

The Build menu contains commands for building (compiling) your project. The two basic commands in this menu are the Build and Rebuild All commands. The Build command compiles (builds the executable) of the entire solution, but it doesn't compile any components

of the project that haven't changed since the last build. The Rebuild All command does the same, but it clears any existing files and builds the solution from scratch.

Debug Menu

This menu contains commands to start or end an application, as well as the basic debugging tools

Data Menu

This menu contains commands you will use with projects that access data.

Format Menu

The Format menu, which is visible only while you design a Windows or Web form, contains commands for aligning the controls on the form.

Tools Menu

This menu contains a list of tools, and most of them apply to C++. The Macros command of he Tools menu leads to a submenu with commands for creating macros. Just as you can create macros in an Office application to simplify many tasks, you can create macros to automate many of the repetitive tasks you perform in the IDE. I'm not going to discuss macros in this book, but once you familiarize yourself with the environment, you should look up the topic of writing macros in the documentation.

Window Menu

This is the typical Window menu of any Windows application. In addition to the list of open windows, it also contains the Hide command, which hides all Toolboxes and devotes the entire window of the IDE to the code editor or the Form Designer. The Toolboxes don't disappear completely. They're all retracted, and you can see their tabs on the left and right edges of the IDE window. To expand a Toolbox, just hover the mouse pointer over the corresponding tab.

Help Menu

This menu contains the various help options. The Dynamic Help command opens the Dynamic Help window, which is populated with topics that apply to the current operation. The Index command opens the Index window, where you can enter a topic and get help on the specific topic.

The Toolbox Window

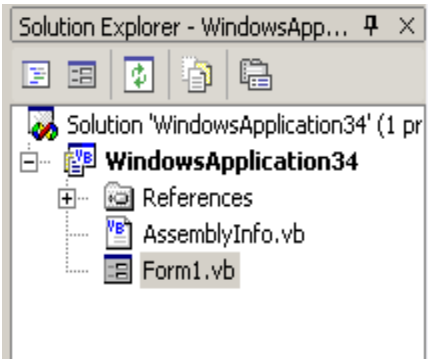
Here you will find all the controls you can use to build your application's interface. The Toolbox window is usually retracted, and you must move the pointer over it to view the Toolbox. This window contains these tabs:

Crystal Reports
Data
XML Schema
Dialog Editor
Web Forms
Components

Windows Forms
HTML
Clipboard Ring
General

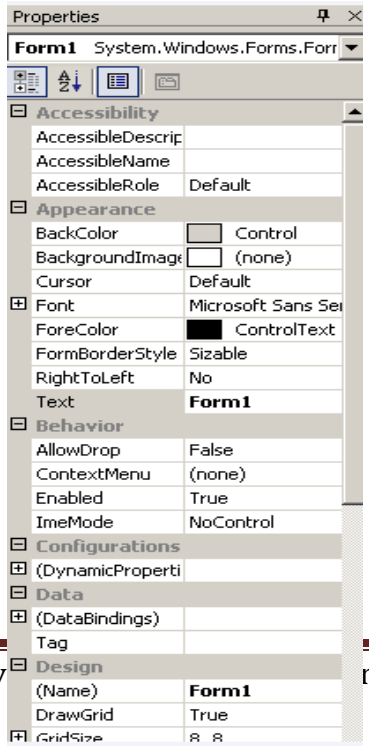
Solution Explorer Window

The Solution Explorer window gives an overview of the solution we are working with and lists all the files in the project. An image of the Solution Explorer window is shown on the right.



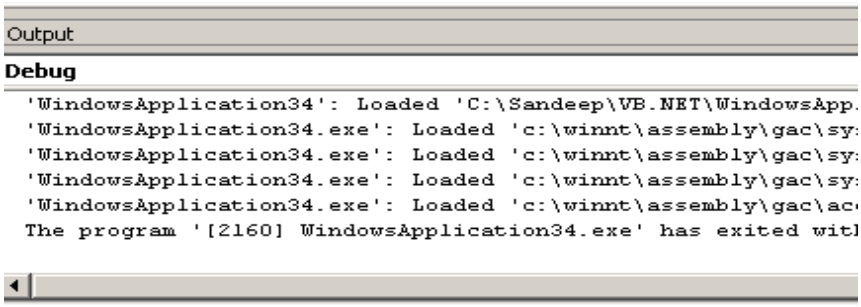
Properties Window

The properties window allows us to set properties for various objects at design time. For example, if you want to change the font, font size, backcolor, name, text that appears on a button, textbox etc, you can do that in this window. Below is the image of properties window. You can view the properties window by selecting View->Properties Window from the main menu or by pressing F4 on the keyboard.



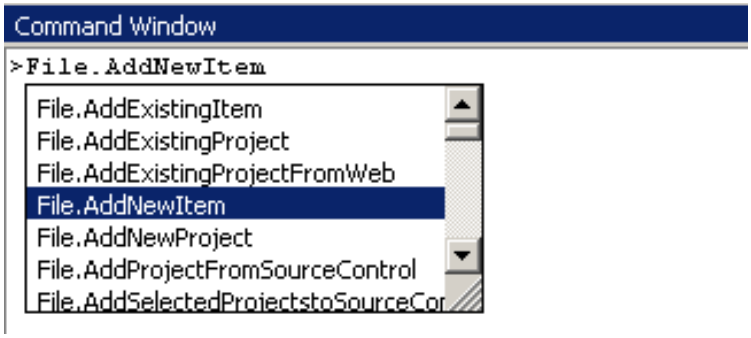
Output Window

The output window as you can see in the image below displays the results of building and running applications. When a project is compiled the result of compilation, Build succeeded or failed are displayed in the output wndow



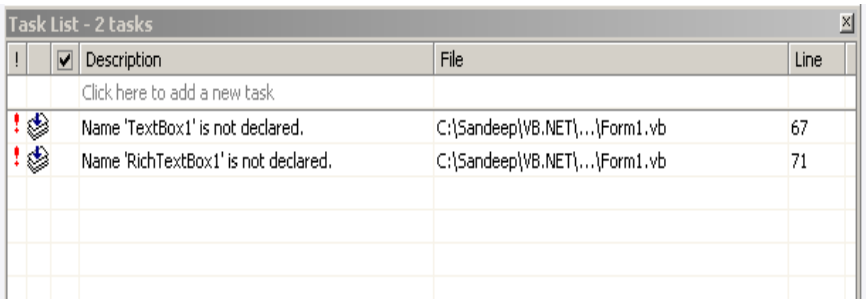
Command Window

The command window in the image below is a useful window. Using this window we can add new item to the project, add new project and so on. You can view the command window by selecting View->Other Windows -> Command Window from the main menu. The command window in the image displays all possible commands with File.



Task List Window

The task list window displays all the tasks that VB .NET assumes we still have to finish. You can view the task list window by selecting View->Show tasks->All or View->Other Windows->Task List from the main menu. The image below shows that. As you can see from the image, the task list displayed "TextBox1 not declared", "RichTextBox1 not declared". The reason for that message is, there were no controls on the form and attempts where made to write code for a textbox and a rich textbox. Task list also displays syntax errors and other errors you normally encounter during coding.



VISUAL BASIC: THE LANGUAGE

Variables

A variable is nothing but a name given to a storage area that our programs can manipulate. Each variable in VB.Net has a specific type, which determines the size and layout of the variable's memory; the range of values that can be stored within that memory; and the set of operations that can be applied to the variable.

Declaring Variables

To declare a variable, use the Dim statement followed by the variable's name, the As keyword, and its type, as follows:

```
Dimmeters As Integer
Dim greetings As String
```

The first variable, meters, will store integers, such as 3 or 1,002; the second variable, greetings, will store text. You can declare multiple variables of the same or different type in the same line, as follows:

```
Dim Qty As Integer, Amount As Decimal, CardNum As String
```

If you want to declare multiple variables of the same type, you need not repeat the type. Just separate all the variables of the same type with commas and set the type of the last variable:

```
Dim Length, Width, Height As Integer, Volume, Area As Double
```

This statement declares three Integer variables and two Double variables. Double variables hold fractional values (or floating-point values, as they're usually called) that are similar to the Single data type, except that they can represent noninteger values with greater accuracy.

Variable-Naming Conventions

When declaring variables, you should be aware of a few naming conventions. A variable's name

- Must begin with a letter, followed by more letters or digits.
- Can't contain embedded periods or other special punctuation symbols. The only special character that can appear in a variable's name is the underscore character.
- Mustn't exceed 255 characters.
- Must be unique within its scope. This means that you can't have two identically named variables in the same subroutine, but you can have a variable named counter in many different subroutines.

Variable names in VB 2008 are case-insensitive: myAge, myage, and MYAGE all refer to the same variable in your code. Actually, as you enter variable names, the editor converts their casing so that they match their declaration.

Variable Initialization

The general form of initialization is:

```
variable_name = value;
```

for example,

```
Dim pi As Double
pi = 3.14159
```

You can initialize a variable at the time of declaration as follows:

```
Dim StudentID As Integer = 100
Dim StudentName As String = "Bill Smith"
```

Example

Try the following example which makes use of various types of variables:

```
Module variablesNdataypes
  Sub Main()
    Dim a As Short
    Dim b As Integer
    Dim c As Double
    a = 10
    b = 20
    c = a + b
    Console.WriteLine("a = {0}, b = {1}, c = {2}", a, b, c)
    Console.ReadLine()
  End Sub
End Module
```

When the above code is compiled and executed, it produces the following result:

```
a = 10, b = 20, c = 30
```

Types of Variables

Visual Basic recognizes the following five categories of variables:

- Numeric
- String
- Boolean
- Date
- Object

Data Type Identifier

Finally, you can omit the As clause of the Dim statement, yet create typed variables, with the variable declaration characters, or data type identifiers. These characters are special symbols that you append to the variable name to denote the variable's type. To create a string variable, you can use this statement:

Dim myText$

The dollar sign signifies a string variable. Notice that the name of the variable includes the dollar sign — it's myText$, not myText. To create a variable of a particular type, use one of the data declaration characters shown in the following table. (Not all data types have their own identifiers.)

Table 2.3 - Data Type Definition Characters

Symbol	Data Type	Example
$	String	A$, messageText$
%	Integer (Int32)	counter%, var%
&	Long (Int64)	population&, colorValue&
!	Single	distance!
#	Double	ExactDistance
@	Decimal	Balance@

Using type identifiers doesn't help to produce the cleanest and easiest-to-read code.

The Strict and Explicit options

The Visual Basic compiler provides three options that determine how it handles variables:

- The Explicit option indicates whether you will declare all variables.
- The Strict option indicates whether all variables will be of a specific type.
- The Infer option indicates whether the compiler should determine the type of a variable from its value.

To change the default behavior, you must insert the following statement at the beginning of the file:

Option Explicit Off

The Option Explicit statement must appear at the very beginning of the file. This setting affects the code in the current module, not in all files of your project or solution. You can turn on the Strict (as well as the Explicit) option for an entire solution. Open the solution's properties dialog box (right-click the solution's name in Solution Explorer and select Properties), select the Compile tab, and set the Strict and Explicit options accordingly, as shown in Figure

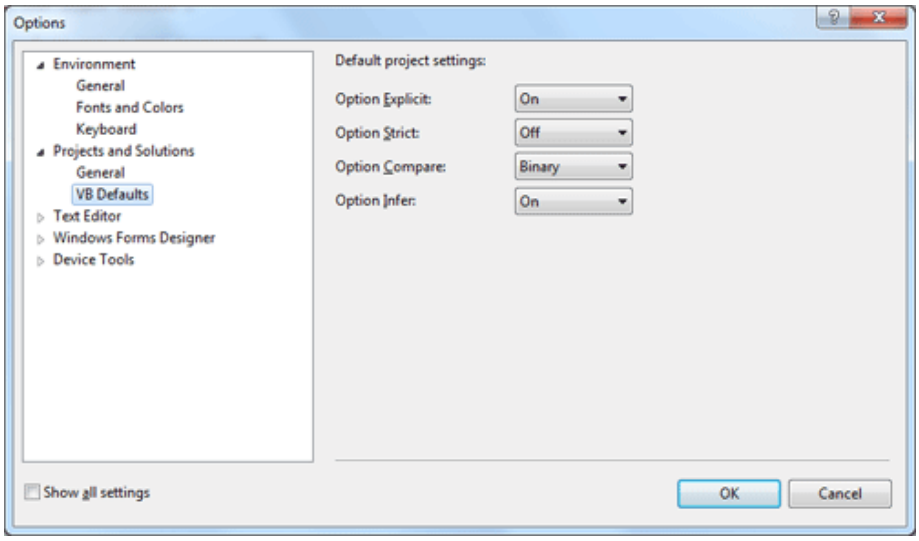


Figure - Setting the variable-related options in the Visual Studio Options dialog box

The Strict option requires that variables are declared with a specific type. In other words, the Strict option disallows the use of generic variables that can store any data type.

The default value of the Explicit statement is On. This is also the recommended value, and you should not make a habit of changing this setting. In the section "Reasons for Decalring Variables" later in this chapter, you will see an example of the pitfalls you'll avoid by declaring your variables. By setting the Explicit option to Off, you're telling VB that you intend to use variables without declaring them. As a consequence, VB can't make any assumption about the variable's type, so it uses a generic type of variable that can hold any type of information. These variables are called Object variables, and they're equivalent to the old variants.

While the option Explicit is set to Off, every time Visual Basic runs into an undeclared variable name, it creates a new variable on the spot and uses it. The new variable's type is Object, the generic data type that can accommodate all other data types. Using a new variable in your code is equivalent to declaring it without type. Visual Basic adjusts its type according to the value you assign to it. Create two variables, var1 and var2, by referencing them in your code with statements like the following ones:

Option Strict On

If you attempt to execute any of the last two code segments while the Strict option is on, the compiler will underline a segment of the statement to indicate an error. If you rest the pointer over the underlined segment of the code, the following error message will appear in a tip box:

Option strict disallows implicit conversions from String to Double
(or whatever type of conversion is implied by the statement).

When the Strict option is set to On, the compiler doesn't disallow all implicit conversions between data types. For example, it will allow you to assign the value of an integer to a Long, but not the opposite. The Long value might exceed the range of values that can be represented by an Integer variable.

Object Variables

Variants — variables without a fixed data type— were the bread and butter of VB programmers up to version 6. Variants are the opposite of strictly typed variables: They can store all types of values, from a single character to an object. If you're starting with VB 2008, you should use strictly typed variables. However, variants are a major part of the history of

VB, and most applications out there (the ones you may be called to maintain) use them. I will discuss variants briefly in this section and show you what was so good (and bad) about them.
Variants, or object variables, were the most flexible data types because they could accommodate all other types. A variable declared as Object (or a variable that hasn't been declared at all) is handled by Visual Basic according to the variable's current contents. If you assign an integer value to an object variable, Visual Basic treats it as an integer. If you assign a string to an object variable, Visual Basic treats it as a string. Variants can also hold different data types in the course of the same program. Visual Basic performs the necessary conversions for you.
To declare a variant, you can turn off the Strict option and use the Dim statement without specifying a type, as follows:

```
Dim myVar
```

If you don't want to turn off the Strict option (which isn't recommended, anyway), you can declare the variable with the Object data type:

```
Dim myVar As Object
```

Every time your code references a new variable, Visual Basic will create an object variable. For example, if the variable validKey hasn't been declared, when Visual Basic runs into the following line, it will create a new object variable and assign the value 002-6abbgd to it:

```
validKey = "002-6abbgd"
```

You can use object variables in both numeric and string calculations. Suppose that the variable modemSpeed has been declared as Object with one of the following statements:

```
Dim modemSpeed ' with Option Strict = Off
Dim modemSpeed As Object ' with Option Strict = On
```

and later in your code you assign the following value to it:

```
modemSpeed = "28.8"
```

The modemSpeed variable is a string variable that you can use in statements such as the following:

```
MsgBox "We suggest a " & modemSpeed & " modem."
```

This statement displays the following message:
"We suggest a 28.8 modem."

Converting Variable Types

In many situations, you will need to convert variables from one type into another. Table 2.4 shows the methods of the Convert class that perform data-type conversions.
In addition to the methods of the Convert class, you can still use the data-conversion functions of VB (CInt() to convert a numeric value to an Integer, CDbl() to convert a numeric value to a Double, CSng() to convert a numeric value to a Single, and so on), which you can look up in the documentation. If you're writing new applications in VB 2008, use the new Convert class to convert between data types.
To convert the variable initialized as the following

```
Dim A As Integer
```

to a Double, use the ToDouble method of the Convert class:

```
DimBAsDouble
B = Convert.ToDouble(A)
```

Suppose that you have declared two integers, as follows:

```
DimAAsInteger,BAsInteger
A=23
B = 7
```

The result of the operation A / B will be a Double value. The following statement

```
Debug.Write(A / B)
```

displays the value 3.28571428571429. The result is a Double value, which provides the greatest possible accuracy. If you attempt to assign the result to a variable that hasn't been declared as Double, and the Strict option is on, then VB 2008 will generate an error message. No other data type can accept this value without loss of accuracy. To store the result to a Single variable, you must convert it explicitly with a statement like the following:

```
Convert.ToSingle(A / B)
```

You can also use the DirectCast() function to convert a variable or expression from one type to another. The DirectCast() function is identical to the CType() function. Let's say the variable A has been declared as String and holds the value 34.56. The following statement converts the value of the A variable to a Decimal value and uses it in a calculation:

```
DimAAsString="34.56"
DimBAsDouble
B = DirectCast(A, Double) / 1.14
```

The conversion is necessary only if the Strict option is on, but it's a good practice to perform your conversions explicitly. The following section explains what might happen if your code relies on implicit conversions.

Table 2.4 - The Data-Type Conversion Methods of the Convert Class

Method	Converts Its Argument To
ToBoolean	Boolean
ToByte	Byte
ToChar	Unicode character
ToDateTime	Date
ToDecimal	Decimal
ToDouble	Double
ToInt16	Short Integer (2-byte integer, Int16)
ToInt32	Integer (4-byte integer, Int32)
ToInt64	Long (8-byte integer, Int64)
ToSByte	Signed Byte
CShort	Short (2-byte integer, Int16)
ToSingle	Single

ToString	String
ToUInt16	Unsigned Integer (2-byte integer, Int16)
ToUInt32	Unsigned Integer (4-byte integer, Int32)
ToUInt64	Unsigned Long (8-byte integer, Int64)

Constants

Some variables don't change value during the execution of a program. These variables are constants that appear many times in your code. For instance, if your program does math calculations, the value of pi (3.14159. . .) might appear many times. Instead of typing the value 3.14159 over and over again, you can define a constant, name it pi, and use the name of the constant in your code. The statement
circumference = 2 * pi * radius
is much easier to understand than the equivalent
circumference = 2 * 3.14159 * radius
You could declare pi as a variable, but constants are preferred for two reasons:
Constants don't change value. This is a safety feature. After a constant has been declared, you can't change its value in subsequent statements, so you can be sure that the value specified in the constant's declaration will take effect in the entire program.
Constants are processed faster than variables. When the program is running, the values of constants don't have to be looked up. The compiler substitutes constant names with their values, and the program executes faster.

```
' The following statements declare constants.
Const maxval As Long = 4999
Public Const message As String = "HELLO"
Private Const piValue As Double = 3.1415
```

Example

The following example demonstrates declaration and use of a constant value:

```
Module constantsNenum
  Sub Main()
    Const PI = 3.14149
    Dim radius, area As Single
    radius = 7
    area = PI * radius * radius
    Console.WriteLine("Area = " & Str(area))
    Console.ReadKey()
  End Sub
End Module
```

When the above code is compiled and executed, it produces the following result:

```
Area = 153.933
```

Print and Display Constants in VB.Net

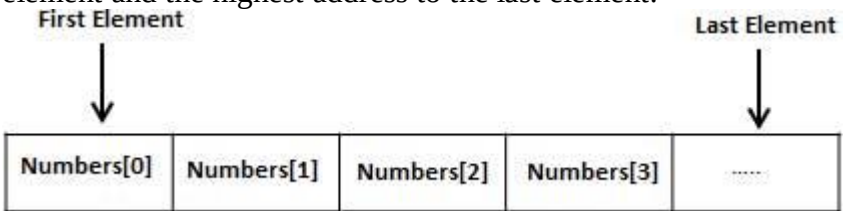
VB.Net provides the following print and display constants:

Constant	Description
vbCrLf	Carriage return/linefeed character combination.
vbCr	Carriage return character.
vbLf	Linefeed character.
vbNewLine	Newline character.
vbNullChar	Null character.
vbNullString	Not the same as a zero-length string (""); used for calling external procedures.
vbObjectError	Error number. User-defined error numbers should be greater than this value. For example: Err.Raise(Number) = vbObjectError + 1000
vbTab	Tab character.
vbBack	Backspace character.

Arrays

An array stores a fixed-size sequential collection of elements of the same type. An array is used to store a collection of data, but it is often more useful to think of an array as a collection of variables of the same type.

All arrays consist of contiguous memory locations. The lowest address corresponds to the first element and the highest address to the last element.



Creating Arrays in VB.Net

To declare an array in VB.Net, you use the Dim statement. For example,

```
Dim intData(30)      ' an array of 31 elements
Dim strData(20) As String   ' an array of 21 strings
Dim twoDarray(10, 20) As Integer     'a two dimensional array of integers
Dim ranges(10, 100)           'a two dimensional array
```

You can also initialize the array elements while declaring the array. For example,

```
Dim intData() As Integer = {12, 16, 20, 24, 28, 32}
Dim names() As String = {"Karthik", "Sandhya","Shivangi", "Ashwitha", "Somnath"}
Dim miscData() As Object = {"Hello World", 12d, 16ui, "A"c}
```

Initializing Arrays

Just as you can initialize variables in the same line in which you declare them, you can initialize arrays, too, with the following constructor (an array initializer, as it's called):

Dim arrayname() As type = {entry0, entry1, ... entryN}
Here's an example that initializes an array of strings:
Dim Names() As String = {"Joe Doe", "Peter Smack"}
This statement is equivalent to the following statements, which declare an array with two elements and then set their values:
DimNames(1)AsString
Names(0)="JoeDoe"
Names(1) = "Peter Smack"

Array Limits

The first element of an array has index 0. The number that appears in parentheses in the Dim statement is one fewer than the array's total capacity and is the array's upper limit (or upper bound). The index of the last element of an array (its upper bound) is given by the method GetUpperBound, which accepts as an argument the dimension of the array and returns the upper bound for this dimension.

The arrays we examined so far are one-dimensional and the argument to be passed to the GetUpperBound method is the value 0. The total number of elements in the array is given by the method GetLength, which also accepts a dimension as an argument. The upper bound of the following array is 19, and the capacity of the array is 20 elements:
Dim Names(19) As Integer
The first element is Names(0), and the last is Names(19). If you execute the following statements, the highlighted values will appear in the Output window:
Debug.WriteLine(Names.GetLowerBound(0))
0
Debug.WriteLine(Names.GetUpperBound(0))
19
To assign a value to the first and last element of the Names array, use the following statements:
Names(0)="Firstentry"
Names(19) = "Last entry"
If you want to iterate through the array's elements, use a loop like the following one:
DimiAsInteger,myArray(19)AsInteger
Fori=0TomyArray.GetUpperBound(0)
myArray(i)=i*1000
Next
The actual number of elements in an array is given by the expression myArray.GetUpperBound(0) + 1. You can also use the array's Length property to retrieve the count of elements. The following statement will print the number of elements in the array myArray in the Output window:
Debug.WriteLine(myArray.Length)

Dynamic Arrays

Dynamic arrays are arrays that can be dimensioned and re-dimensioned as par the need of the program. You can declare a dynamic array using the **ReDim** statement.
Syntax for ReDim statement:

```
ReDim [Preserve] arrayname(subscripts)
```

Where,

The **Preserve** keyword helps to preserve the data in an existing array, when you resize it.
arrayname is the name of the array to re-dimension.
subscripts specifies the new dimension.

```
Module arrayApl
  Sub Main()
    Dim marks() As Integer
    ReDim marks(2)
    marks(0) = 85
    marks(1) = 75
    marks(2) = 90
    ReDim Preserve marks(10)
    marks(3) = 80
    marks(4) = 76
    marks(5) = 92
    marks(6) = 99
    marks(7) = 79
    marks(8) = 75
    For i = 0 To 10
       Console.WriteLine(i & vbTab & marks(i))
    Next i
    Console.ReadKey()
  End Sub
End Module
```

Multi-Dimensional Arrays

VB.Net allows multidimensional arrays. Multidimensional arrays are also called rectangular arrays.

You can declare a 2-dimensional array of strings as:

```
Dim twoDStringArray(10, 20) As String
```

or, a 3-dimensional array of Integer variables:

```
Dim threeDIntArray(10, 10, 10) As Integer
```

The following program demonstrates creating and using a 2-dimensional array:

```
Module arrayApl
  Sub Main()
    ' an array with 5 rows and 2 columns
    Dim a(,) As Integer = {{0, 0}, {1, 2}, {2, 4}, {3, 6}, {4, 8}}
    Dim i, j As Integer
    ' output each array element's value '
    For i = 0 To 4
       For j = 0 To 1
          Console.WriteLine("a[{0},{1}] = {2}", i, j, a(i, j))
       Next j
    Next i
    Console.ReadKey()
  End Sub
```

End Module

Reinitializing Arrays

We can change the size of an array after creating them. The ReDim statement assigns a completely new array object to the specified array variable. You use ReDim statement to change the number of elements in an array. The following lines of code demonstrate that. This code reinitializes the Test array declared above.

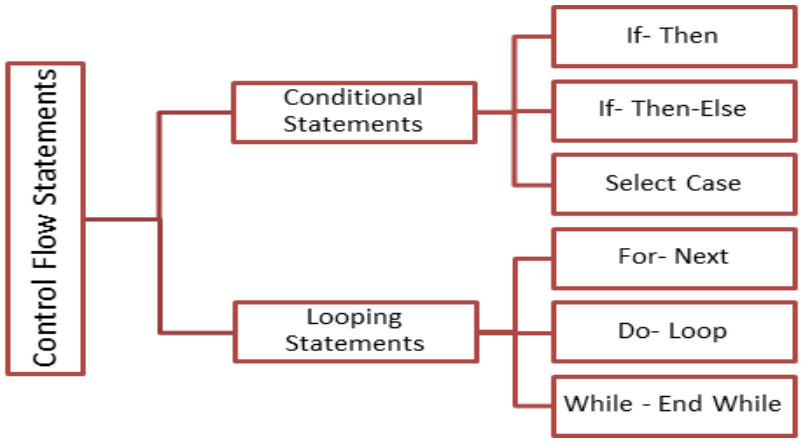
```
Dim Test(10) as Integer
ReDim Test(25) as Integer
'Reinitializing the array
```

When using the Redim statement all the data contained in the array is lost. If you want to preserve existing data when reinitializing an array then you should use the Preserve keyword which looks like this:

```
Dim Test() as Integer={1,3,5}
'declares an array an initializes it with three members
ReDim Preserve Test(25)
'resizes the array and retains the the data in elements 0 to 2
```

Flow Control statements

Decision making structures require that the programmer specify one or more conditions to be evaluated or tested by the program, along with a statement or statements to be executed if the condition is determined to be true, and optionally, other statements to be executed if the condition is determined to be false



Decision Statements

Applications need a mechanism to test conditions and take a different course of action depending on the outcome of the test. Visual Basic provides three such decision, or conditional, statements:

- If. . .Then
- If. . .Then. . .Else
- Select Case

Loop Statements

Loop statements allow you to execute one or more lines of code repetitively. Many tasks consist of operations that must be repeated over and over again, and loop statements are an important part of any programming language. Visual Basic supports the following loop statements:

- For. . .Next
- Do. . .Loop
- While. . .End While

Decision Statements

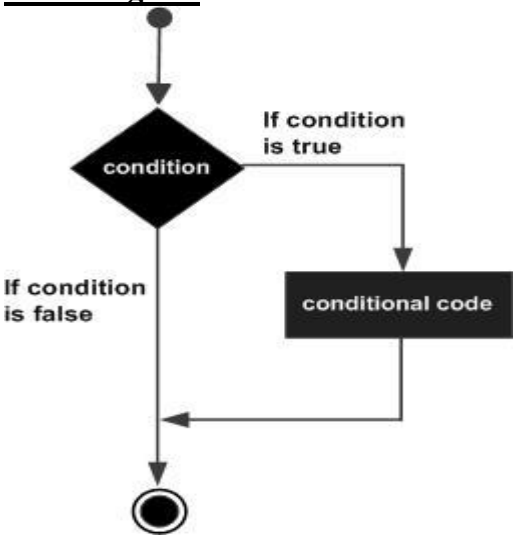
1) If Then Statement

If Then statement is a control structure which executes a set of code only when the given condition is true.

Syntax:

If [Condition] Then
  [Statements]
In the above syntax when the **Condition** is true then the **Statements** after **Then** are executed.

Flow Diagram:



Example:

```
Private Sub Button1_Click_1(ByVal sender As System.Object,
    ByVal e As System.EventArgs) Handles Button1.Click
  If Val(TextBox1.Text) > 25 Then
     TextBox2.Text = "Eligible"
  End If
```

Description:

In the above If Then example the button click event is used to check if the age got using **TextBox1** is greater than **25**, if true a message is displayed in **TextBox2**

2) If Then Else Statement

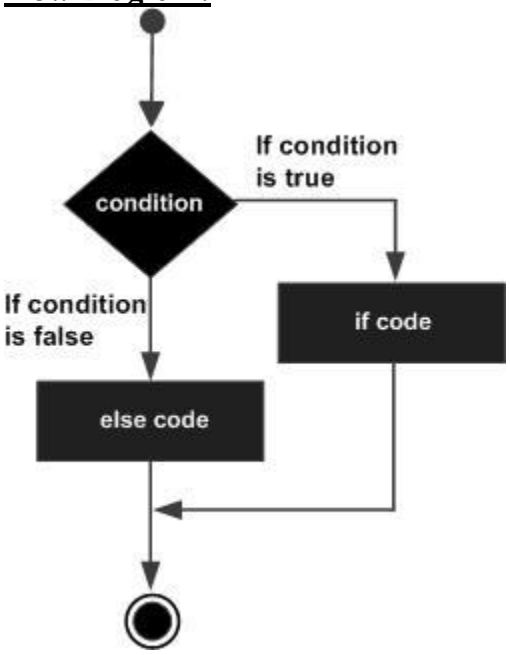
If Then Else statement is a control structure which executes different set of code statements when the given condition is true or false.

Syntax:

```
If [Condition] Then
  [Statements]
Else
  [Statements]
```

In the above syntax when the **Condition** is true, the **Statements** after **Then** are executed.If the condition is false then the statements after the **Else** part is executed.

Flow Diagram:



Example:

```
Private Sub Button1_Click(ByVal sender As System.Object,
    ByVal e As System.EventArgs) Handles Button1.Click
  If Val(TextBox1.Text) >= 40 Then
    MsgBox("GRADUATED")
     Else
    MsgBox("NOT GRADUATED")
  End If
End Sub
```

Description:

In the above If Then Else example the marks are entered in **TextBox1**.When a button is clicked a message **GRADUATED** is displayed if the condition (>40) is true and **NOT GRADUATED** if it is false.

3) Nested If Then Else Statement

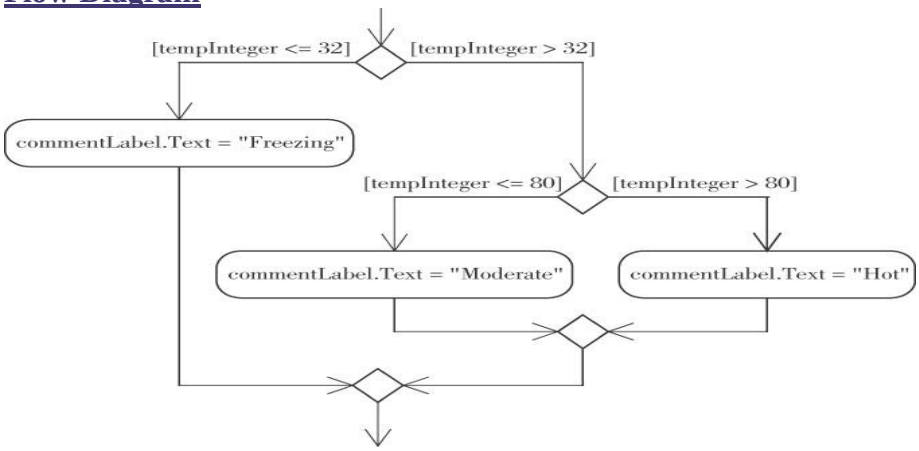
Nested If..Then..Else statement is used to check multiple conditions using if then else statements nested inside one another.

Syntax:

```
If [Condition] Then
  If [Condition] Then
    [Statements]
  Else
    [Statements]
Else
  [Statements]
```

In the above syntax when the **Condition** of the first if then else is true, the second if then else is executed to check another two conditions. If false the statements under the Else part of the first statement is executed.

Flow Diagram



Example:

```
Private Sub Button1_Click(ByVal sender As System.Object,
    ByVal e As System.EventArgs) Handles Button1.Click
  If Val(TextBox1.Text) >= 40 Then
    If Val(TextBox1.Text) >= 60 Then
      MsgBox("You have FIRST Class")
    Else
      MsgBox("You have SECOND Class")
    End If
  Else
    MsgBox("Check your Average marks entered")
  End If
End Sub
```

Description:

In the above nested if then else statement example first the average mark is checked if it is more than 40, if true the second if then else control is used check for first or second class. If the first condition is false the statements under the else part is executed.

4) Select Case Statement

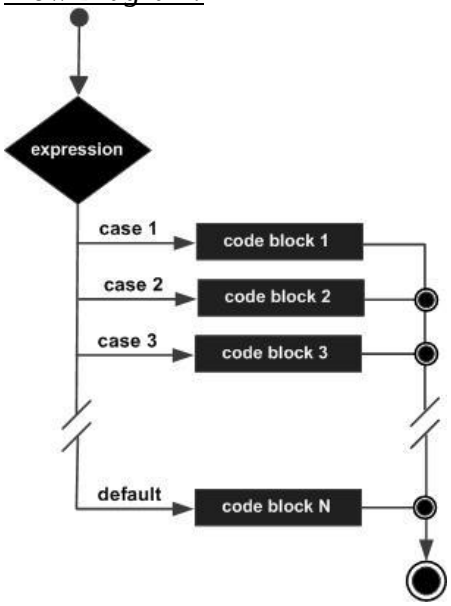
Select case statement is used when the expected results for a condition can be known previously so that different set of operations can be done based on each condition.

Syntax:

```
Select Case Expression
  Case Expression1
    Statement1
  Case Expression2
    Statement2
  Case Expressionn
    Statementn
    ...
  Case Else
    Statement
End Select
```

In the above syntax, the value of the **Expression** is checked with **Expression1..n** to check if the condition is true. If none of the conditions are matched the statements under the **Case Else** is executed.

Flow Diagram:



Example:

```
Private Sub Button1_Click(ByVal sender As System.Object,
    ByVal e As System.EventArgs) Handles Button1.Click
  Dim c As String
  c = TextBox1.Text
  Select c
  Case "Red"
    MsgBox("Color code of Red is::#FF0000")
  Case "Green"
    MsgBox("Color code of Green is::#808000")
  Case "Blue"
    MsgBox("Color code of Blue is:: #0000FF")
  Case Else
```

```
    MsgBox("Enter correct choice")
  End Select
End Sub
```

Description:

In the above example based on the color input in **TextBox1**, the color code for RGB colors are displayed, if the color is different then the statement under **Case Else** is executed. Thus we can easily execute the select case statement.

Loop Statements

1) Do While Loop Statement

Do While Loop Statement is used to execute a set of statements only if the condition is satisfied. But the loop get executed once for a false condition once before exiting the loop. This is also know as **Entry Controlled**loop.

Syntax:

```
Do While [Condition]
  [Statements]
Loop
```

In the above syntax the **Statements** are executed till the **Condition** remains true.

Example:

```
Private Sub Form1_Load(ByVal sender As System.Object,
    ByVal e As System.EventArgs) Handles MyBase.Load
  Dim a As Integer
  a = 1
  Do While a < 100
    a = a * 2
    MsgBox("Product is::" & a)
  Loop
End Sub
```

Description:

In the above Do While Loop example the loop is continued after the value 64 to display 128 which is false according to the given condition and then the loop exits.

2) Do Loop While Statement

Do Loop While Statement executes a set of statements and checks the condition, this is repeated until the condition is true. .It is also known as an **Exit Control** loop

Syntax:

```
Do
  [Statements]
Loop While [Condition]
```

In the above syntax the **Statements** are executed first then the **Condition** is checked to find if it is true.

Example:

```
Private Sub Form1_Load(ByVal sender As System.Object,
```

```
    ByVal e As System.EventArgs) Handles MyBase.Load
   Dim cnt As Integer

   Do
     cnt = 10
       MsgBox("Value of cnt is::" & cnt)
   Loop While cnt <= 9
 End Sub
```

Description:

In the above Do Loop While example, a message is displayed with a value 10 only after which the condition is checked, since it is not satisfied the loop exits.

3) For Next Loop Statement

For Next Loop Statement executes a set of statements repeatedly in a loop for the given initial, final value range with the specified step by step increment or decrement value.

Syntax:

```
For counter = start To end [Step]
  [Statement]
Next [counter]
```

In the above syntax the **Counter** is range of values specified using the **Start** ,**End** parameters. The **Step** specifies step increment or decrement value of the counter for which the statements are executed.

Example:

```
Private Sub Form1_Load(ByVal sender As System.Object,
  ByVal e As System.EventArgs) Handles MyBase.Load
   Dim i As Integer
   Dim j As Integer
   j = 0
   For i = 1 To 10 Step 1
     j = j + 1
     MsgBox("Value of j is::" & j)
   Next i
End Sub
```

Description:

In the above For Next Loop example the counter value of i is set to be in the range of 1 to 10 and is incremented by 1. The value of j is increased by 1 for 10 times as the loop is repeated.

Nested Control Structures

You can place, or nest, control structures inside other control structures (such as an If. . .Then block within a For. . .Next loop). Control structures in Visual Basic can be nested in as many levels as you want. The editor automatically indents the bodies of nested decision and loop structures to make the program easier to read.

When you nest control structures, you must make sure that they open and close within the same structure. In other words, you can't start a For. . .Next loop in an If statement and close the loop after the corresponding End If. The following code segment demonstrates how to nest several

flow-control statements. (The curly brackets denote that regular statements should appear in their place and will not compile, of course.)

```
Fora=1To100
{statements}
Ifa=99Then
{statements}
EndIf
Whileb<a
{statements}
Iftotal<=0Then
{statements}
EndIf
EndWhile
Forc=1toa
{statements}
Nextc
Next a
```

Listing 3.7: Simple Nested If Statements

```
DimIncomeAsDecimal
Income=Convert.ToDecimal(InputBox("Enteryourincome"))
IfIncome>0Then
IfIncome>12000Then
MsgBox"You will pay taxes this year"
Else
MsgBox"You won't pay any taxes this year"
End If
Else
MsgBox"Bummer"
End If
```

The Exit Statement

The Exit statement allows you to exit prematurely from a block of statements in a control structure, from a loop, or even from a procedure. Suppose that you have a For. . .Next loop that calculates the square root of a series of numbers. Because the square root of negative numbers can't be calculated (the Math.Sqrt method will generate a runtime error

```
Fori=0ToUBound(nArray)
IfnArray(i)<0Then
MsgBox("Can'tcompletecalculations"&vbCrLf&_
"Item"&i.ToString&"isnegative!"
ExitFor
EndIf
nArray(i)=Math.Sqrt(nArray(i))
Next
```

If a negative element is found in this loop, the program exits the loop and continues with the statement following the Next statement.

There are similar Exit statements for the Do loop (Exit Do), the While loop (Exit While), the Select statement (Exit Select), and for functions and subroutines (Exit Function and Exit Sub).

If the previous loop was part of a function, you might want to display an error and exit not only the loop, but also the function itself by using the Exit Function statement.

WRITING AND USING PROCEDURE

Procedures are also used for implementing repeated tasks, such as frequently used calculations. The two types of procedures supported by Visual Basic-***subroutines*** and ***functions***

MODULAR CODING

The idea of breaking a large application into smaller, more manageable sections is not new to computing. Few tasks, programming or otherwise, can be managed as a whole. The event handlers are just one example of breaking a large application into smaller tasks. Some event handlers may require a lot of code.

Subroutines

A subroutine is a block of statements that carries out a well-defined task. The block of statements is placed within a set of Sub. . .End Sub statements and can be invoked by name.
The following subroutine displays the current date in a message box and can be called by its name, ShowDate():

```
Sub ShowDate()
MsgBox(Now().ToShortDateString)
End Sub
```

Most procedures also accept and act upon arguments. The ShowDate() subroutine displays the current date in a message box. If you want to display any other date, you have to implement it differently and add an argument to the subroutine:

```
Sub ShowDate(ByVal birthDate As Date)
MsgBox(birthDate.ToShortDateString)
End Sub
```

birthDate is a variable that holds the date to be displayed; its type is Date. The ByVal keyword means that the subroutine sees a copy of the variable, not the variable itself. What this means practically is that the subroutine can't change the value of the variable passed by the calling application. To display the current date in a message box, you must call the ShowDate() subroutine as follows from within your program:
ShowDate() -To display any other date with the second implementation of the subroutine, use a statement like the following:

```
Dim myBirthDate = #2/9/1960#
ShowDate(myBirthDate)
```

Or, you can pass the value to be displayed directly without the use of an intermediate variable:

```
ShowDate(#2/9/1960#)
```

Functions

A function is similar to a subroutine, but a function returns a result. Because they return values, functions — like variables — have types. The value you pass back to the calling program from a function is called the return value, and its type must match the type of the function. Functions accept arguments, just like subroutines. The statements that make up a function are placed in a set of Function. . .End Function statement

A procedure is a group of statements that together perform a task, when called. After the procedure is executed, the control returns to the statement calling the procedure. VB.Net has two types of procedures:

- ✓ Functions
- ✓ Sub procedures or Subs

Functions return a value, where Subs do not return a value.

Defining a Function

The Function statement is used to declare the name, parameter and the body of a function. The syntax for the Function statement is:

```
[Modifiers] Function FunctionName [(ParameterList)] As ReturnType
   [Statements]
End Function
```

Where,

- ✓ ***Modifiers***: specifiy the access level of the function; possible values are: Public, Private, Protected, Friend, Protected Friend and information regarding overloading, overriding, sharing, and shadowing.
- ✓ ***FunctionName***: indicates the name of the function
- ✓ ***ParameterList***: specifies the list of the parameters
- ✓ ***ReturnType***: specifies the data type of the variable the function returns

Example

Following code snippet shows a function *FindMax* that takes two integer values and returns the larger of the two.

```
Function FindMax(ByVal num1 As Integer, ByVal num2 As Integer) As Integer
  ' local variable declaration */
  Dim result As Integer
  If (num1 > num2) Then
     result = num1
  Else
     result = num2
  End If
  FindMax = result
End Function
```

Function Returning a Value

In VB.Net a function can return a value to the calling code in two ways:

- ✓ By using the return statement
- ✓ By assigning the value to the function name

The following example demonstrates using the *FindMax* function:

```
Module myfunctions
  Function FindMax(ByVal num1 As Integer, ByVal num2 As Integer) As Integer
    ' local variable declaration */
```

```
    Dim result As Integer
    If (num1 > num2) Then
       result = num1
    Else
       result = num2
    End If
    FindMax = result
  End Function
  Sub Main()
    Dim a As Integer = 100
    Dim b As Integer = 200
    Dim res As Integer
    res = FindMax(a, b)
    Console.WriteLine("Max value is : {0}", res)
    Console.ReadLine()
  End Sub
End Module
```

When the above code is compiled and executed, it produces following result:

```
Max value is : 200
```

More Types of Function Return Values

1) Functions returning Structures

Suppose you need a function that returns a customer's savings and checking account balances. So far, you've learned that you can return two or more values from a function by supplying arguments with the ByRef keyword. A more elegant method is to create a custom data type (a structure) and write a function that returns a variable of this type.

Here's a simple example of a function that returns a custom data type. This example outlines the steps you must repeat every time you want to create functions that return custom data types:

1. Create a new project and insert the declarations of a custom data type in the declarations section of the form:

```
Structure CustBalance
    Dim SavingsBalance As Decimal
    Dim CheckingBalance As Decimal
End Structure
```

2. Implement the function that returns a value of the custom type. In the function's body, you must declare a variable of the type returned by the function and assign the proper values to its fields. The following function assigns random values to the fields CheckingBalance and SavingsBalance. Then assign the variable to the function's name, as shown next:

```
Function GetCustBalance(ID As Long) As CustBalance
    Dim tBalance As CustBalance
    tBalance.CheckingBalance = CDec(1000 + 4000 * rnd())
```

```
        tBalance.SavingsBalance = CDec(1000 + 15000 * rnd())
        Return(tBalance)
    End Function
```

3. Place a button on the form from which you want to call the function. Declare a variable of the same type and assign to it the function's return value. The example that follows prints the savings and checking balances in the Output window:

```
    Private Sub Button1 Click(...) Handles Button1.Click
    Dim balance As CustBalance
    balance = GetCustBalance(1)
    Debug.WriteLine(balance.CheckingBalance)
    Debug.WriteLine(balance.SavingsBalance)
    End Sub
```

The code shown in this section belongs to the Structures sample project. Create this project from scratch, perhaps by using your own custom data type, to explore its structure and experiment with functions that return custom data types.

2) Function Returning Arrays

In addition to returning custom data types, VB 2008 functions can also return arrays. This is an interesting possibility that allows you to write functions that return not only multiple values, but also an unknown number of values.

In this section, we'll write the Statistics() function, similar to the CalculateStatistics() function you saw a little earlier in this chapter. The Statistics() function returns the statistics in an array. Moreover, it returns not only the average and the standard deviation, but the minimum and maximum values in the data set as well. One way to declare a function that calculates all the statistics is as follows:

Function Statistics(ByRef DataArray() As Double) As Double()

This function accepts an array with the data values and returns an array of Doubles. To implement a function that returns an array, you must do the following:

1. Specify a type for the function's return value and add a pair of parentheses after the type's name. Don't specify the dimensions of the array to be returned here; the array will be declared formally in the function.
2. In the function's code, declare an array of the same type and specify its dimensions. If the function should return four values, use a declaration like this one:

   ```
   Dim Results(3) As Double
   ```

   The Results array, which will be used to store the results, must be of the same type as the function— its name can be anything.
3. To return the Results array, simply use it as an argument to the Return statement:

   ```
   Return(Results)
   ```
4. In the calling procedure, you must declare an array of the same type without dimensions:

   ```
   Dim Statistics() As Double
   ```
5. Finally, you must call the function and assign its return value to this array:

   ```
   Stats() = Statistics(DataSet())
   ```

Here, DataSet is an array with the values whose basic statistics will be calculated by the Statistics() function. Your code can then retrieve each element of the array with an index value as usual.

ARGUMENTS

Subroutines and functions aren't entirely isolated from the rest of the application. Most procedures accept arguments from the calling program. Recall that an argument is a value you pass to the procedure and on which the procedure usually acts. This is how subroutines and functions communicate with the rest of the application.

Subroutines and functions may accept any number of arguments, and you must supply a value for each argument of the procedure when you call it. Some of the arguments may be optional, which means you can omit them; you will see shortly how to handle optional arguments.

The custom function Min(), for instance, accepts two numbers and returns the smaller one:

```
Function Min(ByVal a As Single, ByVal b As Single) As Single
Min = IIf(a < b, a, b)
End Function
```

IIf() is a built-in function that evaluates the first argument, which is a logical expression. If the expression is True, the IIf() function returns the second argument. If the expression is False, the function returns the third argument.

To call the Min() custom function, use a few statements like the following:

```
Dim val1 As Single = 33.001
Dim val2 As Single = 33.0011
Dim smallerVal as Single
smallerVal = Min(val1, val2)
Debug.Write("The smaller value is " & smallerVal)
```

If you execute these statements (place them in a button's Click event handler), you will see the following in the Immediate window:

```
The smaller value is 33.001
```

If you attempt to call the same function with two Double values, with a statement like the following, you will see the value 3.33 in the Immediate window:

```
Debug.WriteLine(Min(3.33000000111, 3.33000000222))
```

The compiler converted the two values from Double to Single data type and returned one of them.

Interesting things will happen if you attempt to use the Min() function with the Strict option turned on. Insert the statement Option Strict On at the very beginning of the file, or set Option Strict to On in the Compile tab of the project's Properties pages. The editor will underline the statement that implements the Min() function: the IIf() function. The IIf() function accepts two Object variables as arguments, and returns one of them as its result. The Strict option prevents the compiler from converting an Object to a numeric variable. To use the IIf() function with the Strict option, you must change its implementation as follows:

```
Function Min(ByVal a As Object, ByVal b As Object) As Object
Min = IIf(Val(a) < Val(b), a, b)
End Function
```

Argument Passing Mechanisms

One of the most important topics in implementing your own procedures is the mechanism used to pass arguments. The examples so far have used the default mechanism: passing arguments by value. The other mechanism is passing them by reference. Although most programmers use the default mechanism, it's important to know the difference between the two mechanisms and when to use each.

- ✓ Passing arguments By Value
- ✓ Passing arguments by Reference

- ✓ Returning Multiple Values
- ✓ Passing Objects as Arguments

Passing arguments by value

This is the default mechanism for passing parameters to a method. In this mechanism, when a method is called, a new storage location is created for each value parameter. The values of the actual parameters are copied into them. So, the changes made to the parameter inside the method have no effect on the argument.

In VB.Net, you declare the reference parameters using the **ByVal** keyword. The following example demonstrates the concept:

```
Module paramByval
   Sub swap(ByVal x As Integer, ByVal y As Integer)
      Dim temp As Integer
      temp = x ' save the value of x
      x = y    ' put y into x
      y = temp 'put temp into y
   End Sub
   Sub Main()
      ' local variable definition
      Dim a As Integer = 100
      Dim b As Integer = 200
      Console.WriteLine("Before swap, value of a : {0}", a)
      Console.WriteLine("Before swap, value of b : {0}", b)
      ' calling a function to swap the values '
      swap(a, b)
      Console.WriteLine("After swap, value of a : {0}", a)
      Console.WriteLine("After swap, value of b : {0}", b)
      Console.ReadLine()
   End Sub
End Module
```

When the above code is compiled and executed, it produces following result:

```
Before swap, value of a :100
Before swap, value of b :200
After swap, value of a :100
After swap, value of b :200
```

It shows that there is no change in the values though they had been changed inside the function.

Passing Parameters by Reference

A reference parameter is a reference to a memory location of a variable. When you pass parameters by reference, unlike value parameters, a new storage location is not created for these parameters. The reference parameters represent the same memory location as the actual parameters that are supplied to the method.

In VB.Net, you declare the reference parameters using the **ByRef** keyword. The following example demonstrates this:

```
Module paramByref
```

```
  Sub swap(ByRef x As Integer, ByRef y As Integer)
    Dim temp As Integer
    temp = x ' save the value of x
    x = y    ' put y into x
    y = temp 'put temp into y
  End Sub
  Sub Main()
    ' local variable definition
    Dim a As Integer = 100
    Dim b As Integer = 200
    Console.WriteLine("Before swap, value of a : {0}", a)
    Console.WriteLine("Before swap, value of b : {0}", b)
    ' calling a function to swap the values '
    swap(a, b)
    Console.WriteLine("After swap, value of a : {0}", a)
    Console.WriteLine("After swap, value of b : {0}", b)
    Console.ReadLine()
  End Sub
End Module
```

When the above code is compiled and executed, it produces following result:

```
Before swap, value of a : 100
Before swap, value of b : 200
After swap, value of a : 200
After swap, value of b : 100
```

Returning Multiple Values

If you want to write a function that returns more than a single result, you will most likely pass additional arguments by reference and set their values from within the function's code. The CalculateStatistics() function, calculates the basic statistics of a data set. The values of the data set are stored in an array, which is passed to the function by reference. The CalculateStatistics() function must return two values: the average and standard deviation of the data set. Here's the declaration of the CalculateStatistics() function:

Function CalculateStatistics(ByRef Data() As Double, ByRef Avg As Double, ByRef StDev As Double) As Integer

The function returns an integer, which is the number of values in the data set. The two important values calculated by the function are returned in the Avg and StDev arguments:

Function CalculateStatistics(ByRef Data() As Double, ByRef Avg As Double, ByRef StDev As Double) As Integer

Dim i As Integer, sum As Double, sumSqr As Double, points As Integer

points = Data.Length

For i = 0 To points - 1

sum = sum + Data(i)

sumSqr = sumSqr + Data(i) ^ 2

Next

```
Avg = sum / points
StDev = System.Math.Sqrt(sumSqr / points - Avg ^ 2)
Return(points)
End Function
```

To call the CalculateStatistics() function from within your code, set up an array of Doubles and declare two variables that will hold the average and standard deviation of the data set:

```
Dim Values(99) As Double
' Statements to populate the data set
Dim average, deviation As Double
Dim points As Integer
points = Stats(Values, average, deviation)
Debug.WriteLine points & " values processed."
Debug.WriteLine "The average is " & average & " and"
Debug.WriteLine "the standard deviation is " & deviation
```

Using ByRef arguments is the simplest method for a function to return multiple values. However, the definition of your functions might become cluttered, especially if youwant to returnmore than a few values. Another problem with this technique is that it's not clear whether an argument must be set before calling the function. As you will see shortly, it is possible for a function to return an array or a custom structure with fields for any number of values.

Passing Objects as Arguments

When you pass objects as arguments, they're passed by reference, even if you have specified the ByVal keyword. The procedure can access and modify the members of the object passed as an argument, and the new value will be visible in the procedure that made the call.

The following code segment demonstrates this. The object is an ArrayList, which is an enhanced form of an array. The ArrayList is discussed in detail later in the tutorial, but to follow this example all you need to know is that the Add method adds new items to the ArrayList, and you can access individual items with an index value, similar to an array's elements. In the Click event handler of a Button control, create a new instance of the ArrayList object and call the PopulateList() subroutine to populate the list. Even if the ArrayList object is passed to the subroutine by value, the subroutine has access to its items:

```
Private Sub Button1 Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles Button1.Click

Dim aList As New ArrayList()
PopulateList(aList)
Debug.WriteLine(aList(0).ToString)
Debug.WriteLine(aList(1).ToString)
Debug.WriteLine(aList(2).ToString)

End Sub

Sub PopulateList(ByVal list As ArrayList)
list.Add("1")
list.Add("2")
list.Add("3")
End Sub
```

The same is true for arrays and all other collections. Even if you specify the ByVal keyword, they're passed by reference.

Passing unknown number of Arguments

VB 2008 supports the ParamArray keyword, which allows you to pass a variable number of arguments to a procedure.

Let's look at an example. Suppose that you want to populate a ListBox control with elements. To add an item to the ListBox control, you call the Add method of its Items collection as follows:

```
ListBox1.Items.Add("new item")
```

This statement adds the string new item to the ListBox1 control. If you frequently add multiple items to a ListBox control from within your code, you can write a subroutine that performs this task. The following subroutine adds a variable number of arguments to the ListBox1 control:

```
Sub AddNamesToList(ByVal ParamArray NamesArray() As Object)
Dim x As Object
For Each x In NamesArray
ListBox1.Items.Add(x)
Next x
End Sub
```

This subroutine's argument is an array prefixed with the keyword ParamArray, which holds all the parameters passed to the subroutine. If the parameter array holds items of the same type, you can declare the array to be of the specific type (string, integer, and so on). To add items to the list, call the AddNamesToList() subroutine as follows:

```
AddNamesToList("Robert", "Manny", "Renee", "Charles", "Madonna")
```

If you want to know the number of arguments actually passed to the procedure, use the Length property of the parameter array. The number of arguments passed to the AddNamesToList() subroutine is given by the following expression:

```
NamesArray.Length
```

The following loop goes through all the elements of the NamesArray and adds them to the list:

```
Dim i As Integer
For i = 0 to NamesArray.GetUpperBound(0)
ListBox1.Items.Add(NamesArray(i))
Next i
```

VB arrays are zero-based (the index of the first item is 0), and the GetUpperBound method returns the index of the last item in the array.

A procedure that accepts multiple arguments relies on the order of the arguments. To omit some of the arguments, you must use the corresponding comma. Let's say you want to call such a procedure and specify the first, third, and fourth arguments. The procedure must be called as follows:

```
ProcName(arg1, , arg3, arg4)
```

The arguments to similar procedures are usually of equal stature, and their order doesn't make any difference. A function that calculates the mean or other basic statistics of a set of numbers, or a subroutine that populates a ListBox or ComboBox control, are prime candidates for implementing this technique. If the procedure accepts a variable number of arguments that aren't equal in stature, you should consider the technique described in the following section. If the function accepts a parameter array, this must the last argument in the list, and none of the other parameters can be optional.

Param Arrays

At times, while declaring a function or sub procedure you are not sure of the number of arguments passed as a parameter. VB.Net param arrays (or parameter arrays) come into help at these times.

The following example demonstrates this:

```
Module myparamfunc
  Function AddElements(ParamArray arr As Integer()) As Integer
    Dim sum As Integer = 0
    Dim i As Integer = 0
    For Each i In arr
       sum += i
    Next i
    Return sum
  End Function
  Sub Main()
    Dim sum As Integer
    sum = AddElements(512, 720, 250, 567, 889)
    Console.WriteLine("The sum is: {0}", sum)
    Console.ReadLine()
  End Sub
End Module
```

When the above code is compiled and executed, it produces following result:

```
The sum is: 2938
```

Named Arguments

The main limitation of the argument-passing mechanism, though, is the order of the arguments. By default, Visual Basic matches the values passed to a procedure to the declared arguments by their order.

This limitation is lifted by Visual Basic's capability to specify named arguments. With named arguments, you can supply arguments in any order because they are recognized by name and not by their order in the list of the procedure's arguments. Suppose you've written a function that expects three arguments: a name, an address, and an email address:

Function Contact(Name As String, Address As String, EMail As String)

When calling this function, you must supply three strings that correspond to the arguments Name, Address, and EMail, in that order. However, there's a safer way to call this function: Supply the arguments in any order by their names. Instead of calling the Contact() function as follows:

Contact("Peter Evans", "2020 Palm Ave., Santa Barbara, CA 90000", _
"PeterEvans@example.com")

you can call it this way:

Contact(Address:="2020 Palm Ave., Santa Barbara, CA 90000", _
EMail:="PeterEvans@example.com", Name:="Peter Evans")

The := operator assigns values to the named arguments. Because the arguments are passed by name, you can supply them in any order.

To test this technique, enter the following function declaration in a form's code:

```
Function Contact(ByVal Name As String, ByVal Address As String, _
ByVal EMail As String) As String
Debug.WriteLine(Name)
Debug.WriteLine(Address)
Debug.WriteLine(EMail)
Return ("OK")
End Function
```

Then call the Contact() function from within a button's Click event with the following statement:

```
Debug.WriteLine( Contact(Address:="2020 Palm Ave., Santa Barbara, CA 90000", _
Name:="Peter Evans", EMail:="PeterEvans@example.com"))
```

You'll see the following in the Immediate window:

```
Peter Evans
2020 Palm Ave., Santa Barbara, CA 90000
PeterEvans@example.com
OK
```

The function knows which value corresponds to which argument and can process them the same way that it processes positional arguments. Notice that the function's definition is the same, whether you call it with positional or named arguments. The difference is in how you call the function and not how you declare it.

Named arguments make code safer and easier to read, but because they require a lot of typing, most programmers don't use them. Besides, when IntelliSense is on, you can see the definition of the function as you enter the arguments, and this minimizes the chances of swapping two values by mistake.

Named Visual Basic Arguments

Some obvious ways to write readable code include the use of program comments in your code -- no matter what the language you are using to develop your program, all major languages provide for comments. Something else that can make your Visual Basic more readable is the use of Named Arguments.

This is illustrated by executing the Visual Basic MsgBox Function to display a Windows Message Box. The Visual Basic MsgBox function has one required argument (Prompt), and four optional arguments (Buttons, Title, HelpFile and Context).

```
MsgBox "I love Visual Basic"
```

By default, this code will display a Message Box with a single command button captioned OK, with the text "I love Visual Basic", and the Visual Basic Project name displayed in the Title Bar of the Message Box.

Suppose I'm not happy with the default Title in the Message Box, and I decide I want to customize it. Doing this is easy-all I need to do is supply the Title argument to the MsgBox function. However, since Title is the third argument, I either need to supply the second argument -- Buttons, which is by default presumed to be the value vbOKOnly -- or provide a 'comma placeholder', like this.

MsgBox "I love Visual Basic",, "SearchVB.Com"

Notice the two commas back-to-back, with no value in-between. This is the 'comma placeholder' and is how we tell VB that although we have a value for the third argument, we have no explicit value for the second argument.

When we execute this code, we'll see a Message Box that reads "I love Visual Basic", and that has "SearchVB.Com" for its Title Bar.

Named Arguments can make passing optional arguments easier-and make your code infinitely easier to read and modify. For instance, the code we wrote above can be re-written the following way using Named Arguments.

MsgBox Prompt:="I love Visual Basic", Title:="SearchVB.Com"

With Named Arguments, we specify the name of the argument, followed by a colon and equals sign (:=), then the value for the argument. By using Named Arguments, we don't need to provide a 'comma placeholder' for the second argument Buttons. Since we are naming the argument, VB knows that 'SearchVB.Com' is the value for the Optional Argument 'Title'. And since we name the arguments, being able to read and understand the code in the future is much easier.

Overloading Functions

Function overloading, means that you can have multiple implementations of the same function, each with a different set of arguments and possibly a different return value. Yet all overloaded functions share the same name.

The Next method of the System.Random class returns an integer value from –2,147,483,648 to 2,147,483,647. (This is the range of values that can be represented by the Integer data type.) We should also be able to generate random numbers in a limited range of integer values. To emulate the throw of a die, we want a random value in the range from 1 to 6, whereas for a roulette game we want an integer random value in the range from 0 to 36. You can specify an upper limit for the random number with an optional integer argument. The following statement will return a random integer in the range from 0 to 99:

randomInt = rnd.Next(100)

You can also specify both the lower and upper limits of the random number's range. The following statement will return a random integer in the range from 1,000 to 1,999:

randomInt = rnd.Next(1000, 2000)

The same method behaves differently based on the arguments we supply. The behavior of the method depends either on the type of the arguments, the number of the arguments, or both. As you will see, there's no single function that alters its behavior based on its arguments. There are as many different implementations of the same function as there are argument combinations. All the functions share the same name, so they appear to the user as a single multifaceted function. These functions are overloaded, and you'll see how they're implemented in the following section.

Let's return to the Min() function we implemented earlier in this chapter. The initial implementation of the Min() function is shown next:

```
Function Min(ByVal a As Double, ByVal b As Double) As Double
Min = IIf(a < b, a, b)
End Function
```

To write a Min() function that can handle both numeric and string values, you must, in essence, write two Min() functions. All Min() functions must be prefixed with the Overloads keyword. The following statements show two different implementations of the same function:

```
Overloads Function Min(ByVal a As Double, ByVal b As Double) As Double
Min = Convert.ToDouble(IIf(a < b, a, b))
End Function
Overloads Function Min(ByVal a As String, ByVal b As String) As String
Min = Convert.ToString(IIf(a < b, a, b))
End Function
```

We need a third overloaded form of the same function to compare dates. If you call the Min() function, passing as an argument two dates, as in the following statement, the Min() function will compare them as strings and return (incorrectly) the first date.

```
Debug.WriteLine(Min(#1/1/2009#, #3/4/2008#))
```

This statement is not even valid when the Strict option is on, so you clearly need another overloaded form of the function that accepts two dates as arguments, as shown here:

```
Overloads Function Min(ByVal a As Date, ByVal b As Date) As Date
Min = IIf(a < b, a, b)
End Function
```

If you now call the Min() function with the dates #1/1/2009# and #3/4/2008#, the function will return the second date, which is chronologically smaller than the first.

Event-Handler Arguments

Events are basically a user action like key press, clicks, mouse movements etc., or some occurrence like system generated notifications. Applications need to respond to events when they occur.

Clicking on a button, or entering some text in a text box, or clicking on a menu item all are examples of events. An event is an action that calls a function or may cause another event.

Event handlers are functions that tell how to respond to an event.

VB.Net is an event-driven language. There are mainly two types of events:

- ✓ Mouse events
- ✓ Keyboard events

Handling Mouse Events

Mouse events occur with mouse movements in forms and controls. Following are the various mouse events related with a Control class:

- ✓ **MouseDown** - it occurs when a mouse button is pressed
- ✓ **MouseEnter** - it occurs when the mouse pointer enters the control
- ✓ **MouseHover** - it occurs when the mouse pointer hovers over the control
- ✓ **MouseLeave** - it occurs when the mouse pointer leaves the control
- ✓ **MouseMove** - it occurs when the mouse pointer moves over the control
- ✓ **MouseUp** - it occurs when the mouse pointer is over the control and the mouse button is released
- ✓ **MouseWheel** - it occurs when the mouse wheel moves and the control has focus

The event handlers of the mouse events get an argument of type **MouseEventArgs**.
The MouseEventArgs object is used for handling mouse events. It has the following properties:

- ✓ **Buttons** - indicates the mouse button pressed
- ✓ **Clicks** - indicates the number of clicks
- ✓ **Delta** - indicates the number of detents the mouse wheel rotated
- ✓ **X** - indicates the x-coordinate of mouse click
- ✓ **Y** - indicates the y-coordinate of mouse click

Handling Keyboard Events

Following are the various keyboard events related with a Control class:

- ✓ **KeyDown** - occurs when a key is pressed down and the control has focus
- ✓ **KeyPress** - occurs when a key is pressed and the control has focus
- ✓ **KeyUp** - occurs when a key is released while the control has focus
- ✓

The event handlers of the KeyDown and KeyUp events get an argument of type **KeyEventArgs**. This object has the following properties:

- ✓ **Alt** - it indicates whether the ALT key is pressed/p>
- ✓ **Control** - it indicates whether the CTRL key is pressed
- ✓ **Handled** - it indicates whether the event is handled
- ✓ **KeyCode** - stores the keyboard code for the event
- ✓ **KeyData** - stores the keyboard data for the event
- ✓ **KeyValue** - stores the keyboard value for the event
- ✓ **Modifiers** - it indicates which modifier keys (Ctrl, Shift, and/or Alt) are pressed
- ✓ **Shift** - it indicates if the Shift key is pressed
- ✓

The event handlers of the KeyDown and KeyUp events get an argument of type **KeyEventArgs**. This object has the following properties:

- ✓ **Handled** - indicates if the KeyPress event is handled
- ✓ **KeyChar** - stores the character corresponding to the key pressed

WORKING WITH FORMS

In Visual Basic, the *form* is the container for all the controls that make up the user interface. When a Visual Basic application is executing, each window it displays on the desktop is a form. In previous chapters, we concentrated on placing the elements of the user interface on forms, setting their properties, and adding code behind selected events. Now, we'll look at forms themselves and at a few related topics, such as menus (forms are the only objects that can have menus attached), how to design forms that can be automatically resized, and how to access the controls of one form from within another form's code. The form is the top-level object in a Visual Basic application, and every application starts with the form.

The forms that constitute the visible interface of your application are called *Windows forms;* this term includes both the regular forms and dialog boxes, which are simple forms you use for

very specific actions, such as to prompt the user for a specific piece of data or to display critical information. A *dialog box* is a form with a small number of controls, no menus, and usually an OK and a Cancel button to close it. These are also called Modal Forms and the regular forms are non-Modal.

APPEARANCE OF FORMS

Applications are made up of one or more forms (usually more than one), and the forms are what users see. You should craft your forms carefully, make them functional, and keep them simple and intuitive. You already know how to place controls on the form, but there's more to designing forms than populating them with controls. The main characteristic of a form is the title bar on which the form's caption is displayed.

Clicking the icon on the left end of the title bar opens the Control menu, which contains the commands shown in Table 2.1 On the right end of the title bar are three buttons: Minimize, Maximize, and Close. Clicking these buttons performs the associated function. When a form is maximized, the Maximize button is replaced by the Restore button. When clicked, this button resets the form to the size and position before it was maximized. The Restore button is then replaced by the Maximize button

Commands of the Control Menu of the Form

Command	Effect
Restore	Restores a maximized form to the size it was before it was maximized; available only if the form has been maximized.
Move	Lets the user move the form around with the arrow keys.
Size	Lets the user resize the form with the arrow keys.
Minimize	Minimizes the form.
Maximize	Maximizes the form.
Close	Closes the current form

Properties of the Form Object

You're familiar with the appearance of forms, even if you haven't programmed in the Windows environment in the past; you have seen nearly all types of windows in the applications you're using every day. The floating toolbars used by many graphics applications, for example, are actually forms with a narrow title bar. The dialog boxes that display critical information or prompt you to select the file to be opened are also forms. You can duplicate the look of any window or dialog box through the following properties of the Form object.

AcceptButton, CancelButton

These two properties let you specify the default Accept and Cancel buttons. The Accept button is the one that's automatically activated when you press Enter, no matter which control has the focus at the time, and is usually the button with the OK caption. Likewise, the Cancel button is the one that's automatically activated when you hit the Esc key and is usually the button with the Cancel caption. To specify the Accept and Cancel buttons on a form, locate the AcceptButton and CancelButton properties of the form and select the corresponding controls from a drop-down list, which contains the names of all the buttons on the form. For more information on these two properties, see the section "Forms versus Dialog Boxes in VB.NET," later in this chapter.

AutoScaleMode

This property determines how the control is scaled, and its value is a member of the AutoScale-Mode enumeration: None (automatic scaling is disabled), Font (the controls on the form are scaled relative to the size of their font), Dpi, which stands for dots per inch (the controls on the form are scaled relative to the display resolution), and Inherit (the controls are scaled according to the AutoScaleMode property of their parent class). The default value is Font; if you change the form's font size, the controls on it are scaled to the new font size.

AutoScroll

The **AutoScroll** property is a True/False value that indicates whether scroll bars will be automatically attached to the form if the form is resized to a point that not all its controls are visible. Use this property to design large forms without having to worry about the resolution of the monitor on which they'll be displayed. The AutoScroll property is used in conjunction with two other properties (described a little later in this section): **AutoScrollMargin** and **AutoScrollMinSize**. Note that the AutoScroll property applies to a few controls as well, including the Panel and SplitContainer controls. For example, you can create a form with a fixed and a scrolling pane by placing two Panel controls on it and setting the AutoScroll property of one of them (the Panel you want to scroll) to True.

AutoScrollPosition

This property is available from within your code only (you can't set this property at design time), and it indicates the number of pixels that the form was scrolled up or down. Its initial value is zero, and it assumes a value when the user scrolls the form (provided that the form's AutoScroll property is True). Use this property to find out the visible controls from within your code, or scroll the form programmatically to bring a specific control into view.

AutoScrollMargin

This is a margin, expressed in pixels, that's added around all the controls on the form. If the form is smaller than the rectangle that encloses all the controls adjusted by the margin, the appropriate scroll bar(s) will be displayed automatically.

AutoScrollMinSize

This property lets you specify the minimum size of the form before the scroll bars are attached. If your form contains graphics that you want to be visible at all times, set the Width and Height members of the AutoScrollMinSize property to the dimensions of the graphics. (Of course, the graphics won't be visible at all times, but the scroll bars indicate that there's more to the form than can fit in the current window.) Notice that this isn't the form's minimum size; users can make the form even smaller. To specify a minimum size for the form, use the MinimumSize property, described later in this section.

FormBorderStyle

The FormBorderStyle property determines the style of the form's border; its value is one of the FormBorderStyle enumeration's members, which are shown in Table 2.3. You can make the form's title bar disappear altogether by setting the form's FormBorderStyle property to FixedToolWindow, the ControlBox property to False, and the Text property (the form's caption) to an empty string

Tabel 2.3 - The FormBorderStyle Enumeration

Value	Effect
None	A borderless window that can't be resized. This setting is rarely used.
Sizable	(default) A resizable window that's used for displaying regular forms.
Fixed3D	A window with a fixed visible border, ‘‘raised" relative to the main area. Unlike the None setting, this setting allows users to minimize and close the window.
FixedDialog	A fixed window used to implement dialog boxes.
FixedSingle	A fixed window with a single-line border.
FixedToolWindow	A fixed window with a Close button only. It looks like a toolbar displayed by drawing and imaging applications.
SizableToolWindow	Same as the FixedToolWindow, but is resizable. In addition, its caption font is smaller than the usual.

ControlBox

This property is also True by default. Set it to False to hide the control box icon and disable the Control menu. Although the Control menu is rarely used, Windows applications don't disable it. When the ControlBox property is False, the three buttons on the title bar are also disabled. If you set the Text property to an empty string, the title bar disappears altogether.

MinimizeBox, MaximizeBox

These two properties, which specify whether the Minimize and Maximize buttons will appear on the form's title bar, are True by default. Set them to False to hide the corresponding buttons on the form's title bar.

MinimumSize, MaximumSize

These two properties read or set the minimum and maximum size of a form. When users resize the form at runtime, the form won't become any smaller than the dimensions specified by the MinimumSize property and no larger than the dimensions specified by the MaximumSize property. The MinimumSize property is a Size object, and you can set it with a statement like the following:

```
Me.MinimumSize = New Size(400, 300)
```

Or you can set the width and height separately:

```
Me.MinimumSize.Width = 400
Me.MinimumSize.Height = 300
```

The MinimumSize.Height property includes the height of the form's title bar; you should take that into consideration. If the minimum usable size of the form is 400 × 300, use the following statement to set the MinimumSize property:

Me.MinimumSize = New Size(400, 300 + SystemInformation.CaptionHeight)

The default value of both properties is (0, 0), which means that no minimum or maximum size is imposed on the form, and the user can resize it as desired.

KeyPreview

This property enables the form to capture all keystrokes before they're passed to the control that has the focus. Normally, when you press a key, the KeyPress event of the control with the focus is triggered (as well as the KeyUp and KeyDown events), and you can handle the keystroke from within the control's appropriate handler. In most cases, you let the control handle the keystroke and don't write any form code for that.

SizeGripStyle

This property gets or sets the style of the sizing handle to display in the bottom-right corner of the form. You can set it to a member of the SizeGripStyle enumeration: Auto (the size grip is displayed as needed), Show (the size grip is displayed at all times), or Hide (the size grip is not displayed, but users can still resize the form with the mouse).

StartPosition, Location

The StartPosition property, which determines the initial position of the form when it's first displayed, can be set to one of the members of the FormStartPosition enumeration: Center-Parent (the form is centered in the area of its parent form), CenterScreen (the form is centered on the monitor), Manual (the position of the form is determined by the Location property), WindowsDefaultLocation (the form is positioned at the Windows default location), and WindowsDefaultBound (the form's location and bounds are determined by Windows defaults). The Location property allows you to set the form's initial position at design time or to change the form's location at runtime.

TopMost

This property is a True/False value that lets you specify whether the form will remain on top of all other forms in your application. Its default property is False, and you should change it only on rare occasions. Some dialog boxes, such as the Find & Replace dialog box of any text-processing application, are always visible, even when they don't have the focus.

Size

Use the Size property to set the form's size at design time or at runtime. Normally, the form's width and height are controlled by the user at runtime. This property is usually set from within the form's Resize event handler to maintain a reasonable aspect ratio when the user resizes the form. The Form object also exposes the Width and Height properties for controlling its size.

Placing Controls on Forms

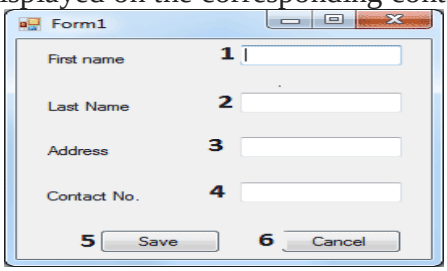
The first step in designing your application's interface is, of course, the analysis and careful planning of the basic operations you want to provide through your interface. The second step is to design the forms. Designing a form means placing Windows controls on it, setting the controls' properties, and then writing code to handle the events of interest.

To place controls on your form, you select them in the Toolbox and then draw, on the form, the rectangle in which the control will be enclosed. Or you can double-click the control's icon to place an instance of the control on the form. All controls have a default size, and you can resize the control on the form by using the mouse.

Setting the TabIndex Property

Another important issue in form design is the tab order of the controls on the form. As you know, pressing the Tab key at runtime takes you to the next control on the form. The order of the controls is the order in which they were placed on the form, but this is never what we want. When you design the application, you can specify in which order the controls receive the focus (the tab order, as it is known) with the help of the TabIndex property. Each control has its own TabIndex setting, which is an integer value. When the Tab key is pressed, the focus is moved to the control whose tab order immediately follows the tab order of the current control. The values of the TabIndex properties of the various controls on the form need not be consecutive.

To specify the tab order of the various controls, you can set their TabIndex property in the Properties window or you can choose the Tab Order command from the View menu. The tab order of each control will be displayed on the corresponding control, as shown in Figure 5.3.



Setting the Tab order by using the TabIndex property of the form

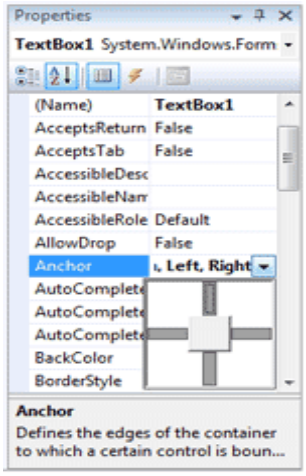
To set the tab order of the controls, click each control in the order in which you want them to receive the focus. You must click all of them in the desired order, starting with the first control in the tab order. Each control's index in the tab order appears in the upper-left corner of the control. When you're finished, choose the Tab Order command from the View menu again to hide these numbers. As you place controls on the form, don't forget to lock them, so that you won't move them around by mistake as you work with other controls. You can lock the controls in their places either by setting each control's Locked property to True or by locking all the controls on the form at once via the Format > Lock Controls command.

Anchoring and Docking Controls

Anchoring Controls

The Anchor property lets you attach one or more edges of the control to corresponding edges of the form. The anchored edges of the control maintain the same distance from the corresponding edges of the form.

Place a TextBox control on a new form, set its MultiLine property to True, and then open the control's Anchor property in the Properties window. You will see a rectangle within a larger rectangle and four pegs that connect the small control to the sides of the larger box. The large box is the form, and the small one is the control. The four pegs are the anchors, which can be either white or gray. The gray anchors denote a fixed distance between the control and the form. By default, the control is placed at a fixed distance from the top-left corner of the form. When the form is resized, the control retains its size and its distance from the top-left corner of the form.

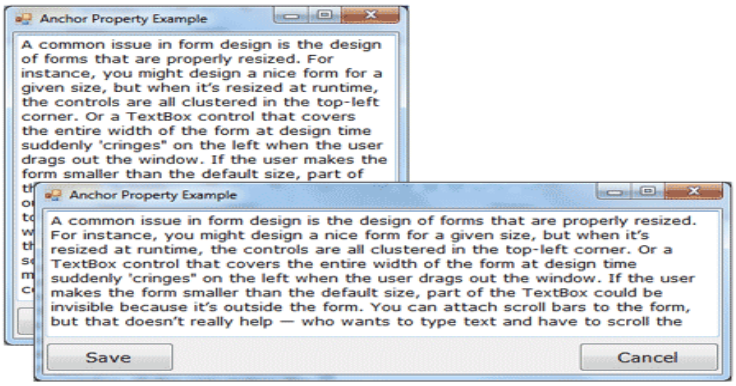


The settings of the Anchor property

We want our TextBox control to fill the width of the form, be aligned to the top of the form, and leave some space for a few buttons at the bottom. We also want our form to maintain this arrangement, regardless of its size. Make the TextBox control as wide as the form (allowing, perhaps, a margin of a few pixels on either side). Then place a couple of buttons at the bottom of the form and make the TextBox control tall enough that it stops above the buttons. This is the form of the Anchor property example project.

Now open the TextBox control's Anchor property and make all four anchors gray by clicking them. This action tells the Form Designer to resize the control accordingly at runtime, so that the distances between the sides of the control and the corresponding sides of the form are the same as those you set at design time. Select each button on the form and set their Anchor properties in the Properties window: Anchor the left button to the left and bottom of the form, and the right button to the right and bottom of the form.

Resize the form at design time without running the project, and you'll see that all the controls are resized and rearranged on the form at all times. Figure shows the Anchor project's main form in two different sizes.



Use the Anchor property of the various controls to design forms that can be resized gracefully at runtime.

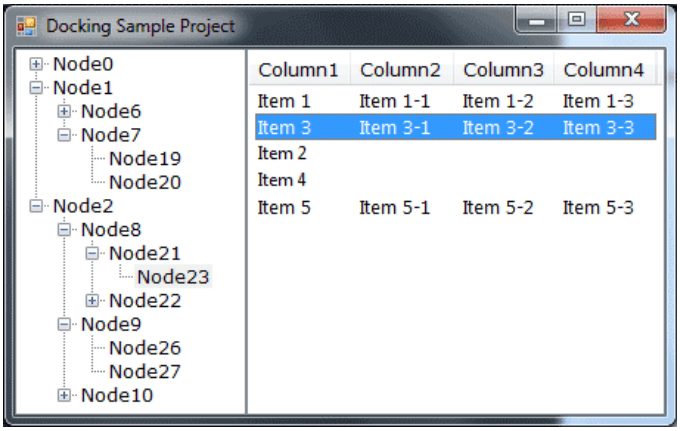
Yet, there's a small problem: If you make the form very narrow, there will be no room for both buttons across the form's width. The simplest way to fix this problem is to impose a minimum size for the form. To do so, you must first decide the form's minimum width and height and then set the MinimumSize property to these values. You can also use the AutoScroll properties, but it's not recommended that you add scroll bars to a small form like ours.

Docking Controls

In addition to the Anchor property, most controls provide the Dock property, which determines how a control will dock on the form. The default value of this property is None.

Create a new form, place a multiline TextBox control on it, and then open the control's Dock property. The various rectangular shapes are the settings of the property. If you click the middle rectangle, the control will be docked over the entire form: It will expand and shrink both horizontally and vertically to cover the entire form. This setting is appropriate for simple forms that contain a single control, usually a TextBox, and sometimes a menu. Try it out.

Let's create a more complicated form with two controls (see the Docking sample project). The form shown in Figure contains a TreeView control on the left and a ListView control on the right. The two controls display folder and file data on an interface that's very similar to that of Windows Explorer. The TreeView control displays the directory structure, and the ListView control displays the selected folder's files.



Setting the Dock property of the controls to Fill so the form at runtime will be filled with controls even when it is re-sized

Place a TreeView control on the left side of the form and a ListView control on the right side of the form. Then dock the TreeView to the left and the ListView to the right. If you run the application now, as you resize the form, the two controls remain docked to the two sides of the form — but their sizes don't change. If you make the form wider, there will be a gap between the two controls. If you make the form narrower, one of the controls will overlap the other.

End the application, return to the Form Designer, select the ListView control, and set its Dock property to Fill. This time, the ListView will change size to take up all the space to the right of the TreeView. The ListView control will attempt to fill the form, but it won't take up the space of another control that has been docked already.

Form Events

The Form object triggers several events. The most important are Activated, Deactivate, Form-Closing, Resize, and Paint.

The Activated and Deactivate Events

When more than one form is displayed, the user can switch from one to the other by using the mouse or by pressing Alt+Tab. Each time a form is activated, the Activated event takes place. Likewise, when a form is activated, the previously active form receives the Deactivate event. Insert in these two event handlers the code you want to execute when a form is activated (set certain control properties, for example) and when a form loses the focus or is deactivated. These two events are the form's equivalents of the Enter and Leave events of the various

controls. Notice an inconsistency in the names of the two events: the Activated event takes place after the form has been activated, whereas the Deactivate event takes place right before the form is deactivated.

The FormClosing and FormClosed Events

The FormClosing event is fired when the user closes the form by clicking its Close button. If the application must terminate because Windows is shutting down, the same event will be fired as well. Users don't always quit applications in an orderly manner, and a professional application should behave gracefully under all circumstances. The same code you execute in the application's Exit command must also be executed from within the closing event.

Listing: Cancelling the Closing of a Form

```
Public Sub Form1 FormClosing(...) Handles Me.FormClosing
Dim reply As MsgBoxResult
reply = MsgBox("Document has been edited. " &
"OK to terminate application, Cancel to " &
"return to your document.", MsgBoxStyle.OKCancel)
If reply = MsgBoxResult.Cancel Then
e.Cancel = True
End If
End Sub
```

The e argument of the FormClosing event provides the CloseReason property, which reports how the form is closing. Its value is one of the following members of the CloseReason enumeration: FormOwnerClosing, MdiFormClosing, None, TaskManagerClosing, WindowsShutDown. The names of the members are self-descriptive, and you can query the CloseReason property to determine how the window is closing.

The FormClosed event fires after the form has been closed. You can find out the action that caused the form to be closed through the e.CloseReason property, but it's too late to cancel the closing of the form.

The Resize, ResizeBegin, and ResizeEnd Events

The Resize event is fired every time the user resizes the form by using the mouse. With previous versions of VB, programmers had to insert quite a bit of code in the Resize event's handler to resize the controls and possibly rearrange them on the form.With the Anchor and Dock properties, much of this overhead can be passed to the form itself. If you want the two sides of the form to maintain a fixed ratio, however, you have to resize one of the dimensions from within the Resize event handler

```
Private Form1 Resize(...) Handles Me.Resize
Me.Width = (0.75 * Me.Height)
End Sub
```

The Resize event is fired continuously while the form is being resized. If youwant to keep track of the initial form's size and perform all the calculations after the user has finished resizing the form, you can use the ResizeBegin and ResizeEnd events, which are fired at the beginning and after the end of a resize operation, respectively. Store the form's width and height to two global variables in the ResizeBegin event and use these two variables in the ResizeEnd event handler.

The Scroll Event

The Scroll event is fired by forms that have their AutoScroll property set to True when the user scrolls the form. The second argument of the Scroll event handler exposes the OldValue and NewValue properties, which are the displacements of the form before and after the scroll operation. This event can be used to keep a specific control in view when the form's contents are scrolled.

The AutoScroll property is handy for large forms, but it has a serious drawback: It scrolls the entire form. In most cases, we want to keep certain controls in view at all times. Instead of a scrollable form, you can create forms with scrollable sections by exploiting the AutoScroll properties of the Panel and/or the SplitContainer controls. You can also reposition certain controls from within the form's Scroll event handler. Let's say you have placed a few controls on a Panel container and you want to keep this Panel at the top of a scrolling form. The following statements in the form's Scroll event handler reposition the Panel at the top of the form every time the user scrolls the form:

```
Private Sub Form1 Scroll(...) Handles Me.Scroll
Panel1.Top = Panel1.Top + (e.NewValue - e.OldValue)
End Sub
```

The Paint Event

This event takes place every time the form must be refreshed, and we use its handler to execute code for any custom drawing on the form. When you switch to another form that partially or totally overlaps the current one and then switch back to the first form, the Paint event will be fired to notify your application that it must redraw the form. The form will refresh its controls automatically, but any custom drawing on the form won't be refreshed automatically.

LOADING AND SHOWING FORMS

One of the operations you'll have to perform with multi-form applications is to load and manipulate forms from within other forms' code. For example, you may wish to display a second form to prompt the user for data specific to an application. You must explicitly load the second form, read the information entered by the user, and then close the form. Or, you may wish to maintain two forms open at once and let the user switch between them.. To show Form2 when an action takes place on Form1, first declare a variable that references Form2:

```
Dim frm As New Form2
```

This declaration must appear in Form1 and must be placed outside any procedure. (If you place it in a procedure's code, then every time the procedure is executed, a new reference to Form2 will be created. This means that the user can display the same form multiple times.

Then, to invoke Form2 from within Form1, execute the following statement:

```
frm.Show
```

This statement will bring up Form2 and usually appears in a button's or menu item's Click event handler. At this point, the two forms don't communicate with one another. However, they're both on the desktop and you can switch between them. There's no mechanism to move information from Form2 back to Form1, and neither form can access the other's controls or variables. The Show method opens Form2 in a modaless manner. The two forms are equal in stature on the desktop, and the user can switch between them. You can also display the second form in a modal manner, which means that users won't be able to return to the form from which they invoked it.

While a modal form is open, it remains on top of the desktop and you can't move the focus to the any other form of the same application (but you can switch to another application). To open a modal form, use the statement

```
frm.ShowDialog
```

The modal form is, in effect, a dialog box, like the Open File dialog box. You must first select a file on this form and click the Open button, or click the Cancel button, to close the dialog box and return to the form from which the dialog box was invoked.

The Startup Form

A typical application has more than a single form. When an application starts, the main form is loaded. You can control which form is initially loaded by setting the startup object in the Project Properties window. To open this, right-click the project's name in the Solution Explorer and select Properties. In the project's Property Pages, select the Startup Object from the drop-down list.

You can also start an application with a subroutine without loading a form. This subroutine must be called Main() and must be placed in a Module. Right-click the project's name in the Solution Explorer window and select the Add Item command. When the dialog box appears, select a Module. Name it StartUp (or anything you like; you can keep the default name Module1) and then insert the Main() subroutine in the module. The Main() subroutine usually contains initialization code and ends with a statement that displays one of the project's forms; to display the AuxiliaryForm object from within the Main() subroutine, use the following statements:

```
Module StartUpModule
  Sub Main()

  System.Windows.Forms.Application.Run(New _ AuxiliaryForm())
  End Sub
End Module
```

Then, you must open the Project Properties dialog box and specify that the project's startup object is the subroutine Main(). When you run the application, the form you specified in the Run method will be loaded.

Controlling One Form from within Another

Loading and displaying a form from within another form's code is fairly trivial. In some situations, this is all the interaction you need between forms. Each form is designed to operate independently of the others, but they can communicate via public variables (see, "Private & Public Variables"). In most situations, however, you need to control one form from within another's code. Controlling the form means accessing its controls and setting or reading values from within another form's code.

Example:

TextPad is a text editor that consists of the main form and an auxiliary form for the Find & Replace operation. All other operations on the text are performed with the commands of the menu you see on the main form. When the user wants to search for and/or replace a string, the program displays another form on which they specify the text to find, the type of search, and so on. When the user clicks one of the Find & Replace form's buttons, the corresponding code must access the text on the main form of the application and search for a word or replace a

string with another. The Find & Replace dialog box not only interacts with the TextBox control on the main form, it also remains visible at all times while it's open, even if it doesn't have the focus, because its TopMost property was set to True. In the Properties window, you can specify which form is to be displayed when the application starts.

Forms Vs Dialog Boxes

A dialog box is simply a modal form. When we display forms as dialog boxes, we change the border of the forms to the setting FixedDialog and invoke them with the ShowDialog method. Modeless forms are more difficult to program, because the user may switch among them at any time. Not only that, but the two forms that are open at once must interact with one another. When the user acts on one of the forms, this may necessitate some changes in the other, and you'll see shortly how this is done.

PART-B
POSSIBLE QUESTIONS(5X8=40 Marks)

1. Discuss in detail about IDE components in VB.NET with neat sketch.

2. Discuss about the properties of forms in VB.Net with neat sketch. .
3. Explain in detail about types of variables in VB.NET with example

4. Explain in detail about Argument Passing Mechanism
5. Explicate the appearance of forms in VB.NET with neat sketch.

6. Explain in detail about control flow statements with examples
7. Discuss the following with examples (i) Variables (ii) Constants (iii)Arrays
8. Elucidate the process of loading and showing forms with neat sketch.
9. Compare and contrast the subroutines and functions and give example.

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CLASS : III-B.Sc COMPUTER SCIENCE(2015-20

Online Examination

VISUAL PROGRAMMING (15CSU

questions	opt1	opt2	opt3
.Net is a technology developed by _____ company	Microsoft	Sun Microsystems	IBM
VB.Net is a _____programming paradigm.	Procedural	Structured	Object Oriented
IDE stands for _____	Internet Design Environment	Integrated Development Environment	Internet Distributed Environment
The final compiled version of a Project is ____	Form	Software	Components
_____ is a collection of files that can be compiled to create a distributed component	Form	Software	Components
_____menu contains commands for opening and saving projects	File	Edit	View
Every object has a distinct set of attributes knowns as	members	datas	properties
The property that must be set first for any new object is the _____	Name	Colour	Size
Objects that can be placed on a form are called _____	Pictures	Tools	Buttons
Controls that do not have physical appearance are called _____	invisible-at-runtime-controls	visible-at-runtime-controls	virtual controls
The Design window appears_____ by default.	Auto-Hidden	Docked	Floating
_____ windows appears attached to the side, top or bottom of the work area or to some other window	Auto-Hidden	Docked	Floating
_____window gives an overview of the solution we are working with and lists all the files in the project.	Solution Explorer	Properties window	Explorer

_____window allows us to set properties for various objects at design time	Explorer	Solution Explorer	Properties window
_____window as you can see in the image below displays the results of building and running applications	Command window	output window	Task window
When we type the period(dot) after the object name a small dropdown list containing all the properties and methods related to that object appears. This feature is called _____	IntelliSense	OnlineHelp	QuickMenu
____window displays all the tasks that VB .NET	Task window	output window	command window
_____is nothing but a name given to a storage area that our programs can manipulate.	Variable name	variable declaration	variable initialization
To declare a variable, use the _____statement followed by the variable's name, the As keyword, and its type,	Dim	integer	String
The data type of the variable is defined by using the --------- clause	in	where	as
------- is the operator used for string concatenation	Cat	Str	^
Logical operators are also called _____ operators	Boolean	Relational	comparision
In Select Case _____ Case is used to define codes that executes, if the expression does not evaluate to any of the Case statement	Default	Otherwise	Else
_____data type can be used for currency values	Currency	Dollar	Object
Which function returns the system's current date and time	DateTime.Now	DateTime.Today	DateTime.System
What statement is used to close a loop started with For statement?	Close	End For	Loop
What statement is used to terminate a Do..Loop without evaluating the test expression?	End Do	Loop	Exit

--------- method is create a new String object with the same content	CopyTo()	Copy()	Format()
The ---------- function remeove an item from a specified position	Add	Insert()	RemoveAt
The String data type comes from the ------- class	System.String	System	System.Forms
The String is ----------	locatable	mutable	immutable
The --------- function in String Class will insert a String in a specified index in the String instance.	Length()	Insert()	Length()
Which of the following when turned on do not allow to use any variable without proper declaration?	Option Restrict	Option Explicit	Option Implicit
Which of the following methods cane be used to add items to an ArrayList class?	Insert method	collection method	top method
Parameters to methods in VB.NET are declared by default as ---------	ByVal	ByRef	Val
Which of the following does not denote a arithmetic operator allowed in VB.Net?	Mod	/	*
Which of the following denote the method used for compatible type conversions?	TypeCov()	Type()	CTyp()
Which of the following does not denote a data type in VB.Net?	Boolean	Float	Decimal
The fornat used for Date is ---------	{0:D}	{0:T}	{0:DD}
The fornat used for Time is ---------	{0:D}	{0:T}	{0:TT}
_____ is an alternative to If…Then….Else.	select…case	case…select	select
Do Loop While Statement executes a set of statements and checks the condition, this is repeated until the condition is true. .It is also known as ____	Exit control	Entry control	control
_____ is the value range of integer	-32767 to 32768	-32768 to 32767	32767 to -32768

_____ are used for storing values temporarily.	character	constant	variable
_____ is the value range of byte	0 to 255	1 to 255	0 to 266
The _____ statement first executex the statemetn and then test the condition after each execution	do….while	while….do	select….case
_____ structure executes the statements until the condition is satisfied	do…loop	do..loop until	do while…loop
do…loop until is --------- loop	finite	infinite	long
_____ function retrives only date	for…next	next…for	exit for
A _____ loop can be terminated by an exit for statement	for…next	next…for	exit for
do….while loop is terminated using _____ statement	exit for	for exit	exit do
A sequence of variables by the same name can be referred using _____	arrays	modules	sub-routines
_____operator in VB is used for string concatenation	&	*	+
_____is the container for all the controls that make up the user interface.	Form	form window	tool window
The forms that constitute the visible interface of your application are called_____	forms	Windows forms	Form window
Which helps the user are not sure of the number of arguments passed as a parameter while declaring a function or sub procedure	Named Arrays	Param Arrays	Unknown arrays
The default value of FormBorderStyle property is	FixedSingle	FixedToolWindow	Sizable
This property is used to change/display the titile of the form	Name	Text	Title
Which of the following statement should be used to return the control from the middle of a subroutine?	Exit	Exit Subroutine	Exit Sub

How many values is a subroutine capable of returning?	0	1	Any number of values

ATION

21

18)

501)

opt4	answer
Apple compters	Microsoft
Monolithic	Object Oriented
Interface Design Environment	Integrated Development Environment
Files	Components
Project	Project
Project	File
methods	properties
Binding	Name
Controls	Controls
physical controls	invisible-at-runtime-controls
Closed	Docked
Closed	Docked
Output	Solution Explorer

Code Window	Properties window
ToolBar Window	output window
DropHelp	IntelliSense
Property window	Task window
constants	Variable
Dim as	Dim
is	as
&	&
String	Boolean
False	Else
Decimal	Decimal
DateTime.Current	DateTime.Now
Next	End For
Exit Do	Exit Do

Compare()	Copy()
Remove	Remove
System.Array	System.String
notable	immutable
Format()	Insert()
Option All	Option Explicit
Add method	Add method
Ref	ByVal
~	~
CType()	CType()
Byte	Float
{0:Dy}	{0:D}
{0:TTY}	{0:T}
Case	select…case
loopback	Exit control
32768 to -32767	-32768 to 32767

module	variable
1 to 266	0 to 255
while	do….while
if….else	do..loop until
small	infinite
exit do	for…next
for exit	for…next
do exit	exit do
functions	arrays
|	&
Code Window	Form
Parent Form	Windows forms
Arrays	Param Arrays
SizableToolWindow	Sizable
Form	Name
All the above	Exit Sub

Asmany argments it use	0

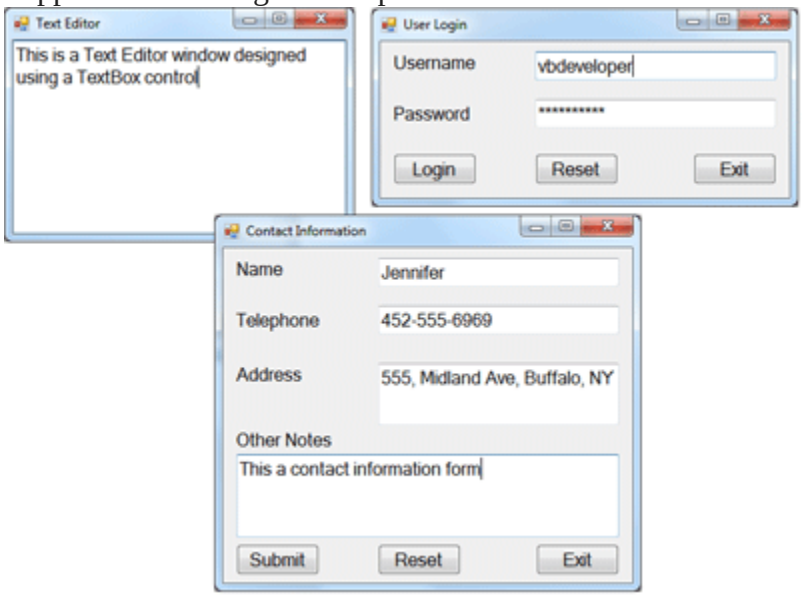
UNIT-II
SYLLABUS

Basic Windows Controls: Textbox Control- ListBox, CheckedListBox-Scrollbar and TrackBar Controls. More Windows Control: The common Dialog Controls-The Rich TextBox Control.The TreeView and ListView Controls -Designing Menus. Multiple Document Interface

Basic Windows Controls

The TextBox Control

The TextBox control is the primary mechanism for displaying and entering text. It is a small text editor that provides all the basic text-editing facilities: inserting and selecting text, scrolling if the text doesn't fit in the control's area, and even exchanging text with other applications through the Clipboard.



TextBox Examples

Basic Properties of the TextBox Control

Let's start with the properties that specify the appearance and, to some degree, the functionality of the TextBox control; these properties are usually set at design time through the Propertieswindow.

TextAlign

This property sets (or returns) the alignment of the text on the control, and its value is a member of the HorizontalAlignment enumeration: Left, Right, or Center.

MultiLine

This property determines whether the TextBox control will hold a single line or multiple lines of text. Every time you place a TextBox control on your form, it's sized for

a single line of text and you can change its width only. To change this behavior, set the MultiLine property to True. When creating multiline TextBoxes, you will most likely have to set one or more of the MaxLength, ScrollBars, and WordWrap properties in the Properties window.

MaxLength

This property determines the number of characters that the TextBox control will accept. Its default value is 32,767, which was the maximum number of characters the VB 6 version of the control could hold. Set this property to zero, so that the text can have any length, up to the control's capacity limit — 2,147,483,647 characters, to be exact.

ScrollBars

This property lets you specify the scroll bars you want to attach to the TextBox if the text exceeds the control's dimensions. Single-line text boxes can't have a scroll bar attached, even if the text exceeds the width of the control. Multiline text boxes can have a horizontal or a vertical scroll bar, or both.

WordWrap

This property determines whether the text is wrapped automatically when it reaches the right edge of the control. The default value of this property is True. If the control has a horizontal scroll bar, however, you can enter very long lines of text.

AcceptsReturn, AcceptsTab

These two properties specify how the TextBox control reacts to the Return (Enter) and Tab keys. The Enter key activates the default button on the form, if there is one. The default button is usually an OK button that can be activated with the Enter key, even if it doesn't have the focus.

The default value of the AcceptsReturn property is True, so pressing Enter creates a new line on the control. If you set it to False, users can still create new lines in the TextBox control, but they'll have to press Ctrl+Enter.

Likewise, the AcceptsTab property determines how the control reacts to the Tab key.Normally, the Tab key takes you to the next control in the Tab order, and we generally avoid changing the default setting of the AcceptsTab property.

CharacterCasing

This property tells the control to change the casing of the characters as they're entered by the user. Its default value is Normal, and characters are displayed as typed. You can set it to Upper or Lower to convert the characters to upper- or lowercase automatically.

PasswordChar

This property turns the characters typed into any character you specify. If you don't want to display the actual characters typed by the user (when entering a password, for instance), use this property to define the character to appear in place of each character the user types.

The default value of this property is an empty string, which tells the control to display the characters as entered. If you set this value to an asterisk (*), for example, the user sees an asterisk in the place of every character typed. This property doesn't affect the control's Text property, which contains the actual characters. If the **PasswordChar property of the TextBox control** is set to any character, the user can't copy or cut the text on the control.

ReadOnly, Locked

If you want to display text on a TextBox control but prevent users from editing it (such as for an agreement or a contract they must read, software installation instructions, and so on), you can set the ReadOnly property to True.When ReadOnly is set to True, you can put text on the control from within your code, and users can view it, yet they can't edit it.

Text-Manipulation Properties

Most of the properties for manipulating text in a TextBox control are available at runtime only. This section presents a breakdown of each property.

Text

The most important property of the TextBox control is the Text property, which holds the control's text. You can set this property at design time to display some text on the control initially. Notice that there are two methods of setting the Text property at design time. For single-line TextBox controls, set the Text property to a short string, as usual. For multiline TextBox controls, open the Lines property and enter the text in the String Collection Editor window, which will appear.

```
Dim strLen As Integer = TextBox1.Text.Length
```

The IndexOf method of the String class will locate a specific string in the control's text. The following statement returns the location of the first occurrence of the string Visual in the text:

```
Dim location As Integer
location = TextBox1.Text.IndexOf("Visual")
```

Formore information on locating strings in a TextBox control, see the section "VB 2008 The TextPad Project" later in this chapter, where we'll build a text editor with search-and-replace capabilities. For a detailed discussion of the String class, see Chapter, "Handling Strings, Characters, and Dates."

To store the control's contents in a file, use a statement such as the following:

```
StrWriter.Write(TextBox1.Text)
```

Similarly, you can read the contents of a text file into a TextBox control by using a statement such as the following:

```
TextBox1.Text = StrReader.ReadToEnd
```

Listing 6.1: Locating All Instances of a String in a TextBox

```
Dim startIndex = -1
startIndex = TextBox1.Text.IndexOf("Basic", startIndex + 1)
While startIndex > 0
Console.WriteLine "String found at " & startIndex
startIndex = TextBox1.Text.IndexOf("Basic", startIndex + 1)
End While
```

The following statement appends a string to the existing text on the control:

```
TextBox1.Text = TextBox1.Text & newString
```

To append a string to a TextBox control, use the following statement:

```
TextBox1.AppendText(newString)
TextBox1.AppendText(newString & vbCrLf)
```

Lines

In addition to the Text property, you can access the text on the control by using the Lines property. The Lines property is a string array, and each element holds a paragraph of text. The first paragraph is stored in the element Lines(0), the second paragraph in the element Lines(1), and so on. You can iterate through the text lines with a loop such as the following:

```
Dim iLine As Integer
For iLine = 0 To TextBox1.Lines.GetUpperBound(0) - 1
{ process string TextBox1.Lines(iLine) }
Next
```

READONLY, LOCKED

If you want to display text on a TextBox control but prevent users from editing it (an agreement or a contract they must read, software installation instructions, and so on), you can set the ReadOnly property to True. When ReadOnly is set to True, you can put text on the control from within your code, and users can view it, yet they can't edit it

PASSWORDCHAR

Available at design time, this property turns the characters typed into any character you specify. If you don't want to display the actual characters typed by the user (when entering a password, for instance), use this property to define the character to appear in place of each character the user types.

The default value of this property is an empty string, which tells the control to display the characters as entered. If you set this value to an asterisk (*), for example, the user sees an asterisk in the place of every character typed.

Text-Selection Properties

The TextBox control provides three properties for manipulating the text selected by the user: SelectedText, SelectionStart, and SelectionLength. Users can select a range of text with a click-and-drag operation, and the selected text will appear in reverse color. You can access the selected text from within your code through the SelectedText property, and its location in the control's text through the SelectionStart and SelectionLength properties.

SelectedText

This property returns the selected text, enabling you to manipulate the current selection from within your code. For example, you can replace the selection by assigning a new value to the SelectedText property. To convert the selected text to uppercase, use the ToUpper method of the String class:

```
TextBox1.SelectedText = TextBox1.SelectedText.ToUpper
```

SelectionStart, SelectionLength

Use these two properties to read the text selected by the user on the control, or to select text from within your code. The SelectionStart property returns or sets the position of the first character of the selected text, somewhat like placing the cursor at a specific

location in the text and selecting text by dragging the mouse. The SelectionLength property returns or sets the length of the selected text.

```
Dim seekString As String = "Visual"
Dim strLocation As Long
strLocation = TextBox1.Text.IndexOf(seekString)
If strLocation > 0 Then
TextBox1.SelectionStart = strLocation
TextBox1.SelectionLength = seekString.Length
End If
TextBox1.ScrollToCaret()
```

HideSelection

The selected text in the TextBox does not remain highlighted when the user moves to another control or form; to change this default behavior, set the HideSelection property to False. Use this property to keep the selected text highlighted, even if another form or a dialog box, such as a Find & Replace dialog box, has the focus. Its default value is True, which means that the text doesn't remain highlighted when the TextBox loses the focus.

Locating the Cursor Position in the Control

The SelectionStart and SelectionLength properties always have a value even if no text is selected on the control. In this case, SelectionLength is 0, and SelectionStart is the current position of the pointer in the text. If you want to insert some text at the pointer's location, simply assign it to the SelectedText property, even if no text is selected on the control.

Text-Selection Methods

In addition to properties, the TextBox control exposes two methods for selecting text. You can select some text by using the Select method, whose syntax is shown next:

```
TextBox1.Select(start, length)
```

The Select method is equivalent to setting the SelectionStart and SelectionLength properties. To select the characters 100 through 105 on the control, call the Select method, passing the values 99 and 6 as arguments:

```
TextBox1.Select(99, 6)
TextBox1.Select(3, 4)
```

If you insert a line break every third character and the text becomes the following, the same statement will select the characters DE only:

```
ABC
DEF
GHI
```

In reality, it has also selected the two characters that separate the first two lines, but special characters aren’t displayed and can’t be highlighted. The length of the selection, however, is 4. A variation of the Select method is the SelectAll method, which selects all the text on the control.

Undoing Edits - CanUndo property

An interesting feature of the TextBox control is that it can automatically undo the most recent edit operation. To undo an operation from within your code, you must first

examine the value of the CanUndo property. If it's True, the control can undo the operation; then you can call the Undo method to undo the most recent edit.

The ListBox, CheckedBox, and ComboBox Controls

The ListBox, CheckedListBox, and ComboBox controls present lists of choices, from which the user can select one or more. The ListBox control occupies a user-specified amount of space on the form and is populated with a list of items. If the list of items is longer than can fit on the control, a vertical scroll bar appears automatically.

The CheckedListBox control is a variation of the ListBox control. It's identical to the ListBox control, but a check box appears in front of each item. The user can select any number of items by selecting the check boxes in front of them. As you know, you can also select multiple items from a ListBox control by pressing the Shift and Ctrl keys.

The ComboBox control also contains multiple items but typically occupies less space on the screen. The ComboBox control is an expandable ListBox control: The user can expand it to make a selection, and collapse it after the selection is made. The real advantage of the ComboBox control, however, is that the user can enter new information in the ComboBox, rather than being forced to select from the items listed.

Basic Properties The ListBox, CheckedListBox, and ComboBox Controls

In this section, you'll find the properties that determine the functionality of the three controls. These properties are usually set at design time, but you can change their setting from within your application's code.

IntegralHeight

This property is a Boolean value (True/False) that indicates whether the control's height will be adjusted to avoid the partial display of the last item. When set to True, the control's actual height changes in multiples of the height of a single line, so only an integer number of rows are displayed at all times.

Items

The Items property is a collection that holds the control's items. At design time, you can populate this list through the String Collection Editor window. At runtime, you can access and manipulate the items through the methods and properties of the Items collection, which are described shortly.

MultiColumn

A ListBox control can display its items in multiple columns if you set its MultiColumn property to True. The problem with multicolumn ListBoxes is that you can't specify the column in which each item will appear. ListBoxes with many items and their MultiColumn property set to True expand horizontally, not vertically. A horizontal scroll bar will be attached to a multicolumn ListBox, so that users can bring any column into view. This property does not apply to the ComboBox control.

SelectionMode

This property, which applies to the ListBox and CheckedListBox controls only, determines how the user can select the list's items. The possible values of this property—members of the SelectionMode enumeration— are shown in Table 4.3.

Table 4.3 - The SelectionMode Enumeration

Value	Description

None	No selection at all is allowed.
One	(Default) Only a single item can be selected.
MultiSimple	Simple multiple selection: A mouse click (or pressing the spacebar) selects or deselects an item in the list. You must click all the items you want to select.
MultiExtended	Extended multiple selection: Press Shift and click the mouse (or press one of the arrow keys) to expand the selection. This process highlights all the items between the previously selected item and the current selection. Press Ctrl and click the mouse to select or deselect single items in the list.

Sorted

When this property is True, the items remain sorted at all times. The default is False, because it takes longer to insert new items in their proper location. This property's value can be set at design time as well as runtime.

Text

The Text property returns the selected text on the control. Although you can set the Text property for the ComboBox control at design time, this property is available only at runtime for the other two controls. Notice that the items need not be strings.

The Items Collection

To manipulate a ListBox control from within your application, you should be able to do the following:

- Add items to the list
- Remove items from the list
- Access individual items in the list

If you add a Color object and a Rectangle object to the Items collection with the following statements:

```
ListBox1.Items.Add(New Font("Verdana", 12, FontStyle.Bold)
ListBox1.Items.Add(New Rectangle(0, 0, 100, 100))
```

then the following strings appear on the first two lines of the control:

```
[Font: Name=Verdana, Size=12, Units=3, GdiCharSet=1, gdiVerticalFont=False]
{X=0, Y=0, Width=100, Height=100}
```

However, you can access the members of the two objects because the ListBox stores objects, not their descriptions.

```
Debug.WriteLine(ListBox1.Items.Item(1).Width)
100
If ListBox1.Items.Item(0).GetType Is GetType(Rectangle) Then
Debug.WriteLine(CType(ListBox1.Items.Item(0), Rectangle).Width)
End If
```

The Add Method

To add items to the list, use the Items.Add or Items.Insert method. The syntax of the Add method is as follows:

```
ListBox1.Items.Add(item)
```

The following loop adds the elements of the array words to a ListBox control, one at a time:

```
Dim words(100) As String
{ statements to populate array }
Dim i As Integer
For i = 0 To 99
ListBox1.Items.Add(words(i))
Next
```

Similarly, you can iterate through all the items on the control by using a loop such as the following:

```
Dim i As Integer
For i = 0 To ListBox1.Items.Count - 1
{ statements to process item ListBox1.Items(i) }
Next
```

You can also use the For Each . . . Next statement to iterate through the Items collection, as shown here:

```
Dim itm As Object
For Each itm In ListBox1.Items
{ process the current item, represented by the itm variable }
Next
```

The Insert Method

To insert an item at a specific location, use the Insert method, whose syntax is as follows:

```
ListBox1.Items.Insert(index, item)
```

The Clear Method

The Clear method removes all the items from the control. Its syntax is quite simple:

```
List1.Items.Clear
```

The Count Property

This is the number of items in the list. If you want to access all the items with a For . . . Next loop, the loop's counter must go from 0 to ListBox.Items.Count - 1, as shown in the example of the Add method.

The CopyTo Method

The CopyTo method of the Items collection retrieves all the items from a ListBox control and stores them in the array passed to the method as an argument. The syntax of the CopyTo method is

```
ListBox.CopyTo(destination, index)
```

The Remove and RemoveAt Method

To remove an item from the list, you must first find its position (index) in the list, and all the Remove method passing the position as argument:

```
ListBox1.Items.Remove(index)
```

The index parameter is the order of the item to be removed, and this time it’s not optional. The following statement removes the item at the top of the list:

```
ListBox1.Remove(0)
```

If the control contains strings, pass the string to be removed. If the same string appears multiple times on the control, only the first instance will be removed. If the control contains object, pass a variable that references the item you want to remove.
You can also remove an item by specifying its position (reference) in the list via the RemoveAt method, which accepts as argument the position of the item to be removed:

```
ListBox1.Items.RemoveAt(index)
```

The index parameter is the order of the item to be removed, and the first item's order is 0.

The Contains Method

The Contains method of the Items collection — not to be confused with the control's Contains method — accepts an object as an argument and returns a True/False value that indicates whether the collection contains this object. Use the Contains method to avoid the insertion of identical objects into the ListBox control. The following statements add a string to the Items collection, only if the string isn't already part of the collection:

```
Dim itm As String = "Remote Computing"
If Not ListBox1.Items.Contains(itm) Then
ListBox1.Items.Add(itm)
End If
```

Searching

Two of the most useful methods of the ListBox control are the**FindString** and **FindStringExact** methods, which allow you to quickly locate any item in the list. The **FindString** method locates a string that partially matches the one you're searching for;**FindStringExact** finds an exact match. If you're searching for Man, and the control contains a name such as Mansfield, **FindString**matches the item, but **FindStringExact** does not.
Both the FindString and FindStringExact methods perform case-insensitive searches. If you're searching for visual, and the list contains the item Visual, both methods will locate it. Their syntax is the same:

```
itemIndex = ListBox1.FindString(searchStr As String)
```

where searchStr is the string you're searching for. An alternative form of both methods allows you to specify the order of the item at which the search will begin:

```
itemIndex = ListBox1.FindString(searchStr As String, startIndex As Integer)
```

The startIndex argument allows you to specify the beginning of the search, but you can't specify where the search will end.

The ComboBox Control

The ComboBox control is similar to the ListBox control in the sense that it contains multiple items and the user may select one, but it typically occupies less space onscreen. The ComboBox is practically an expandable ListBox control, which can grow when the user wants to make a selection and retract after the selection is made. Normally, the ComboBox control displays one line with the selected item, as this control doesn't allow multiple item selection. The essential difference, however, between ComboBox and ListBox controls is that the ComboBox allows the user to specify items that don't exist in the list.

Table 4.4 - Styles of the ComboBox Control

Value	Effect
DropDown	(Default) The control is made up of a drop-down list, which is visible at all times, and a text box. The user can select an item from the list or type a new one in the text box.
DropDownList	This style is a drop-down list from which the user can select one of its items but can't enter a new one. The control displays a single item, and the list is expanded as needed.
Simple	The control includes a text box and a list that doesn't drop down. The user can select from the list or type in the text box.

The DropDown and Simple ComboBox controls allow the user to select an item from the list or enter a new one in the edit box of the control. Moreover, they're collapsed by default and they display a single item, unless the user expands the list of items to make a selection. The DropDownList ComboBox is similar to a ListBox control in the sense that it restricts the user to selecting an item (the user cannot enter a new one).

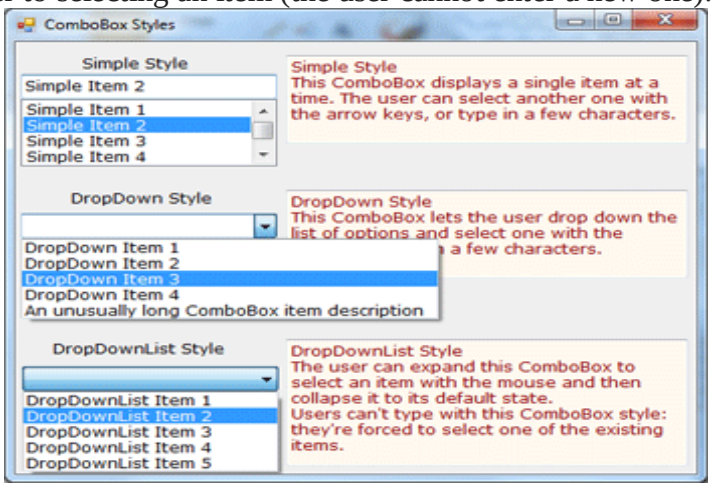


Figure 4.6 - VB.NET ComboBox control's Simple style, DropDown style and DropDownList style.

Adding Items to the ComboBox Control

Although the ComboBox control allows users to enter text in the control's edit box, it doesn't provide a simple mechanism for adding new items at runtime. Let's say you provide a ComboBox with city names. Users can type the first few characters and quickly locate the desired item.

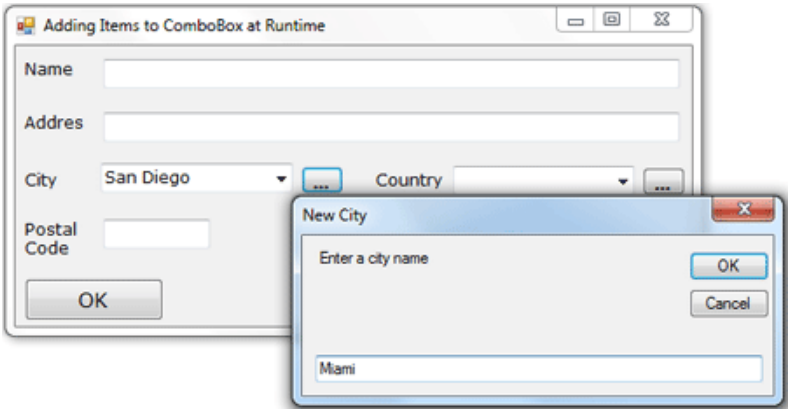


Figure 4.7 - Adding items to ComboBox control at runtime - VB.NET

The ScrollBar and TrackBar Controls

The ScrollBar and TrackBar controls let the user specify a magnitude by scrolling a selector between its minimum and maximum values. In some situations, the user doesn't know in advance the exact value of the quantity to specify (in which case, a text box would suffice), so your application must provide a more-flexible mechanism for specifying a value, along with some type of visual feedback.

The vertical scroll bar that lets a user move up and down a long document is a typical example of the use of the ScrollBar control. The scroll bar and visual feedback are the prime mechanisms for repositioning the view in a long document or in a large picture thatwon't fit entirely in its window.

The TrackBar control is similar to the ScrollBar control, but it doesn't cover a continuous range of values. The TrackBar control has a fixed number of tick marks, which the developer can label. Users can place the slider's indicator to he desired value.Whereas the ScrollBar control relies on some visual feedback outside the control to help the user position the indicator to the desired value, the TrackBar control forces the user to select from a range of valid values.

The ScrollBar Control

There's no ScrollBar control per se in the Toolbox; instead, there are two versions of it: the HScroll-Bar and VScrollBar controls. They differ only in their orientation, but because they share the same members, I will refer to both controls collectively as ScrollBar controls. Actually, both controls inherit from the ScrollBar control, which is an abstract control: It can be used to implement vertical and horizontal scroll bars, but it can't be used directly on a form. Moreover, the HScrollBar and VScrollBar controls are not displayed in the Common Controls tab of the Toolbox. You have to open the All Windows Forms tab to locate these two controls.

Minimum - The control's minimum value. The default value is 0, but because this is an Integer value, you can set it to negative values as well.

Maximum - The control's maximum value. The default value is 100, but you can set it to any value that you can represent with the Integer data type.

Value - The control's current value, specified by the indicator's position.

The ScrollBar Control's Events

The user can change the ScrollBar control's value in three ways: by clicking the two arrows at its ends, by clicking the area between the indicator and the arrows, and by

dragging the indicator with the mouse. You can monitor the changes of the ScrollBar's value from within your code by using two events: ValueChanged and Scroll. Both events are fired every time the indicator's position is changed. If you change the control's value from within your code, only the ValueChanged event will be fired.

The Scroll event can be fired in response to many different actions, such as the scrolling of the indicator with the mouse, a click on one of the two buttons at the ends of the scroll bars, and so on. If you want to know the action that caused this event, you can examine the Type property of the second argument of the event handler. The settings of the e.Type property are members of the ScrollEventType enumeration (LargeDecrement, SmallIncrement, Track, and so on).

The TrackBar Control

The TrackBar control is similar to the ScrollBar control, but it lacks the granularity of ScrollBar. Suppose that you want the user of an application to supply a value in a specific range, such as the speed of a moving object. Moreover, you don't want to allow extreme precision; you need only a few settings, as shown in the examples in this page. The user can set the control's value by sliding the indicator or by clicking on either side of the indicator.

Granularity is how specific youwant to be inmeasuring. Inmeasuring distances between towns, a granularity of amile is quite adequate. In measuring (or specifying) the dimensions of a building, the granularity could be on the order of a foot or an inch. The TrackBar control lets you set the type of granularity that's necessary for your application.

Similar to the ScrollBar control, SmallChange and LargeChange properties are available. SmallChange is the smallest increment by which the Slider value can change. The user can change the slider by the SmallChange value only by sliding the indicator. (Unlike the ScrollBar control, there are no arrows at the two ends of the Slider control.) To change the Slider's value by LargeChange, the user can click on either side of the indicator.

Common Dialog Controls

The common dialog controls are invisible at runtime, and they're not placed on your forms, because they're implemented as modal dialog boxes and they're displayed as needed. You simply add them to the project by double-clicking their icons in the Toolbox; a new icon appears in the components tray of the form, just below the Form Designer. The common dialog controls in the Toolbox are the following:

- **OpenFileDialog** - Lets users select a file to open. It also allows the selection of multiple files for applications that must process many files at once.
- **SaveFileDialog** - Lets users select or specify the path of a file in which the current document will be saved.
- **ColorDialog** - Lets users select a color from a list of predefined colors or specify custom colors. FontDialog Lets users select a typeface and style to be applied to the current text selection. The Font dialog box has an Apply button, which you can intercept from within your code and use to apply the currently selected font to the text without closing the dialog box.

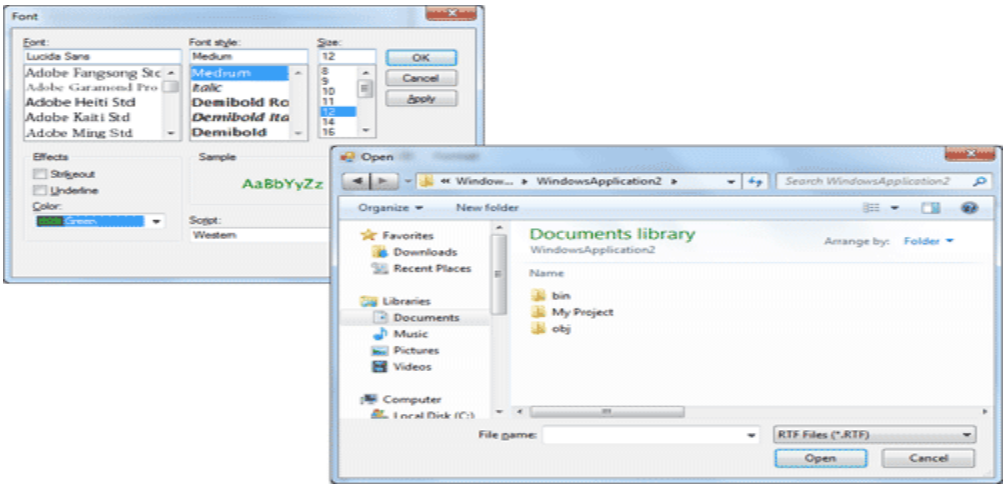


Figure 4.10 - Common Font and Open dialog controls

There are three more common dialog controls: the PrintDialog, PrintPreviewDialog, and PageSetupDialog controls. These controls are discussed in detail in Chapter, "Printing with Visual Basic 2008," in the context of VB's printing capabilities.

Using the Common Dialog Controls

To display any of the common dialog boxes from within your application, you must first add an instance of the appropriate control to your project. Then you must set some basic properties of the control through the Properties window. Most applications set the control's properties from within the code because common dialogs interact closely with the application. When you call the Color common dialog, for example, you should preselect a color from within your application and make it the default selection on the control. When prompting the user for the color of the text, the default selection should be the current setting of the control's ForeColor property. Likewise, the Save dialog box must suggest a filename when it first pops up (or the file's extension, at least).

Here is the sequence of statements used to invoke the Open common dialog and retrieve the selected filename:

```
If OpenFileDialog1.ShowDialog = Windows.Forms.DialogResult.OK Then
fileName = OpenFileDialog1.FileName
' Statements to open the selected file
End If
```

The ShowDialog method returns a value indicating how the dialog box was closed. You should read this value from within your code and ignore the settings of the dialog box if the operation was cancelled.

The variable fileName in the preceding code segment is the full pathname of the file selected by the user. You can also set the FileName property to a filename, which will be displayed when the Open dialog box is first opened:

```
OpenFileDialog1.FileName = "C:\WorkFiles\Documents\Document1.doc"
If OpenFileDialog1.ShowDialog = Windows.Forms.DialogResult.OK Then
fileName = OpenFileDialog1.FileName
```

```
' Statements to open the selected file
End If
```

Similarly, you can invoke the Color dialog box and read the value of the selected color by using the following statements:

```
ColorDialog1.Color = TextBox1.BackColor
If ColorDialog1.ShowDialog = DialogResult.OK Then
TextBox1.BackColor = ColorDialog1.Color
End If
```

The ShowDialog method is common to all controls. The Title property is also common to all controls and it's the string displayed in the title bar of the dialog box. The default title is the name of the dialog box (for example, Open, Color, and so on), but you can adjust it from within your code with a statement such as the following:

```
ColorDialog1.Title = "Select Drawing Color"
```

Color Dialog Box Control

The Color dialog box, shown in Figure 4.11, is one of the simplest dialog boxes. Its Color property returns the color selected by the user or sets the initially selected color when the user opens the dialog box.

The following statements set the initial color of the ColorDialog control, display the dialog box, and then use the color selected in the control to fill the form. First, place a ColorDialog control in the form and then insert the following statements in a button's Click event handler:

```
Private Sub Button1 Click(...) Handles Button1.Click
ColorDialog1.Color = Me.BackColor
If ColorDialog1.ShowDialog =
Windows.Forms.DialogResult.OK Then
Me.BackColor = ColorDialog1.Color
End If
End Sub
```

The following sections discuss the basic properties of the ColorDialog control.

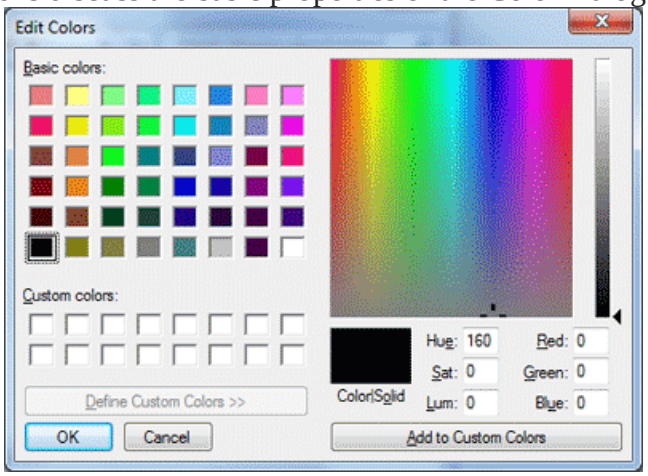


Figure 4.11 - The Color Dialog Box

AllowFullOpen

Set this property to True if you want users to be able to open the dialog box and define their own custom colors, like the one shown in Figure 8.2. The AllowFullOpen property

doesn't open the custom section of the dialog box; it simply enables the Define Custom Colors button in the dialog box. Otherwise, this button is disabled.

AnyColor

This property is a Boolean value that determines whether the dialog box displays all available colors in the set of basic colors.

Color

This is the color specified on the control. You can set it to a color value before showing the dialog box to suggest a reasonable selection. On return, read the value of the same property to find out which color was picked by the user in the control:

```
ColorDialog1.Color = Me.BackColor
If ColorDialog1.ShowDialog = DialogResult.OK Then
Me.BackColor = ColorDialog1.Color
End If
```

CustomColors

This property indicates the set of custom colors that will be shown in the dialog box. The Color dialog box has a section called Custom Colors, in which you can display 16 additional custom colors. The CustomColors property is an array of integers that represent colors. To display three custom colors in the lower section of the Color dialog box, use a statement such as the following:

```
Dim colors() As Integer = {222663, 35453, 7888}
ColorDialog1.CustomColors = colors
```

You'd expect that the CustomColors property would be an array of Color values, but it's not. You can't create the array CustomColors with a statement such as this one:

```
Dim colors() As Color = {Color.Azure, Color.Navy, Color.Teal}
```

Because it's awkward to work with numeric values, you should convert color values to integer values by using a statement such as the following:

```
Color.Navy.ToArgb
```

The preceding statement returns an integer value that represents the color navy. This value, however, is negative because the first byte in the color value represents the transparency of the color. To get the value of the color, you must take the absolute value of the integer value returned by the previous expression. To create an array of integers that represent color values, use a statement such as the following:

```
Dim colors() As Integer = {Math.Abs(Color.Gray.ToArgb),
Math.Abs(Color.Navy.ToArgb), Math.Abs(Color.Teal.ToArgb)}
```

Now you can assign the colors array to the CustomColors property of the control, and the colors will appear in the Custom Colors section of the Color dialog box.

SolidColorOnly

This indicates whether the dialog box will restrict users to selecting solid colors only. This setting should be used with systems that can display only 256 colors. Although today few systems can't display more than 256 colors, some interfaces are limited to this number. When you run an application through Remote Desktop, for example, only the solid colors are displayed correctly on the remote screen, regardless of the remote computer's graphics card (and that's for efficiency reasons).

Font Dialog Box Control

The Font dialog box, shown in Figure 4.12, lets the user review and select a font and then set its size and style. Optionally, users can also select the font's color and even

apply the current settings to the selected text on a control of the form without closing the dialog box, by clicking the Apply button.

```
FontDialog1.Font = TextBox1.Font
If FontDialog1.ShowDialog = DialogResult.OK Then
TextBox1.Font = FontDialog1.Font
End If
```

Use the following properties to customize the Font dialog box before displaying it.

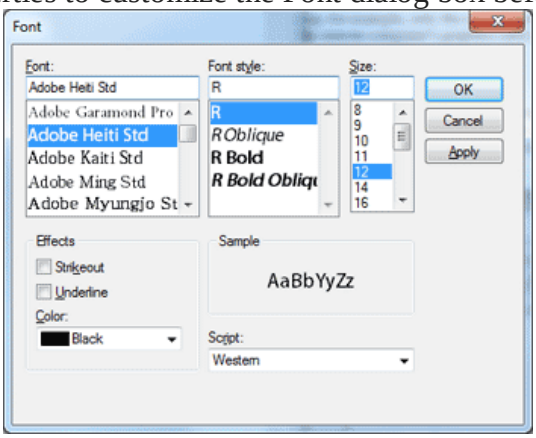


Figure 4.12 - The Font Dialog Control

AllowScriptChange

This property is a Boolean value that indicates whether the Script combo box will be displayed in the Font dialog box. This combo box allows the user to change the current character set and select a non-Western language (such as Greek, Hebrew, Cyrillic, and so on).

AllowVerticalFonts

This property is a Boolean value that indicates whether the dialog box allows the display and selection of both vertical and horizontal fonts. Its default value is False, which displays only horizontal fonts.

Color, ShowColor

The Color property sets or returns the selected font color. To enable users to select a color for the font, you must also set the ShowColor property to True.

FixedPitchOnly

This property is a Boolean value that indicates whether the dialog box allows only the selection of fixed-pitch fonts. Its default value is False, which means that all fonts (fixed- and variable-pitch fonts) are displayed in the Font dialog box. Fixed-pitch fonts, or monospaced fonts, consist of characters of equal widths that are sometimes used to display columns of numeric values so that the digits are aligned vertically.

Font

This property is a Font object. You can set it to the preselected font before displaying the dialog box and assign it to a Font property upon return. You've already seen how to preselect a font and how to apply the selected font to a control from within your application.

You can also create a new Font object and assign it to the control's Font property. Upon return, the TextBox control's Font property is set to the selected font:

```
Dim newFont As Font("Verdana", 12, FontStyle.Underline)
FontDialog1.Font = newFont
If FontDialog1.ShowDialog() = DialogResult.OK Then
TextBox1.ForeColor = FontDialog1.Color
End If
```

FontMustExist

This property is a Boolean value that indicates whether the dialog box forces the selection of an existing font. If the user enters a font name that doesn't correspond to a name in the list of available fonts, a warning is displayed. Its default value is True, and there's no reason to change it.

MaxSize, MinSize

These two properties are integers that determine the minimum and maximum point size the user can specify in the Font dialog box. Use these two properties to prevent the selection of extremely large or extremely small font sizes, because these fonts might throw off a well-balanced interface (text will overflow in labels, for example).

ShowApply

This property is a Boolean value that indicates whether the dialog box provides an Apply button. Its default value is False, so the Apply button isn't normally displayed. If you set this property to True, you must also program the control's Apply event — the changes aren't applied automatically to any of the controls in the current form.

The following statements display the Font dialog box with the Apply button:

```
Private Sub Button2 Click(...) Handles Button2.Click
FontDialog1.Font = TextBox1.Font
FontDialog1.ShowApply = True
If FontDialog1.ShowDialog = DialogResult.OK Then
TextBox1.Font = FontDialog1.Font
End If
End Sub
```

The FontDialog control raises the Apply event every time the user clicks the Apply button. In this event's handler, you must read the currently selected font and use it in the form, so that users can preview the effect of their selection:

```
Private Sub FontDialog1 Apply(...) Handles FontDialog1.Apply
TextBox1.Font = FontDialog1.Font
End Sub
```

ShowEffects

This property is a Boolean value that indicates whether the dialog box allows the selection of special text effects, such as strikethrough and underline. The effects are returned to the application as attributes of the selected Font object, and you don't have to do anything special in your application.

Open Dialog Box and Save Dialog Box Controls

Open and Save As, the two most widely used common dialog boxes (see Figure 4.13), are implemented by the OpenFileDialog and SaveFileDialog controls. Nearly every application prompts users for filenames, and the .NET Framework provides two controls for this purpose. The two dialog boxes are nearly identical, and most of their properties are common, so we'll start with the properties that are common to both controls.

When either of the two controls is displayed, it rarely displays all the files in any given folder. Usually the files displayed are limited to the ones that the application recognizes so that users can easily spot the file they want. The Filter property limits the types of files that will appear in the Open or Save As dialog box.

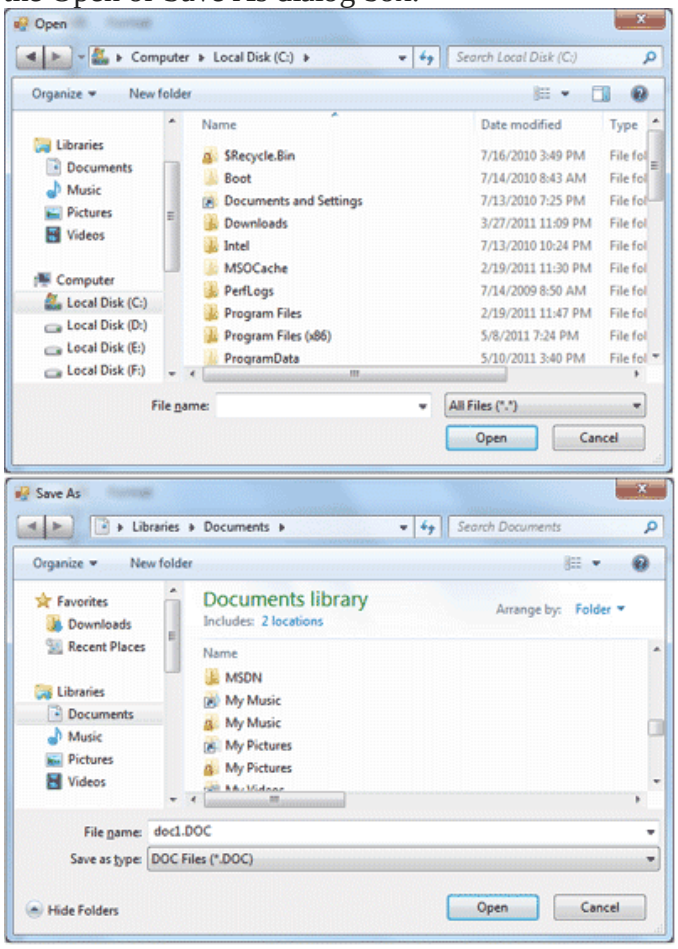


Figure 4.13 - The OpenDialog and SaveDialog controls

The extension of the default file type for the application is described by the DefaultExtension property, and the list of the file types displayed in the Save As Type box is determined by the Filter property.

To prompt the user for a file to be opened, use the following statements. The Open dialog box displays the files with the extension .bin only.

```
OpenFileDialog1.DefaultExt = ".bin"
OpenFileDialog1.AddExtension = True
OpenFileDialog1.Filter = "Binary Files|*.bin"
If OpenFileDialog1.ShowDialog() =
Windows.Forms.DialogResult.OK Then
Debug.WriteLine(OpenFileDialog1.FileName)
End If
```

The following sections describe the properties of the OpenFileDialog and SaveFileDialog controls.

AddExtension

This property is a Boolean value that determines whether the dialog box automatically adds an extension to a filename if the user omits it. The extension added automatically is the one specified by the DefaultExtension property, which you must set before calling the ShowDialog method. This is the default extension of the files recognized by your application.

CheckFileExists

This property is a Boolean value that indicates whether the dialog box displays a warning if the user enters the name of a file that does not exist in the Open dialog box, or if the user enters the name of a file that exists in the Save dialog box.

CheckPathExists

This property is a Boolean value that indicates whether the dialog box displays a warning if the user specifies a path that does not exist, as part of the user-supplied filename.

DefaultExt

This property sets the default extension for the filenames specified on the control. Use this property to specify a default filename extension, such as .txt or .doc, so that when a file with no extension is specified by the user, the default extension is automatically appended to the filename. You must also set the AddExtension property to True. The default extension property starts with the period, and it's a string — for example, .bin.

DereferenceLinks

This property indicates whether the dialog box returns the location of the file referenced by the shortcut or the location of the shortcut itself. If you attempt to select a shortcut on your desktop when the DereferenceLinks property is set to False, the dialog box will return to your application a value such as C:\WINDOWS\SYSTEM32\lnkstub.exe, which is the name of the shortcut, not the name of the file represented by the shortcut. If you set the DereferenceLinks property to True, the dialog box will return the actual filename represented by the shortcut, which you can use in your code.

FileName

Use this property to retrieve the full path of the file selected by the user in the control. If you set this property to a filename before opening the dialog box, this value will be the proposed filename. The user can click OK to select this file or select another one in the control. The two controls provide another related property, the FileNames property, which returns an array of filenames. To find out how to allow the user to select multiple files, see the discussion of the MultipleFiles and FileNames properties in ‘‘VB 2008 at Work: Multiple File Selection" at the end of this section.

Filter

This property is used to specify the type(s) of files displayed in the dialog box. To display text files only, set the Filter property to Text files|*.txt. The pipe symbol separates the description of the files (what the user sees) from the actual extension (how the operating system distinguishes the various file types).

If you want to display multiple extensions, such as .BMP, .GIF, and .JPG, use a semicolon to separate extensions with the Filter property. Set the Filter property to the string Images|*.BMP; *.GIF;*.JPG to display all the files of these three types when the user selects Images in the Save As Type combo box, under the box with the filename.

Don't include spaces before or after the pipe symbol because these spaces will be displayed on the dialog box. In the Open dialog box of an image-processing application,

you'll probably provide options for each image file type, as well as an option for all images:

```
OpenFileDialog1.Filter =
"Bitmaps|*.BMP|GIF Images|*.GIF|" &
"JPEG Images|*.JPG|All Images|*.BMP;*.GIF;*.JPG"
```

FilterIndex

When you specify more than one file type when using the Filter property of the Open dialog box, the first file type becomes the default. If you want to use a file type other than the first one, use the FilterIndex property to determine which file type will be displayed as the default when the Open dialog box is opened. The index of the first type is 1, and there's no reason to ever set this property to 1. If you use the Filter property value of the example in the preceding section and set the FilterIndex property to 2, the Open dialog box will display GIF files by default.

InitialDirectory

This property sets the initial folder whose files are displayed the first time that the Open and Save dialog boxes are opened. Use this property to display the files of the application's folder or to specify a folder in which the application stores its files by default. If you don't specify an initial folder, the dialog box will default to the last folder where the most recent file was opened or saved. It's also customary to set the initial folder to the application's path by using the following statement:

```
OpenFileDialog1.InitialDirectory = Application.ExecutablePath
```

The expression Application.ExecutablePath returns the path in which the application's executable file resides.

RestoreDirectory

Every time the Open and Save As dialog boxes are displayed, the current folder is the one that was selected by the user the last time the control was displayed. The RestoreDirectory property is a Boolean value that indicates whether the dialog box restores the current directory before closing. Its default value is False, which means that the initial directory is not restored automatically. The InitialDirectory property overrides the RestoreDirectory property.

The following four properties are properties of the OpenFileDialog control only: FileNames, MultiSelect, ReadOnlyChecked, and ShowReadOnly.

FileNames

If the Open dialog box allows the selection of multiple files (see the later section "VB 2008 at Work: Multiple File Selection"), the FileNames property contains the pathnames of all selected files. FileNames is a collection, and you can iterate through the filenames with an enumerator. This property should be used only with the OpenFileDialog control, even though the SaveFileDialog control exposes a FileNames property.

MultiSelect

This property is a Boolean value that indicates whether the user can select multiple files in the dialog box. Its default value is False, and users can select a single file. When the MultiSelect property is True, the user can select multiple files, but they must all come from the same folder (you can't allow the selection of multiple files from different folders). This property is unique to the OpenFileDialog control.

ReadOnlyChecked, ShowReadOnly

The ReadOnlyChecked property is a Boolean value that indicates whether the Read-Only check box is selected when the dialog box first pops up (the user can clear this box to open a file in read/write mode). You can set this property to True only if the ShowReadOnly property is also set to True. The ShowReadOnly property is also a Boolean value that indicates whether the Read-Only check box is available..

The OpenFile and SaveFile Methods

The OpenFileDialog control exposes the OpenFile method, which allows you to quickly open the selected file. Likewise, the SaveFileDialog control exposes the SaveFile method, which allows you to quickly save a document to the selected file.

OpenDialog and SaveDialog controls example: Multiple File Selection

The Open dialog box allows the selection of multiple files. This feature can come in handy when you want to process files en masse. You can let the user select many files, usually of the same type, and then process them one at a time. Or, you might want to prompt the user to select multiple files to be moved or copied.

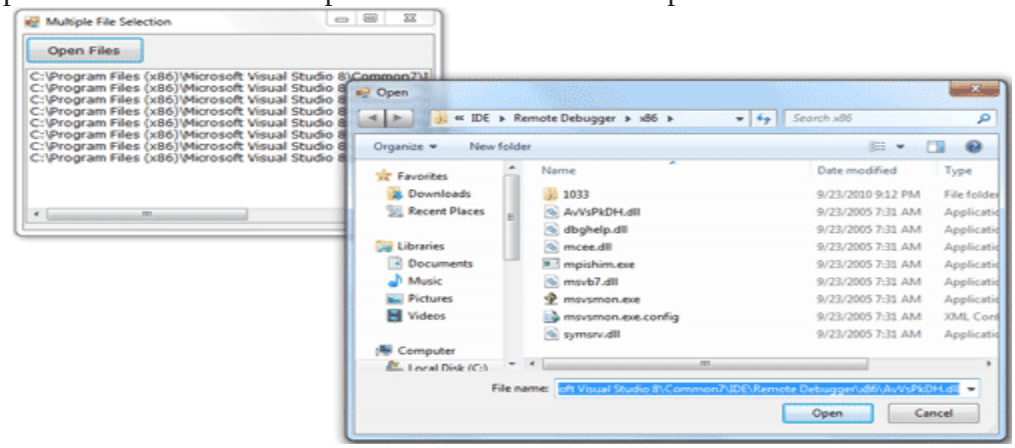


Figure 4.14 - Selecting multiple files in an open dialog box - Visual Basic

The code behind the Open Files button is shown in Listing 4.17. In this example, I used the array's enumerator to iterate through the elements of the FileNames array. You can use any of the methods discussed in the section "Arrays in Visual basic 2008" to iterate through the array.

Listing 4.17: Processing Multiple Selected Files

```
Private Sub bttnFile Click(...) Handles bttnFile.Click
OpenFileDialog1.Multiselect = True
OpenFileDialog1.ShowDialog()
Dim filesEnum As IEnumerator
ListBox1.Items.Clear()
filesEnum = OpenFileDialog1.FileNames.GetEnumerator()
While filesEnum.MoveNext
ListBox1.Items.Add(filesEnum.Current)
End While
End Sub
```

Print Dialog Box Control

A PrintDialog control is used to open the Windows Print Dialog and let user select the printer, set printer and paper properties and print a file. A typical Open File Dialog looks like Figure 1 where you select a printer from available printers, set printer properties, set

print range, number of pages and copies and so on. Clicking on OK button sends the document to the printer.

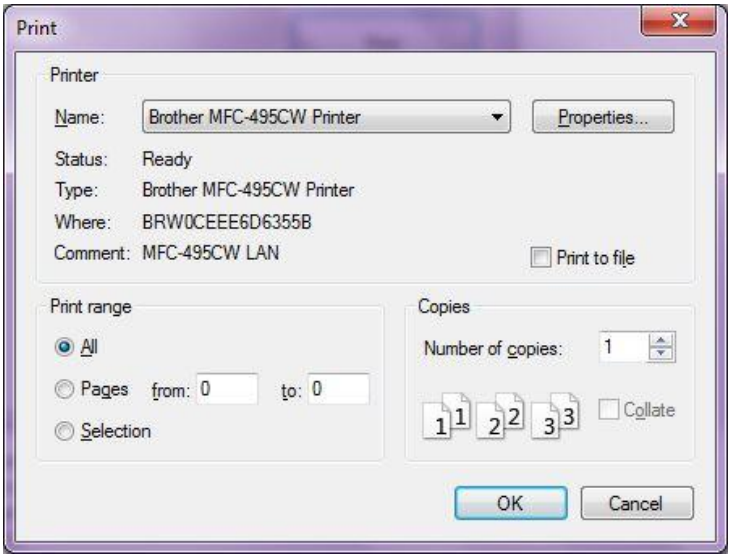


Figure 1

Creating a PrintDialog

We can create a PrintDialog at design-time as well as at run-time.

Design-time

To create a PrintDialog control at design-time, you simply drag and drop a PrintDialog control from Toolbox to a Form in Visual Studio. After you drag and drop a PrintDialog on a Form, the PrintDialog looks like Figure 2.

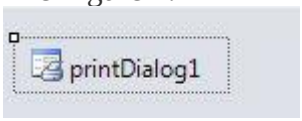


Figure 2

Run-time

Creating a PrintDialog control at run-time is simple. First step is to create an instance of PrintDialog class and then call the ShowDialog method. The following code snippet creates a PrintDialog control.

```
Dim PrintDialog1 As New PrintDialog()
PrintDialog1.ShowDialog()
```

Printing Documents

PrintDocument object represents a document to be printed. Once a PrintDocument is created, we can set the Document property of PrintDialog as this document. After that we can also set other properties. The following code snippet creates a PrintDialog and sends some text to a printer.

```
Imports System.Drawing.Printing

Public Class Form1

    Private Sub PrintButton_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles PrintButton.Click
```

```
    Dim printDlg As New PrintDialog()

    Dim printDoc As  New PrintDocument()
    printDoc.DocumentName = "Print Document"
    printDlg.Document = printDoc
    printDlg.AllowSelection = True
    printDlg.AllowSomePages = True

    If (printDlg.ShowDialog() = DialogResult.OK) Then
       printDoc.Print()
    End If

  End Sub
End Class
```

The RichTextBox Control

The **RichTextBox** control is the core of a full-blown word processor. It provides all the functionality of a TextBox control; it can handle multiple typefaces, sizes, and attributes, and offers precise control over the margins of the text (see Figure 4.16). You can even place images in your text on a RichTextBox control (although you won't have the kind of control over the embedded images that you have with Microsoft Word).

The fundamental property of the **RichTextBox** control is its Rtf property. Similar to the Text property of the TextBox control, this property is the text displayed on the control. Unlike the Text property, however, which returns (or sets) the text of the control but doesn't contain formatting information, the Rtf property returns the text along with any formatting information.

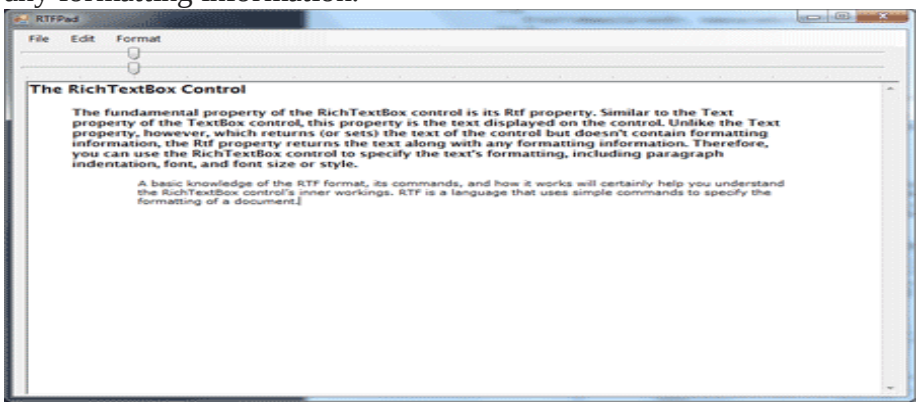


Figure 4.16 - A word processor based on the functionality of the RichTextBox control

The RTF Language

A basic knowledge of the RTF format, its commands, and how it works will certainly help you understand the RichTextBox control's inner workings. RTF is a language that uses simple commands to specify the formatting of a document. These commands, or tags, are ASCII strings, such as \par (the tag that marks the beginning of a new paragraph) and \b (the tag that turns on the bold style). And this is where the value of the RTF format lies. RTF documents don't contain special characters and can be easily

exchanged among different operating systems and computers, as long as there is an RTF-capable application to read the document. Let's look at an RTF document in action.
Open the WordPad application (choose *Start* > *Programs* > *Accessories* > *WordPad*) and enter a few lines of text (see Figure 4.17). Select a few words or sentences, and format them in different ways with any of WordPad's formatting commands. Then save the document in RTF format: Choose *File* > *Save As*, select Rich Text Format, and then save the file as Document.rtf. If you open this file with a text editor such as Notepad, you'll see the actual RTF code that produced the document. A section of the RTF file for the document shown in Figure 4.17 is shown in Listing 4.20.

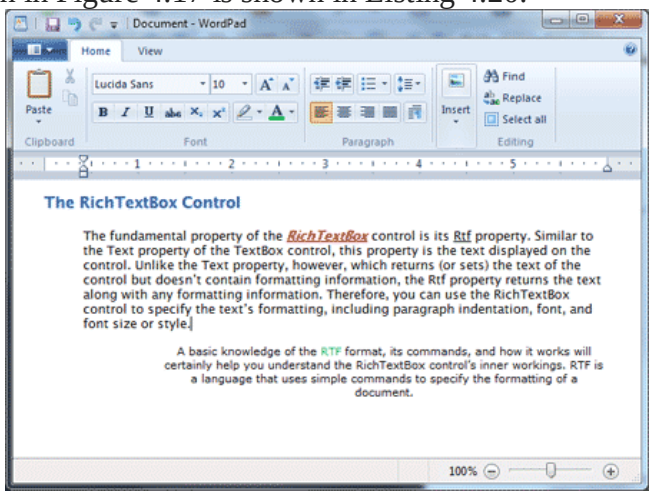


Figure 4.17 - The formatting applied to the text by using WordPad's commands is stored along with the text in RTF format.

Listing 4.20: The RTF Code for the First Paragraph of the Document in Figure 4.17

```
{\rtf1\ansi\ansicpg1252\deff0\deflang1033
{\fonttbl{\f0\fnil\fcharset0 Verdana;}{\f1\fswiss\fcharset0 Arial;}}
\viewkind4\uc1\pard\nowidctlpar\fi720 \b\f0\fs18 RTF
\b0 stands for \i Rich Text Format\i0 ,
which is a standard for storing formatting
information along with the text. The beauty
of the RichTextBox control for programmers
is that they don\rquote t need to supply the
formatting codes. The control provides simple
properties that turn the selected text into bold,
change the alignment of the current paragraph, and so on.\par
```

RTF is similar to Hypertext Markup Language (HTML), and if you're familiar with HTML, a few comparisons between the two standards will provide helpful hints and insight into the RTF language. Like HTML, RTF was designed to create formatted documents that could be displayed on different systems. The following RTF segment displays a sentence with a few words in italics:

```
\bRTF\b0 (which stands for Rich Text Format) is a \i
document formatting language\i0 that uses simple
commands to specify the formatting of the document.
```

The following is the equivalent HTML code:

RTF (which stands for Rich Text Format) is a
document formatting language that uses simple
commands to specify the formatting of the document.

The `<b>` and `<i>` tags of HTML, for example, are equivalent to the `\b` and `\i` tags of RTF. The closing tags in RTF are `\b0` and `\i0`, respectively.

The RichTextBox's Properties

The **RichTextBox** control provides properties for manipulating the selected text on the control. The names of these properties start with the Selection or Selected prefix, and the most commonly used ones are shown in Table 4.5. Some of these properties are discussed in further detail in following sections.

SelectedText

The `SelectedText` property represents the selected text, whether it was selected by the user via the mouse or from within your code. To assign the selected text to a variable, use the following statement:

selText=RichTextbox1.SelectedText

You can also modify the selected text by assigning a new value to the `SelectedText` property. The following statement converts the selected text to uppercase:

RichTextbox1.SelectedText =
RichTextbox1.SelectedText.ToUpper

You can assign any string to the `SelectedText` property. If no text is selected at the time, the statement will insert the string at the location of the pointer.

Table 4.5 - RichTextBox Properties for Manipulating Selected Text

Property	What It Manipulates
SelectedText	The selected text
SelectedRtf	The RTF code of the selected text
SelectionStart	The position of the selected text's first character
SelectionLength	The length of the selected text
SelectionFont	The font of the selected text
SelectionColor	The color of the selected text
SelectionBackColor	The background color of the selected text
SelectionAlignment	The alignment of the selected text
SelectionIndent, SelectionRightIndent, SelectionHangingIndent	The indentation of the selected text
RightMargin	The distance of the text's right margin from the left edge of the control
SelectionTabs	An array of integers that sets the tab stop positions in the control
SelectionBullet	Whether the selected text is bulleted
BulletIndent	The amount of bullet indent for the selected text

SelectionStart, SelectionLength

+

`electionLength`, report (or set) the position of the first selected character in the text and the length of the selection, respectively, regardless of the formatting of the selected text. One obvious use of these properties is to select (and highlight) some text on the control:

```
RichTextBox1.SelectionStart = 0
RichTextBox1.SelectionLength = 100
```

You can also use the `Select` method, which accepts as arguments the starting location and the length of the text to be selected.

SelectionAlignment

Use this property to read or change the alignment of one or more paragraphs. This property's value is one of the members of the `HorizontalAlignment` enumeration: Left, Right, and Center. Users don't have to select an entire paragraph to align it; just placing the pointer anywhere in the paragraph will do the trick, because you can't align part of the paragraph.

SelectionIndent, SelectionRightIndent, SelectionHangingIndent

These properties allow you to change the margins of individual paragraphs. The `SelectionIndent` property sets (or returns) the amount of the text's indentation from the left edge of the control. The `SelectionRightIndent` property sets (or returns) the amount of the text's indentation from the right edge of the control. The `SelectionHangingIndent` property indicates the indentation of each paragraph's first line with respect to the following lines of the same paragraph. All three properties are expressed in pixels.

The `SelectionHangingIndent` property includes the current setting of the `SelectionIndent` property. If all the lines of a paragraph are aligned to the left, the `SelectionIndent` property can have any value (this is the distance of all lines from the left edge of the control), but the `SelectionHangingIndent` property must be zero. If the first line of the paragraph is shorter than the following lines, the `SelectionHangingIndent` has a negative value. Figure 4.18 shows several differently formatted paragraphs. The settings of the `SelectionIndent` and `SelectionHangingIndent` properties are determined by the two sliders at the top of the form.

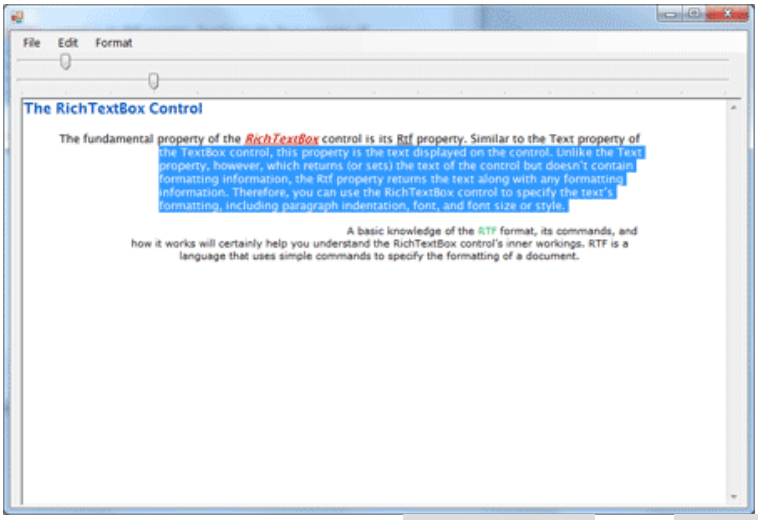


Figure 4.18 - Various combinations of the `SelectionIndent` *and* `SelectionHangingIndent` *properties produce all possible paragraph styles.*

SelectionBullet, BulletIndent

You use these properties to create a list of bulleted items. If you set the `SelectionBullet` property to True, the selected paragraphs are formatted with a bullet style, similar to the `<ul>` tag in HTML. To create a list of bulleted items, select them from within your code and assign the value True to the `SelectionBullet` property. To change a list of bulleted items back to normal text, make the same property False.

The paragraphs formatted as bullets are also indented from the left by a small amount. To set the amount of the indentation, use the `BulletIndent` property, which is also expressed in pixels.

SelectionTabs

Use this property to set the tab stops in the RichTextBox control. The Selection tab should be set to an array of integer values, which are the absolute tab positions in pixels. Use this property to set up a RichTextBox control for displaying tab-delimited data.

Methods Of the RichTextBox control

The first two methods of the RichTextBox control you need to know are `SaveFile` and `LoadFile`. The `SaveFile` method saves the contents of the control to a disk file, and the `LoadFile` method loads the control from a disk file.

SaveFile

The syntax of the SaveFile method is as follows:

RichTextBox1.SaveFile(path, filetype)

where path is the path of the file in which the current document will be saved. By default, the SaveFile method saves the document in RTF format and uses the .RTF extension. You can specify a different format by using the second optional argument, which can take on the value of one of the members of the RichTextBoxStreamType enumeration, described in Table 4.6.

Table 4.6 - The RichTextBoxStreamType Enumeration

Format	Effect
PlainText	Stores the text on the control without any formatting

RichNoOLEObjs	Stores the text without any formatting and ignores any embedded OLE objects
RichText	Stores the text in RTF format (text with embedded RTF commands)
TextTextOLEObjs	Stores the text along with the embedded OLE objects
UnicodePlainText	Stores the text in Unicode format

LoadFile

Similarly, the `LoadFile` method loads a text or RTF file to the control. Its syntax is identical to the syntax of the SaveFile method:

RichTextBox1.LoadFile(path, filetype)

The filetype argument is optional and can have one of the values of the `RichTextBoxStreamType` enumeration. Saving and loading files to and from disk files is as simple as presenting a Save or Open common dialog to the user and then calling one of the `SaveFile` or `LoadFile` methods with the filename returned by the common dialog box.

Select, SelectAll

The `Select` method selects a section of the text on the control, similar to setting the `SelectionStart` and `SelectionLength` properties. The `Select` method accepts two arguments: the location of the first character to be selected and the length of the selection:

RichTextBox1.Select(start, length)

The SelectAll method accepts no arguments and it selects all the text on the control.

Tree View and List View Controls

The TreeView control implements a data structure known as a tree. A tree is the most appropriate structure for storing hierarchical information. The organizational chart of a company, for example, is a tree structure. Every person reports to another person above him or her, all the way to the president or CEO. Figure 4.21 depicts a possible organization of continents, countries, and cities as a tree. Every city belongs to a country, and every country to a continent. In the same way, every computer file belongs to a folder that may belong to an even bigger folder, and so on up to the drive level. You can't draw large tree structures on paper, but it's possible to create a similar structure in the computer's memory without size limitations.

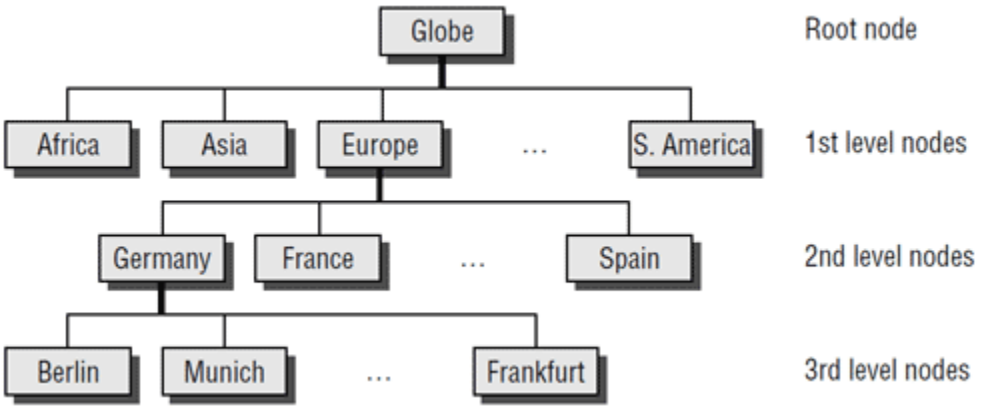


Figure 4.21 - The World View as Tree

Note: ***The items displayed on a TreeView control are just strings***. Moreover, the TreeView control doesn't require that the items be unique. You can have identically named nodes in the same branch — as unlikely as this might be for a real application. There's no property that makes a node unique in the tree structure or even in its own branch.

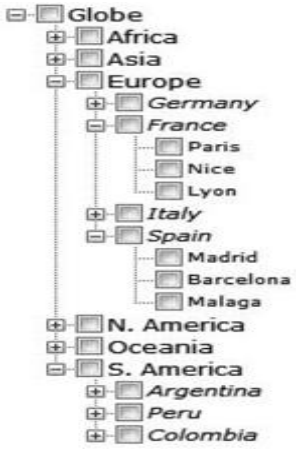


Figure 4.22 - The tree implemented with a TreeView control

The tree structure is ideal for data with parent-child relations (relations that can be described as belongs to or owns). The continents-countries-cities data is a typical example. The folder structure on a hard disk is another typical example. Any given folder is the child of another folder or the root folder.

The ListView control implements a simpler structure, known as a list. A list's items aren't structured in a hierarchy; they are all on the same level and can be traversed serially, one after the other. You can also think of the list as a multidimensional array, but the list offersmore features. A list item can have subitems and can be sorted according to any column. For example, you can set up a list of customer names (the list's items) and assign a number of subitems to each customer: a contact, an address, a phone number, and so on. Or you can set up a list of files with their attributes as subitems. Figure 4.23 shows a Windows folder mapped on a ListView control. Each file is an item, and its attributes are the subitems. As you already know, you can sort this list by filename, size, file type, and so on. All you have to do is click the header of the corresponding column.

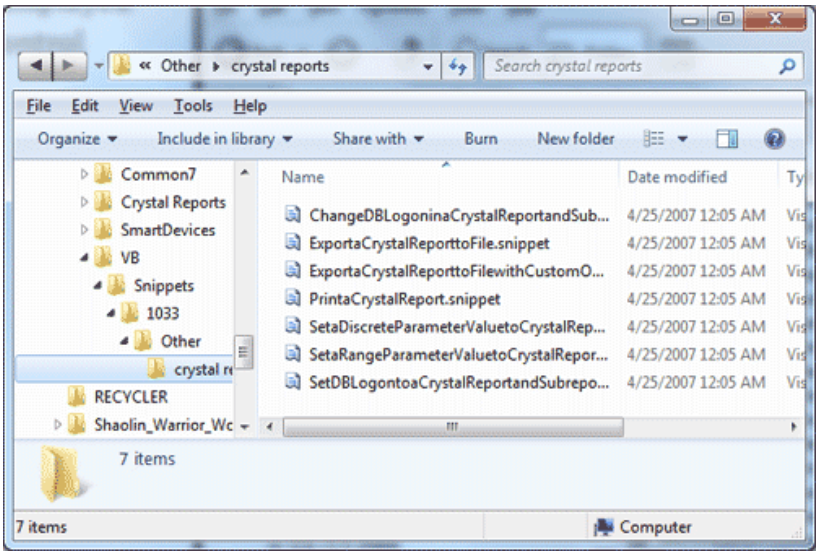


Figure 4.23 - A folder's files displayed in a ListView control (Details view)

The ListView control is a glorified ListBox control. If all you need is a control to store sorted objects, use a ListBox control. If you want more features, such as storing multiple items per row, sorting them in different ways, or locating them based on any subitem's value, you must consider the ListView control. You can also look at the ListView control as a view-only grid.

The TreeView and ListView controls are commonly used along with the ImageList control. The ImageList control is a simple control for storing images so they can be retrieved quickly and used at runtime. You populate the ImageList control with the images you want to use on your interface, usually at design time, and then you recall them by an index value at runtime. Before we get into the details of the TreeView and ListView controls, a quick overview of the ImageList control is in order.

TreeView Control

Let's start our discussion of TreeView control with a few simple properties that you can set at design time. To experiment with the properties discussed in this section, open the TreeView Example project. The project's main form is shown in Figure 4.25. After setting some properties (they are discussed next), run the project and click the Populate button to populate the control. After that, you can click the other buttons to see the effect of the various property settings on the control.

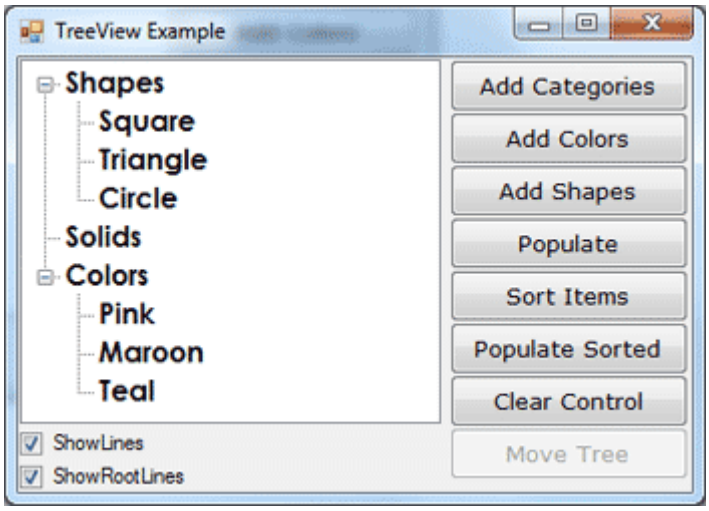


Figure 4.25 - The TreeView Example project demonstrates the basic properties and methods of the TreeView control.

Here are the basic properties that determine the appearance of the control:

- **ShowCheckBoxes -** If this property is True, a check box appears in front of each node. If the control displays check boxes, you can select multiple nodes; otherwise, you're limited to a single selection.
- **FullRowSelect** - This True/False value determines whether a node will be selected even if the user clicks outside the node's caption.
- **HideSelection** - This property determines whether the selected node will remain highlighted when the focus is moved to another control. By default, the selected node doesn't remain highlighted when the control loses the focus.
- **HotTracking** - This property is another True/False value that determines whether nodes are highlighted as the pointer hovers over them.When it's True, the TreeView control behaves like a web document with the nodes acting as hyperlinks — they turn blue while the pointer hovers over them. Use the NodeMouseHover event to detect when the pointer hovers over a node.
- **Indent** - This property specifies the indentation level in pixels. The same indentation applies to all levels of the tree—each level is indented by the same number of pixels with respect to its parent level.
- **PathSeparator** - A node's full name is made up of the names of its parent nodes, separated by a backslash. To use a different separator, set this property to the desired symbol.
- **ShowLines** - The ShowLines property is a True/False value that determines whether the control's nodes will be connected to its parent items with lines. These lines help users visualize the hierarchy of nodes, and it's customary to display them.
- **ShowPlusMinus** - The ShowPlusMinus property is a True/False value that determines whether the plus/minus button is shown next to the nodes that have children. The plus button is displayed when the node is collapsed, and it causes the node to expand when clicked. Likewise, the minus sign is displayed when the node is expanded, and it causes the node to collapse when clicked. Users can

also expand the current node by pressing the left-arrow button and collapse it with the right-arrow button.

- **ShowRootLines** - This is another True/False property that determines whether there will be lines between each node and root of the tree view. Experiment with the ShowLines and ShowRootLines properties to find out how they affect the appearance of the control.
- **Sorted** - This property determines whether the items in the control will be automatically sorted. The control sorts each level of nodes separately. In our Globe example, it will sort the continents, then the countries within each continent, and then the cities within each country.

Adding New Items at Design Time

Let's look now at the process of populating the TreeView control. Adding an initial collection of nodes to a TreeView control at design time is trivial. Locate the Nodes property in the Properties window, and you'll see that its value is Collection. To add items, click the ellipsis button, and the TreeNode Editor dialog box will appear, as shown in Figure 4.26. To add a root item, just click the Add Root button. The new item will be named Node0 by default. You can change its caption by selecting the item in the list and setting its Text property accordingly. You can also change the node's Name property, as well as the node's appearance by using the NodeFont, FontColor, and ForeColor properties.

To specify an image for the node, set the control's ImageList property to the name of an ImageList control that contains the appropriate images, and then set either the node's ImageKey property to the name of the image, or the node's ImageIndex property to the index of the desired image in the ImageList control. If you want to display a different image when the control is selected, set the `SelectedImageKey` or the `SelectedImageIndex` property accordingly.

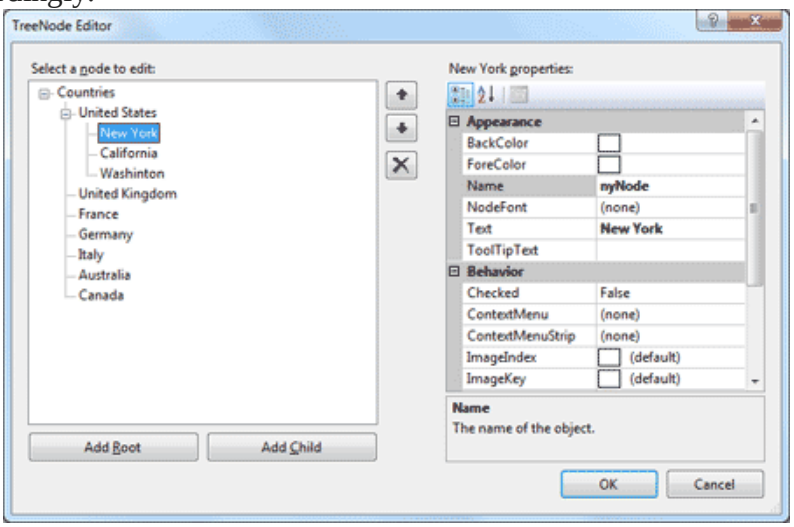


Figure 4.26 - The TreeNode Editor dialog box

Click the Add Root button first. A new node is added automatically to the list of nodes, and it is named Node0. Select it with the mouse, and its properties appear in the right pane of the TreeNode Editor window. Here you can change the node's Text property to Countries. You can specify the appearance of each node by setting its font and fore/background colors.

Adding New Items at Runtime

Adding items to the control at runtime is a bit more involved. All the nodes belong to the control's Nodes collection, which is made up of TreeNode objects. To access the **Nodes** collection, use the following expression, where TreeView1 is the control's name and **Nodes** is a collection of TreeNode objects:

TreeView1.Nodes

This expression returns a collection of TreeNode objects and exposes the proper members for accessing and manipulating the individual nodes. The control's **Nodes** property is the collection of all root nodes.

To access the first node, use the expression **TreeView.Nodes(0)** (this is the Globe node in our example). The Text property returns the node's value, which is a string. **TreeView1.Nodes(0).Text** is the caption of the root node on the control. The caption of the second node on the same level is **TreeView1.Nodes(1).Text**, and so on.

The following statements print the strings shown highlighted below them (these strings are not part of the statements; they're the output that the statements produce):

```
Debug.WriteLine(TreeView1.Nodes(0).Text)
Countries
Debug.WriteLine(TreeView1.Nodes(0).Nodes(0).Text)
UnitedStates
Debug.WriteLine(TreeView1.Nodes(0).Nodes(0).Nodes(1).Text)
New York
```

Let's take a closer look at these expressions. **TreeView1.Nodes(0)** is the first root node, the Countries node. Under this node, there is a collection of nodes, the **TreeView1.Nodes(0).Nodes** collection. Each node in this collection is a country name. The first node in this collection is United States, and you can access it with the expression **TreeView1.Nodes(0).Nodes(0)**. If you want to change the appearance of the node United States, type a period after the preceding expression to access its properties (the NodeFont property to set its font, the ForeColor property to set it color, the ImageIndex property, and so on). Likewise, this node has its own Nodes collection, which contains the states under the specific country.

Adding New Nodes

The Add method adds a new node to the Nodes collection. The Addmethod accepts as an argument a string or a TreeNode object. The simplest form of the Add method is

```
newNode = Nodes.Add(nodeCaption)
```

where **nodeCaption** is a string that will be displayed on the control. Another form of the Add method allows you to add a TreeNode object directly (**nodeObj** is a properly initialized TreeNode variable):

```
newNode = Nodes.Add(nodeObj)
```

To use this form of the method, you must first declare and initialize a TreeNode object:

```
Dim nodeObj As New TreeNode
nodeObj.Text = "Tree Node"
nodeObj.ForeColor = Color.BlueViolet
TreeView1.Nodes.Add(nodeObj)
```

The last overloaded form of the Add method allows you to specify the index in the current Nodes collection, where the node will be added:
newNode = Nodes.Add(index, nodeObj)
The nodeObj TreeNode object must be initialized as usual. To add a child node to the root node, use a statement such as the following:
TreeView1.Nodes(0).Nodes.Add("United States")
To add a state under United States, use a statement such as the following:
TreeView1.Nodes(0).Nodes(1).Nodes.Add("New York")
The expressions can get quite lengthy. The proper way to add child items to a node is to create a TreeNode variable that represents the parent node, under which the child nodes will be added. Let's say that the CountryNode variable in the following example represents the node United States:
Dim CountryNode As TreeNode
CountryNode = TreeView1.Nodes(0).Nodes(2)
Then you can add child nodes to the ContinentNode node:
CountryNode.Nodes.Add("New York")
CountryNode.Nodes.Add("California")
To add yet another level of nodes, the city nodes, create a new variable that represents a specific state. The Add method actually returns a TreeNode object that represents the newly added node, so you can add a state and a few cities by using statements such as the following:
Dim StateNode As TreeNode
StateNode = CountryNode.Nodes.Add("New York")
StateNode.Nodes.Add("Alberny")
StateNode.Nodes.Add("Amsterdam")
StateNode.Nodes.Add("Auburn")
Then you can continue adding states under another country as follows:
StateNode = CountryNode.Nodes.Add("United Kingdom")
StateNode.Nodes.Add("London")
StateNode.Nodes.Add("Manchester")

The ListView Control

The ListView control is similar to the ListBox control except that it can display its items in many forms, along with any number of subitems for each item. To use the ListView control in your project, place an instance of the control on a form and then set its basic properties, which are described in the following list.

View and Arrange - Two properties determine how the various items will be displayed on the control: the View property, which determines the general appearance of the items, and the Arrange property, which determines the alignment of the items on the control's surface. The View property can have one of the values shown in Table 4.8.

Table 4.8: Settings of the View Property of VB.NET ListView Control

Setting	Description
LargeIcon (Default)	Each item is represented by an icon and a caption below the icon.
SmallIcon	Each item is represented by a small icon and a caption that

	appears to the right of the icon.
List	Each item is represented by a caption.
Details	Each item is displayed in a column with its subitems in adjacent columns.
Tile	Each item is displayed with an icon and its subitems to the right of the icon. This view is available only on Windows XP and Windows Server 2003.

The Arrange property can have one of the settings shown in Table 4.9.

Table 4.9: Settings of the Arrange Property of VB.NET ListView Control

Setting	Description
Default	When an item is moved on the control, the item remains where it is dropped.
Left	Items are aligned to the left side of the control.
SnapToGrid	Items are aligned to an invisible grid on the control. When the user moves an item, the item moves to the closest grid point on the control.
Top	Items are aligned to the top of the control.

HeaderStyle - This property determines the style of the headers in Details view. It has no meaning when the View property is set to anything else, because only the Details view has columns. The possible settings of the HeaderStyle property are shown in Table 4.10.

Table 4.10: Settings of the HeaderStyle Property of VB.NET ListView Control

Setting	Description
Clickable	Visible column header that responds to clicking
Nonclickable (Default)	Visible column header that does not respond to clicking
None	No visible column header

AllowColumnReorder - This property is a True/False value that determines whether the user can reorder the columns at runtime, and it's meaningful only in Details view. If this property is set to True, the user can move a column to a new location by dragging its header with the mouse and dropping it in the place of another column.

Activation - This property, which specifies how items are activated with the mouse, can have one of the values shown in Table 4.11.

Table 4.11: Settings of the Activation Property of VB.NET ListView Control

Setting	Description
OneClick	Items are activated with a single click. When the cursor is over an item, it changes shape, and the color of the item's text changes.
Standard (Default)	Items are activated with a double-click. No change in the selected item's text color takes place.
TwoClick	Items are activated with a double-click, and their text

changes color as well.

FullRowSelect - This property is a True/False value, indicating whether the user can select an entire row or just the item's text, and it's meaningful only in Details view. When this property is False, only the first item in the selected row is highlighted.

GridLines - Another True/False property. If True, grid lines between items and subitems are drawn. This property is meaningful only in Details view.

Group - The items of the ListView control can be grouped into categories. To use this feature, you must first define the groups by using the control's Group property, which is a collection of strings. You can add as many members to this collection as you want.

LabelEdit - The LabelEdit property lets you specify whether the user will be allowed to edit the text of the items. The default value of this property is False. Notice that the LabelEdit property applies to the item's Text property only; you can't edit the subitems (unfortunately, you can't use the ListView control as an editable grid).

MultiSelect - A True/False value, indicating whether the user can select multiple items from the control. To select multiple items, click them with the mouse while holding down the Shift or Ctrl key. If the control's ShowCheckboxes property is set to True, users can select multiple items by marking the check box in front of the corresponding item(s).

Scrollable - A True/False value that determines whether the scroll bars are visible. Even if the scroll bars are invisible, users can still bring any item into view. All they have to do is select an item and then press the arrow keys as many times as needed to scroll the desired item into view.

Sorting - This property determines how the items will be sorted, and its setting can be None, Ascending, or Descending. To sort the items of the control, call the Sort method, which sorts the items according to their caption. It's also possible to sort the items according to any of their subitems, as explained in the section "Sorting the ListView Control" later in this chapter.

DESIGNING MENUS

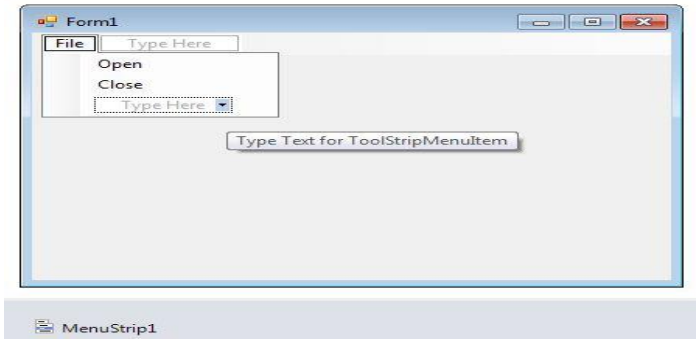
The MenuStrip class is the foundation of menus functionality in Windows Forms. If you have worked with menus in .NET 1.0 and 2.0, you must be familiar with the MainMenu control. In .NET 3.5 and 4.0, the MainMenu control is replaced with the MenuStrip control.

Menu Editor

Menus can be attached only to forms, and they're implemented through the MenuStrip control. The items that make up the menu are ToolStripMenuItem objects. As you will see, the MenuStrip control and ToolStripMenuItem objects give you absolute control over the structure and appearance of the menus of your application. The MenuStrip control is a variation of the Strip control, which is the base of menus, toolbars, and status bars.

We can create a MenuStrip control using a Forms designer at design-time or using the MenuStrip class in code at run-time or dynamically. To create a MenuStrip control at design-time, you simply drag and drop a MenuStrip control from Toolbox to a Form in Visual Studio. After you drag and drop a MenuStrip on a Form, the MenuStrip1 is added to the Form and looks like Figure below. Once a MenuStrip is on the Form, you can add menu items and set its properties and events.

Creating a MenuStrip control at run-time is merely a work of creating an instance of MenuStrip class, set its properties and adds MenuStrip class to the Form controls.
First step to create a dynamic MenuStrip is to create an instance of MenuStrip class. The following code snippet creates a MenuStrip control object.



VB.NET Code:

```
Dim MainMenu As New MenuStrip()
```

In the next step, you may set properties of a MenuStrip control. The following code snippet sets background color, foreground color, Text, Name, and Font properties of a MenuStrip.

```
MainMenu.BackColor = Color.OrangeRed
MainMenu.ForeColor = Color.Black
MainMenu.Text = "File Menu"
MainMenu.Font = New Font("Georgia", 16)
```

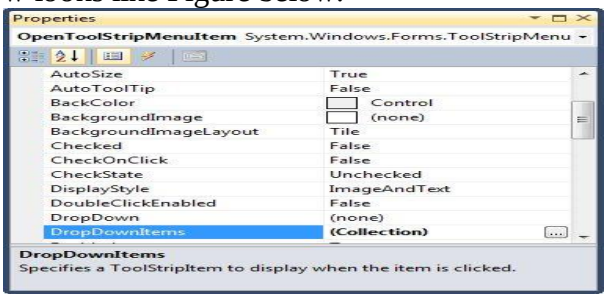
Once the MenuStrip control is ready with its properties, the next step is to add the MenuStrip to a Form. To do so, first we set MainMenuStrip property and then use Form.Controls.Add method that adds MenuStrip control to the Form controls and displays on the Form based on the location and size of the control. The following code snippet adds a MenuStrip control to the current Form.

```
Me.MainMenuStrip = MainMenu
Controls.Add(MainMenu)
```

Setting MenuStrip Properties

After you place a MenuStrip control on a Form, the next step is to set properties.
The easiest way to set properties is from the Properties Window. You can open Properties window by pressing F4 or right click on a control and select Properties menu item.

The Properties window looks like Figure below.



Name

Name property represents a unique name of a MenuStrip control. It is used to access the control in the code. The following code snippet sets and gets the name and text of a MenuStrip control.

```
MainMenu.Name = "MailMenu"
```

Positioning a MenuStrip

The Dock property is used to set the position of a MenuStrip. It is of type DockStyle that can have values Top, Bottom, Left, Right, and Fill. The following code snippet sets Location, Width, and Height properties of a MenuStrip control.

```
MainMenu.Dock = DockStyle.Left
```

Font

Font property represents the font of text of a MenuStrip control. If you click on the Font property in Properties window, you will see Font name, size and other font options. The following code snippet sets Font property at run-time.

```
MainMenu.Font = new Font("Georgia", 16)
```

Background and Foreground

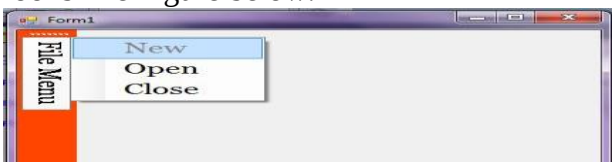
BackColor and ForeColor properties are used to set background and foreground color of a MenuStrip respectively. If you click on these properties in Properties window, the Color Dialog pops up.

Alternatively, you can set background and foreground colors at run-time. The following code snippet sets

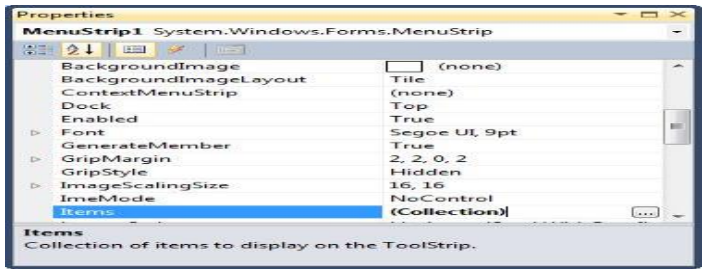
BackColor and ForeColor properties.

```
MainMenu.BackColor = System.Drawing.Color.OrangeRed
MainMenu.ForeColor = System.Drawing.Color.Black
```

Then the MenuStrip looks like Figure below.



MenuStrip Items A Menu control is nothing without menu items. The Items property is used to add and work with items in a MenuStrip. We can add items to a MenuStrip at design-time from Properties Window by clicking on Items Collection as you can see in Figure below.



When you click on the Collections, the String Collection Editor window will pop up where you can type strings. Each line added to this collection will become a MenuStrip item. (See the Figure below.)

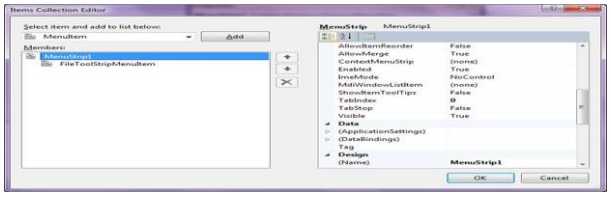
A ToolStripMenuItem represents a menu items. The following code snippet creates a menu item and sets its properties.

```
Dim FileMenu As New ToolStripMenuItem("File")
FileMenu.BackColor = Color.OrangeRed
FileMenu.ForeColor = Color.Black
FileMenu.Text = "File Menu"
FileMenu.Font = New Font("Georgia", 16)

FileMenu.TextAlign = ContentAlignment.BottomRight
FileMenu.TextDirection =  ToolStripTextDirection.Vertical90

FileMenu.ToolTipText = "Click Me"
```

Figure showing Menu Item Collection

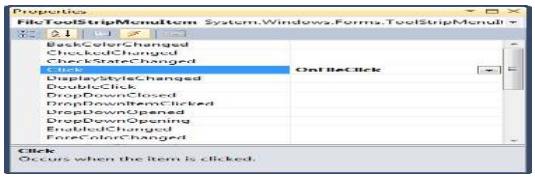


Once a menu item is created, we can add it to the main menu by using MenuStrip.Items.Add method. The following code snippet adds FileMenu item to the MainMenu.

```
MainMenu.Items.Add(FileMenu)
```

Adding Menu Item Click Event Handler

The main purpose of a menu item is to add a click event handler and write code that we need to execute on the menu item click event handler. For example, on File >> New menu item click event handler, we may want to create a new file. To add an event handler, you go to Events window and double click on Click and other as you can see in Figure below.



We can also define and implement an event handler dynamically. The following code snippet defines and implements these events and their respective event handlers.

```
Dim NewMenuItem As New ToolStripMenuItem("New", Nothing, New
EventHandler(AddressOf NewMenuItemClick))

Private Sub NewMenuItemClick(ByVal sender As Object, ByVal e As EventArgs)
MessageBox.Show("New menu item clicked!")
End Sub
```

Manipulating Menu's at Runtime

Dynamic menus change at runtime to display more or fewer commands, depending on the current status of the program. This section explores two techniques for implementing dynamic menus:

- Creating short and long versions of the same menu
- Adding and removing menu commands at runtime

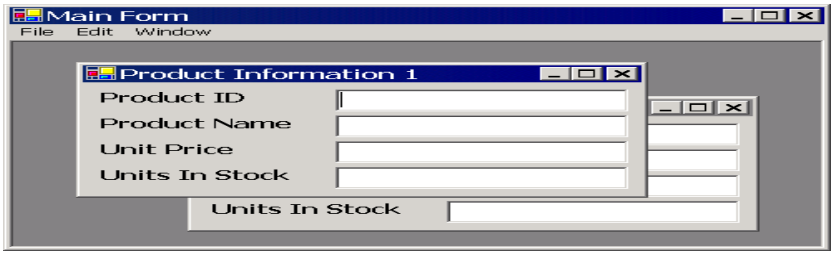
Iterating a Menu's Items

The last menu-related topic in this chapter demonstrates how to iterate through all the items of a menu structure, including their submenus, at any depth. The main menu of an application can be accessed by the expression Me.MenuStrip1 (assuming that you're using the default names). This is a reference to the top-level commands of the menu, which appear in the form's menu bar. Each command, in turn, is represented by a ToolStripMenuItem object. All the items under a menu command form a ToolStripMenuItems collection, which you can scan to retrieve the individual commands.
The first command in a menu is accessed with the expression Me.MenuStrip1.Items(0); this is the File command in a typical application. The expression Me.MenuStrip1.Items(1) is the second command on the same level as the File command (typically, the Edit menu).
To access the items under the first menu, use the DropDownItems collection of the top command. The first command in the File menu can be accessed by this expression:
Me.MenuStrip1.Items(0).DropDownItems(0)
The same items can be accessed by name as well, and this is how you should manipulate the menu items from within your code. In unusual situations, or if you're using dynamic menus to which you add and subtract commands at runtime, you'll have to access the menu items through the DropDownItems collection.

MULTIPLE DOCUMENT INTERFACE

MDI Overview

This session introduces the concept of Multiple Document Interface (MDI) and to create menus within an MDI application. You will learn to create an MDI application in Microsoft Visual Studio .NET and learn why you might want to use this type of interface. You will learn about child forms that are contained within the MDI application, and learn to create shortcut, or context-sensitive, menus.
MDI is a popular interface because it allows you to have multiple documents (or forms) open in one application. Examples of MDI applications include Microsoft Word, Microsoft Excel, Microsoft PowerPoint®, and even the Visual Studio integrated development environment itself. Each application consists of one (or more) parent windows, each containing an MDI client area—the area where the child forms (or documents) will be displayed. Code you write displays as many instances of each of the child forms that you want displayed, and each child form can only be displayed within the confines of the parent window—this means you can't drag the child forms outside the MDI container. Figure shows a basic MDI application in use.



Using MDI – multiple windows contained within the parent area

Single Document Interface

MDI is only one of several possible paradigms for creating a user interface. You can also create applications that display just a single form. They're easier to create, in fact. Those applications are called Single Document Interface (SDI) applications. Microsoft Windows® Notepad is an SDI application, and you can only open a single document at a time. (If you want multiple documents open, you simply run Notepad multiple times.) You are under no obligation to create your applications using the MDI paradigm. Even if you have multiple forms in your project, you can simply have each one as a stand-alone form, not contained by any parent form.

Uses of MDI

MDI are used most often in applications where the user might like to have multiple forms or documents open concurrently. Word processing applications (like Microsoft Word), spreadsheet applications (like Microsoft Excel), and project manager applications (like Microsoft Project) are all good candidates for MDI applications. MDI is also handy when you have a large application, and you want to provide a simple mechanism for closing all the child forms when the user exits the application

Creating an MDI Parent Form

To create an MDI parent form, you can simply take one of your existing forms and set its IsMDIContainer property to **True**. This form will now be able to contain other forms as child forms. You may have one or many container forms within your application.

Tip Note the difference here between Visual Studio .NET and Microsoft Visual Basic® 6.0 behavior. In Visual Basic 6.0, you could only have a single MDI parent form per application, and you had to use the **Project** menu to add that one special form. In Visual Studio .NET, you can turn any form into an MDI parent form by simply modifying a property, and you can have as many MDI parent forms as you require within the same project.

You may have as many different child forms (the forms that remain contained within the parent form) as you want in your project. A child form is nothing more than a regular form for which you dynamically set the **MdiParent** property to refer to the MDI container form.

Run-time Features of MDI Child Forms

At run time, the MDI parent form and the MDI child forms take on special features:

- All child forms are displayed within the MDI parent's *client* area. The client area is the area below the MDI parent's title bar, any menus, and any tool bars.
- Child forms can be moved and sized only within the MDI parent's client area.
- Child forms can be minimized and their icon will be displayed within the parent's client area.

- Child forms can be maximized within the parent's client area and the caption of the child form is appended to the caption of the MDI form.
- Windows automatically gives child forms that have their **FormBorderStyle** property set to a sizable border a default size. This size is based on the size of the MDI parent's client area. You can override this by setting the **FormBorderStyle** property of the child form to any of the fixed type of borders.
- Child forms cannot be displayed modally.

Create an MDI Project

In this section, you will walk through the steps of creating a simple MDI application using Visual Studio .NET. To do this, you will create a new form that will be the MDI parent form. You will add some menus to this new form, and then you will load the product form from a menu as a child form.

Create the MDI Parent Form

To create the MDI parent form

1. Open Visual Studio .NET
2. Create a new Windows application project.
3. Set the name of the project to **MDI.sln**.
4. Rename the form that is created automatically to **frmMain.vb**.
5. With the frmMain selected, set the form's **IsMdiContainer** property to **True**.
6. Set the **WindowState** property to **Maximized**.

Now we have created an MDI parent form.

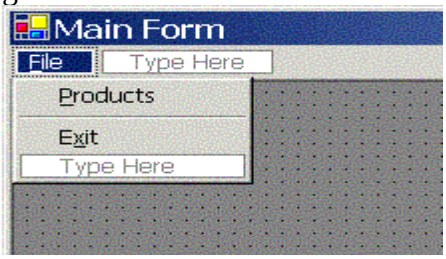
Creating Menus in MDI Main Form

Your main form will require menus so that you can perform actions such as opening child forms, copying and pasting data, and arranging windows. Visual Studio .NET includes a new menu designer that makes creating & modifying menus easy.

To add menus to your MDI parent form

1. Double-click the MenuStrip tool in the Toolbox window to add a new object named MenuStrip1 to the form tray.
2. At the top of the MDI parent form, click the box with **Type Here** in it and type **&File**.
3. Press **Enter** to move to the next menu item and type **&Products**.
4. Press **Enter** to move to the next menu item and type a hyphen (-).
5. Press **Enter** and type **E&xit**.

You have now created the first drop-down menu on your main form. You should have something that looks like Figure.



The menu designer allows you to type your menu structure in a WYSIWYG fashion

To the right of the **File** menu and at the same level, you'll see another small box with the text, **Type Here**. Click it and type the following menu items by pressing **Enter** after each one.

- &Edit

- Cu&t
- &Copy
- &Paste

Once more to the right of the Edit menu and at the same level, add the following menu items in the same manner.

- &Window
  - &Cascade
  - Tile &Horizontal
  - Tile &Vertical
  - &Arrange Icons

Creating Names for Each Menu

After creating all the menu items, you'll need to set the **Name** property for each. (Because you'll refer to the name of each menu item from any code you write concerning that menu item, it's important to choose a name you can understand from within your code.) Instead of clicking each menu item one at a time and then moving over to the Properties window to set the **Name** property, Visual Studio provides a shortcut: Right-click an item in the menu, then select **Edit Names** from the context menu..

Use the following names for your menu items:

- mnuFile
  - mnuFProducts
  - mnuFExit
- mnuEdit
  - mnuECut
  - mnuECopy
  - mnuEPaste
- mnuWindow
  - mnuWCasade
  - mnuWHorizontal
  - mnuWVertical
  - mnuWArrange

Test out your application: Press **F5** and you should see your main MDI window appear with your menu system in place.

Display a Child Form

To add the code that displays the child form, frmProducts, make sure the main form is open in Design view, and on the **File** menu, double-click **Products**. Visual Studio .NET will create the stub of the menu item's Click event handler for you. Modify the procedure so that it looks like the following:

```
Private Sub mnuFProducts_Click( _
 ByVal sender As System.Object, _
 ByVal e As System.EventArgs) Handles_  mnuFProducts.Click
   Dim frm As New frmProducts()

   frm.MdiParent = Me
```

```
    frm.Show()
End Sub
```

This code declares a variable, frm, which refers to a new instance of the frmProducts form in the sample project. Then, you set the **MdiParent** property of the new form, indicating that its parent should be the current form (using the **Me** keyword). Finally, the code calls the **Show** method of the child form, making it appear on the screen.

Child Menus in MDI Applications

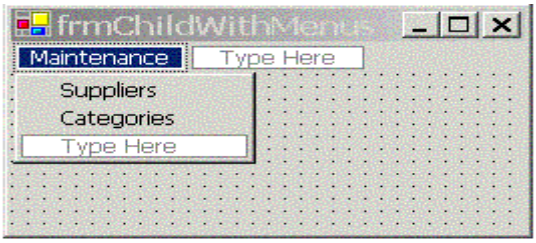
In Visual Studio .NET, however, you can control how the menus interact, using the **MergeOrder** and **MergeType** properties of the individual menu items.

The **MergeOrder** property controls the relative position of the menu item when its menu structure gets merged with the parent form's menus. The default value for this property is 0, indicating that this menu item will be added at the end of the existing menu items. The **MergeType** property controls how the menu item behaves when it has the same merge order as another menu item being merged. Table shows a list of the possible values you can assign to the **MergeType** property.

The MergeType property allows you to specify what happens when menu items merge

Value	Description
Add	The MenuItem is added to the collection of existing MenuItem objects in a merged menu. (Default)
MergeItems	All submenu items of this MenuItem are merged with those of existing MenuItem objects at the same position in a merged menu
Remove	The MenuItem is not included in a merged menu.
Replace	The MenuItem replaces an existing MenuItem at the same position in a merged menu.

By default, a menu item's **MergeOrder** property is set to 0. The **MergeType** property is set to **Add** by default. This means that if you create a child form with a menu on it, the menu will be added at the end of the main menu. Consider Figure 3, which shows a child form called from the parent form's main menu. This form has a **Maintenance** menu on it (and the parent form does not). All of the items on the parent's main menu have their **MergeOrder** properties set to 0 and this menu's **MergeOrder** property is set to 0, so this menu will be added at the end of the main menu on the MDI parent form.



A child form that has menus will by default be added to the end of the main menu

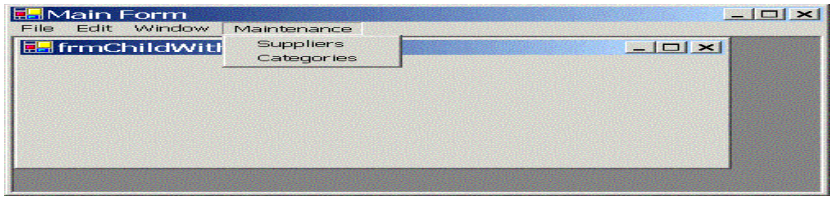
To create the form in Figure 3

1. On the **Project** menu, click **Add Windows Form**.
2. Set the new form's name to frmChildWithMenus.vb.
3. Add a MenuStrip control to this form.
4. Set the Name property for the MenuStrip control to **mnuMainMaint**.
5. Add the following menus as shown in Table 2.

Windows Form menus

Menu	Name
&Maintenance	mnuMaint
&Suppliers	mnuMSuppliers
&Categories	mnuMCategories

If you were to call this form exactly like you did the Products form in the previous section you will see that your main form looks like Figure 4. You can see that by default, the menu is added to the end of this form.



Menus are added to the end of the main menu by default

Call this form by adding a new menu item under the **File** menu:

1. Open frmMain.vb in Design view.
2. Click on the separator after the **Products** menu item and press the **Insert** key to add a new menu item.
3. Type **Child form with Menus** as the text of this new menu item.
4. Set the Name property of this new menu item to **mnuFChild**.
5. Double click this new menu item and modify its Click event handler so that it looks like this:

```
Private Sub mnuFChildMenus_Click( _
 ByVal sender As System.Object, _
 ByVal e As System.EventArgs) _
 Handles mnuFChildMenus.Click
   Dim frm As New frmChildWithMenus()
   frm.MdiParent = Me
   frm.Show()
End Sub
```

Note: If you wish to merge the **Maintenance** menu in between the **Edit** and **Window** menus, you could set the **MergeOrder** property on the **Edit** menu item to 1, and the **MergeOrder** property on the **Window** menu to a 2. Then on the **Maintenance** menu

item on frmChildWithMenus, set the **MergeOrder** property to 1 and leave the **MergeType** with its default value, **Add**. Taking these steps will add the **Maintenance** menu after the menu on the main form with the same **MergeOrder** number as it has (that is, after the **Edit** menu, but before the **Window** menu).

Working with MDI Child Forms

If you have multiple child forms open, you may want to have them arrange themselves, much as you can do in Word or Excel, choosing options under the **Window** menu. Table lists the available options when arranging child windows.

Choose one of these values when arranging child windows

Menu Item	Enumerated Value
Tile Horizontal	MdlLayout.TileHorizontal
Tile Vertical	MdiLayout.TileVertical
Cascade	MdiLayout.Cascade
Arrange Icons	MdiLayout.ArrangeIcons

Add some menus to your main form for each of these options:

1. Open **frmMain.vb** in Design view.
2. On the **Window menu,** double-click **Cascade**.
3. For the Cascade menu item, modify the Click event handler so that it looks like the following:

```
Private Sub mnuWCascade_Click( _
 ByVal sender As System.Object, _
 ByVal e As System.EventArgs) _
 Handles mnuWCascade.Click
   Me.LayoutMdi(MdiLayout.Cascade)
End Sub
```

On the **Window** menu, double-click each menu item and add the appropriate code.

Tracking Child Windows

Visual Basic .NET will keep track of all child forms that you create, and it's easy to create a window list menu to manage the child windows. If you wish to see a list of all of the child forms and be able to give a specific child form focus, follow these steps:

1. Load frmMain in Design view.
2. Select frmMain's Window menu.
3. In the Properties window, set the **MdiList** to **True**.
4. Run the project, open a couple of Products forms, and then click the Window drop-down menu. You should see each instance of the Product form that you opened displayed in the window list.

Ending an MDI Application

In most cases, ending an application with the End statement isn't necessarily the most user-friendly approach. Before you end an application, you must always offer your users a chance to save their work. Ideally, you should maintain a *True/False* variable whose value is set every time the user edits the open document terminating an MDI application with the End statement is unacceptable. First, you need a mechanism to detect

whether a document needs to be saved or not. In a text-processing application, you can examine the Modified property of the TextBox control.

Insert the proper code in the Close command's event handler to detect whether the document being closed contains unsaved data and prompt the user accordingly. When the user clicks the child form's Close button, the child form's Closing event is fired, this time by the child form. Finally, when the MDI form is closed, each of the child forms receives the Closing event. In addition, the MDI form's Closing event is also fired. Normally, there's no reason to program this event. As long as you handle the Closing event of the child form, no data will be lost. In the Closing event, you can cancel the operation of closing a document, or the MDI form itself, by settings the e.Cancel property to True.

To close the active child form, execute the following statements (they must appear in the Close command's Click event handler):

```
Private Sub FileExit_Click(ByVal sender As System.Object, _
ByVal e As System.EventArgs) Handles FileExit.Click
Me.Close()
End Sub
```

The Close method invokes the Closing event of the child form.

PART-B
POSSIBLE QUESTIONS(8 MARKS)

1. Discuss about some basic properties of Textbox Control
2. Elucidate in detail about the Multiple Document Interface.
3. Illustrate the use of Open and Save Dialog Boxes with neat diagram.
4. How will you manipulate Menu's at run-time? Explain in detail.
5. Explain in detail about scrollbar and trackbar Controls.
6. Explain in detail about Text-Manipulation and Selection Properties with example
7. Explain in detail about Tree View and List View Controls.
8. Discuss about the properties and methods of Rich Textbox Control with example.
9. Write program to demonstrate Mouse Events

KARPAGAM ACADEMY OF HIGHER EDUCATION

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CLASS : III-B.Sc COMPUTER SCIENCE(2015-2018)

Online Examination

VISUAL PROGRAMMING (15CSU501)

questions	opt1	opt2	opt3	opt4
The ----- event happens when the mouse pointer hovers over the form/control	MouseWheel	MouseUp	MouseDown	MouseHover
the ____occurs when a mouse button is pressed	MouseDown	MouseUp	MouseWheel	MouseHover
------ specifies number of times the mouse button is pressed and released	Button	Click	Delta	X
If the number of items exceed the value that can be displayed, _____ bars will automatically appear on the control	icon	option button	command button	scroll bars
_____ provides easy navigation through a list of items or a large amount of information	scroll bar	command button	tool bar	tool box
the _____ToolWindow, but is resizable. In addition, its caption font is smaller than the usual.	Sizable	non sizable	large	small
The _____ is an one example of breaking a large application into smaller tasks.	Event Handler	Coding	function	subroutine
when a mouse button is pressed _____ event will fired	Mouse Enter	Mouse Up	Mouse down	MouseHover
_____ is a segment of the code that is executed each time an external condition triggers the event	Event Handler	function	Coding	built-in function
Which property has to be set to minimize maximize ot restore a form in code?	Windows Applications	WindowState	FormBorderStyle	WindowSize

Which property is used to specify the tab order of the various controls	tab order	Accept return	Control Box	Auto tab
The tab order command will appear in which menu	File	Format	View	Edit
Which property is used to not move the controls around the forms.	Control	Top	Locked	Name
The user action like key press, clicks, mouse movements are called __	Handlers	Triggers	Events	Methods
_____ event is fired when a key is released while the control has focus	Key Up	Key press	Key Down	Key Enter
___ allows the user to open the menu by pressing the Alt key and a letter	Access key	shortcut key	accept key	Tab key
The _____ property is one that automatically activated when you press Enter	Accept button	Cancel button	Control box	Border style
A ------- is a component used to accept input from the user or display the information on the form	text	container	control	counter
Which controls do not have events?	TextBox	Label	ToolTip	ImageList
_____ refers to the position a control has relative to the edge of the form	Anchor	Dock	Key stokes	Key preview
_____ refers to how much space the control to take up on the form	Anchor	Dock	Key stokes	Key preview
The _____ event takes place every time the form must be refreshed	Resize	Paint	Close	refersh
The default value of FormBorderStyle property is	FixedSingle	FixedToolWindow	Sizable	SizableToolWindow
The _____ property determines the initial position of the form when its first displayed	initial position	Start position	sizedripstyle	none

the _____ value position the form at the default location and size determined by windows	WindowsDefault Location	WindowsDefault Bounds	Fixed Dialog	Fixed 3D
To attach the scroll bar automatically to the form, which property to set true.	Auto Scale	Auto scroll	Auto scroll bar	Auto accept
Without the _____ the form cannot be repositioned by the user	Minimize / Maximize button	Border	Title bar	Control Menu
_____ method does not simply hides the form, but destroy it completely	Close()	Hide()	Distroy()	Remove()
The simplest method for two forms to communicate with each other is via ____ variables	Private	Common	public	form
How many parent form will be in MDI	2	0	1	many
Which class is used to run the EXE application file in VB.NET	Process	Application	Exe	Execute
What is the property used to enlarge the inmage in picture box?	Size	SizeMode	Mode	Stretch
What is the default event for Picture Box?	Click	Disposed	Layout	Resize
The textbox can accept a maximum of ------ characters	1024.00	2048.00	156.00	1028.00
The -------- property allows you to display multiple lines of text in a textbox control	Text	Multiline	PasswordChar	Autosize
The -------- property allows automatic resizing of the label control according to the length of its caption	Text	Multiline	PasswordChar	Autosize
The ---------- is used to display the text as a link	label	textbox	linklabel	listview
The ---------- property is used to get or set the color used to display the active link	LinkColor	DisabledLinkColor	ActiveLinlColor	LinkVisited

The ---------- property is used to get or set a value indicating whether a link should be displayed as though it was vivited	LinkColor	DisabledLinkColor	LinkVisited	ActiveLinlColor
The ------- property is used to get or set the mode behavior of the listbox control	Sorted	SelectionMode	SelectedIndex	SelectedItem
The ------- property is used to set or retrieve the currently selected item in the combobox control	Sorted	SelectionMode	SelectedIndex	SelectedItem
The --------- control is used to set Yes/No options	CheckBox	RadioButton	GroupBox	Button
The --------- control is used to group related controls together	RadioButton	StatusBar	GroupBox	CheckBox
The -------- property is used to specify whether or not the statusbar should display panels	Text	Checked	SelectedIndex	ShowPanels
The -------- property is used to specify the location of a control in terms of X and Y coordinates	Name	Visible	Location	Enabled
In VB.Net the -------- class is the base class for displaying common dialog boxes.	Inherits	String	CommonDialog	MyBase
The classes that are inherited from the CommonDialog class are categorized as --------	4.00	6.00	5.00	3.00
Button class is based on ------- class	Stirng	TextBoxBase	ButtonBase	Windows
The ------ property doesn't allow the user to enter	Enabled	Multiline	ReadOnly	TextAllign
The default event of the CheckBox is ----------	Click	CheckedChange	Changed	DoubleClick
RadioButton control is based on the -------- class	Stirng	TextBoxBase	ButtonBase	Windows
The ListBox control is based on the -------- class	Stirng	TextBoxBase	ButtonBase	ListControl
To display the list as multiple columns in list box --------- property is used	SelectionMode	SelectedIndex	SelectedItem	MultiColumn

The default event of ListBox is the ---------	Click	CheckedChange	DoubleClick	SelectedIndexChanged
The ---------- property in the Appearance section of the properties window	TextAllign	ReadOnly	Enabled	DropDownStyle
The ---------- Gets/Sets whether the tree node is checked	ReadOnly	Checked	IsEditing	IsSelected
The --------- Gets the collection of nodes in the current node	Checked	IsEditing	IsSelected	Nodes
Default event of the Tree View control is the ----------	Click	Selected	AfterSelect	Load
---------- is a combination of a ListBox and a CheckBox	DropDownBox	CheckedListBox	LinkBox	TreeView
-------- cannot display captions where as GroupBoxes can	Panels	PictureBox	Splitter	ToolTip
To assign ToolTip's with controls ------- is used	SetTip	SetToolTip	GetTip	SetTool
Notable property in ErrorProvider is ---------	AutoScroll	SetTip	Allign	BlinkRate
The default event of the MenuItem is ----------	CheckedChange	AfterSelect	Click	Active
The ------- property is used to display a menu item as a radio button	RadioCheck	Checked	Shortcut	DefaultItem
The menus that appear on the menu bar are created using the -------- object	MenuItem	MainMenu	Context	MenuDesigner
The --------- property allows to set the initial directory which should open while using the OpenFileDialog.	InitialDirectory	FilterIndex	RestoreIndex	ShowHelp
The ------ property checks whether the specified path exists before returning from the dialog.	InitialDirectory	CheckPathExists	RestoreIndex	FilterIndex
WindowState property is --------- by default	Normal	Maximized	Minimuzed	Flat
This property is used to change/display the titile of the form	Name	Text	Title	Form

The default BackColor of the Form is the system color named	gray	white	pale	control
Toolbar items are part of ---------- collection	items	Buttons	properties	Opions
The control with the tab index ---------- first gets focus when the form is shown	0.00	1.00	Maximum value	Minimum value
What is the return type of InputBox() function	Integer	Object	String	Double
In Message Box which is the required parameter, that must be supplied a value?	prompt	button	title	name
If the number of items exceed the value that can be displayed, _____ bars will automatically appear on the control	Icon	option button	command button	scroll bars
The _____ method is used to add items to a list at run time.	item	index	remove item	add item
The _____ property sets the index number of the currently selected item	index number	list index	list count	none
The sorted property is set to ____ to enable a list to appear in alphanumeric order	0.00	1.00	TRUE	FALSE
_____ box saves the space on a form	list box	tool box	combo box	none
_____ used in groups to display multiple choices from which the user can select one or more.	option button	check box	combo box	label box
In _____ control the user can set the control's value by sliding the indicator or by clicking on either side of the indicator.	Scroll Bar	Track Bar	status bar	image bar
The _____ method is used to remove an item from the list	item	index	remove item	add item

When a common dialog control is added, a new icon appears in the ____ of the form	component tray	component list	status bar	component bar
The _____ property is used to wrap the text in Textbox control when text reaches the right edge	Wrap Word	Word Wrap	Accept returns	Accept Tab
Each item in a Tree View is called _____	branch	subtree	leaf	node
In _____ Dialog control the user review and select a font and then set its size and style	Color Dialog	Font Dialog	Open Dialog	Format Dialog
Which property is used to specify the type(s) of files displayed in the dialog box	DereferenceLinks	Filter	File Name	Text

answer
MouseHover
MouseDown
Click
scroll bars
scroll bar
Sizable
Event Handler
Mouse down
Event Handler
WindowState

tab order
View
Locked
Events
Key Up
Access key
Accept button
control
ImageList
Anchor
Dock
Paint
Sizable
Start position

WindowsDefault Bounds
Auto scroll
Title bar
Close()
public
1
Process
SizeMode
Click
2048.00
Multiline
Autosize
linklabel
ActiveLinlColor

LinkVisited
SelectionMode
SelectedItem
CheckBox
GroupBox
ShowPanels
Location
CommonDialog
5.00
ButtonBase
ReadOnly
CheckedChange
ButtonBase
ListControl
MultiColumn

SelectedIndexChanged
DropDownStyle
Checked
Nodes
AfterSelect
CheckedListBox
Panels
SetToolTip
BlinkRate
Click
RadioCheck
MainMenu
InitialDirectory
CheckPathExists
Normal
Text

control
Buttons
0.00
String
prompt
scroll bars
add item
list index
TRUE
combo box
check box
Track Bar
remove item

component tray
Word Wrap
node
Font Dialog
Filter

UNIT- III
SYLLABUS

Handling Strings, characters and Dates: Handling Strings and Characters – Handling Dates. Working with Folders and Files: Accessing Folders and Files – Accessing Files. Drawing and Painting with Visual Basic: Displaying Images – Drawing with GDI – Co-ordinate Transformation – Bitmaps.

Handling Strings, Characters and Dates

The .NET Framework provides two basic classes for manipulating text: the String and String-Builder classes.

The distinction between the two classes is that the String class is better suited for static strings, whereas the StringBuilder class is better suited for dynamic strings. Use the String class for strings that don't change frequently in the course of an application, and use the StringBuilder class for strings that grow and shrink dynamically. The two classes expose similar methods, but the String class's methods return new strings; if you need to manipulate large strings extensively, using the String class might fill the memory quite quickly.

Handling String and Characters

The Char Class

The Char data type stores characters as individual, double-byte (16-bit), Unicode values; and it exposes methods for classifying the character stored in a Char variable. You can use methods such as IsDigit and IsPunctuation on a Char variable to determine its type, and other similar methods that can simplify your string validation code.
To use a character variable in your application, you must declare it with a statement such as the following one:

```
Dim ch As Char
ch = Convert.ToChar("A")
```

Properties

The Char class provides two trivial properties: MaxValue and MinValue. They return the largest and smallest character values you can represent with the Char data type.

Methods

The Char data type exposes several useful methods for handling characters. All the methods described here have the same syntax: They accept either a single argument, which is the character they act upon, or a string and the index of a character in the string on which they act.

GetNumericValue

This method returns a positive numeric value if called with an argument that is a digit, and the value −1 otherwise. If you call the GetNumericValue with the argument 5, it will return the numeric value 5. If you call it with the symbol @, it will return the value −1.

GetUnicodeCategory

This method returns a numeric value that is a member of the UnicodeCategory enumeration and identifies the Unicode group to which the character belongs. The Unicode groups characters into categories such as math symbols, currency symbols, and quotation marks. Look up the UnicodeCategory enumeration in the documentation for more information.

IsLetter, IsDigit, IsLetterOrDigit

These methods return a True/False value indicating whether their argument, which is a character, is a letter, decimal digit, or letter/digit, respectively. You can write an event handler by using the IsDigit method to accept numeric keystrokes and to reject letters and punctuation symbols.

IsLower, IsUpper

These methods return a True/False value indicating whether the specified character is lowercase or uppercase, respectively.

IsNumber

This method returns a True/False value indicating whether the specified character is a number. The IsNumber method takes into consideration hexadecimal digits (the characters 0123456789-ABCDEF) in the same way as the IsDigit method does for decimal numbers.

IsPunctuation, IsSymbol, IsControl

These methods return a True/False value indicating whether the specified character is a punctuation mark, symbol, or control character, respectively. The Backspace and Esc keys, for example, are ISO (International Organization for Standardization) control characters.

IsSeparator

This method returns a True/False value indicating whether the character is categorized as a separator (space, new-line character, and so on).

IsWhiteSpace

This method returns a True/False value indicating whether the specified character is white space. Any sequence of spaces, tabs, line feeds, and form feeds is considered white space. Use this method along with the IsPunctuation method to remove all characters in a string that are not words.

ToLower, ToUpper

These methods convert their argument to a lowercase or uppercase character, respectively, and return it as another character.

ToString

This method converts a character to a string. It returns a single-character string, which you can use with other string-manipulation methods or functions.

The String Class

The String class implements the String data type, which is one of the richest data types in terms of the members it exposes. We have used strings extensively in earlier chapters, but this is a formal discussion of the String data type and all of the functionality it exposes.

To create a new instance of the String class, you simply declare a variable of the String type. You can also initialize it by assigning to the corresponding variable a text value:

```
Dim title As String = "Visual Basic 2008 Tutorial"
```

The Replace method, like all other methods of the String class, doesn't operate directly on the string to which it's applied. Instead, it creates a new string and returns it as a new string. You can also use Visual Basic's string-manipulation functions to work with strings. For example, you can replace the string VB with Visual Basic by using the following statement:

```
newTitle = Replace(title, "VB", "Visual Basic")
```

Like the methods of the String class, the string-manipulation functions don't act on the original string; they return a new string.

Properties

The String class exposes only two properties, the Length and Chars properties, which return a string's length and its characters, respectively. Both properties are read-only.

Length

The Length property returns the number of characters in the string and is read-only. To find out the number of characters in a string variable, use the following statement:

```
chars = myString.Length
```

Chars

The Chars property is an array of characters that holds all the characters in the string.

Methods

All the functionality of the String class is available through methods, which are described next. They are all shared methods: They act on a string and return a new string with the modified value.

Compare

This method compares two strings and returns a negative value if the first string is less than the second, a positive value if the second string is less than the first, and zero if the

two strings are equal. Of course, the simplest method of comparing two strings is to use the comparison operators, as shown here:

```
If name1 < name 2 Then
' name1 is alphabetically smaller than name 2
Else If name 1 > name 2 Then
' name2 is alphabetically smaller than name 1
Else
' name1 is the same as name2
End If
```

CompareOrdinal

The CompareOrdinal method compares two strings similar to the Compare method, but it doesn't take into consideration the current locale. This method returns zero if the two strings are the same, and a positive or negative value if they're different. These values, however, are not 1 and −1; they represent the numeric difference between the Unicode values of the first two characters that are different in the two strings.

Concat

This method concatenates two or more strings (places them one after the other) and forms a new string. The simpler form of the Concat method has the following syntax and it is equivalent to the & operator:

```
newString = String.Concat(string1, string2)
```

This statement is equivalent to the following:

```
newString = string1 & string2
```

Copy

The Copy method copies the value of one string variable to another. Notice that the value to be copied must be passed to the method as an argument. The Copy method doesn't apply to the current instance of the String class. Most programmers will use the assignment operator and will never bother with the Copy method.

EndsWith, StartsWith

These two methods return True if their argument ends or starts with a user-supplied substring. The syntax of these methods is as follows:

```
found = str.EndsWith(string)
found = str.StartsWith(string)
```

These two methods are equivalent to the Left() and Right() functions, which extract a given number of characters from the left or right end of the string, respectively.

IndexOf, LastIndexOf

These two methods locate a substring in a larger string. The IndexOf method starts searching from the beginning of the string, and the LastIndexOf method starts searching from the end of the string. Both methods return an integer, which is the order of the substring's first character in the larger string (the order of the first character is zero).

To locate a string within a larger one, use the following forms of the IndexOf method:

```
pos = str.IndexOf(searchString)
pos = str.IndexOf(SearchString, startIndex)
pos = str.IndexOf(SearchString, startIndex, endIndex)
```

The startIndex and the endIndex arguments delimit the section of the string where the search will take place, and pos is an integer variable.
The last three overloaded forms of the IndexOf method search for an array of characters in the string:

```
str.IndexOf(Char())
str.IndexOf(Char(), startIndex)
str.IndexOf(Char(), startIndex, endIndex)
```

IndexOfAny

This is an interesting method that accepts as an argument an array of arguments and returns the first occurrence of any of the array's characters in the string. The syntax of the IndexOfAny method is

```
Dim pos As Integer = str.IndexOfAny(chars)
```

where chars is an array of characters.

This method attempts to locate the first instance of any member of the chars array in the string. If the character is found, its index is returned. If not, the process is repeated with the second character, and so on until an instance is found or the array has been exhausted.

Insert

The Insert method inserts one or more characters at a specified location in a string and returns the new string. The syntax of the Insert method is as follows:

```
newString = str.Insert(startIndex, subString)
```

startIndex is the position in the str variable, where the string specified by the second argument will be inserted.

Join

This method joins two or more strings and returns a single string with a separator between the original strings. Its syntax is the following, where separator is the string that will be used as the separator, and strings is an array with the strings to be joined:

```
newString = String.Join(separator, strings)
```

Split

Just as you can join strings, you can split a long string into smaller ones by using the Split method, whose syntax is the following, where delimiters is an array of characters and str is the string to be split:

```
strings() = String.Split(delimiters, str)
```

The string is split into sections that are separated by any one of the delimiters specified with the first argument. These strings are returned as an array of strings.

Splitting Strings with Multiple Separators

The delimiters array allows you to specify multiple delimiters, which makes it a great tool for isolating words in a text. You can specify all the characters that separate words in text (spaces, tabs, periods, exclamation marks, and so on) as delimiters and pass them along with the text to be parsed to the Split method.

The statements in Listing 3.3 isolate the parts of a path, which are delimited by a backslash character.

Listing 3.3: Extracting a Path's Components

```
Dim path As String = "c:\My Documents\Business\Expenses"
Dim delimiters() As Char = {"\"c}
Dim parts() As String
parts = path.Split(delimiters)
Dim iPart As IEnumerator
iPart = parts.GetEnumerator
While iPart.MoveNext
Debug.WriteLine(iPart.Current.tostring)
End While
```

Remove

The Remove method removes a given number of characters from a string, starting at a specific location, and returns the result as a new string. Its syntax is the following, where startIndex is the index of the first character to be removed in the str string variable and count is the number of characters to be removed:

```
newSrting = str.Remove(startIndex, count)
```

Replace

This method replaces all instances of a specified character (or substring) in a string with a new one. It creates a new instance of the string, replaces the characters as specified by its arguments, and returns this string. The syntax of this method is

```
newString = str.Replace(oldChar, newChar)
```

where oldChar is the character in the str variable to be replaced, and newChar is the character to replace the occurrences of oldChar.

You can change the last statement to replace tabs with a specific number of spaces — usually three, four, or five spaces.

```
Dim txt, newTxt As String
Dim vbTab As String = vbCrLf
txt = "some text with two tabs"
newTxt = txt.Replace(vbTab, " ")
```

PadLeft, PadRight

These two methods align the string left or right in a specified field and return a fixed-length string with spaces to the right (for right-padded strings) or to the left (for left-padded strings). After the execution of these statements

```
Dim LPString, RPString As String
RPString = "[" & "Learning VB".PadRight(20) & "]"
LPString = "[" & "Learning VB".PadLeft(20) & "]"
```

the values of the LPString and RPString variables are as follows:

```
[Mastering VB         ]
[         Mastering VB]
```

There are eight spaces to the left of the left-padded string and eight spaces to the right of the right-padded string.

The StringBulider Class

The StringBuilder class stores dynamic strings and exposes methods to manipulate them much faster than the String class. As you will see, the StringBuilder class is extremely fast, but it uses considerably more memory than the string it holds. To use the StringBuilder class in an application, you must import the System.Text namespace (unless you want to fully qualify each instance of the StringBuilder class in your code). Assuming that you have imported the System.Text class in your code module, you can create a new instance of the class via the following statement:

```
Dim txt As New StringBuilder
```

To create a new instance of the StringBuilder class, you can call its constructor without any arguments, or pass the initial string as an argument:

```
Dim txt As New StringBuilder("some string")
```

Properties

You have already seen the two basic properties of the StringBuilder class: the Capacity and MaxCapacity properties. In addition, the StringBuilder class provides the Length and Chars properties, which are the same as the corresponding properties of the String class. The Length property returns the number of characters in the current instance of the StringBuilder class, and the Chars property is an array of characters. Unlike the Chars property of the String class, this one is read/write.

Methods

Many of the methods of the StringBuilder class are equivalent to the methods of the String class, but they act directly on the string to which they're applied, and they don't return a new string.

Append

The Append method appends a base type to the current instance of the StringBuilder class, and its syntax is the following, where the value argument can be a single character, a string, a date, or any numeric value:

```
SB.Append(value)
```

When you append numeric values to a StringBuilder, they're converted to strings; the value appended is the string returned by the type's ToString method. You can also append an object to the StringBuilder — the actual string that will be appended is the value of the object's ToString property.

AppendFormat

The AppendFormat method is similar to the Append method. Before appending the string, however, AppendFormat formats it. The string to be appended contains format specifications and the appropriate values. The syntax of the AppendFormat method is as follows:

```
SB.AppendFormat(string, values)
```

The first argument is a string with embedded format specifications, and values is an array with values (objects, in general

Insert

This method inserts a string into the current instance of the StringBuilder class, and its syntax is as follows:

SB.Insert(index, value)

The index argument is the location where the new string will be inserted in the current instance of the StringBuilder, and value is the string to be inserted.

Remove

This method removes a number of characters from the current StringBuilder, starting at a specified location; its syntax is the following, where startIndex is the position of the first character to be removed from the string, and count is the number of characters to be removed:

SB.Remove(startIndex, count)

Replace

This method replaces all instances of a string in the current StringBuilder object with another string. The syntax of the Replace method is the following, where the two arguments can be either strings or characters:

SB.Replace(oldValue, newValue)

Unlike the String class, the replacement takes place in the current instance of the StringBuilder class and the method doesn't return another string.

ToString

Use this method to convert the StringBuilder instance to a string and assign it to a String variable. The ToString method returns the string represented by the StringBuilder variable to which it's applied.

Handling Dates

The Date Time Class

The DateTime class is used for storing date and time values, and it's one of the Framework's base data types. Date and time values are stored internally as Double numbers. The integer part of the value corresponds to the date, and the fractional part corresponds to the time. To convert a DateTime variable to a Double value, use the method ToOADateTime, which returns a value that is an OLE (Object Linking and Embedding) Automation-compatible date. The value 0 corresponds to midnight of December 30, 1899.

To initialize a DateTime variable, supply a date value enclosed in a pair of pound symbols. If the value contains time information, separate it from the date part by using a space:

```
Dim date1 As Date = #4/15/2007#
Dim date2 As Date = #4/15/2007 2:01:59#
```

Properties

The DateTime class exposes the following properties, which are straightforward.

Date, TimeOfDay

The Date property returns the date from a date/time value and sets the time to midnight. The TimeOfDay property returns the time part of the date. The following statements

```
Dim date1 As DateTime
date1 = Now()
Debug.WriteLine(date1)
Debug.WriteLine(date1.Date)
Debug.WriteLine(date1.TimeOfDay)
```

will print something like the following values in the Output window:

```
8/5/2007 9:41:55 AM
8/5/2007 12:00:00 AM
09:41:55.5296000
DayOfWeek, DayOfYear
```

Hour, Minute, Second, Millisecond

These properties return the corresponding time part of the date value passed as an argument. If the current time is 9:47:24 p.m., the three properties of the DateTime class will return the integer values 9, 47, and 24 when applied to the current date and time:

```
Debug.WriteLine("The current time is " & Date.Now.ToString)
Debug.WriteLine("The hour is " & Date.Now.Hour)
Debug.WriteLine("The minute is " & Date.Now.Minute)
Debug.WriteLine("The second is " & Date.Now.Second)
```

Day, Month, Year

These three properties return the day of the month, the month, and the year of a DateTime value, respectively. The Day and Month properties are numeric values, but you can convert them to the appropriate string (the name of the day or month) with the WeekDayName() and MonthName() functions.

Ticks

This property returns the number of ticks from a date/time value. Each tick is 100 nanoseconds (or 0.0001 milliseconds). To convert ticks to milliseconds, multiply them by 10,000 (or use the TimeSpan object's TicksPerMillisecond property.

Methods

The DateTime class exposes several methods for manipulating dates. The most practical methods add and subtract time intervals to and from an instance of the DateTime class.

Compare

Compare is a shared method that compares two date/time values and returns an integer value indicating the relative order of the two values. The syntax of the Compare method is the following, where date1 and date2 are the two values to be compared:

```
order = System.DateTime.Compare(date1, date2)
```

DaysInMonth

This shared method returns the number of days in a specific month. Because February contains a variable number of days depending on the year, the DaysInMonth method accepts as arguments both the month and the year:

```
monDays = DateTime.DaysInMonth(year, month)
```

FromOADate

This shared method creates a date/time value from an OLE Automation-compatible date.

```
newDate = DateTime.FromOADate(dtvalue)
```

The argument dtvalue must be a Double value in the range from −657,434 (first day of year 100) to 2,958,465 (last day of year 9999).

IsLeapYear

This shared method returns a True/False value that indicates whether the specified year is a leap year:

```
Dim leapYear As Boolean = DateTime.IsLeapYear(year)
```

Add

This method adds a TimeSpan object to the current instance of the DateTime class.

```
Dim TS As New TimeSpan()
Dim thisMoment As Date = Now()
TS = New TimeSpan(3, 6, 2, 50)
Debug.WriteLine(thisMoment)
Debug.WriteLine(thisMoment.Add(TS))
```

The values printed in the Output window when I tested this code segment were as follows:

```
9/1/2007 10:10:49 AM
9/4/2007 4:13:39 PM
```

Subtract

This method is the counterpart of the Add method; it subtracts a TimeSpan object from the current instance of the DateTime class and returns another Date value.

Adding Intervals to Dates

Various methods add specific intervals to a date/time value. Each method accepts the number of intervals to add (days, hours, milliseconds, and so on) to the current instance of the DateTime class. These methods are the following: AddYears, AddMonths, AddDays, AddHours, AddMinutes, AddSeconds, AddMilliseconds, and AddTicks.

To add 3 years and 12 hours to the current date, use the following statements:

```
Dim aDate As Date
aDate = Now()
aDate = aDate.AddYears(3)
aDate = aDate.AddHours(12)
```

If the argument is a negative value, the corresponding intervals are subtracted from the current instance of the class.

ToString

This method converts a date/time value to a string, using a specific format. The DateTime class recognizes numerous format patterns, which are listed in the following two tables. Table lists the standard format patterns, and Table lists the characters that can format individual parts of the date/time value. You can combine the custom format characters to format dates and times in any way you wish.

The syntax of the ToString method is the following, where formatSpec is a format specification:

```
aDate.ToString(formatSpec)
```

The D named date format, for example, formats a date value as a long date; the following statement will return the highlighted string shown below the statement:

```
Debug.Writeline(#9/17/2010#.ToString("D"))
Friday, September 17, 2010
```

Table 3.1 lists the named formats for the standard date and time patterns. The format characters are case-sensitive — for example, g and G represent slightly different patterns.

Named Format	Output	Format Name
d	MM/dd/yyyy	ShortDatePattern
D	dddd, MMMM dd, yyyy	LongDatePattern
F	dddd, MMMM dd, yyyy HH:mm:ss.mmm	FullDateTimePattern (long date and long time)
f	dddd, MMMM dd, yyyy HH:mm.ss	FullDateTimePattern (long date and short time)
g	MM/dd/yyyy HH:mm	general (short date and short time)
G	MM/dd/yyyy HH:mm:ss	General (short date and long time)
M	m MMMM dd	MonthDayPattern (month and day)
r, R	ddd, dd MMM yyyy HH:mm:ss GMT	RFC1123Pattern

Table 3.2: Date Format Specifier

Format Character	Description
d	The date of the month

dd	The day of the month with a leading zero for single-digit days
ddd	The abbreviated name of the day of the week (a member of the AbbreviatedDayNames enumeration)
dddd	The full name of the day of the week (a member of the DayNamesFormat enumeration)
M	The number of the month
MM	The number of the month with a leading zero for single-digit months
MMM	The abbreviated name of the month (a member of the AbbreviatedMonthNames enumeration)
MMMM	The full name of the month

The following examples format the current date by using all the format patterns listed in Table 13.1. An example of the output produced by each statement is shown under each statement, indented and highlighted.

```
Debug.WriteLine(now().ToString("d"))
6/1/2008
Debug.WriteLine(now().ToString("D"))
Sunday, June 01, 2008
Debug.WriteLine(now().ToString("f"))
Sunday, June 01, 2008 10:29 AM
Debug.WriteLine(now().ToString("F"))
Sunday, June 01, 2008 10:29:35 AM
Debug.WriteLine(now().ToString("g"))
6/1/2008 10:29 AM
Debug.WriteLine(now().ToString("G"))
6/1/2008 10:29:35 AM
```

To display the full month name and the day in the month, for instance, use the following statement:
Debug.WriteLine(now().ToString("MMMM d")).

Date Conversion Methods

The DateTime class supports methods for converting a date/time value to many of the other base types, which are presented here briefly.

ToFileTime, FromFileTime

The ToFileTime method converts the value of the current Date instance to the format of the local system file time. There's also an equivalent FromFileTime method, which converts a file time value to a Date value.

ToLongDateString, ToShortDateString

These two methods convert the date part of the current DateTime instance to a string with the long (or short) date format. The following statement will return a value like the one highlighted, which is the long date format:
Debug.WriteLine(Now().ToLongDateString)
Tuesday, July 15, 2008

ToLongTimeString, ToShortTimeString
These two methods convert the time part of the current instance of the Date class to a string with the long (or short) time format. The following statement will return a value like the one highlighted:

```
Debug.WriteLine(Now().ToLongTimeString)
6:40:53 PM
```

ToOADate
This method converts the DateTime instance into an OLE Automation-compatible date (a long value).

ToUniversalTime, ToLocalTime
ToUniversalTime converts the current instance of the DateTime class into universal coordinated time (UCT). The method ToLocalTime converts a UCT time value to local time.

Dates as Numeric Values
The Date type encapsulates complicated operations, and it's worth taking a look at the inner workings of the classes that handle dates and times. Let's declare two variables to experiment a little with dates: a Date variable, which is initialized to the current date, and a Double variable.

```
Dim Date1 As Date = Now()
Dim dbl As Double
```

Insert a couple of statements to convert the date to a Double value and print it:

```
dbl = Date1.ToOADate
Debug.WriteLine(dbl)
```

The TimeSpan Class
The last class discussed in this chapter is the TimeSpan class, which represents a time interval and can be expressed in many different units — from ticks and milliseconds to days. The TimeSpan is usually the difference between two date/time values, but you can also create a TimeSpan for a specific interval and use it in your calculations.
To use the TimeSpan variable in your code, just declare it with a statement such as the following:

```
Dim TS As New TimeSpan
```

You can initialize an instance of the TimeSpan object by creating two date/time values and getting their difference, as in the following statements:

```
Dim TS As New TimeSpan
Dim date1 As Date = #4/11/1985#
Dim date2 As Date = Now()
TS = date2.Subtract(date1)
Debug.WriteLine(TS)
```

Depending on the day on which you execute these statements, they will print something like the following in the Output window:

```
8086.15:37:01.6336000
```

Properties

The TimeSpan type exposes the properties described in the following sections. Most of these properties are shared.

Field Properties

TimeSpan exposes the simple properties shown in Table 13.3, which are known as fields and are all shared.

Table 3: The Fields of the TimeSpan Object

Property	Returns
Empty	An Empty TimeSpan object
MaxValue	The largest interval you can represent with a TimeSpan object
MinValue	The smallest interval you can represent with a TimeSpan object
TicksPerDay	The number of ticks in a day
TicksPerHour	The number of ticks in an hour
TicksPerMillisecond	The number of ticks in a millisecond
TicksPerMinute	The number of ticks in one minute
TicksPerSecond	The number of ticks in one second
Zero	A TimeSpan object of zero duration

Interval Properties

In addition to the fields, the TimeSpan class exposes two more groups of properties that return the various intervals in a TimeSpan value (shown in Tables 13.4 and 13.5). The members of the first group of properties return the number of specific intervals (days, hours, and so on) in a TimeSpan value. The second group of properties returns the entire TimeSpan's duration in one of the intervals recognized by the TimeSpan method.

Table 3.4: The Intervals of a TimeSpan Value

Property	Returns
Days	The number of whole days in the current TimeSpan.
Hours	The number of whole hours in the current TimeSpan.
Milliseconds	The number of whole milliseconds in the current TimeSpan. The largest value of this property is 999.
Minutes	The number of whole minutes in the current TimeSpan. The largest value of this property is 59.
Seconds	The number of whole seconds in the current TimeSpan. The largest value of this property is 59.
Ticks	The number of whole ticks in the current TimeSpan.

Table 3.5: The Total Intervals of a TimeSpan Value

Property	Returns
TotalDays	The number of days in the current TimeSpan
TotalHours	The number of hours in the current TimeSpan
TotalMilliseconds	The number of whole milliseconds in the current TimeSpan
TotalMinutes	The number of whole minutes in the current TimeSpan

Duration

This property returns the duration of the current instance of the TimeSpan class. The duration is expressed as the number of days followed by the number of hours, minutes, seconds, and milliseconds. The following statements create a TimeSpan object of a few seconds (or minutes, if you don't mind waiting) and print its duration in the Output window.

```
Dim T1, T2 As DateTime
T1 = Now
MsgBox("Click OK to continue")
T2 = Now
Dim TS As TimeSpan
TS = T2.Subtract(T1)
Debug.WriteLine("Total duration = " & TS.Duration.ToString)
Debug.WriteLine("Minutes = " & TS.Minutes.ToString)
Debug.WriteLine("Seconds = " & TS.Seconds.ToString)
Debug.WriteLine("Ticks = " & TS.Ticks.ToString)
```

```
Debug.WriteLine("Milliseconds = " & TS.TotalMilliseconds.ToString)
Debug.WriteLine("Total seconds = " & TS.TotalSeconds.ToString)
```

If you place these statements in a button's Click event handler and execute them, you'll see a series of values like the following in the Immediate window:

```
Total duration = 00:01:34.2154752
Minutes = 1
Seconds = 34
Ticks = 942154752
Milliseconds = 94215,4752
Total seconds = 94,2154752
```

Methods

There are various methods for creating and manipulating instances of the TimeSpan class, and they're described in the following sections.

Interval Methods

The methods in Table 13.6 create a new TimeSpan object of a specific duration. The TimeSpan's duration is specified as a number of intervals, accurate to the nearest millisecond.

All methods accept a single argument, which is a Double value that represents the number of the corresponding intervals (days, hours, and so on).

Parse(string)

This method creates a new TimeSpan object from a string with the TimeSpan format (days;followed by a period; followed by the hours, minutes, and seconds separated by colons). The following statements create a new TimeSpan variable with a duration of 3 days, 12 hours, 20 minutes, 30 seconds, and 500 milliseconds:

```
Dim SP As New TimeSpan()
SP = TimeSpan.Parse("3.12:20:30.500")
Debug.WriteLine(SP)
3.12:20:30.5000000
```

Accessing Files and Folders

The Directory Class

The System.IO.Directory class exposes all the members you need to manipulate folders. Because the Directory class belongs to the System.IO namespace, you must import the IO namespace into any project that might require the Directory object's members with the following statement:

```
Imports System.IO
```

Methods

The Directory object exposesmethods for accessing folders and their contents, which are described in the following sections.

- CreateDirectory
- Delete
- Exists
- Move
- GetCurrentDirectory, SetCurrentDirectory
- GetDirectoryRoot
- GetDirectories
- GetFiles
- GetFileSystemEntries
- GetCreationTime, SetCreationTime
- GetLastAccessTime, SetLastAccessTime
- GetLastWriteTime, SetLastWriteTime
- GetLogicalDrives
- GetParent

CreateDirectory

This method creates a new folder, whose path is passed to the method as a string argument:

Directory.CreateDirectory(path)

The CreateDirectory method returns a DirectoryInfo object, which contains information about the newly created folder. The DirectoryInfo object is discussed later in this chapter, along with the FileInfo object. Notice that the CreateDirectory method can create multiple nested folders in a single call. The following statement will create the folder folder1 (if it doesn't exist), folder2 (if it doesn't exist) under folder1, and finally folder3 under folder2 in the C: drive:

```
Directory.CreateDirectory("C:\folder1\folder2\folder3")
```

Delete

This method deletes a folder and all the files in it. If the folder contains subfolders, the Delete method will optionally remove the entire directory tree under the node you're removing. The simplest form of the Delete method accepts as an argument the path of the folder to be deleted:

```
Directory.Delete(path)
```

To delete a folder recursively (that is, also delete any subfolders under it), use the following form of the Delete method, which accepts a second argument:

```
Directory.Delete(path, recursive)
```

Exists

This method accepts a path as an argument and returns a True/False value indicating whether the specified folder exists:
Directory.Exists(path)

Move

This method moves an entire folder to another location in the file system; its syntax is the following, where source is the name of the folder to be moved and destination is the name of the destination folder:
Directory.Move(source, destination)

GetCurrentDirectory, SetCurrentDirectory

Use these methods to retrieve and set the path of the current directory. By default, the GetCurrentDirectory method returns the folder in which the application is running. SetCurrentDirectory accepts a string argument, which is a path, and sets the current directory to the specified path. You can change the current folder by specifying an absolute or a relative path, such as the following:
Directory.SetCurrentDirectory("..\Resources")

GetDirectoryRoot

This method returns the root part of the path passed as argument, and its syntax is the following:
root = Directory.GetDirectoryRoot(path)

GetDirectories

This method retrieves all the subfolders of a specific folder and returns their names as an array of strings:
Dim Dirs() As String
Dirs = Directory.GetDirectories(path)

GetFiles

This method returns the names of the files in the specified folder as an array of strings. The syntax of the GetFiles method is the following, where path is the path of the folder whose files you want to retrieve and files is an array of strings that's filled with the names of the files:
Dim files() As String = Directory.GetFiles(path)

GetCreationTime, SetCreationTime

These methods read or set the date that a specific folder was created. The GetCreationTime method accepts a path as an argument and returns a Date value:
Dim CreatedOn As Date
CreatedOn = Directory.GetCreationTime(path)
SetCreationTime accepts a path and a date value as arguments and sets the specified folder's creation time to the value specified by the second argument:
Directory.SetCreationTime(path, datetime)

GetLastAccessTime, SetLastAccessTime

These two methods are equivalent to the GetCreationTime and SetCreationTime methods, except they return and set the most recent date and time that the file was accessed.

GetLastWriteTime, SetLastWriteTime

These two methods are equivalent to the GetCreationTime and SetCreationTime methods, but they return and set the most recent date and time the file was written to.

GetLogicalDrives

This method returns an array of strings, which are the names of the logical drives on the computer. The statements in Listing 5 print the names of all logical drives.

Listing 5: Retrieving the Names of All Drives on the Computer

```
Dim drives() As String
drives = Directory.GetLogicalDrives
Dim drive As String
For Each drive In drives
Debug.WriteLine(drive)
Next
```

When executed, these statements will produce a list such as the following:

```
C:\
D:\
E:\
F:\
```

Notice that the GetLogicalDrives method doesn't return any floppy drives, unless there's a disk inserted into the drive.

GetParent

This method returns a DirectoryInfo object that represents the properties of a folder's parent folder. The syntax of the GetParent method is as follows:

```
Dim parent As DirectoryInfo = Directory.GetParent(path)
```

The name of the parent folder, for example, is parent.Name, and its full name is parent.FullName.

The File Class

The System.IO.File class exposes methods for manipulating files (copying them, moving them around, opening them, and closing them), similar to the methods of the Directory class. The names of the methods are self-descriptive, and most of them accept as an argument the path of the file on which they act. Use these methods to implement the common operations that users normally perform through the Windows interface, from within your application.

Methods

Many of the following methods allow you to open existing or create new files. We'll use some of these methods later in the chapter to write data to, and read from, text and binary files.

AppendText

This method appends some text to a file, whose path is passed to the method as an argument, along with the text to be written:

File.AppendText(path, text)

Copy

This method copies an existing file to a new location; its syntax is the following, where source is the path of the file to be copied and destination is the path where the file will be copied to:

File.Copy(source, destination)

If the destination file exists, the Copy method will fail. An exception will be thrown also if either the source or the destination folder does not exist.

Create

This method creates a new file and returns a FileStream object, which you can use to write to or read from the file. (The FileStream object is discussed in detail later in this chapter, along with the methods for writing to or reading from the file.) The simplest form of the Create method accepts a single argument, which is the path of the file you want to create:

Dim FStream As FileStream = File.Create(path)

CreateText

This method is similar to the Create method, but it creates a text file and returns a StreamWriter object for writing to the file. The StreamWriter object is similar to the FileStream object but is used for text files only, whereas the FileStream object can be used with both text and binary files.

Dim SW As StreamWriter = File.CreateText(path)

Delete

This method removes the specified file from the file system. The syntax of the Delete method is the following, where path is the path of the file you want to delete:

File.Delete(path)

Exists

This method accepts as an argument the path of a file and returns a True/False value that indicates whether a file exists. The following statements delete a file, after making sure that the file exists:

```
If File.Exists(path) Then
File.Delete(path)
Else
MsgBox("The file " & path & " doesn't exist")
End If
```

GetAttributes

The GetAttributes method accepts a file path as an argument and returns the attributes of the specified file as a FileAttributes object. A file can have more than a single attribute (for instance, it can be hidden and compressed).

GetCreationTime, SetCreationTime

The GetCreationTime method returns a date value, which is the date and time the file was created. This value is set by the operating system, but you can change it with the SetCreationTime method. SetCreationTime accepts as an argument the file's path and the new creation time:

```
File.SetCreationTime(path, datetime)
```

GetLastAccessTime, SetLastAccessTime

The GetLastAccessTime method returns a date value, which is the date and time the specified file was accessed for the last time. Use the SetLastAccessTime method to set this value.

GetLastWriteTime, SetLastWriteTime

The GetLastWriteTime method returns a date value, which is the date and time that the specified file was written to for the last time. To change this attribute, use the SetLastWriteTime method.

Move

This method moves the specified file to a new location. You can also use the Move method to rename a file by simply moving it to another name in the same folder. Moving a file is equivalent to copying it to another location and then deleting the original file. The Move method works across volumes:

```
File.Move(sourceFileName, destFileName)
```

Open

This method opens an existing file for read-write operations. The simplest form of the method is the following, which opens the file specified by the path argument and returns a FileStream object to this file:

FStream = File.Open(path)
You can use the FStream object's methods to write to or read from the file. The following form of the method allows you to specify the mode in which you want to open the file, where the fileMode argument can have one of the values shown in Table below.
FStream = File.Open(path, fileMode)

FileMode Enumeration

Value	Effect
Append	Opens the file in write mode, and all the data you write to the file are appended to its existing contents.
Create	Requests the creation of a new file. If a file by the same name exists, this will be overwritten.
CreateNew	Requests the creation of a new file. If a file by the same name exists, an exception will be thrown. This mode will create and open a file only if it doesn't already exist and it's the safest mode.
Open	Requests that an existing file be opened.
OpenOrCreate	Opens the file in read-write mode if the file exists, or creates a new file and opens it in read-write mode if the file doesn't exist.
Truncate	Opens an existing file and resets its size to zero bytes. As you can guess, this file must be opened in write mode.

OpenRead

This method opens an existing file in read mode and returns a FileStream object associated with this file. You can use this stream to read from the file. The syntax of the OpenRead method is the following:
Dim FStream As FileStream = File.OpenRead(path)
The OpenRead method is equivalent to opening an existing file with read-only access via the Open method.

OpenText

This method opens an existing text file for reading and returns a StreamReader object associated with this file. Its syntax is the following:
Dim SR As StreamReader = File.OpenText(path)

OpenWrite

This method opens an existing file in write mode and returns a FileStrem object associated with this file. The syntax of the OpenRead method is as follows, where path is the path of the file:
Dim FStream As FileStream = File.OpenWrite(path)

The DirectoryInfo Class

To create a new instance of the DirectoryInfo class that references a specific folder, supply the folder's path in the class's constructor:
Dim DI As New DirectoryInfo(path)

CreateSubdirectory

This method creates a subfolder under the folder specified by the current instance of the class, and its syntax is as follows:
DI.CreateSubdirectory(path)

GetFileSystemInfos

This method returns an array of FileSystemInfo objects, one for each item in the folder referenced by the current instance of the class. The items can be either folders or files. To retrieve information about all the entries in a folder, create an instance of the DirectoryInfo class and then call its GetFileSystemInfos method:

```
Dim DI As New DirectoryInfo(path)
Dim itemsInfo() As FileSystemInfo
itemsInfo = DI.GetFileSystemInfos()
```

The FileInfo Class

The FileInfo class exposes many properties and methods, which are equivalent to the members of the File class, so I'm not going to repeat all of them here. The Copy/Delete/Move methods allow you to manipulate the file represented by the current instance of the FileInfo class, similar to the methods by the same name of the File class.

Length Property

This property returns the size of the file represented by the FileInfo object in bytes. The File class doesn't provide an equivalent property or method.

CreationTime, LastAccessTime, LastWriteTime Properties

These properties return a date value, which is the date the file was created, accessed for the last time, or written to for the last time, respectively. They are equivalent to the methods of the File object by the same name and the Get prefix.

Name, FullName, Extension Properties

These properties return the filename, full path, and extension, respectively, of the file represented by the current instance of the FileInfo class. They have no equivalents in the File class because the File class's methods require that you specify the path of the file, so its path and extension are known.

CopyTo, MoveTo Methods

These two methods copy or move, respectively, the file represented by the current instance of the FileInfo class. Both methods accept a single argument, which is the destination of the operation (the path to which the file will be copied or moved). If the destination file exists already, you can overwrite it by specifying a second optional argument, which has a True/False value:
FileInfo.CopyTo(path, force)

Directory Method

This method returns a DirectoryInfo value that contains information about the file's parent directory.

DirectoryName Method

This method returns a string with the name of the file's parent directory. The following statements return the two (identical) strings shown highlighted in this code segment:

```
Dim FI As FileInfo
FI = New FileInfo("c:\folder1\folder2\folder3\test.txt")
Debug.WriteLine(FI.Directory().FullName)
c:\folder1\folder2\folder3
Debug.WriteLine(FI.DirectoryName()) c:\folder1\folder2\folder3
```

The Path Class

The Path class contains an interesting collection of methods, which you can think of as utilities. The Path class's methods perform simple tasks such as retrieving a file's name and extension, returning the full path description of a relative path, and so on. The Path class's members are shared, and you must specify the path on which they will act as an argument.

Properties

The Path class exposes the following properties. Notice that none of these properties applies to a specific path; they're general properties that return settings of the operating system. The FileSystem component doesn't provide equivalent properties to the ones discussed in this section.

DirectorySeparatorChar

This property returns the directory separator character, which is the backslash character (\).

InvalidPathChars

This property returns the list of invalid characters in a path as an array of the following characters:

/ \ " < > —

You can use these characters to validate user input or pathnames read from a file. If you have a choice, let the user select the files through the Open dialog box, so that their pathnames will always be valid.

PathSeparator, VolumeSeparatorChar

These properties return the separator characters that appear between multiple paths (:) and volumes (;), respectively.

Methods

The most useful methods exposed by the Path class are utilities for manipulating filenames and pathnames, described in the following sections. Notice that the methods of the Path class are shared: You must specify the path on which they will act as an argument.

ChangeExtension

This method changes the extension of a file. Its syntax is as follows:
newExtension = Path.ChangeExtension(path, extension)

Combine

This method combines two path specifications into one. Its syntax is as follows:
newPath = Path.Combine(path1, path2)
Use this method to combine a folder path with a file path. The following expression will return the highlighted string:
Path.Combine("c:\textFiles", "test.txt")
c:\textFiles\test.txt

GetDirectoryName

This method returns the directory name of a path. The following statement:
Path.GetDirectoryName("C:\folder1\folder2\folder3\Test.txt")
will return this string:
C:\folder1\folder2\folder3

GetFileName, GetFileNameWithoutExtension

These two methods return the filename in a path, with and without its extension, respectively.

GetFullPath

This method returns the full path of the specified path; you can use it to convert relative pathnames to fully qualified pathnames. The following statement returned the highlighted string on my computer (it will be quite different on your computer, depending on the current directory):
Console.WriteLine(Path.GetFullPath("..\..\Test.txt"))
C:\WorkFiles\Learn VB\Chapters\Chapter 11\Projects\Test.txt

GetTempFile, GetTempPath

The GetTempFile method returns a unique filename, which you can use as a temporary storage area from within your application. The name of the temporary file can be anything, because no user will ever access it. In addition, the GetTempFile method creates a zero-length file on the disk, which you can open with the Open method. A typical temporary filename is the following:
C:\DOCUME~1\TOOLKI~1\LOCALS~1\Temp\tmp105.tmp
It was returned by the following statement on my system:
Debug.WriteLine(Path.GetTempFile)

HasExtension

This method returns a True/False value, indicating whether a path includes a file extension.

Accessing Files

There are two types of files: text files and binary files. To access a file, you must first set up a Stream object. Stream objects are created by the various methods that open or create files, as you have seen in the previous sections, and they return information about the file they're connected to.

Using Streams

Another benefit of using streams is that you can combine them. The typical example is that of encrypting and decrypting data. Data is encrypted through a special type of Stream, the CryptoStream.

The FileStream Class

The Stream class is an abstract one, and you can't use it directly in your code. To prepare your application to write to a file, you must set up a FileStream object, which is the channel between your application and the file. The methods for writing and reading data are provided by the StreamReader/StreamWriter or BinaryReader/BinaryWriter classes, which are created on top of the FileStream object.

Properties

You can use the following properties of the FileStream object to retrieve information about the underlying file.

Length

This read-only property returns the length of the file associated with the FileStream current object in bytes.

Position

This property gets or sets the current position within the stream. You can compare the Position property to the Length property to find out whether you have reached the end of an existing file. When these two properties are equal, there are no more data to read.

Methods

The FileStream object exposes a fewmethods, which are discussed here. Themethods for accessing a file's contents are discussed in the following section.

Lock

This method allows you to lock the file you're accessing, or part of it. The syntax of the Lock method is the following, where position is the starting position and length is the length of the range to be locked:

Lock(position, length)
To lock the entire file, use this statement:
FileStream.Lock(1, FileStream.Length)

Seek

This method sets the current position in the file represented by the FileStream object:
FileStream.Seek(offset, origin)
The new position is offset bytes from the origin. In place of the origin argument, use one of he SeekOrigin enumeration members, listed in Table below.

Table: SeekOrigin Enumeration

Value	Effect
Begin	The offset is relative to the beginning of the file.
Current	The offset is relative to the current position in the file.
End	The offset is relative to the end of the file.

SetLength

This method sets the length of the file represented by the FileStream object. Use this method after you have written to an existing file to truncate its length. The syntax of the SetLength method is this:
FileStream.SetLength(newLength)

The StreamWriter Class

The StreamWriter class is the channel through which you send data to a text file. To create a new StreamWriter object, declare a variable of the StreamWriter type. The first overloaded form of the constructor accepts a file's path as an argument and creates a new StreamWriter object for the file:
Dim SW As New StreamWriter(path)

NewLine Property

The StreamWriter object provides a handy property, the NewLine property, which allows you to change the string used to terminate each line in the file. This terminator is written to the text file by the WriteLine method, following the text. The default line-terminator string is a carriage return followed by a line feed (\r\n). The StreamReader object doesn't provide a similar property. It reads lines terminated by the carriage return (\r), line feed (\n), or carriage return/line feed (\r\n) characters only.

Methods

To send information to the underlying file, use the following methods of the StreamWriter object.

AutoFlush

This property is a True/False value that determines whether the methods that write to the file (the Write and WriteString methods) will also flush their buffer. If you set this property to False, the buffer will be flushed when the operating system gets a chance,

when the Flush method is called, or when you close the FileStream object. When AutoFlush is True, the buffer is flushed with every write operation.

Close

This method closes the StreamWriter object and releases the resources associated with it to the system. Always call the Close method after you finish using the StreamWriter object. If you have created the StreamWriter object on top of a FileStream object, you must also close the underlying stream too.

Flush

This method writes any data in the buffer to the underlying file.

WriteLine(data)

This method is identical to the Write method, but it appends a line break after saving the data to the file. You will find examples on using the StreamWriter class after we discuss the methods of the StreamReader class.

The StreamReader Class

The StreamReader class provides the necessary methods for reading from a text file and exposes methods that match those of the StreamWriter class (the Write and WriteLine methods). The StreamReader class's constructor is overloaded. You can specify the FileStream object it will use to read data from the file, the encoding scheme, and the buffer size. The simplest form of the constructor is the following:

```
Dim SR As New StreamReader(FS)
```

Methods

The StreamReader class provides the following methods for writing data to the underlying file.

Close

The Close method closes the current instance of the StreamReader class and releases any system resources associated with this object.

Peek

The Peek method returns the next character as an integer value, without actually removing it from the input stream. The Peek method doesn't change the current position in the stream. If there are no more characters left in the stream, the value −1 is returned. The Peek method will also return −1 if the current stream doesn't allow peeking.

Read

This method reads a number of characters from the StreamReader class to which it's applied and returns the number of characters read. The syntax of the Read method is as follows, where count is the number of characters to be read, starting at the startIndex location in the file:

```
charsRead = SR.Read(chars, startIndex, count)
```

ReadBlock

This method reads a number of characters from a text file and stores them in an array of characters. It accepts the same arguments as the Read method and returns the number of characters read.

```
Dim chars(count - 1) As Char
charsRead = SR.Read(chars, startIndex, count)
```

ReadLine

This method reads the next line from the text file associated with the StreamReader class and returns a string. If you're at the end of the file, the method returns the Null value. The syntax of the ReadLine method is the following:

```
Dim txtLine As String
txtLine = SR.ReadLine()
```

ReadToEnd

The last method for reading characters from a text file reads all the characters from the current position to the end of the file. We usually call this method once to read the entire file with a single statement and store its contents to a string variable. The syntax of the ReadToEnd method is as follows:

```
allText = SR.ReadToEnd()
```

The BinaryWriter Class

To prepare your application to write to a binary file, you must set up a BinaryWriter object, with the statement shown here, where FS is a properly initialized FileStream object:

```
Dim BW As New BinaryWriter(FS)
```

To specify the encoding of the text in the binary file, use the following form of the method:

```
Dim BW As New BinaryWriter(FS, encoding)
Dim BW As New BinaryWriter(path, encoding)
```

Methods

The BinaryWriter class exposes the following methods for manipulating binary files.

Close

This method flushes and closes the current BinaryWriter and releases any system resources associated with it.

Flush

This method clears all buffers for the current writer and writes all buffered data to the underlying file.

Seek

This method sets the position within the current stream. Its syntax is the following, where origin is a member of the SeekOrigin enumeration and offset is the distance from the origin:

Seek(offset, origin)

Write

The Write method writes a value to the current stream. This method is heavily overloaded, but it accepts a single argument, which is the value to be written to the file. The data type of its argument determines how it will be written. The Write method can save all the base types to the file in their native format, unlike the Write method of the TextWriter class, which stores them as strings.

WriteString

Whereas all other data types can be written to a binary file with the Write method, strings must be written with the WriteString method. This method writes a length-prefixed string to the file and advances the current position by the appropriate number of bytes. The string is encoded by the current encoding scheme, and the default value is UTF8Encoding.

The BinaryReader Class

The BinaryReader class provides the methods you need to read data from a binary file. As you have seen, binary files might also hold text, and the BinaryReader class provides the ReadString method to read strings written to the file by the WriteString method.

To use the methods of the BinaryReader class in your code, you must first create an instance of the class. The BinaryReader object must be associated with a FileStream object, and the simplest form of its constructor is the following, where streamObj is the FileStream object:

Dim BR As New BinaryReader(streamObj)

.

Methods

The BinaryReader class exposes the following methods for accessing the contents of a binary file.

Close

This method is the same as the Close method of the StreamReader class. It closes the current reader and releases the underlying stream.

PeekChar

This method returns the next available character from the streamwithout repositioning the current pointer. The character read is returned as an integer, or −1 if there are no more characters to be read from the stream.

Drawing and Painting with Visual Basic

In general, graphics fall into two major categories: vector and bitmap. Vector graphics are images generated by graphics methods such as DrawLine and DrawEllipse. The drawing you create is based on mathematical descriptions of the various shapes. Bitmap graphics are images made up of pixels arranged in rows and columns. Each pixel is represented by a Long numeric value, which is the pixel's color.

Display and size images. - The most appropriate control for displaying images is the PictureBox control. You can assign an image to the control through its Image property, either at design time or at runtime. To display a user-supplied image at runtime, call the DrawImage method of the control's Graphics object.
Generate graphics by using the drawing methods. - Every object you draw on, such as forms and PictureBox controls, exposes the CreateGraphics method, which returns a Graphics object. The Paint event's e argument also exposes the Graphics object of the control or form. To draw something on a control, retrieve its Graphics object and then call the Graphics object's drawing methods.
Display text in various ways, including gradient fills. - The Graphics object provides the DrawString method, which prints a user-supplied string on a control. You can also specify the coordinates of the string's upper-left corner and its font. To position the string, you need to know its dimensions..

Drawing with GDI+

The most recent version on GDI is called GDI+.One of the basic characteristics of GDI is that it's stateless. This means that each graphics operation is totally independent of the previous one and can't affect the following one. To draw a line, you must specify a Pen object and the two endpoints of the line.

The GDI+ classes reside in the following namespaces, and you must import one or more of them in your projects: System.Drawing, System.Drawing2D, System.Drawing.Imaging, and System.Drawing.Text. This chapter explores all three aspects of GDI+ — namely vector drawing, imaging, and typography.

Here are the statements to draw a line on the form:

```
Dim redPen As Pen = New Pen(Color.Red, 2)
Dim point1 As Point = New Point(10,10)
Dim point2 As Point = New Point(120,180)
Me.CreateGraphics.DrawLine(redPen, point1, point2)
```

The Basic Drawing Objects

This is a good point to introduce some of the objects we'll be using all the time when drawing. No matter what you draw or which drawing instrument you use, one or more of the objects discussed in this section will be required.

The Graphics Object

The Graphics object is the drawing surface — your canvas. All the controls you can draw on expose a Graphics property, which is an object, and you can retrieve it with the CreateGraphics method. Start by declaring a variable of the Graphics type and initialize it to the Graphics object returned by the control's CreateGraphics method:

```
Dim G As Graphics
G = PictureBox1.CreateGraphics
```

DpiX, DpiY - These two properties return the horizontal and vertical resolutions of the drawing surface, respectively. Resolution is expressed in pixels per inch (or dots per inch, if the drawing surface is your printer). On an average monitor, these two properties return a resolution of 96 dots per inch (dpi).

PageUnit - This property determines the units in which you want to express the coordinates on the Graphics object; its value can be a member of the GraphicsUnit enumeration

TextRenderingHint - This property specifies how the Graphics object will render text; its value is one of the members of the TextRenderingHint enumeration: AntiAlias, AntiAliasGrid- Fit, ClearTypeGridFit, SingleBitPerPixel, SingleBitPerPixelGridFit, and SystemDefault.

SmoothingMode - This property is similar to the TextRenderingHint, but it applies to shapes drawn with the Graphics object's drawing methods. Its value is one of the members of the SmoothingMode enumeration: AntiAlias, Default, HighQuality, HighSpeed, Invalid, and None.

The Point Class

The Point class represents a point on the drawing surface and is expressed as a pair of (x, y) coordinates. The x-coordinate is its horizontal distance from the origin, and the y-coordinate is its vertical distance from the origin. The origin is the point with coordinates (0, 0), and this is the top-left corner of the drawing surface.

The Rectangle Class

Another class that is often used in drawing is the Rectangle class. The Rectangle object is used to specify areas on the drawing surface. Its constructor accepts as arguments the coordinates of the rectangle's top-left corner and its dimensions:

```
Dim box As Rectangle
box = New Rectangle(X, Y, width, height)
```

The following statement creates a rectangle whose top-left corner is 1 pixel to the right and 1 pixel down from the origin, and its dimensions are 100 by 20 pixels:

```
box = New Rectangle(1, 1, 100, 20)
```

The Size Class

The Size class represents the dimensions of a rectangle; it's similar to a Rectangle object, but it doesn't have an origin, just dimensions. To create a new Size object, use the following constructor:
Dim S1 As New Size(100, 400)

The Color Class

The Color class represents colors, and there are many ways to specify a color. We'll discuss the Color class in more detail in Chapter 19, "Manipulating Images and Bitmaps." In the meantime, you can specify colors by name. Declare a variable of the Color type and initialize it to one of the named colors exposed as properties of the Color class:
Dim myColor As Color
myColor = Color.Azure

The Font Class

The Font class represents fonts, which are used when rendering strings via the DrawString method. To specify a font, you must create a new Font object; set its family name, size, and style; and then pass it as argument to the DrawString method. To create a new Font object, use a statement like the following:
Dim drawFont As New Font(”Verdana”, 12, FontStyle.Bold)

The Pen object exposes these properties:

Alignment - Determines the alignment of the Pen, and its value is one of the members of the PenAlignment enumeration: Center or Inset. When set to Center, the width of the pen is centered on the outline (half the width is inside the shape, and half is outside). When set to Inset, the entire width of the pen is inside the shape. The default value of this property isPenAlignment.Center.

LineJoin - Determines how two consecutive line segments will be joined. Its value is one of the members of the LineJoin enumeration: Bevel, Miter, MiterClipped, and Round. StartCap, EndCap Determines the caps at the two ends of a line segment, respectively. Their value is one of the members of the LineCap enumeration: Round, Square, Flat, Diamond, and so on.

DashCap - Determines the caps to be used at the beginning and end of a dashed line. Its value is one of the members of the DashCap enumeration: Flat, Round, and Triangle.

DashStyle - Determines the style of the dashed lines drawn with the specific Pen. Its value is one of the members of the DashStyle enumeration (Solid, Dash, DashDot, DashDotDot, Dot, and Custom).

PenType - Determines the style of the Pen; its value is one of the members of the PenType enumeration: HatchFilled, LinearGradient, PathGradient, SolidColor, and TextureFill.

The Brush Class

The Brush class represents the instrument for filling shapes; you can create brushes that fill with a solid color, a pattern, or a bitmap. In reality, there's no Brush object. The Brush class is actually an abstract class that is inherited by all the classes that implement a

brush, but you can't declare a variable of the Brush type in your code. The brush objects are shown in Table below.

Table - Brush Styles

Brush	Fill Effect
SolidBrush	Fills shapes with a solid color
HatchBrush	Fills shapes with a hatched pattern
LinearGradientBrush	Fills shapes with a linear gradient
PathGradientBrush	Fills shapes with a gradient that has one starting color and many ending colors

Solid Brushes

To fill a shape with a solid color, you must create a SolidBrush object with the following constructor, where brushColor is a color value, specified with the help of the Color object: Dim sBrush As SolidBrush

sBrush = New SolidBrush(brushColor)

Every filled object you draw with the sBrush object will be filled with the color of the brush.

Hatched Brushes

To fill a shape with a hatch pattern, you must create a HatchBrush object with the following constructor:

Dim hBrush As HatchBrush

HBrush = New HatchBrush(hatchStyle, hatchColor, backColor)

The HatchStyle enumeration has 54 members, so Table belowshows only a few common patterns.

Table - The HatchStyle Enumeration

Value	Effect
BackwardDiagonal	Diagonal lines from top-right to bottom-left
Cross	Vertical and horizontal crossing lines
DiagonalCross	Diagonally crossing lines
ForwardDiagonal	Diagonal lines from top-left to bottom-right
Horizontal	Horizontal lines
Vertical	Vertical lines

Gradient Brushes

A gradient brush fills a shape with a specified gradient. The LinearGradientBrush fills a shape with a linear gradient, and the PathGradientBrush fills a shape with a gradient that has one starting color and one or more ending colors. Gradient brushes are discussed in detail in the section titled "Gradients," later in this chapter.

Textured Brushes

In addition to solid and hatched shapes, you can fill a shape with a texture by using a TextureBrush object. The texture is a bitmap that is tiled as needed to fill the shape. Textured brushes are used to create rather fancy graphics, and we won't explore them in this tutorial.

The Path Class

The Path class represents shapes made up of various drawing entities, such as lines, rectangles, and curves. You can combine as many of these drawing entities as you'd like and build a new entity, which is called a path. Paths are usually closed and filled with a color, a gradient, or a bitmap. You can create a path in several ways. The simplest method is to create a new Path object and then use one of the following methods to append the appropriate shape to the path:

- AddArc
- AddEllipse
- AddPolygon
- AddBezier
- AddLine
- AddRectangle
- AddCurve
- AddPie
- AddString

The following method draws an ellipse:

```
Me.CreateGraphics.DrawEllipse(mypen, 10, 30, 40, 50)
```

To add the same ellipse to a Path object, use the following statement:

```
Dim myPath As New Path
myPath.AddEllipse(10, 30, 40, 50)
```

To display the path, call the DrawPath method, passing a Pen and Path object as arguments:

```
Me.CreateGraphics.DrawPath(myPen, myPath)
```

Drawing Shapes

Before getting into the details of the drawing methods, however, let's write a simple application that draws a couple of simple shapes on a form. First, we must create a Graphics object with the following statements:

```
Dim G As Graphics
G = Me.CreateGraphics
```

Everything you'll draw on the surface represented by the G object will appear on the form. Then, we must create a Pen object to draw with. The following statement creates a Pen object that's 1 pixel wide and draws in blue:

```
Dim P As New Pen(Color.Blue)
```

Persistent Drawing

If you switch to the Visual Studio IDE or any other window, and then return to the form of the SimpleShapes application, you'll see that the drawing has disappeared! The same will happen if you minimize the window and then restore it to its normal size. Everything you draw on the Graphics object is temporary. It doesn't become part of the Graphics object and is visible only while the control, or the form, need not be redrawn. As soon as the form is redrawn, the shapes disappear.

Drawing Methods

The Framework provides several drawing methods, one for each basic shape. All drawing methods have a few things in common. The first argument is always a Pen object, which will be used to render the shape on the Graphics object.

Table below shows the names of the drawing methods. The first column contains the methods for drawing stroked shapes, and the second column contains the corresponding methods for drawing filled shapes (if there's a matching method).

Table - The Drawing Methods

Drawing Method	Filling Method	Description
DrawArc		Draws an arc
DrawBezier		Draws very smooth curves with fixed endpoints, whose exact shape is determined by two control points
DrawBeziers		Draws multiple Bezier curves in a single call
DrawClosedCurve	FillClosedCurve	Draws a closed curve
DrawCurve		Draws curves that pass through certain points

DrawLine

The DrawLine method draws a straight-line segment between two points with a pen supplied as an argument. The simplest forms of the DrawLine method are the following, where point1 and point2 are either Point or PointF objects, depending on the coordinate system in use:

```
Graphics.DrawLine(pen, X1, Y1, X2, Y2)
Graphics.DrawLine(pen, point1, point2)
```

DrawRectangle

The DrawRectangle method draws a stroked rectangle and has two forms:
Graphics.DrawRectangle(pen, rectangle)
Graphics.DrawRectangle(pen, X1, Y1, width, height)

DrawEllipse

An ellipse is an oval or circular shape, determined by the rectangle that encloses it. To draw an ellipse, call the DrawEllipse method, which has two basic forms:

Graphics.DrawEllipse(pen, rectangle)
Graphics.DrawEllipse(pen, X1, Y1, width, height)

The arguments are the same as with the DrawRectangle method because an ellipse is basically a circle deformed to fit in a rectangle. The two ellipses and their enclosing rectangles shown in Figure 14.7 were generated with the statements of Listing 14.5.

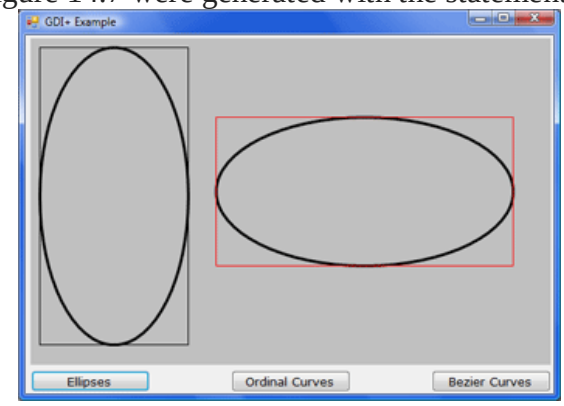

Figure 14.7 - Two ellipses with their enclosing rectangles

Listing 14.5: Drawing Ellipses and Their Enclosing Rectangles

```
Private Sub bttnEllipses_Click(ByVal sender As System.Object, _
ByVal e As System.EventArgs) Handles bttnEllipses.Click
Dim G As Graphics
G = PictureBox1.CreateGraphics
G.Clear(PictureBox1.BackColor)
G.SmoothingMode = Drawing.Drawing2D.SmoothingMode.AntiAlias
G.FillRectangle(Brushes.Silver, ClientRectangle)
Dim R1, R2 As Rectangle
R1 = New Rectangle(10, 10, 160, 320)
R2 = New Rectangle(200, 85, 320, 160)
G.DrawEllipse(New Pen(Color.Black, 3), R1)
G.DrawRectangle(Pens.Black, R1)
G.DrawEllipse(New Pen(Color.Black, 3), R2)
G.DrawRectangle(Pens.Red, R2)
End Sub
```

DrawPie

A pie is a shape similar to a slice of pie (an arc along with the two line segments that connect its endpoints to the center of the circle or the ellipse, to which the arc belongs). The DrawPie method has two forms:

Graphics.DrawPie(pen, rectangle, start, sweep)
Graphics.DrawPie(pen, X, Y, width, height, start, sweep)

The statements of Listing 14.6 create a pie chart by drawing individual pie slices. Each pie starts where the previous one ends, and the sweeping angles of all pies add up to 360

degrees, which corresponds to a full rotation (a full circle). Unlike the other samples of this section, I've used the FillPie method, because we hardly ever draw the outlines of the pies; we fill each one with a different color instead. Figure 14.8 shows the output produced by Listing 14.6.

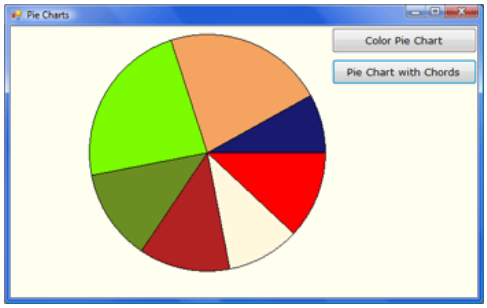

Figure 14.8 - A simple pie chart generated with the FillPie method

Listing 14.6: Drawing a Simple Pie Chart with the FillPie Methods

```
Private Sub Button2_Click(ByVal sender As System.Object, _
ByVal e As System.EventArgs) Handles Button2.Click
Dim g As System.Drawing.Graphics
g = Me.CreateGraphics
Dim brush As System.Drawing.SolidBrush
Dim rect As Rectangle
brush = New System.Drawing.SolidBrush(Color.Green)
Dim Angles() As Single = {0, 43, 79, 124, 169, 252, 331, 360}
Dim colors() As Color = {Color.Red, Color.Cornsilk, _
Color.Firebrick, Color.OliveDrab, _
Color.LawnGreen, Color.SandyBrown, Color.MidnightBlue}
g.Clear(Color.Ivory)
rect = New Rectangle(100, 10, 300, 300)
Dim angle As Integer
For angle = 1 To Angles.GetUpperBound(0)
brush.Color = colors(angle - 1)
g.FillPie(brush, rect, Angles(angle - 1), Angles(angle) - Angles(angle - 1))
Next
g.DrawEllipse(Pens.Black, rect)
End Sub
```

DrawPolygon

The DrawPolygon method draws an arbitrary polygon. It accepts two arguments: the Pen that it will use to render the polygon and an array of points that define the polygon. The syntax of the DrawPolygon method is the following:

```
Graphics.DrawPolygon(pen, points())
```

where points is an array of points, which can be declared with a statement like the following:

```
Dim points() As Point = {New Point(x1, y1), New Point(x2, y2), ...}
```

DrawCurve

Curves are smooth lines drawn as cardinal splines. The simplest form of the DrawCurve method has the following syntax, where points is an array of points:

Graphics.DrawCurve(pen, points, tension)

DrawBezier

The DrawBezier method draws Bezier curves, which are smoother than cardinal splines. A Bezier curve is defined by two endpoints and two control points. The DrawBezier method accepts a pen and four points as arguments:

Graphics.DrawBexier(pen, X1, Y1, X2, Y2, X3, Y3, X4, Y4)

Graphics.DrawBezier(pen, point1, point2, point3, point4)

DrawPath

This method accepts a Pen object and a Path object as arguments and renders the specified path on the screen:

Graphics.DrawPath(pen, path)

DrawString, MeasureString

The DrawString method renders a string in a single line or multiple lines. As a reminder, the TextRenderingHint property of the Graphics object allows you to specify the quality of the rendered text. The simplest f orm of the DrawString method is the following:

```
Graphics.DrawString(string, font, brush, X, Y)
```

The simplest form of the MeasureString method is the following, where string is the string to be rendered and font is the font in which the string will be rendered:

```
Dim textSize As SizeF
textSize = Me.Graphics.MeasureString(string, font)
```

The StringFormat Object

Some of the overloaded forms of the DrawString method accept an argument of the StringFormat type. This argument determines characteristics of the text and exposes a few properties of its own, which include the following:

- **Alignment** - Determines the alignment of the text; its value is a member of the StringAlignment enumeration: Center (text is aligned in the center of the layout rectangle), Far (text is aligned far from the origin of the layout rectangle), and Near (text is aligned near the origin of the layout rectangle).
- **Trimming** - Determines how text will be trimmed if it doesn't fit in the layout rectangle. Its value is one of the members of the StringTrimming enumeration: Character (text is trimmed to the nearest character), EllipsisCharacter (text is trimmed to the nearest character and an ellipsis is inserted at the end to indicate that some of the text is missing), EllipsisPath (text at the middle of the string is removed and replaced by an ellipsis), EllipsisWord (text is trimmed to the nearest word and an ellipsis is inserted at the end), None (no trimming), and Word (text is trimmed to the nearest word).
- **FormatFlags** - Specifies layout information for the string. Its value can be one of the members of the StringFormatFlags enumeration. The two members of this

enumeration that you might need often are DirectionRightToLeft (prints to the left of the specified point) and DirectionVertical.

DrawImage

The DrawImage method, which renders an image on the Graphics object, is a heavily overloaded and quite flexiblemethod. The following form of themethod draws the image at the specified location. Both the image and the location of its top-left corner are passed to the method as arguments (as Image and Point arguments, respectively):

```
Graphics.DrawImage(img, point)
```

Gradients

In this section, you'll look at the tools for creating gradients. The techniques for gradients can get quite complicated, but I will limit the discussion to the types of gradients you'll need for business or simple graphics applications.

Linear Gradients

To draw a linear gradient, you must create an instance of the LinearGradientBrush class with a statement like the following:

```
Dim lgBrush As LinearGradientBrush
lgBrush = New LinearGradientBrush(rect, startColor, endColor, gradientMode)
```

Path Gradients

This is the ultimate gradient tool. Using a PathGradientBrush, you can create a gradient that starts at a single point and fades into multiple different colors in different directions. You can fill a rectangle starting from a point in the interior of the rectangle, which is colored, say, black.

Each corner of the rectangle might have a different ending color. The PathGradientBrush will change color in the interior of the shape and will generate a gradient that's smooth in all directions. Figure 14.14 shows a rectangle filled with a path gradient, although the gray shades on the printed page won't show the full impact of the gradient. Open the Gradients project you downloaded earlier to see the same figure in color (use the Path Gradient button).

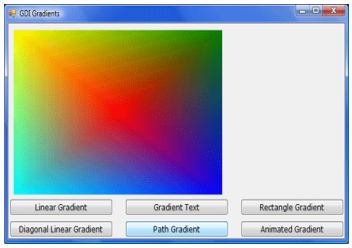

Figure 14.14 - A path gradient starting at the middle of the rectangle

Clipping

The SetClip method has the following forms:

```
Graphics.SetClip(Graphics)
Graphics.SetClip(Rectangle)
Graphics.SetClip(GraphicsPath)
Graphics.SetClip(Region)
```

Applying Transformations

In computer graphics, there are three types of transformations: scaling, translation, and rotation:

The scaling transformation changes the dimensions of a shape but not its basic form. If you scale an ellipse by 0.5, you'll get another ellipse that's half as wide and half as tall as the original one. The translation transformation moves a shape by a specified distance. If you translate a rectangle by 30 pixels along the x-axis and 90 pixels along the y-axis, the new origin will be 30 pixels to the right and 90 pixels down from the original rectangle's top-left corner.

The rotation transformation rotates a shape by a specified angle, expressed in degrees; 360 degrees correspond to a full rotation, and the shape appears the same. A rotation by 180 degrees is equivalent to flipping the shape vertically and horizontally.

Transformations are stored in a 5 × 5 matrix, but you need not set it up yourself. The Graphics object provides the ScaleTransform, TranslateTransform, and RotateTransform methods, and you can specify the transformation to be applied to the shape by calling one or more of these methods and passing the appropriate argument(s).

The ScaleTransform method accepts as arguments scaling factors for the horizontal and vertical directions:

```
Graphics.ScaleTransformation(Sx, Sy)
```

The TranslateTransform method accepts two arguments, which are the displacements along the horizontal and vertical directions:

```
Graphics.TranslateTransform(Tx, Ty)
```

The Tx and Ty arguments are expressed in the coordinates of the current coordinate system. The shape is moved to the right by Tx units and down by Ty units. If one of the arguments is negative, the shape is moved in the opposite direction (to the left or up).

The RotateTransform method accepts a single argument, which is the angle of rotation expressed in degrees:

```
Graphics.RotateTransform(rotation)
```

The rotation takes place about the origin. As you will see, the final position and orientation of a shape is different if two identical rotation and translation transformations are applied in a different order.
Every time you call one of these methods, the elements of the transformation matrix are set accordingly. All transformations are stored in this matrix, and they have a cumulative effect. If you specify two translation transformations, for example, the shape will be

translated by the sum of the corresponding arguments in either direction. These two transformations:

```
Graphics.TranslateTransform(10, 40)
Graphics.TranslateTransform(20, 20)
```

are equivalent to the following one:

```
Graphics.TranslateTransform(30, 60)
```

To start a new transformation after drawing some shapes on the Graphics object, call the Reset-Transform method, which clears the transformation matrix.

Bitmaps

Specifying Colors

The model of designing colors based on the intensities of their RGB components is called the RGB model, and it's a fundamental concept in computer graphics. If you aren't familiar with this model, this section is well worth reading. Nearly every color you can imagine can be constructed by mixing the appropriate percentages of the three basic colors.

Defining Colors

To manipulate colors, use the Color class of the Framework. This is a shared class, and you need not create new Color objects; just call the appropriate property or method of the Color class. The Color class exposes 128 predefined colors as properties, which you can access by name, and additional members for specifying custom colors. For example, you can define colors by using the FromARGB method of the Color class. This method accepts three arguments, which are the components of the primary colors in the desired color:

```
Color.FromARGB(Red, Green, Blue)
```

The method returns a Color value, which you can assign to a variable of the same type, or use it directly as the value of a Color property. To change the form's background color to yellow, you can assign the value returned by the FromARGB method to the BackColor property of a form or control:

```
Form1.BackColor = FromARGB(255, 128, 128)
```

Alpha Blending

Besides the red, green, and blue components, a Color value might also contain a transparency component. This value determines whether the color is opaque (255) or transparent (0). In the case of transparent colors, you can specify the degree of transparency. This component is the alpha component. The following statement creates a new color value, which is yellow and 25 percent transparent:

```
Dim trYellow As Color
trYellow = Color.FromARGB(192, Color.Yellow)
```

The preceding statements print the logo at two locations on the image of the PictureBox1 control with different colors, as shown in Figure 15.2.

Figure 15.2 - Watermarking an image with a semitransparent string

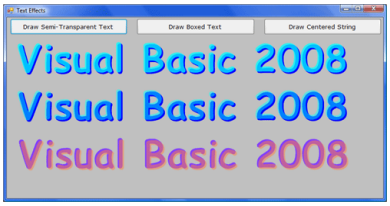

Figure 15.3 - Creating a 3D effect by superimposing transparency on an opaque and a semitransparent string

The code behind the Draw Semi-Transparent Text button is quite simple, really. First it draws the string with the solid blue brush:

```
brush = New SolidBrush(Color.FromARGB(255, 0, 0, 255))
```

Processing Bitmaps

A bitmap is a two-dimensional array of color values. These values are stored in disk files, and when an image is displayed on a PictureBox or Form control, each of its color values is mapped to a pixel on the PictureBox or form. This is true when the image isn't resized, of course.

Refreshing the Image

When you draw on a bitmap, which is associated with the Image property of a PictureBox control, the image on the control isn't refreshed every time the bitmap is modified. Instead, the image is modified when the Paint event has a chance to be serviced. The processing is implemented with two nested loops that iterate through the bitmap's rows and columns, as in the following code:

```
For pxlCol As Integer = 0 To PictureBox1.Image.Height - 1
For pxlRow As Integer = 0 To PictureBox1.Image.Width - 1
' statements to process current pixel:
' (pxlRow, pxlCol)
Next
Next
```

The image on the control won't be refreshed until the outer loop has finished. As a result, users can't see the progress of the operation; they will see the new image after all its pixels have been processed.
To force the PictureBox control to refresh its image, you must call the Refresh method.

PART-B

POSSIBLE QUESTIONS(8 MARKS)

1. How the dates are handled in VB.NET. Explain its methods with example
2. Elaborate Directory Class and File Class with example
3. Explain in detail about bitmaps in VB.NET.
4. Write a program to draw Ellipses and enclosing it with rectangles in VB.NET
5. Explain the properties and methods of the Char Class with syntax and example.
6. Discuss about displaying images in Vb.NET
7. Elaborate the time span class with an example.
8. Explicate the methods in drawing with GDI with example.
9. Explain in detail about handling strings in VB.NET with examples.
10. Elucidate the different methods of co-ordinate transformation

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VISUAL PROGRAMMIN

questions	opt1
The ____ data type stores characters as individual	char
. _____ class is used to store the string and also to manipulate the string	The string class
The _____ method to accept numeric keystrokes and to reject letters and punctuation symbols.	IsDigit
The ____method takes into consideration hexadecimal digits	IsLetter
_____methods convert their argument to the lowercase character	ToUpper
_____methods convert their argument to the uppercase character	ToUpper
The String class implements the _____ data type	char
The____method concatenates the two or more strings	strcat
The ____method copies the value of one string variable to another	string
The_____method inserts one or more characters at a specified location in a string	add
The ____method joins two or more strings	concat
split a long string into smaller ones by using the____ method	strsplit()
The ____ method removes a given number of characters from a string	Remove
The____Method replaces all instances of a specified character	remove
There are eight spaces to the left of the _____string	left
The tick property in DateTime Class, Each tick represents _____ nanoseconds	10
The _____ method is used to find the given character is lower case	. Islower()
. _____ class is used to store the string and also to manipulate the string	The string class
The _____ method appends a base type to the current instance of the StringBuilder class,	Append Format

_____method returns the number of days in a specific month	**DaysInMonth**
The day of the month with a leading zero for single-digit days_____	d
_____The full name of the month	mm
_____time converts the current instance of the DateTime class into universal coordinated time (UCT).	ToUniversalTime
_____ method converts a UCT time value to local time.	ToUniversalTime
_____ method creates a new folder	CreateDirectory
_____ method deletes a folder and all the files in it.	delete
The____ method accepts a path as an argument and returns a True/False value indicating whether the specified folder exists	exit
The_____ method moves an entire folder to another location in the file system	move
_____accepts a string argument, which is a path, and sets the current directory to the specified path.	GetCurrentDirectory
_____ method accepts a path as an argument and returns a Date value	GetCreationTime
____ time accepts a path and a date value as arguments and sets the specified folder's	GetCreationTime
The _____File class exposes methods for manipulating files	System.IO.
The___ method creates a new file and returns a FileStream object	**create**
The___ character returns the directory separator character	/
The___ method changes the extension of a file	ChangeExtension
The___method sets the current position in the file represented by the FileStream object	seekorigin
The___ property gets or sets the current position within the stream.	Position
The ____ class is the channel through which you send data to a text file.	**StreamWriter**
The___ method writes any data in the buffer to the underlying file.	AutoFlush
The____ method doesn't change the current position in the stream.	seek
The ____ class provides the methods you need to read data from a binary file.	BinaryReader

The_____ method returns the next available character from the streamwithout repositioning the current pointer	Peek
_____ is represented by a Long numeric value, which is the pixel's color.	pixelcolor
The most recent version on GDI is called____	GDI+.
The____ coordinate is its horizontal distance from the origin	y
The____ coordinate is its vertical distance from the origin	**y**
the ____ coordinate to top-left corner of the drawing surface.	y
The _____class represents the dimensions of a rectangle	NewSize
____Determines how two consecutive line segments will be joined	merge
_____Determines the caps to be used at the beginning and end of a dashed line	Dashcap
_____Determines the style of the dashed lines drawn with the specific Pen	DashCap
The ____ class represents the instrument for filling shapes	**Brush**
_____ brush Fills shapes with a gradient that has one starting color and many ending colors	Brush
____text is trimmed to the nearest word and an ellipsis is inserted at the end	EllipsisPath
____text is aligned far from the origin of the layout rectangle	Center
_____ control executes timer events at specifies intervals of time	time
What increments of time is applied interval property of the timer control____	Seconds
The _____ transformation changes the dimensions of a shape but not its basic form	Rotation
RGB components is called _____	ARGB
A rotation by ____ degrees is equivalent to flipping the shape vertically and horizontally.	360
GDI stands for _____	Global design interface
Which object is used to draw gon the Graphics object surface?	pencil
Which method is used to draw a string in the specified font on the graphics surface	**DrawString()**

The _____ transformation changes the dimensions of a shape but not its basic form	Rotation
_____Determines the style of the dashed lines drawn with the specific Pen	DashCap
The ____ class represents the instrument for filling shapes	**Brush**
_____ brush Fills shapes with a gradient that has one starting color and many ending colors	Brush
A _____ is a collection of colored pixels, arranged in rows and columns	Colors

ER EDUCATION

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tion

G (15CSU501)

opt2	opt3	opt4	answer
character	both a & b	none	char
the char class	stringbuilder class	both a&b	the string class
IsLetter	IsLetter/IsDigit	none	IsDigit
IsLetter/IsNumber	IsNumber	none	IsNumber
ToLower	IsUpper	IsLower	ToLower
ToLower	IsUpper	IsLower	ToUpper
String	charstring	none	String
cat	concat	none	concat
Copy	strcat	none	Copy
Insert	both a&b	none	Insert
merge	join	both a&b	join
Split	strspliting	none	Split
delete	both a &b	none	Remove
Replace	ReplaceAll	All	Replace
right-padded	left-padded	none	left-padded
100	1000	none	100
IslowerCase()	Tolower()	Isletter()	Tolower()
the char class	stringbuilder class	both a&b	the string class
Append	both a&b	none	Append

month	daymonth	none	**DaysIn Month**
dd	ddd	dddd	dd
mmm	mmmm	m	mmmm
ToLocalTime	UniversalTime	LocalTime	ToUniversalTime
LocalTime	ToLocalTime	UniversalTime	ToLocalTime
Directory.CreateDirectory(path)	directory(path)	none	CreateDirectory
remove	both a&b	none	delete
exists	exitsub	none	exists
moveall	both a&b	none	move
SetCurrentDirectory	GetDirectories	none	SetCurrentDirectory
SetCreationTime	creationTime	none	GetCreationTime
SetCreationTime	creationTime	none	SetCreationTime
import system.io.	imports system.io.	none	System.IO.
add	insert	none	create
\	"	<>	\
ChangingExtension	Extension	none	ChangeExtension
seek	seekoffset	none	seek
PositionOn	OnPosition	none	Position
FileStreamWriter	FileWriter	none	StreamWriter
Flush	Auto	none	Flush
SeekOrigin	Peek	PeekOrigin	Peek
BinaryWriter	StreamReader	StreamWriter	BinaryReader

PeekChar	Seek	SeekChar	PeekChar
pixel	color	none	pixel
GDI	GDI-	none	GDI+.
x	(0,0)	none	x
x	(0,0)	none	y
x	**(0,0)**	none	(0,0)
Size	Sizeobject	none	Size
join	**LineJoin**	none	**LineJoin**
startcap	endcap	Linecap	DashCap
DashStyle	DashDot	DashDotDot	DashStyle
SolidBrush	HatchBrush	PathGradientBrush	Brush
PathGradientBrush	HatchBrush	SolidBrush	PathGradientBrush
EllipsisWord	EllipsisCharacter	none	EllipsisPath
Far	Near	none	Far
watch	timer	none	timer
Nanoseconds	milliseconds	minutes	
Translation	scaling	none	scaling
RGB	custom colors	none	RGB
90	180	0	180
Graphics design interchange	**Graphics design interface**	Global data interchange	Graphics design interface
pen	image	controls	pen
DrawLetters()	DrawChar()	DrawImage()	**DrawString()**

Translation	**scaling**	shape	scaling
DashStyle	DashDot	DashDotDot	DashStyle
SolidBrush	HatchBrush	PathGradientBrush	Brush
PathGradientBrush	HatchBrush	SolidBrush	PathGradientBrush
Bitmaps	blending	images	**Bitmaps**

UNIT-IV
SYLLABUS

Web forms and ASP.NET: Web forms, web controls-ASP.NET Configuration, Scope and state- ASP.NET and state-The Application Object-ASP sessions-The Session object-ASP.NET objects and components-Active server components and controls.

Web forms and ASP.NET

What is Web Forms?

Web Forms is one of the 3 programming models for creating ASP.NET web sites and web applications.

The other two programming models are Web Pages and MVC (Model, View, Controller).

Web Forms is the oldest ASP.NET programming model, with event driven web pages written as a combination of HTML, server controls, and server code.

Web Forms are compiled and executed on the server, which generates the HTML that displays the web pages.

Web Forms comes with hundreds of different web controls and web components to build user-driven web sites with data access.

- Based on Microsoft ASP.NET technology, in which code that runs on the server dynamically generates Web page output to the browser or client device.
- Compatible with any browser or mobile device. An ASP.NET Web page automatically renders the correct browser-compliant HTML for features such as styles, layout, and so on.
- Compatible with any language supported by the .NET common language runtime, such as Microsoft Visual Basic and Microsoft Visual C#.
- Built on the Microsoft .NET Framework. This provides all the benefits of the framework, including a managed environment, type safety, and inheritance.
- Flexible because you can add user-created and third party controls to them

ASP.NET Web Forms offer

- Separation of HTML and other UI code from application logic.
- A rich suite of server controls for common tasks, including data access.

- Powerful data binding, with great tool support.
- Support for client-side scripting that executes in the browser.
- Support for a variety of other capabilities, including routing, security, performance, internationalization, testing, debugging, error handling and state management.

Features of ASP.NET Web Forms

- Server Controls
- Master Pages
- Working with Data
- Membership
- Client Script and Client Frameworks
- Security
- Performance
- Debugging and Error Handling

All server controls must appear within a <form> tag, and the <form> tag must contain the runat="server" attribute. The runat="server" attribute indicates that the form should be processed on the server. It also indicates that the enclosed controls can be accessed by server scripts:

```
<form runat="server">

...HTML + server controls

</form>
```

Note: The form is always submitted to the page itself. If you specify an action attribute, it is ignored. If you omit the method attribute, it will be set to method="post" by default. Also, if you do not specify the name and id attributes, they are automatically assigned by ASP.NET.

Note: An .aspx page can only contain ONE <form runat="server"> control!

Stages in Web Forms Processing

- The ASP.NET page framework processes Web Forms pages in distinct stages.
- During each stage of Web Forms processing, events may be raised, and any event handler that corresponds to the event runs.

- These methods provide you with entry points — hooks — that allow you to update the contents of the Web Forms page.

The table below lists the most common stages of page processing, the events raised when they occur, and typical uses at each stage. These stages are repeated each time the form is requested or posted. The Page.IsPostBack property allows you to test whether the page is being processed for the first time

ASP.NET Configuration, Scope and state

The behavior of an ASP.NET application is affected by different settings in the configuration files:

- machine.config
- web.config

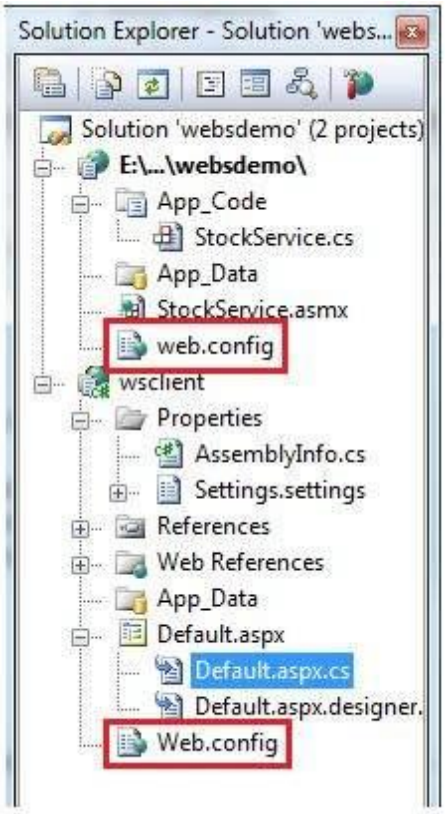
The machine.config file contains default and the machine-specific value for all supported settings. The machine settings are controlled by the system administrator and applications are generally not given access to this file.

An application however, can override the default values by creating web.config files in its roots folder. The web.config file is a subset of the machine.config file.

If the application contains child directories, it can define a web.config file for each folder. Scope of each configuration file is determined in a hierarchical top-down manner.

Any web.config file can locally extend, restrict, or override any settings defined on the upper level.

Visual Studio generates a default web.config file for each project. An application can execute without a web.config file, however, you cannot debug an application without a web.config file.



In this application, there are two web.config files for two projects i.e., the web service and the web site calling the web service.

The web.config file has the configuration element as the root node. Information inside this element is grouped into two main areas: the configuration section-handler declaration area, and the configuration section settings area.

The following code snippet shows the basic syntax of a configuration file:

```
<configuration>

  <!-- Configuration section-handler declaration area. -->
    <configSections>
      <section name="section1" type="section1Handler" />
      <section name="section2" type="section2Handler" />
    </configSections>
  <!-- Configuration section settings area. -->

  <section1>
```

```
    <s1Setting1 attribute1="attr1" />
  </section1>
    <section2>
    <s2Setting1 attribute1="attr1" />
  </section2>

  <system.web>
    <authentication mode="Windows" />
  </system.web>

</configuration>
```

Configuration Section Handler declarations

The configuration section handlers are contained within the <configSections> tags. Each configuration handler specifies name of a configuration section, contained within the file, which provides some configuration data. It has the following basic syntax:

```
<configSections>
  <section />
  <sectionGroup />
  <remove />
  <clear/>
</configSections>
```

It has the following elements:

- **Clear** - It removes all references to inherited sections and section groups.
- **Remove** - It removes a reference to an inherited section and section group.
- **Section** - It defines an association between a configuration section handler and a configuration element.
- **Section group** - It defines an association between a configuration section handler and a configuration section.

Application Settings

The application settings allow storing application-wide name-value pairs for read-only access. For example, you can define a custom application setting as:

```
<configuration>
  <appSettings>
    <add key="Application Name" value="MyApplication" />
  </appSettings>
</configuration>
```

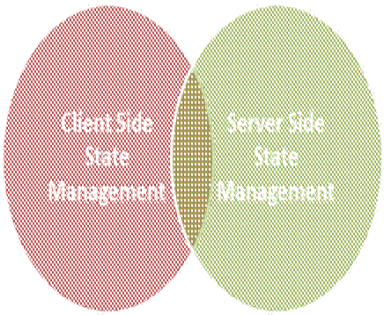
For example, you can also store the name of a book and its ISBN number:

```
<configuration>
  <appSettings>
    <add key="appISBN" value="0-273-68726-3" />
    <add key="appBook" value="Corporate Finance" />
  </appSettings>
</configuration>
```

STATE MANAGEMENT

State management means to preserve state of a control, web page, object/data, and user in the application explicitly because all ASP.NET web applications are stateless, i.e., by default, for each page posted to the server, the state of controls is lost. Nowadays all web apps demand a high level of state management from control to application level.

In ASP.NET, there are 2 state management methodologies. These are:



Client Side State Management

Whenever we do use client side state management, the state related information will directly get stored on the client side. That particular information will travel back and communicate with every request generated by the user then afterwards provides responses after server side communication.

This architecture is something like that:

Server Side State Management

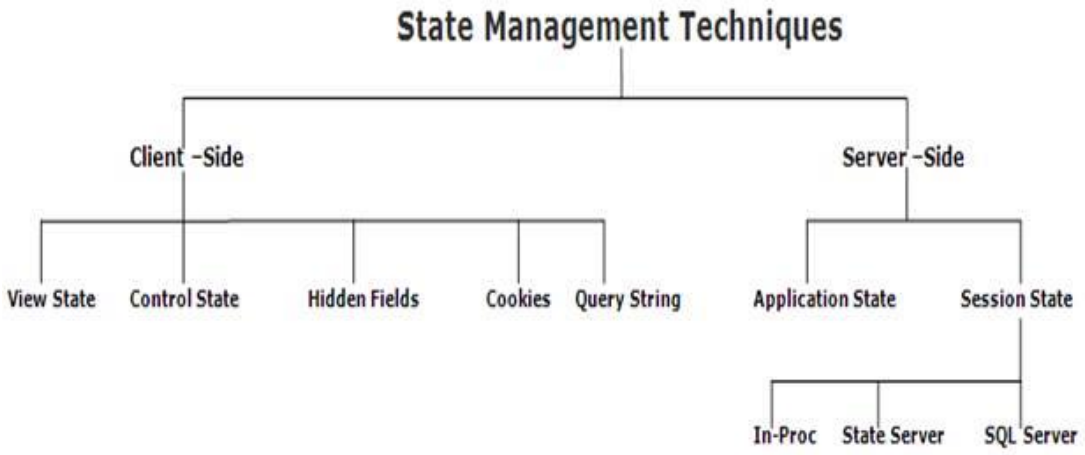
Server side state management is different from client side state management but the operations and working is somewhat same in functionality. In server side state management, all the information is stored in the user memory. Due to this functionality, there are more secure domains at server side in comparison to client side state management.

The structure is something like that:

It will be a little difficult to directly evaluate what will be better for our application. We cannot directly say that we are going to use client side or server side architecture of state management.

State Management | Techniques

State management techniques are based on client side and server side. Their functionality differs according to the change in state so, here is the hierarchy:



Client Side | Techniques

Client side state management techniques are:

- View State
- Hidden field
- Cookies
- Control State
- Query Strings

Server Side | Technique

Server side state management techniques are:

- Session State
- Application State

Levels of state management

1. Control level: In ASP.NET, by default controls provide state management automatically.
2. Variable or object level: In ASP.NET, member variables at page level are stateless and thus we need to maintain state explicitly.
3. Single or multiple page level: State management at single as well as multiple page level i.e., managing state between page requests.
4. User level: State should be preserved as long as a user is running the application.
5. Application level: State available for complete application irrespective of the user, i.e., should be available to all users.

6. Application to application level: State management between or among two or more applications.

Client Side | Techniques

View State

In general, we can say it is used for storing user data in ASP.NET. Sometimes in ASP.NET applications, users want to maintain or store their data temporarily after a post back. In this case, VIEW STATE is the most used and preferred way of doing this mechanism.

This property is enabled by default, but we can make changes according to our functionality, what we need to do is just change EnableViewState value to either TRUE for enabling it or FALSE for opposite operation.

[View State Management]

```
// Page Load Event
protected void Page_Load(object sender, EventArgs e)
{
   if (IsPostBack)
   {
      if (ViewState["count"] != null)
      {
         int ViewstateVal = Convert.ToInt32(ViewState["count"]) + 1;
         View.Text = ViewstateVal.ToString();
         ViewState["count"]=ViewstateVal.ToString();
      }
      else
      {
         ViewState["count"] = "1";
      }
   }
}
// Click Event
protected void Submit(object sender, EventArgs e)
{
```

```
    View.Text=ViewState["count"].ToString();
}
```

Points to Remember

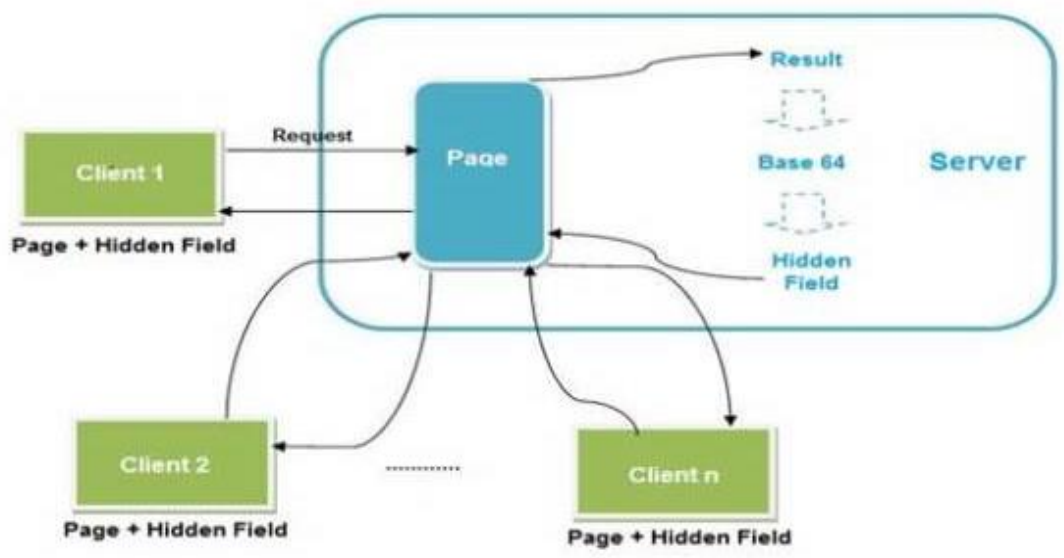
Some of the features of view state are:

- It is page level state management
- Used for holding data temporarily
- Can store any type of data
- Property dependent

Hidden Field

Hidden field is used for storing small amount of data on client side. In most simple words, it's just a container that contains some objects but their result does not get rendered on our web browser. It is invisible in the browser.

It stores one value for the single variable and it is the preferable way when a variable's value is hanged frequently but we don't need to keep track of that every time in our application or web program.



[Hidden Field Management]

```
// Hidden Field
```

```
int newVal = Convert.ToInt32(HiddenField1.Value) + 1;
HiddenField1.Value = newVal.ToString();
Label2.Text = HiddenField1.Value;
```

Points to Remember

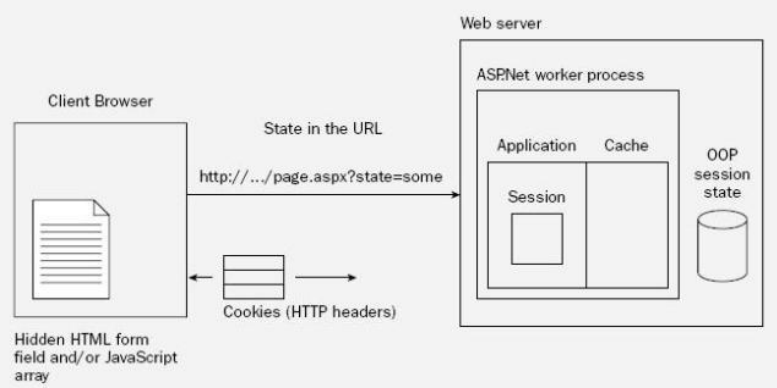
Some features of hidden fields are:

- Contains small amount of memory
- Direct functionality access

Cookies

Cookie is a small text file that gets stored in users hard drive using client's browser. Cookies are just used for the sake of user's identity matching as it only stores information such as sessions ids, some frequent navigation or postback request objects.

Whenever we get connected to the internet for accessing particular service, that cookie file gets accessed from our hard drive via our browser for identifying user. The cookie access depends upon the life cycle of expiration of that particular cookie file.

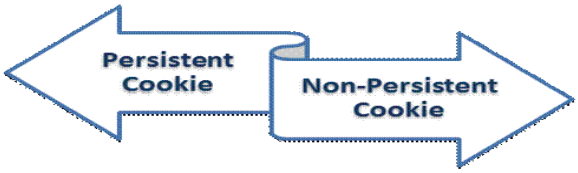


[Cookie Management]

```
int postbacks = 0;
if (Request.Cookies["number"] != null)
{
   postbacks = Convert.ToInt32(Request.Cookies["number"].Value) + 1;
}
// Generating Response
else
{
   postbacks = 1;
}
Response.Cookies["number"].Value = postbacks.ToString();
```

```
Result.Text = Response.Cookies["number"].Value;
```

Cookie | Types



Persistent Cookie

Cookie having expiration date is called persistent cookie. These type of cookies reach their end as their expiration dates comes to end. In this cookie, we set an expiration date.

```
Response.Cookies["UserName"].Value = "Abhishek";
Response.Cookies["UserName"].Expires = DateTime.Now.AddDays(1);


HttpCookie aCookie = new HttpCookie("Session");
aCookie.Value = DateTime.Now.ToString();
aCookie.Expires = DateTime.Now.AddDays(1);
Response.Cookies.Add(aCookie);
```

Non-Persistent Cookie

Non-persistent type of cookie doesn't get stored in client's hard drive permanently. It maintains user information as long as user accesses or uses the services. It's simply the opposite procedure of persistent cookie.

```
HttpCookie aCookie = new HttpCookie("Session");
aCookie.Value = DateTime.Now.ToString();
aCookie.Expires = DateTime.Now.AddDays(1);
Response.Cookies.Add(aCookie);
```

Points to Remember

Some features of cookie are:

- Store information temporarily
- It's just a simple small sized text file
- Can be changed according to requirement

- User preferred
- Requires only few bytes or KBs of space for creating cookies

Control State

Control state is based on custom control option. For expected results from CONTROL STATE, we need to enable the property of view state. As I already described, you can manually change those settings.

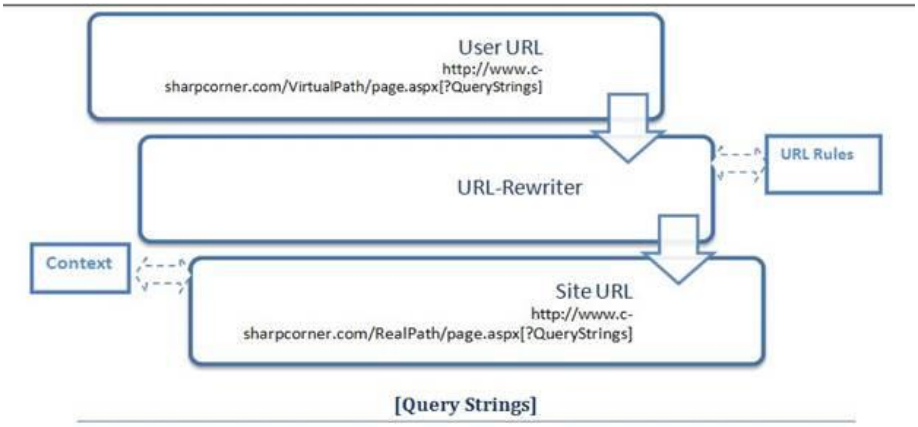
Points to Remember

Some features of query strings are:

- Used for enabling View State Property
- Defines custom view
- View State property declaration
- Can't be modified
- Accessed directly or disabled

Query Strings

Query strings are used for some specific purpose. These in general case are used for holding some value from a different page and move these values to the different page. The information stored in it can be easily navigated from one page to another or to the same page as well.



[Query Strings]

```
// Getting data
if (Request.QueryString["number"] != null)
{
   View.Text = Request.QueryString["number"];
}

// Setting query string
```

```
int postbacks = 0;



if (Request.QueryString["number"] != null)
{
   postbacks = Convert.ToInt32(Request.QueryString["number"]) + 1;
}
else
{
   postbacks = 1;
}

Response.Redirect("default.aspx?number=" + postbacks);
```

Points to Remember

Some of the features are:

- It's generally used for holding values
- Works temporarily
- Switches information from one to another page
- Increased performance
- It uses real and virtual path values for URL routing

Server side

1. Session

Session management is a very strong technique to maintain state. Generally session is used to store user's information and/or uniquely identify a user (or say browser). The server maintains the state of user information by using a session ID. When users makes a request without a session ID, ASP.NET creates a session ID and sends it with every request and response to the same user.

How to get and set value in Session:

```
Session["Count"] = Convert.ToInt32(Session["Count"]) + 1;//Set Value to The Session
Label2.Text = Session["Count"].ToString(); //Get Value from the Sesion
```

Session Events in ASP.NET

To manage a session, ASP.NET provides two events: session_start and session_end that is written in a special file called *Global.asax* in the root directory of the project.

2. Application

Application state is a server side state management technique. The date stored in application state is common for all users of that particular ASP.NET application and can be accessed anywhere in the application. It is also called application level state management. Data stored in the application should be of small size.

How to get and set a value in the **application object**:

```
Application["Count"] = Convert.ToInt32(Application["Count"]) + 1; //Set Value to The Application Object
Label1.Text = Application["Count"].ToString(); //Get Value from the Application Object
```

Application events in ASP.NET

There are three types of events in ASP.NET. Application event is written in a special file called *Global.asax*. This file is not created by default, it is created explicitly by the developer in the root directory. An application can create more than one *Global.asax* file but only the root one is read by ASP.NET.

Application_start: The Application_Start event is raised when an app domain starts. When the first request is raised to an application then the Application_Start event is raised. Let's see the*Global.asax* file.

```
void Application_Start(object sender, EventArgs e)
{
   Application["Count"] = 0;
}
```

Application_Error: It is raised when an unhandled exception occurs, and we can manage the exception in this event.

Application_End: The Application_End event is raised just before an application domain ends because of any reason, may IIS server restarting or making some changes in an application cycle.

Global.asax in ASP.NET

The *Global.asax*, also known as the ASP.NET application file, is used to serve application-level and session-level events. **Global.asax** is helpful in ASP.NET projects. With it we can store variables that persist through requests and sessions. We store these variables once and use them often. We add static fields to our Global.asax file.

Global.asax is a file used to declare application-level events and objects. Global.asax is the ASP.NET extension of the ASP Global.asa file. Code to handle application events (such as the start and end of an application) reside in Global.asax. Such event code cannot reside in the ASP.NET page or web service code itself, since during the start or end of the application, its code has not yet been loaded (or unloaded). Global.asax is also used to declare data that is available across different application requests or across different browser sessions. This process is known as application and session state management.

The Global.asax file must reside in the IIS virtual root. Remember that a virtual root can be thought of as the container of a web application. Events and state specified in the global file are then applied to all resources housed within the web application. If, for example, Global.asax defines a state application variable, all .aspx files within the virtual root will be able to access the variable.

Like an ASP.NET page, the Global.asax file is compiled upon the arrival of the first request for any resource in the application. The similarity continues when changes are made to the Global.asax file: ASP.NET automatically notices the changes, recompiles the file, and directs all new requests to the newest compila

The Global.asax file, also known as the ASP.NET application file, is an optional file that contains code for responding to application-level events raised by ASP.NET or by HttpModules. The Global.asax file resides in the root directory of an ASP.NET-based application. At run time, Global.asax is parsed and compiled into a dynamically generated .NET Framework class derived from the HttpApplication base class. The Global.asax file itself is configured so that any direct URL request for it is automatically rejected; external users cannot download or view the code written within it.

The ASP.NET Global.asax file can coexist with the ASP Global.asax file. You can create a Global.asax file either in a WYSIWYG designer, in Notepad, or as a compiled class that you deploy in your application's \Bin directory as an assembly. However, in the latter case, you still need a Global.asax file that refers to the assembly.

The Global.asax file is optional. If you do not define the file, the ASP.NET page framework assumes that you have not defined any application or session event handlers. When you save changes to an active Global.asax file, the ASP.NET page framework detects that the file has been changed. It completes all current requests for the application, sends the Application_OnEnd event to any listeners, and restarts the application domain. In effect, this reboots the application, closing all browser sessions and flushing all state information.

The Global.asa file

The Global.asa file is an optional file that can contain declarations of objects, variables, and methods that can be accessed by every page in an ASP application.

All valid browser scripts (JavaScript, VBScript, JScript, PerlScript, etc.) can be used within Global.asa.

The Global.asa file can contain only the following:

- Application events
- Session events
- <object> declarations
- TypeLibrary declarations
- the #include directive

Note: The Global.asa file must be stored in the root directory of the ASP application, and each application can only have one Global.asa file.

ASP Application Object

A group of ASP files that work together to perform some purpose is called an application. The Application object is used to tie these files together.

Application Object

An application on the Web may consists of several ASP files that work together to perform some purpose. The Application object is used to tie these files together.

The Application object is used to store and access variables from any page, just like the Session object. The difference is that ALL users share ONE Application object (with Sessions there is ONE Session object for EACH user).

The Application object holds information that will be used by many pages in the application (like database connection information). The information can be accessed from any page. The information can also be changed in one place, and the changes will automatically be reflected on all pages.

The Application object's collections, methods, and events are described below:

Collections

Collection	Description
Contents	Contains all the items appended to the application through a script command
StaticObjects	Contains all the objects appended to the application with the HTML <object> tag

Methods

Method	Description
Contents.Remove	Deletes an item from the Contents collection
Contents.RemoveAll()	Deletes all items from the Contents collection
Lock	Prevents other users from modifying the variables in the Application object
Unlock	Enables other users to modify the variables in the Application object (after it has been locked using the Lock method)

Events

Event	Description
Application_OnEnd	Occurs when all user sessions are over, and the application ends
Application_OnStart	Occurs before the first new session is created (when the Application object is first referenced

ASP Session Object

A Session object stores information about, or change settings for a user session.

Session Object

When you are working with an application on your computer, you open it, do some changes and then you close it. This is much like a Session. The computer knows who you are. It knows when you open the application and when you close it. However, on the internet there is one problem: the web server does not know who you are and what you do, because the HTTP address doesn't maintain state.

ASP solves this problem by creating a unique cookie for each user. The cookie is sent to the user's computer and it contains information that identifies the user. This interface is called the Session object.

The Session object stores information about, or change settings for a user session.

Variables stored in a Session object hold information about one single user, and are available to all pages in one application. Common information stored in session variables are name, id, and preferences. The server creates a new Session object for each new user, and destroys the Session object when the session expires.

The Session object's collections, properties, methods, and events are described below:

Collections

Collection	Description
Contents	Contains all the items appended to the session through a script command
StaticObjects	Contains all the objects appended to the session with the HTML <object> tag

Properties

Property	Description
CodePage	Specifies the character set that will be used when displaying dynamic content
LCID	Sets or returns an integer that specifies a location or region. Contents like date, time, and currency will be displayed according to that location or region

SessionID	Returns a unique id for each user. The unique id is generated by the server
Timeout	Sets or returns the timeout period (in minutes) for the Session object in this application

Methods

Method	Description
Abandon	Destroys a user session
Contents.Remove	Deletes an item from the Contents collection
Contents.RemoveAll()	Deletes all items from the Contents collection

Events

Event	Description
Session_OnEnd	Occurs when a session ends
Session_OnStart	Occurs when a session starts

ASP Objects

- Request and Response Objects
- Application and Session Objects
- Server objects

ASP Components

- Content Linking Component
- AdRotator Component
- Browser Capabilities Component
- Content Rotator Component
- MyInfo Component
- Tools Component
- Counters component
- Page Counter Component

ASP COMPONENTS

ASP AdRotator Component

The ASP AdRotator component creates an AdRotator object that displays a different image each time a user enters or refreshes a page. A text file includes information about the images.

Note: The AdRotator does not work with Internet Information Server 7 (IIS7).

Syntax

```
<%
set adrotator=server.createobject("MSWC.AdRotator")
adrotator.GetAdvertisement("textfile.txt")
%>
```

Example

```
<%
url=Request.QueryString("url")
If url<>"" then Response.Redirect(url)
%>

<!DOCTYPE html>
<html>
```

```
<body>
<%
set adrotator=Server.CreateObject("MSWC.AdRotator")
response.write(adrotator.GetAdvertisement("textfile.txt"))
%>
</body>
</html>
```

ASP AdRotator Properties

Property	Description	Example
Border	Specifies the size of the borders around the advertisement	<% set adrot=Server.CreateObject("MSWC.AdRotator") adrot.Border="2" Response.Write(adrot.GetAdvertisement("ads.txt")) %>
Clickable	Specifies whether the advertisement is a hyperlink	<% set adrot=Server.CreateObject("MSWC.AdRotator") adrot.Clickable=false Response.Write(adrot.GetAdvertisement("ads.txt")) %>
TargetFrame	Name of the frame to display the advertisement	<% set adrot=Server.CreateObject("MSWC.AdRotator") adrot.TargetFrame="target='_blank"' Response.Write(adrot.GetAdvertisement("ads.txt")) %>

ASP AdRotator Methods

Method	Description	Example
GetAdvertisement	Returns HTML that displays the advertisement in the page	<% set adrot=Server.CreateObject("MSWC.AdRotator") Response.Write(adrot.GetAdvertisement("ads.txt")) %>

ASP Content Rotator Component

The ASP Content Rotator component creates a ContentRotator object that displays a different content string each time a visitor enters or refreshes a page.

A text file, called the Content Schedule File, includes the information about the content strings.

The content strings can contain HTML tags so you can display any type of content that HTML can represent: text, images, colors, or hyperlinks.

Syntax

```
<%
Set cr=Server.CreateObject("MSWC.ContentRotator")
%>
```

Example

```
<html>
<body>
<%
set cr=server.createobject("MSWC.ContentRotator")
response.write(cr.ChooseContent("text/textads.txt"))
%>
</body>
</html>
```

ASP Content Rotator Component's Methods

Method	Description	Example
ChooseContent	Gets and displays a content string	<% dim cr Set cr=Server.CreateObject("MSWC.ContentRotator") response.write(cr.ChooseContent("text/textads.txt")) %> Output: 
GetAllContent	Retrieves and displays all of the content strings in the text file	<% dim cr Set cr=Server.CreateObject("MSWC.ContentRotator") response.write(cr.GetAllContent("text/textads.txt")) %> Output: This is a great day!! 

ASP Browser Capabilities Component

The ASP Browser Capabilities component creates a BrowserType object that determines the type, capabilities and version number of a visitor's browser.

When a browser connects to a server, a User Agent header is also sent to the server. This header contains information about the browser.

The BrowserType object compares the information in the header with information in a file on the server called "Browscap.ini".

If there is a match between the browser type and version number in the header and the information in the "Browscap.ini" file, the BrowserType object can be used to list the properties of the matching browser. If there is no match for the browser type and version number in the Browscap.ini file, it will set every property to "UNKNOWN".

Syntax

```
<%
Set MyBrow=Server.CreateObject("MSWC.BrowserType")
%>
```

ASP Browser Capabilities Example

The example below creates a BrowserType object in an ASP file, and displays some of the capabilities of your browser:

Example

```
<!DOCTYPE html>
<html>
<body>
<%
Set MyBrow=Server.CreateObject("MSWC.BrowserType")
%>

<table border="0" width="100%">
<tr>
<th>Client OS</th><th><%=MyBrow.platform%></th>
</tr><tr>
<td >Web Browser</td><td ><%=MyBrow.browser%></td>
</tr><tr>
<td>Browser version</td><td><%=MyBrow.version%></td>
</tr><tr>
<td>Frame support?</td><td><%=MyBrow.frames%></td>
</tr><tr>
<td>Table support?</td><td><%=MyBrow.tables%></td>
</tr><tr>
<td>Sound support?</td><td><%=MyBrow.backgroundsounds%></td>
</tr><tr>
<td>Cookies support?</td><td><%=MyBrow.cookies%></td>
</tr><tr>
<td>VBScript support?</td><td><%=MyBrow.vbscript%></td>
</tr><tr>
<td>JavaScript support?</td><td><%=MyBrow.javascript%></td>
</tr>
</table>

</body>
</html>
```

Output:

Client OS **WinNT**

Web Browser	IE
Browser version	5.0
Frame support?	True
Table support?	True
Sound support?	True
Cookies support?	True
VBScript support?	True
JavaScript support?	True

ASP Content Linking Component

The ASP Content Linking component is used to create a quick and easy navigation system!

The Content Linking component returns a Nextlink object that is used to hold a list of Web pages to be navigated.

Syntax

```
<%
Set nl=Server.CreateObject("MSWC.NextLink")
%>
```

ASP Content Linking Example

First we create a text file - "links.txt":

```
asp_intro.asp ASP Intro
asp_syntax.asp ASP Syntax
asp_variables.asp ASP Variables
asp_procedures.asp ASP Procedures
```

Then we create an include file, "nlcode.inc". The .inc file creates a NextLink object to navigate between the pages listed in "links.txt".

"nlcode.inc":

```
<%
dim nl
Set nl=Server.CreateObject("MSWC.NextLink")
if (nl.GetListIndex("links.txt")>1) then
  Response.Write("<a href='" & nl.GetPreviousURL("links.txt"))
  Response.Write("'>Previous Page</a>")
end if
Response.Write("<a href='" & nl.GetNextURL("links.txt"))
Response.Write("'>Next Page</a>")
%>
```

In each of the .asp pages listed in the text file "links.txt", put one line of code: **<!-- #include file="nlcode.inc"-->**. This line will include the code in "nlcode.inc" on every page listed in "links.txt" and the navigation will work.

ASP Content Linking Component's Methods

Method	Description	Example
GetListCount	Returns the number of items listed in the Content Linking List file	<% dim nl,c Set nl=Server.CreateObject("MSWC.NextLink") c=nl.GetListCount("links.txt") Response.Write("There are ") Response.Write(c) Response.Write(" items in the list") %> Output: There are 4 items in the list
GetListIndex	Returns the index number of the current item in the Content Linking List file. The index number of the first item is 1. 0	<% dim nl,c Set nl=Server.CreateObject("MSWC.NextLink") c=nl.GetListIndex("links.txt") Response.Write("Item number ") Response.Write(c) %> Output: Item number 3

	is returned if the current page is not in the Content Linking List file	
GetNextDescription	Returns the text description of the next item listed in the Content Linking List file. If the current page is not found in the list file it returns the text description of the last page on the list	<% dim nl,c Set nl=Server.CreateObject("MSWC.NextLink") c=nl.GetNextDescription("links.txt") Response.Write("Next ") Response.Write("description is: ") Response.Write(c) %> Next description is: ASP Variables
GetNextURL	Returns the URL of the next item listed in the Content Linking List file. If the current page is not found in the list file it returns the URL of the last page on the list	<% dim nl,c Set nl=Server.CreateObject("MSWC.NextLink") c=nl.GetNextURL("links.txt") Response.Write("Next ") Response.Write("URL is: ") Response.Write(c) %> Next URL is: asp_variables.asp
GetNthDescription	Returns the description	<% dim nl,c

	of the Nth page listed in the Content Linking List file	Set nl=Server.CreateObject("MSWC.NextLink") c=nl.GetNthDescription("links.txt",3) Response.Write("Third ") Response.Write("description is: ") Response.Write(c) %> Third description is: ASP Variables
GetNthURL	Returns the URL of the Nth page listed in the Content Linking List file	<% dim nl,c Set nl=Server.CreateObject("MSWC.NextLink") c=nl.GetNthURL("links.txt",3) Response.Write("Third ") Response.Write("URL is: ") Response.Write(c) %> Third URL is: asp_variables.asp
GetPreviousDescription	Returns the text description of the previous item listed in the Content Linking List file. If the current page is not found in the list file it returns the text description of the first page on the list	<% dim nl,c Set nl=Server.CreateObject("MSWC.NextLink") c=nl.GetPreviousDescription("links.txt") Response.Write("Previous ") Response.Write("description is: ") Response.Write(c) %> Previous description is: ASP Variables
GetPreviousURL	Returns the URL of the previous item listed in the	<% dim nl,c Set nl=Server.CreateObject("MSWC.NextLink") c=nl.GetPreviousURL("links.txt")

	Content Linking List file. If the current page is not found in the list file it returns the URL of the first page on the list	Response.Write("Previous ") Response.Write("URL is: ") Response.Write(c) %> Previous URL is: asp_variables.asp

ASP Content Rotator Component

The ASP Content Rotator component creates a ContentRotator object that displays a different content string each time a visitor enters or refreshes a page.

A text file, called the Content Schedule File, includes the information about the content strings.

The content strings can contain HTML tags so you can display any type of content that HTML can represent: text, images, colors, or hyperlinks.

Syntax

```
<%
Set cr=Server.CreateObject("MSWC.ContentRotator")
%>
```

Example

```
<html>
<body>
<%
set cr=server.createobject("MSWC.ContentRotator")
response.write(cr.ChooseContent("text/textads.txt"))
%>
</body>
</html>
```

ASP Content Rotator Component's Methods

Method	Description	Example
ChooseContent	Gets and displays a content string	<% dim cr Set cr=Server.CreateObject("MSWC.ContentRotator") response.write(cr.ChooseContent("text/textads.txt")) %>

		Output: 
GetAllContent	Retrieves and displays all of the content strings in the text file	<% dim cr Set cr=Server.CreateObject("MSWC.ContentRotator") response.write(cr.GetAllContent("text/textads.txt")) %> Output: This is a great day!! 

PART-B

POSSIBLE QUESTIONS(8Marks)

1. Illustrate the steps to create a web forms in ASP.NET with neat sketch
2. Explain in detail about collections, methods and events of the application objects.
3. Explain the basic web controls in ASP.Net and its usage.
4. Discuss in detail about the session object in ASP.NET.
5. Discuss the application configuration for ASP.NET.
6. Explicate the various methods of state maintenance in ASP.NET.
7. Explain in detail about active server components and controls.
8. Explicate the objects used to manage the ASP.NET state.

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CLASS : III-B.Sc COMPUTER SCIENCE(2015-2018)

Online Examination

VISUAL PROGRAMMING (15CSU501)

questions	opt1	opt2	opt3	opt4
What is the extension of a web user control file ?	.Asmx	.Ascx	.Aspx	.Aspz
Select the validation control used for "PatternMatching"	FieldValidator	RegularExpressionValidator	RangeValidator	PatternValidator
Which of the following server control shows data in a tabular format?	ListBox	Repeater	Data Source	GridView
Skins with SkindID's are known as _____	Application Skins	Named Skins	Default Skins	Reference Skins
Which of the following webserver control used as container for other server controls in a ASP.Net Page?	PlaceHolder	Table	Panel	IamgeMap
Attribute must be set on a validator control for the validation to work.	ControlToValidate	ControlToBind	ValidateControl	Validate
If a developer of ASP.NET defines style information in a common location.Then that location is called as	Master Page	Theme	Customization	Skin
_____ checks the required fields have a value entered by the user submitting the form	RangeValidator	CustomValidator	CompareValidator	RequiredFieldValidator
_____ forms a group of radio buttons that can be selected in a mutually exclusive manner	RadioButton	CheckBoxList	RadioButtonList	DropDownList
Which of the following does not have any visible interface?	Datagrid	Repeater	DropdownLi	Datalist
In ASP.NET in form page the object which contains the user name is _____ ?	Page.User.Identity	Page.User.IsInRole	Page.User.Name	Page.User.Role

Which of the following method must be overridden in a custom control?	The Paint() method	The Control_Build() method	The default constructor	The Render() method
Which is the file extension used for an ASP.NET file?	.asn	.asp	.aspn	.aspx
Which property is used to name a web control?	ControlName	Designation	ID	Name
Which user action will not generate a server-side event?	Mouse Move	Text Change	Button Click	Load
What class does the ASP.Net Web Form class inherit from by default?	System.Web.Form	System.Web.UI.Form	System.Web.GUI.Page	System.Web.UI.Page
Which of the following denote the web control associated with Table Control function of ASP.Net?	DataList	ListBox	TableRow	TableColumn
ASP.Net separates the HTML output from program logic using a feature named as	Exception	Code-behind	Code-front	Code-back
_____ Web Controls are used to achieve graphics in the display.	AdRotator	LinkButton	TextBox	Calendar
The Asp.net server control provides an alternative way of displaying text on web page is	<asp:listitem>	<asp:button>	<asp:label>	<asp:image>
The _____attribute specifies where to store session state information and it may set to Off.	Cookieless	Mode	Timeout	ConnectionString
Which attribute specifies the number of minutes before a session is abandoned because it is idle?	Cookieless	Mode	Timeout	ConnectionString
Which attribute specifies the server and port for storing session state remotely?	Cookieless	Mode	Timeout	ConnectionString
The current status of a Web Forms page and its controls is called the	viewstate	webstatus	round trips	request/response cycle.

ASP.NET applications uses _____ protocol.	WSDL	SOAP	**HTTP**	TCP/IP
_____ dynamically buids Web-based client server applications.	XML	VB	**ASP.NET**	None
The extension of all ASP.NET files are_____	asp	**aspx**	asa	asax
All controls with the attribute RUNAT="SERVER" are called _____	web controls	server controls	html controls	.net controls
ASP.NET applications are configured with special _____ file	XML	HTML	VB	NONE
The configuration setting of the ASP.NET applications are in a file named _____	ASP.config	Web.config	Session.config	Config.Net
Which of the following is used to store the state information of the server side	Sesson State object	Cookies	Hidden fields	Query Strings
Which of the following is used to store the state information of the client side	Sesson State object	Cookies	Application state objects	Databases
DOM stands for	Design Object Model	Document Oreinted Modelling	Document Object Model	Database Object Model
The term _____ refers to the current condition of an application and each of its parts.	section	attribute	state	cookie
Which object has the state information	Request Object	Response Object	Application Object	Server Object
The root element of the web.config file is _____	<configuration>	<system.web>	<compilation>	<httpHandlers>
Whenever an individual user first requests a page of wep application_____ is created.	Session Object	Response Object	Application Object	Server Object
Whenever the first page of a web applicatiom is requests for the first time_____ is created.	Session Object	Response Object	Application Object	Server Object

Cookies are read and written using the _____ object	Request Object	Response Object	Application Object	Server Object
Codes that execute in response to starting an Application are placed in subroutine.	Applicaion_onStart	Applicaion_Start	Application_BeginRequest	Application-Error
This method allows only the current page access the Contents collection of the Application object	Set()	Contents()	Current()	Lock()
_____ maintains the state informations across page requests.	**session**	scope	acess specifiers	form
_____ is created for every user, only when he requests the page for first time	Application Object	Request Object	Response Object	**Session Object**
The_____ control is used to enforce a value-required rule	Compare Validator	Range Validator	**Required Field Validator**	Regular Expression Validator
The _____ control is used to make comparisons between two form elements	**Compare Validator**	Range Validator	Required Field Validator	Regular Expression Validator
A valid comment block in ASP.NET is	<!- - - Comment - - - >	<!- - Comment - - >	**<% - - Comment - - %>**	<% ! - - Comment - - >
_____ refers to the current Object	**Me**	this	super	Current
Which session method ends the current usr session and destroys the session object when the page has finished executing.	remove()	removeAll()	**Abandon()**	AbandonAll( )
_____ are small strings of text with a name/value pairs that are attached to the end of the URL and sent with page requests.	Hidden fields	**Query String**	View State property	Cookies

)N

answer
. Ascx
RegularExpressionValidator
GridView
Named Skins
Panel
ControlToValidate
Theme
RequiredFieldValidator
RadioButtonList
Repeater
Page.User.Identity

The Render() method
.aspx
ID
Mouse Move
System.Web.UI.Page
TableRow
Code-behind
AdRotator
<asp:label>
Mode
Timeout
ConnectionString
viewstate

HTTP
ASP.NET
aspx
server controls
XML
Web.config
Sesson State object
Cookies
Document Object Model
state
Application Object
<configuration>
Session Object
Application Object

Response Object
Applicaion_Start
Lock()
session
Session Object
Required Field Validator
Compare Validator
<% - - Comment - - %>
Me
Abandon()
Query String

UNIT-V
SYLLABUS

Web server and ASP.NET-ASP.NET and SQL server-Using SQL server, using database in ASP.NET applications, ActiveX data objects-The ADO.NET objects model

Web services and ASP.NET

A web service is a web-based functionality accessed using the protocols of the web to be used by the web applications. There are three aspects of web service development:

- Creating the web service
- Creating a proxy
- Consuming the web service

Creating a Web Service

A web service is a web application which is basically a class consisting of methods that could be used by other applications. It also follows a code-behind architecture such as the ASP.NET web pages, although it does not have a user interface.

To understand the concept let us create a web service to provide stock price information. The clients can query about the name and price of a stock based on the stock symbol. To keep this example simple, the values are hardcoded in a two-dimensional array. This web service has three methods:

- A default HelloWorld method
- A GetName Method
- A GetPrice Method

Take the following steps to create the web service:

Step (1) : Select File -> New -> Web Site in Visual Studio, and then select ASP.NET Web Service.

Step (2) : A web service file called Service.asmx and its code behind file, Service.cs is created in the App_Code directory of the project.

Step (3) : Change the names of the files to StockService.asmx and StockService.cs.

Step (4) : The .asmx file has simply a WebService directive on it:

```
<%@ WebService Language="C#" CodeBehind="~/App_Code/StockService.cs" Class="StockService" %>
```

Step (5) : Open the StockService.cs file, the code generated in it is the basic Hello World service.

Step (6) : Change the code behind file to add the two dimensional array of strings for stock symbol, name and price and two web methods for getting the stock information.

Step (7) : Running the web service application gives a web service test page, which allows testing the service methods.

Step (8) : Click on a method name, and check whether it runs properly.

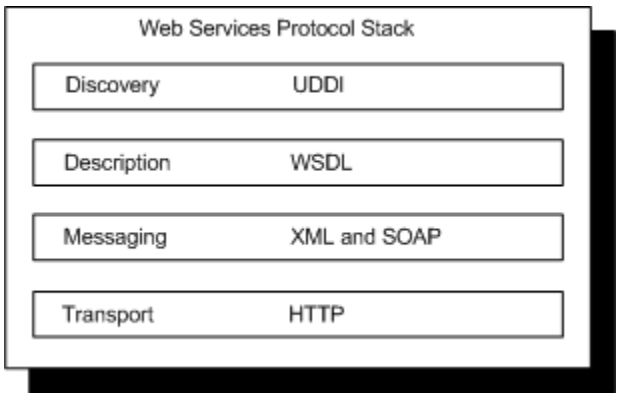
Step (9) : For testing the GetName method, provide one of the stock symbols, which are hard coded, it returns the name of the stock

Web Services Framework

The core enabling technologies for web services follow:

- XML Data
- WSDL Interface
- SOAP Communication
- UDDI Registry

Layers of the Web Services Protocol Stack



XML Data

The eXtensible Markup Language (XML) is a bundle of specifications that provides the foundation of all web services technologies. Using the XML structure and syntax as the

foundation allows for the exchange of data between different programming languages, middleware, and database management systems.

The XML syntax incorporates instance data, typing, structure, and semantic information associated with data. XML describes data independently and also provides information for mapping the data to software systems or programming languages. Because of this flexibility, any software program can be mapped to web services.

When web services are invoked, the underlying XML syntax provides the data encapsulation and transmission format for the exchanged data. The XML elements and attributes define the type and structure information for the data. XML provides the capability to model data and define the structure specific to the programming language (such as Java, C#, or Visual Basic), the database management system, or the software application. Web services use the XML syntax to specify how data is represented, how the data is transmitted, and how the service interacts with the referenced application.

WSDL

WSDL stands for Web Services Description Language. It is the standard format for describing a web service. WSDL was developed jointly by Microsoft and IBM.

Features of WSDL

- WSDL is an XML-based protocol for information exchange in decentralized and distributed environments.
- WSDL definitions describe how to access a web service and what operations it will perform.
- WSDL is a language for describing how to interface with XML-based services.
- WSDL is an integral part of Universal Description, Discovery, and Integration (UDDI), an XML-based worldwide business registry.
- WSDL is the language that UDDI uses.
- WSDL is pronounced as 'wiz-dull' and spelled out as 'W-S-D-L'.

WSDL Usage

WSDL is often used in combination with SOAP and XML Schema to provide web services over the Internet. A client program connecting to a web service can read the WSDL to determine what functions are available on the server. Any special datatypes used are embedded in the

WSDL file in the form of XML Schema. The client can then use SOAP to actually call one of the functions listed in the WSDL.

WSDL stands for Web Services Description Language. It is the standard format for describing a web service. WSDL was developed jointly by Microsoft and IBM.

Features of WSDL

- WSDL is an XML-based protocol for information exchange in decentralized and distributed environments.
- WSDL definitions describe how to access a web service and what operations it will perform.
- WSDL is a language for describing how to interface with XML-based services.
- WSDL is an integral part of Universal Description, Discovery, and Integration (UDDI), an XML-based worldwide business registry.
- WSDL is the language that UDDI uses.
- WSDL is pronounced as 'wiz-dull' and spelled out as 'W-S-D-L'.

SOAP

SOAP is an acronym for Simple Object Access Protocol. It is an XML-based messaging protocol for exchanging information among computers. SOAP is an application of the XML specification.

Points to Note

Below mentioned are some important point which the user should take note of. These points briefly describes the nature of SOAP −

- SOAP is a communication protocol designed to communicate via Internet.
- SOAP can extend HTTP for XML messaging.
- SOAP provides data transport for Web services.
- SOAP can exchange complete documents or call a remote procedure.
- SOAP can be used for broadcasting a message.
- SOAP is platform- and language-independent.
- SOAP is the XML way of defining what information is sent and how.
- SOAP enables client applications to easily connect to remote services and invoke remote methods.

Although SOAP can be used in a variety of messaging systems and can be delivered via a variety of transport protocols, the initial focus of SOAP is remote procedure calls transported via HTTP.

Other frameworks including CORBA, DCOM, and Java RMI provide similar functionality to SOAP, but SOAP messages are written entirely in XML and are therefore uniquely platform- and language-independent.

A SOAP message is an ordinary XML document containing the following elements −

- **Envelope** − Defines the start and the end of the message. It is a mandatory element.
- **Header** − Contains any optional attributes of the message used in processing the message, either at an intermediary point or at the ultimate end-point. It is an optional element.
- **Body** − Contains the XML data comprising the message being sent. It is a mandatory element.
- **Fault** − An optional Fault element that provides information about errors that occur while processing the message.

All these elements are declared in the default namespace for the SOAP envelope − http://www.w3.org/2001/12/soap-envelope and the default namespace for SOAP encoding and data types is − http://www.w3.org/2001/12/soap-encoding

NOTE − All these specifications are subject to change. So keep updating yourself with the latest specifications available on the W3 website.

SOAP Message Structure

The following block depicts the general structure of a SOAP message −

```
<?xml version="1.0"?>
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://www.w3.org/2001/12/soap-envelope"
SOAP-ENV:encodingStyle="http://www.w3.org/2001/12/soap-encoding">

  <SOAP-ENV:Header>
    ...
    ...
  </SOAP-ENV:Header>
```

```
  <SOAP-ENV:Body>
    ...
    ...
    <SOAP-ENV:Fault>
      ...
      ...
    </SOAP-ENV:Fault>
    ...
  </SOAP-ENV:Body>

</SOAP_ENV:Envelope>
```

UDDI Registry

The Universal Description Discovery and Integration (UDDI) service provides registry and repository services for storing and retrieving web services interfaces. UDDI is a public or private XML-based directory for registering and looking up web services.

Content Server currently does not publish to any public or private UDDI sources. However, this does not prevent users from integrating Content Server with other applications using web services.

USING SQL SERVER, USING DATABASE IN ASP.NET APPLICATIONS:

ASP.NET allows the following sources of data to be accessed and used:

- Databases (e.g., Access, SQL Server, Oracle, MySQL)
- XML documents
- Business Objects
- Flat files

ASP.NET hides the complex processes of data access and provides much higher level of classes and objects through which data is accessed easily. These classes hide all complex coding for connection, data retrieving, data querying, and data manipulation.

ADO.NET is the technology that provides the bridge between various ASP.NET control objects and the backend data source. In this tutorial, we will look at data access and working with the data in brief.

Retrieving and Displaying Data

It takes two types of data controls to retrieve and display data in ASP.NET:

 A data source control - It manages the connection to the data, selection of data, and other jobs such as paging and caching of data etc.

 A data view control - It binds and displays the data and allows data manipulation.

We will discuss the data binding and data source controls in detail later. In this section, we will use a SqlDataSource control to access data and a GridView control to display and manipulate data in this chapter.

We will also use an Access database, which contains the details about .Net books
available in the market. Name of our database is ASPDotNetStepByStep.mdb and we will use the data table DotNetReferences.

The table has the following columns: ID, Title, AuthorFirstName, AuthorLastName, Topic, and Publisher.

Here is a snapshot of the data table: Let us directly move to action, take the following steps:

(1) Create a web site and add a SqlDataSourceControl on the web form.

(2) Click on the Configure Data Source option.

(3) Click on the New Connection button to establish connection with a database.

Once the connection is set up, you may save it for further use. At the next step, you are asked to configure the select statement:

Select the columns and click next to complete the steps. Observe the WHERE…,
ORDER BY…, and the Advanced… buttons. These buttons allow you to provide the
ASP.NET where clause, order by clause, and specify the insert, update, and delete commands of SQL respectively. This way, you can manipulate the data.

(6) Add a GridView control on the form. Choose the data source and format the control using AutoFormat option.

After this, the formatted GridView control displays the column headings, and the application is ready to execute.

ACTIVEX DATA OBJECTS:

What is ADO?

- ADO is a Microsoft technology
- ADO stands for **A**ctiveX **D**ata **O**bjects
- ADO is a Microsoft Active-X component
- ADO is automatically installed with Microsoft IIS
- ADO is a programming interface to access data in a database

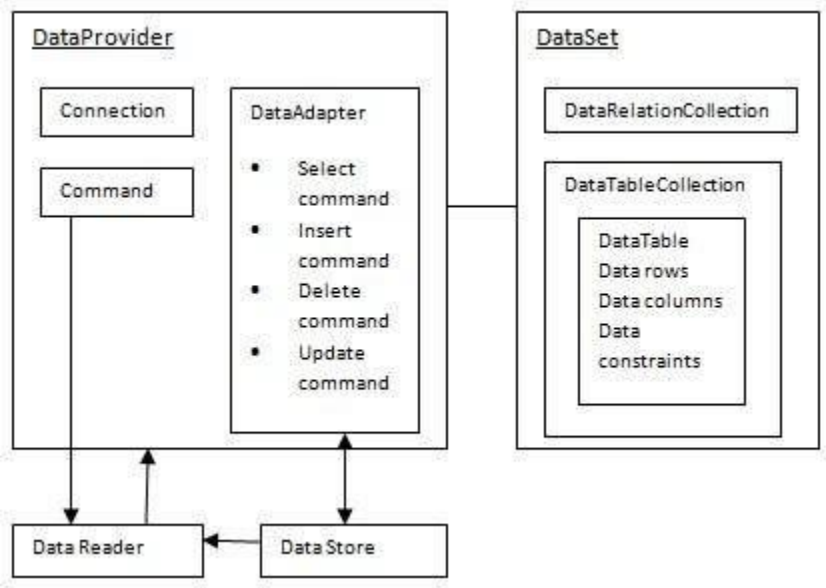
Accessing a Database from an ASP Page

The common way to access a database from inside an ASP page is to:

1. Create an ADO connection to a database
2. Open the database connection
3. Create an ADO recordset
4. Open the recordset
5. Extract the data you need from the recordset
6. Close the recordset
7. Close the connection

ADO.NET provides a bridge between the front end controls and the back end database. The ADO.NET objects encapsulate all the data access operations and the controls interact with these objects to display data, thus hiding the details of movement of data.

The following figure shows the ADO.NET objects at a glance:



ADO and ADO.NET Objects

ADO Objects

- Connection objects
- Command Objects
- Recordset Objects

ADO.NET Objects

Dataset and DataReader Objects

DataTable Object

Datatable mapping, dataview and datarelation objects

ADO Database Connection

Before a database can be accessed from a web page, a database connection has to be established.

Create a DSN-less Database Connection

The easiest way to connect to a database is to use a DSN-less connection. A DSN-less connection can be used against any Microsoft Access database on your web site.

If you have a database called "northwind.mdb" located in a web directory like "c:/webdata/", you can connect to the database with the following ASP code:

```
<%
set conn=Server.CreateObject("ADODB.Connection")
conn.Provider="Microsoft.Jet.OLEDB.4.0"
conn.Open "c:/webdata/northwind.mdb"
%>
```

Note, from the example above, that you have to specify the Microsoft Access database driver (Provider) and the physical path to the database on your computer.

Create an ODBC Database Connection

If you have an ODBC database called "northwind" you can connect to the database with the following ASP code:

```
<%
set conn=Server.CreateObject("ADODB.Connection")
conn.Open "northwind"
%>
```

With an ODBC connection, you can connect to any database, on any computer in your network, as long as an ODBC connection is available.

An ODBC Connection to an MS Access Database

Here is how to create a connection to a MS Access Database:

1. Open the **ODBC** icon in your Control Panel.
2. Choose the **System DSN** tab.
3. Click on **Add** in the System DSN tab.
4. **Select** the Microsoft Access Driver. Click **Finish.**
5. In the next screen, click **Select** to locate the database.
6. Give the database a **D**ata **S**ource **N**ame (DSN).
7. Click **OK**.

Note that this configuration has to be done on the computer where your web site is located. If you are running Personal Web Server (PWS) or Internet Information Server (IIS) on your own computer, the instructions above will work, but if your web site is located on a remote server, you have to have physical access to that server, or ask your web host to do this for you.

The ADO Connection Object

The ADO Connection object is used to create an open connection to a data source. Through this connection, you can access and manipulate a database.

ADO Recordset

To be able to read database data, the data must first be loaded into a recordset.

Create an ADO Table Recordset

After an ADO Database Connection has been created, as demonstrated in the previous chapter, it is possible to create an ADO Recordset.

Suppose we have a database named "Northwind", we can get access to the "Customers" table inside the database with the following lines:

```
<%
set conn=Server.CreateObject("ADODB.Connection")
conn.Provider="Microsoft.Jet.OLEDB.4.0"
conn.Open "c:/webdata/northwind.mdb"

set rs=Server.CreateObject("ADODB.recordset")
```

```
rs.Open "Customers", conn
%>
```

Create an ADO SQL Recordset

We can also get access to the data in the "Customers" table using SQL:

```
<%
set conn=Server.CreateObject("ADODB.Connection")
conn.Provider="Microsoft.Jet.OLEDB.4.0"
conn.Open "c:/webdata/northwind.mdb"

set rs=Server.CreateObject("ADODB.recordset")
rs.Open "Select * from Customers", conn
%>
```

Extract Data from the Recordset

After a recordset is opened, we can extract data from recordset.

Suppose we have a database named "Northwind", we can get access to the "Customers" table inside the database with the following lines:

```
<%
set conn=Server.CreateObject("ADODB.Connection")
conn.Provider="Microsoft.Jet.OLEDB.4.0"
conn.Open "c:/webdata/northwind.mdb"

set rs=Server.CreateObject("ADODB.recordset")
rs.Open "Select * from Customers", conn

for each x in rs.fields
  response.write(x.name)
  response.write(" = ")
  response.write(x.value)
next
%>
```

The ADO Recordset Object

The ADO Recordset object is used to hold a set of records from a database table.

ADO Queries

We may use SQL to create queries to specify only a selected set of records and fields to view.

Display Selected Data

We want to display only the records from the "Customers" table that have a "Companyname" that starts with an A (remember to save the file with an .asp extension):

Example

```
<html>
<body>

<%
set conn=Server.CreateObject("ADODB.Connection")
conn.Provider="Microsoft.Jet.OLEDB.4.0"
conn.Open "c:/webdata/northwind.mdb"

set rs=Server.CreateObject("ADODB.recordset")
sql="SELECT Companyname, Contactname FROM Customers
WHERE CompanyName LIKE 'A%'"
rs.Open sql, conn
%>

<table border="1" width="100%">
  <tr>
  <%for each x in rs.Fields
    response.write("<th>" & x.name & "</th>")
  next%>
  </tr>
  <%do until rs.EOF%>
    <tr>
    <%for each x in rs.Fields%>
```

```
    <td><%Response.Write(x.value)%></td>
   <%next
   rs.MoveNext%>
   </tr>
  <%loop
  rs.close
  conn.close%>
</table>

</body>
</html>
```

ADO Sort

We may use SQL to specify how to sort the data in the record set.

Sort the Data

We want to display the "Companyname" and "Contactname" fields from the "Customers" table, ordered by "Companyname" (remember to save the file with an .asp extension):

Example

```
<html>
<body>

<%
set conn=Server.CreateObject("ADODB.Connection")
conn.Provider="Microsoft.Jet.OLEDB.4.0"
conn.Open "c:/webdata/northwind.mdb"

set rs = Server.CreateObject("ADODB.recordset")
sql="SELECT Companyname, Contactname FROM
Customers ORDER BY CompanyName"
rs.Open sql, conn
%>
```

```
<table border="1" width="100%">
  <tr>
  <%for each x in rs.Fields
    response.write("<th>" & x.name & "</th>")
  next%>
  </tr>
  <%do until rs.EOF%>
    <tr>
    <%for each x in rs.Fields%>
      <td><%Response.Write(x.value)%></td>
    <%next
    rs.MoveNext%>
    </tr>
  <%loop
  rs.close
  conn.close%>
</table>
</body>
</html>
```

ADO Add Records

We may use the SQL INSERT INTO command to add a record to a table in a database.

Add a Record to a Table in a Database

We want to add a new record to the Customers table in the Northwind database. We first create a form that contains the fields we want to collect data from:

```
<html>
<body>
<form method="post" action="demo_add.asp">
<table>
<tr>
<td>CustomerID:</td>
<td><input name="custid"></td>
</tr><tr>
```

```
<td>Company Name:</td>
<td><input name="compname"></td>
</tr><tr>
<td>Contact Name:</td>
<td><input name="contname"></td>
</tr><tr>
<td>Address:</td>
<td><input name="address"></td>
</tr><tr>
<td>City:</td>
<td><input name="city"></td>
</tr><tr>
<td>Postal Code:</td>
<td><input name="postcode"></td>
</tr><tr>
<td>Country:</td>
<td><input name="country"></td>
</tr>
</table>
<br><br>
<input type="submit" value="Add New">
<input type="reset" value="Cancel">
</form>
</body>
</html>
```

When the user presses the submit button the form is sent to a file called "demo_add.asp". The "demo_add.asp" file contains the code that will add a new record to the Customers table:

```
<html>
<body>
<%
set conn=Server.CreateObject("ADODB.Connection")
```

```
conn.Provider="Microsoft.Jet.OLEDB.4.0"
conn.Open "c:/webdata/northwind.mdb"

sql="INSERT INTO customers (customerID,companyname,"
sql=sql & "contactname,address,city,postalcode,country)"
sql=sql & " VALUES "
sql=sql & "('" & Request.Form("custid") & "',"
sql=sql & "'" & Request.Form("compname") & "',"
sql=sql & "'" & Request.Form("contname") & "',"
sql=sql & "'" & Request.Form("address") & "',"
sql=sql & "'" & Request.Form("city") & "',"
sql=sql & "'" & Request.Form("postcode") & "',"
sql=sql & "'" & Request.Form("country") & "')"

on error resume next
conn.Execute sql,recaffected
if err<>0 then
  Response.Write("No update permissions!")
else
  Response.Write("<h3>" & recaffected & " record added</h3>")
end if
conn.close
%>
</body>
</html>
```

Important

If you use the SQL INSERT command be aware of the following:

- If the table contains a primary key, make sure to append a unique, non-Null value to the primary key field (if not, the provider may not append the record, or an error occurs)
- If the table contains an AutoNumber field, do not include this field in the SQL INSERT command (the value of this field will be taken care of automatically by the provider)

What about Fields With no Data?

In a MS Access database, you can enter zero-length strings ("") in Text, Hyperlink, and Memo fields IF you set the AllowZeroLength property to Yes.

Note: Not all databases support zero-length strings and may cause an error when a record with blank fields is added. It is important to check what data types your database supports.

ADO Update Records

We may use the SQL UPDATE command to update a record in a table in a database.

Update a Record in a Table

We want to update a record in the Customers table in the Northwind database. We first create a table that lists all records in the Customers table:

```
<html>
<body>
<%
set conn=Server.CreateObject("ADODB.Connection")
conn.Provider="Microsoft.Jet.OLEDB.4.0"
conn.Open "c:/webdata/northwind.mdb"
set rs=Server.CreateObject("ADODB.Recordset")
rs.open "SELECT * FROM customers",conn
%>

<h2>List Database</h2>
<table border="1" width="100%">
<tr>
<%
for each x in rs.Fields
  response.write("<th>" & ucase(x.name) & "</th>")
next
%>
</tr>
<% do until rs.EOF %>
<tr>
<form method="post" action="demo_update.asp">
```

```
<%
for each x in rs.Fields
  if lcase(x.name)="customerid" then%>
    <td>
    <input type="submit" name="customerID" value="<%=x.value%>">
    </td>
  <%else%>
    <td><%Response.Write(x.value)%></td>
  <%end if
next
%>
</form>
<%rs.MoveNext%>
</tr>
<%
loop
conn.close
%>
</table>          </body>
</html>
```

If the user clicks on the button in the "customerID" column he or she will be taken to a new file called "demo_update.asp". The "demo_update.asp" file contains the source code on how to create input fields based on the fields from one record in the database table. It also contains a "Update record" button that will save your changes:

```
<html>
<body>

<h2>Update Record</h2>
<%
set conn=Server.CreateObject("ADODB.Connection")
conn.Provider="Microsoft.Jet.OLEDB.4.0"
```

```
conn.Open "c:/webdata/northwind.mdb"

cid=Request.Form("customerID")

if Request.form("companyname")="" then
  set rs=Server.CreateObject("ADODB.Recordset")
  rs.open "SELECT * FROM customers WHERE customerID='" & cid & "'",conn
  %>
  <form method="post" action="demo_update.asp">
  <table>
  <%for each x in rs.Fields%>
  <tr>
  <td><%=x.name%></td>
  <td><input name="<%=x.name%>" value="<%=x.value%>"></td>
  <%next%>
  </tr>
  </table>
  <br><br>
  <input type="submit" value="Update record">
  </form>
<%
else
  sql="UPDATE customers SET "
  sql=sql & "companyname='" & Request.Form("companyname") & "',"
  sql=sql & "contactname='" & Request.Form("contactname") & "',"
  sql=sql & "address='" & Request.Form("address") & "',"
  sql=sql & "city='" & Request.Form("city") & "',"
  sql=sql & "postalcode='" & Request.Form("postalcode") & "',"
  sql=sql & "country='" & Request.Form("country") & "'"
  sql=sql & " WHERE customerID='" & cid & "'"
  on error resume next
  conn.Execute sql
```

```
  if err<>0 then
    response.write("No update permissions!")
  else
    response.write("Record " & cid & " was updated!")
  end if
end if
conn.close
%>
</body>
</html>
```

ADO Delete Records

We may use the SQL DELETE command to delete a record in a table in a database.

Delete a Record in a Table

We want to delete a record in the Customers table in the Northwind database. We first create a table that lists all records in the Customers table:

```
<html>
<body>
<%
set conn=Server.CreateObject("ADODB.Connection")
conn.Provider="Microsoft.Jet.OLEDB.4.0"
conn.Open "c:/webdata/northwind.mdb"
set rs=Server.CreateObject("ADODB.Recordset")
rs.open "SELECT * FROM customers",conn
%>

<h2>List Database</h2>
<table border="1" width="100%">
<tr>
<%
for each x in rs.Fields
  response.write("<th>" & ucase(x.name) & "</th>")
```

```
next
%>
</tr>
<% do until rs.EOF %>
<tr>
<form method="post" action="demo_delete.asp">
<%
for each x in rs.Fields
  if x.name="customerID" then%>
    <td>
    <input type="submit" name="customerID" value="<%=x.value%>">
    </td>
  <%else%>
    <td><%Response.Write(x.value)%></td>
  <%end if
next
%>
</form>
<%rs.MoveNext%>
</tr>
<%
loop
conn.close
%>
</table>
</body>
</html>
```

If the user clicks on the button in the "customerID" column he or she will be taken to a new file called "demo_delete.asp". The "demo_delete.asp" file contains the source code on how to create input fields based on the fields from one record in the database table. It also contains a "Delete record" button that will delete the current record:

```
<html>
<body>

<h2>Delete Record</h2>
<%
set conn=Server.CreateObject("ADODB.Connection")
conn.Provider="Microsoft.Jet.OLEDB.4.0"
conn.Open "c:/webdata/northwind.mdb"

cid=Request.Form("customerID")

if Request.form("companyname")="" then
  set rs=Server.CreateObject("ADODB.Recordset")
  rs.open "SELECT * FROM customers WHERE customerID='" & cid & "'",conn
  %>
  <form method="post" action="demo_delete.asp">
  <table>
  <%for each x in rs.Fields%>
  <tr>
  <td><%=x.name%></td>
  <td><input name="<%=x.name%>" value="<%=x.value%>"></td>
  <%next%>
  </tr>
  </table>
  <br><br>
  <input type="submit" value="Delete record">
  </form>
<%
else
  sql="DELETE FROM customers"
  sql=sql & " WHERE customerID='" & cid & "'"
  on error resume next
```

```
  conn.Execute sql
  if err<>0 then
    response.write("No update permissions!")
  else
    response.write("Record " & cid & " was deleted!")
  end if
end if
conn.close
%>
</body>
</html>
```

ADO Command Object

Command Object

The ADO Command object is used to execute a single query against a database. The query can perform actions like creating, adding, retrieving, deleting or updating records.

If the query is used to retrieve data, the data will be returned as a RecordSet object. This means that the retrieved data can be manipulated by properties, collections, methods, and events of the Recordset object.

The major feature of the Command object is the ability to use stored queries and procedures with parameters.

ProgID

```
set objCommand=Server.CreateObject("ADODB.command")
```

Properties

Property	Description
ActiveConnection	Sets or returns a definition for a connection if the connection is closed, or the current Connection object if the connection is open
CommandText	Sets or returns a provider command
CommandTimeout	Sets or returns the number of seconds to wait while attempting to execute a command

CommandType	Sets or returns the type of a Command object
Name	Sets or returns the name of a Command object
Prepared	Sets or returns a Boolean value that, if set to True, indicates that the command should save a prepared version of the query before the first execution
State	Returns a value that describes if the Command object is open, closed, connecting, executing or retrieving data

Methods

Method	Description
Cancel	Cancels an execution of a method
CreateParameter	Creates a new Parameter object
Execute	Executes the query, SQL statement or procedure in the CommandText property

Collections

Collection	Description
Parameters	Contains all the Parameter objects of a Command Object
Properties	Contains all the Property objects of a Command Object

ADO Connection Object

Connection Object

The ADO Connection Object is used to create an open connection to a data source. Through this connection, you can access and manipulate a database.

If you want to access a database multiple times, you should establish a connection using the Connection object. You can also make a connection to a database by passing a connection string via a Command or Recordset object. However, this type of connection is only good for one specific, single query.

ProgID

set objConnection=Server.CreateObject("ADODB.connection")

Properties

Property	Description
Attributes	Sets or returns the attributes of a Connection object
CommandTimeout	Sets or returns the number of seconds to wait while attempting to execute a command
ConnectionString	Sets or returns the details used to create a connection to a data source
ConnectionTimeout	Sets or returns the number of seconds to wait for a connection to open
CursorLocation	Sets or returns the location of the cursor service
DefaultDatabase	Sets or returns the default database name
IsolationLevel	Sets or returns the isolation level
Mode	Sets or returns the provider access permission
Provider	Sets or returns the provider name
State	Returns a value describing if the connection is open or closed
Version	Returns the ADO version number

Methods

Method	Description
BeginTrans	Begins a new transaction
Cancel	Cancels an execution
Close	Closes a connection
CommitTrans	Saves any changes and ends the current transaction

Execute	Executes a query, statement, procedure or provider specific text
Open	Opens a connection
OpenSchema	Returns schema information from the provider about the data source
RollbackTrans	Cancels any changes in the current transaction and ends the transaction

Events

Event	Description
BeginTransComplete	Triggered after the BeginTrans operation
CommitTransComplete	Triggered after the CommitTrans operation
ConnectComplete	Triggered after a connection starts
Disconnect	Triggered after a connection ends
ExecuteComplete	Triggered after a command has finished executing
InfoMessage	Triggered if a warning occurs during a ConnectionEvent operation
RollbackTransComplete	Triggered after the RollbackTrans operation
WillConnect	Triggered before a connection starts
WillExecute	Triggered before a command is executed

Collections

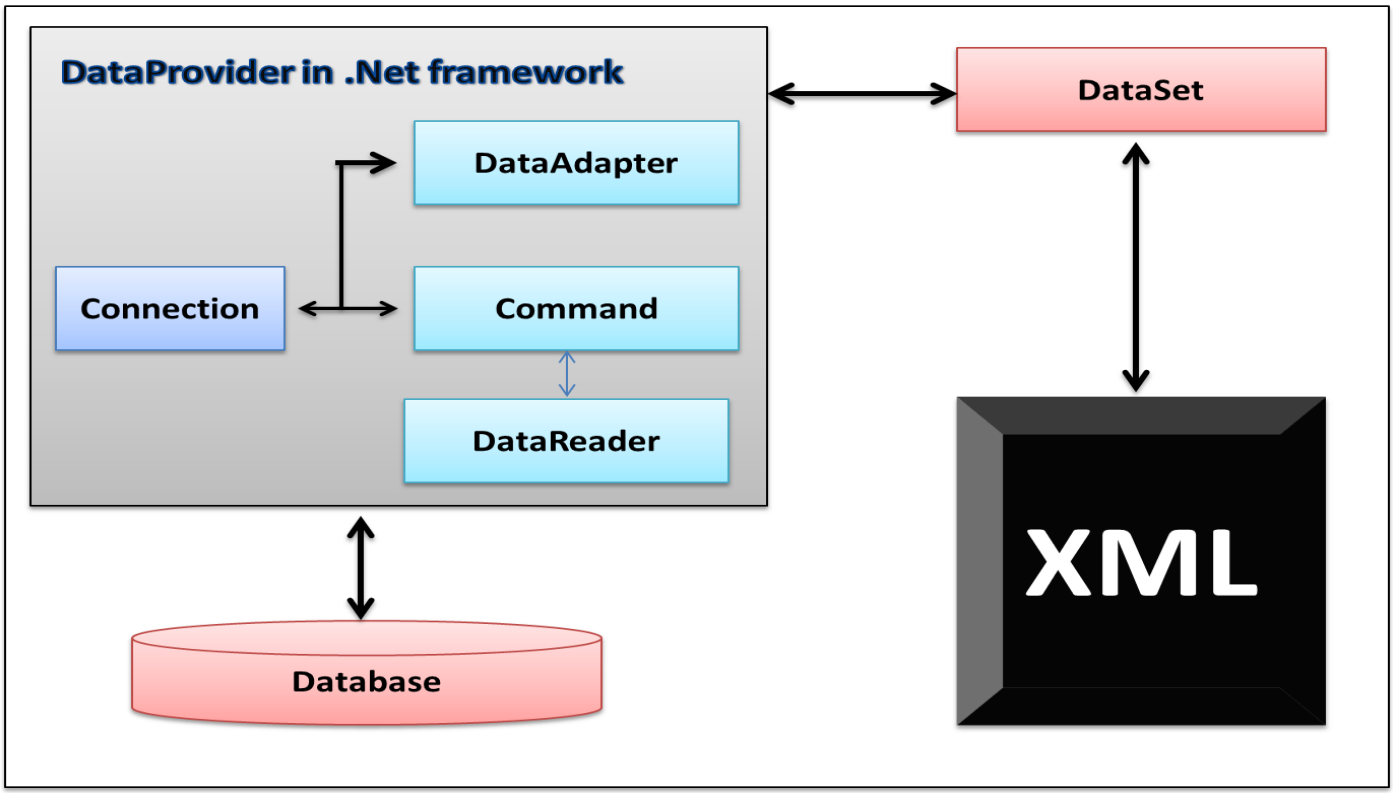
Collection	Description
Errors	Contains all the Error objects of the Connection object
Properties	Contains all the Property objects of the Connection object

---

ADO.NET is designed to help developers work efficiently with multi tier databases, across intranet or Internet scenarios.

The **ADO.NET object model** consists of two key components as follows:

- Connected model (.NET Data Provider - a set of components including the Connection, Command, DataReader, and DataAdapter objects)
- Disconnected model (DataSet).



Connection

The Connection object is the first component of ADO.NET. The connection object opens a connection to your data source.

All of the configurable aspects of a database connection are represented in the Connection object, which includes ConnectionString and ConnectionTimeout.

Connection object helps in accessing and manipulating a database. Database transactions are also dependent upon the Connection object.

In ADO.NET the type of the Connection is depended on what Database system you are working with. The following are the commonly using the connections in the ADO.NET

- SqlConnection
- OleDbConnection
- OdbcConnection

Command

The Command object is used to perform action on the data source. Command object can execute stored procedures and T-SQL commands.

You can execute SQL queries to return data in a DataSet or a DataReader object. Command object performs the standard Select, Insert, Delete and Update T-SQL operations.

DataReader

The DataReader is built as a way to retrieve and examine the rows returned in response to your query as quickly as possible.

No DataSet is created; in fact, no more than one row of information from the data source is in-memory at a time. This makes the DataReader quiet efficient at returning large amounts of data.

The data returned by a DataReader is always read only. This class was built to be a lightweight forward only, read only, way to run through data quickly (this was called a firehose cursor in ADO).

However, if you need to manipulate schema or use some advance display features such as automatic paging, you must use a DataAdapter and DataSet.

DataReader object works in connected model.

DataAdapter

The DataAdapter takes the results of a database query from a Command object and pushes them into a DataSet using the DataAdapter.Fill() method. Additionally the DataAdapter.Update() method will negotiate any changes to a DataSet back to the original data source.

DataAdapter object works in connected model. DataAdapter performs five following steps:

1. Create/open the connection
2. Fetch the data as per command specified
3. Generate XML file of data
4. Fill data into DataSet.
5. Close connection.

Command Builder

It is used to save changes made in-memory cache of data on backend. The work of Command Builder is to generate Command as per changes in DataRows.

Command Builder generates command on basis of row state. There are five row state:

1. Unchanged
2. Added
3. Deleted
4. Modified
5. Detached

Command Builder works on add, delete and modified row state only.

Detached is used when object is not created from row state.

Transaction

The Transaction object is used to execute backend transaction. Transactions are used to ensure that multiple changes to database rows occur as a single unit of work.

The Connection class has a BeginTransaction method that can be used to create a Transaction.

A definite best practice is to ensure that Transactions are placed in Using statements for rapid cleanup if they are not committed. Otherwise the objects (and any internal locks that may be needed) will remain active until the GC gets around to cleaning it up.

PART-B

POSSIBLE QUESTIONS(8 MARKS)

1. Elucidate the standards used by web services in ASP.NET
2. Explain in detail about ActiveX data objects
3. Discuss in detail about the purpose of WSDL and SOAP in ASP.NET.
4. Explain the various ADO objects used to work with the data retrieved from the database.
5. Illustrate the steps to create and access the Web Service.
6. Describe the process of building database tables in SQL Server in detail
7. Discuss in detail about how ASP.NET application will interact with database.

KARPAGAM ACADEMY OF HIGHER EDUCATION

Pollachi Main Road, Eacharani Post, Coimbatore-641 021

CLASS : III-B.Sc COMPUTER SCIENCE(2015-2018)

Online Examination

VISUAL PROGRAMMING (15CSU501)

questions	opt1	opt2	opt3	opt4
WSDL stands for _____	Web Service Development Language	**Web Service Descriptive Language**	Windows System Development Language	Window Service Dimensioning Language
SOAP stands for _____	System Object Analysis Program	System Object Analysis Program	**Simple Object Access Protocol**	Service Object Analysis Protocol
_____ has no user interface	**Web Services**	Web Application	Windows Applications	All the above
If an XML Document conforms to a DTD, then it is said to be ____	small	**valid**	documented	well formed
XML documents should be _____ , otherwise an XML processor will generate an error	small	valid	documented	**well formed**
Web services created in ASP.NET have ___ for file extension.	aspx	asx	**asmx**	asp
_____ are used to resolve naming collsions	classes	**namespaces**	methods	packages
Web services that runs on its own are called	**standalone services**	automatic services	web references	None of the Above
_____ provides a language for describing Web Services	UDDI	**WSDL**	DDT	XML
_____ provides a consistent set of statements that can be used from the WSDL.	**UDDI**	WSDL	DDT	XML
When making a Web Service with VS.NET and the Web Services template, the processing codes are entered in	the Visual Basic file	the interface file	**the Code-Behind of the service**	None of the Above
To access a Web Service within a Web Form add a _____	call statement	Object of Web Service	hyperlink	**web reference**
WSDL description and discovery information are kept in _____	the .aspx file	the .asmx file	**the .vsdisco file**	the .wsdl file

What is the SQL command for specifying criteria in a SELECT statement?	WITHIN	**WHERE**	FROM	FOR
What are the SQL text field delimiters?	**Single Quote**	Double Quote	The Percent sign	The Slash sign
What SQL aggregate function is used to add all values in a particular field	ADD	**SUM**	TOTAL	COUNT
_____ are the user interfaces of database applications used for accessing and navigating data tables	Queries	Reports	**Forms**	Tables
____ are utility tools for retrieving, updating and deleting records	**Queries**	Reports	Forms	Tables
The basic unit of storage in a database is a ____	Queries	Records	Forms	**Tables**
In a Database table Data is stored in the form of _____	Queries	**Records**	Forms	Tables
In a record each individual item of data are stored in _____	Queries	Records	**Fields**	Tables
_____ is used to uniquely identify each record in a database	Index	**Primary key**	Field	Data
Which of these providers is used to access Microsofr Access databases	**Jet OLEDB 4.0**	ODBC drivers	MSDataShape	SQL Server
Which of these does not belong to ADO.NET Object Model	**Request Object**	Connection Object	Dataset Object	DataReader Object
_____ Object is specifically designed to run commands against a data store	Connection	**Command**	Dataset Object	DataReader Object
_____ Object allows to connect to the data stores	**Connection**	Command	Dataset Object	DataReader Object
Which of these is a Access Data Type used to specify web addresses and URLs	Text	BLOB	Memo	**Hyperlink**
In Access, the Image data type are stored using _____ data type	Text	**BLOB**	Memo	Number
In SQL, the Image data type are stored in _____ format	Text	Unicode	**Binary**	Special

SQL supports _____ type of relationships	one-to-one	one-to-many	many-to-many	**All the above**
If a Web Service is to be discovered a _____ document must be available	UDDI	**WSDL**	DDT	XML
The Code Behind page of ASP.NET Web service files, created in VB has _____ file extension	.aspx.vb	.aspw.vb	.asm.vb	**.asmx.vb**
What fundamental difference between web services and web applications made with web forms affects users?	**Web services have no user interface**	Web services respond much more quickly	web services are written in XML	All the above
_____ query adds records matching some criteria from one table to another table	select	delete	**append**	update
The result of _____ query contain every record matcing the specified criteria.	**select**	delete	append	update
_____ query changes all records matching specified criteria form their existing value to a new value	select	delete	append	**update**
Equi-join in SQL is also known as _____	**Inner join**	Outer join	Left join	Right join
The _____ control ensure that the end user value is between a specified range	Compare Validator	**Range Validator**	Required Field Validator	Regular Expression Validator
Content pages use the _____ as file extension	**.aspx**	.asp	.vb.aspx	none of the all
The page directives includes an _____ attribute that can be used to remove theming from asp.net pages	stylesheettheme	**EnableTheming**	runat	none
Expansion for CSS	Compare Style sheet	Cascading structured sheet	**Cascading Style sheet**	Commenting style sheet
In .net Framework _____ is a set of computer software components that can be used by programmers to access data and data services	Access	Oracle	SQL server	**ADO.Net**

_____ object is responsible for using stored procedures, queries etc	Connection object	**Command object**	Data Adapter	Datareader
_____ object acts as a bridge between datastore and DataSet	Connection object	Command object	**Data Adapter**	Datareader
Which objects is used to create foreign key between tables?	**DataRelation**	DataRelationship	DataConstraint	Datakey
Which method of command object doesn't return any row?	ExecuteReader	ExecuteNonQuery	ExecuteQuery	ExecuteScalar
Select the Interface which provides Fast, connected forward-only access to data	IdataRecord	Idatabase	IdataReader	Irecorder
Which architecture does Datasets follow?	Parallel	disconnected	Connection-oriented	Distributed
Data source controls do not render any _____markup to the client.	XML	javascript	vbscript	HTML
Where do we store connection string in ASP.NET?	Web.config	App.config	Global.asax	Console.config
Which of the following is not a member of ConnectionObject?	EndTransaction	BeginTransaction	Open	Execute
The Command object in ADO.NET executes a _____against the database and retrieves a DataReader or DataSet Object	Function	Command	Subroutine	Object
Which of these data source controls do not implement Caching?	LinqDataSource	ObjectDataSource	SqlDataSource	XmlDataSource
Which method do you invoke on the DataAdapter control to load your generated dataset with data?	Load ( )	Fill( )	DataList	DataBind
_____ method copies the structure of the DataSet including all DataTable Schemas, relations, constraints and does not copy any data.	Copy	CopyAll	Clone	Finalize
DataReaderObject is suitable for_____ access such populating a list and then breaking the connection.	Write-only	Read-Write	Read-Write-Execute	Read-only

The_____ property sets the number of seconds that the cache remains valid.	CacheExpirationPolicy	CacheDuration	CacheKeyDependency	EnableCaching
Which objects is used to create foreign key between tables?	DataRelation	DataRelationship	DataConstraint	Datakey
ADO.Net provides the ability to create and process in-memory databases called	views	relations	datasets	tables
_____object can hold more than one rowset from the same data source and the relationships between them	DataReader object	Dataset object	OleDB connection object	Data Adapter
The _____ method of the RadioButtonList control binds the data source with the RadioButtonList control.	DataSource	DataBind( )	DataMember	DataView
DropDownList control is used to give a _____ select option to the user from multiple listed items	multiple	Two	single	four
Method name that fires when user changes the selection of the dropdown box	AppendDataBoundItems	AutoPostBack	SelectedItem	OnSelectedIndexChanged

answer
Web Service Descriptive Language
Simple Object Access Protocol
Web Services
valid
well formed
asmx
namespaces
standalone services
WSDL
UDDI
the Code-Behind of the service
web reference
the .vsdisco file

WHERE
Single Quote
SUM
Forms
Queries
Tables
Records
Fields
Primary key
Jet OLEDB 4.0
Request Object
Command
Connection
Hyperlink
BLOB
Binary

All the above
WSDL
.asmx.vb
Web services have no user interface
append
select
update
Inner join
Range Validator
.aspx
EnableTheming
Cascading Style sheet
ADO.Net

Command object
Data Adapter
DataRelation
ExecuteNonQuery
IdataReader
disconnected
HTML
Web.config
Execute
Command
LinqDataSource
Fill( )
Clone
Read-only

CacheDuration
DataRelation
datasets
Dataset object
DataBind( )
single
OnSelectedIndex Changed

Register Number: _____

[15CSU501]

KARPAGAM ACADEMY OF HIGHER EDUCATION

Karpagam University
(Under Section 3 of UGC Act 1956)
Eachanari, Coimbatore-641021.
(For the candidates admitted from 2015 onwards)
DEPARTMENTOF CS,CA& IT
FIRST INTERNAL EXAMINATION – 2017
Fifth Semester

Visual Programming

Date & Session: 17-7-2017 & AN **Duration:2 Hours**

Marks : 50

PART-A(20*1=20 Marks)

(Answer All The Questions)

1. VB.Net is a _____programming paradigm.

a. Procedural b. Structured **c. Object Oriented** d. Monolithic

2. IDE stands for _____

a. Internet Design Environment **c. Integrated Development Environment**

b. Internet DistributedEnvironment d. Interface Design Environment

3. The final compiled version of a Project is ____

a. Form b. Software c. Components d. Files

4._____ is a collection of files that can be compiled to create a distributed component

a. Form b. Software c. Components **d. Project**

5. Which function returns the system's current date and time

a. DateTime.Now b. DateTime.Today c. DateTime.System d. DateTime.Current

6. Parameters to methods in VB.NET are declared by default as ---------

a. ByVal b. ByRef c. Val d. Ref

7. The String is ----------

a. locatable b. mutable **c. immutable** d. notable

8._____ is the value range of integer

a. -32767 to 32768 **b. -32768 to 32767** c. 32767 to -32768 d. 32768 to -32767

9._____ is used for storing values temporarily.

a. character b. constant **c. variable** d. module

10. This property is used to change/display the title of the form

a. Name b. Text **c. Title** d. Form

11. Which of the following statement should be used to return the control from the middle of a subroutine?

a. Exit b. Exit Subroutine c. Exit Sub d. All the above

12. How many values is a subroutine capable of returning?

a. 0 b. 1 c. Any number of values d. Asmany arguments it use

13. ------ specifies number of times the mouse button is pressed and released

a. Button **b. Click** c. Delta d. X

14. When a mouse button is pressed _____ event will fired

a. Mouse Enter b. Mouse Up c. Mouse down **d. MouseHover**

15. _____provides easy navigation through a list of items or a large amount of information

a. scroll bar b. command button c. tool bar d. tool box

16. The user action like key press, clicks, mouse movements are called _____

a. Handlers **b. Triggers** c. Events d. Methods

17. The ------- property is used to get or set the mode behavior of the listbox control

a. Sorted b. SelectionMode **c. SelectedIndex** d. SelectedItem

18. The ------- property is used to set or retrieve the currently selected item in the combobox control

a. Sorted **b. SelectionMode** c. SelectedIndex d. SelectedItem

19. The -------- property allows automatic resizing of the label control according to the length of it'scaption.

a. Text b. Multiline c. PasswordChar **d. Autosize**

20. A ------- is a component used to accept input from the user or display the information on the form

a. text b. container c. control d. counter

PART – B (3 * 10 = 30 Marks)

(Answer ALL the Questions)

21. a) Discuss in detail about IDE components in VB.NET with neat sketch.

The IDE Components

The IDE of Visual Studio.NET contains numerous components, and it will take you a while to explore them. It's practically impossible to explain what each tool, each window, and each menu does.

The IDE Menu

The IDE main menu provides the following commands, which lead to submenus. Notice that most menus can also be displayed as toolbars. Also, not all options are available at all times. The options that cannot possibly apply to the current state of the IDE are either invisible or disabled. The Edit menu is a typical example.

File Menu

The File menu contains commands for opening and saving projects, or project items, as well as the commands for adding new or existing items to the current project.

Edit Menu

The Edit menu contains the usual editing commands. Among the commands of the Edit menu are the Advanced command and the IntelliSense command.

Advanced Submenu

The more interesting options of the Edit ➢ Advanced submenu are the following. Notice that the Advanced submenu is invisible while you design a form visually and appears when you switch to the code editor.

View White Space Space characters (necessary to indent lines of code and make it easy to read) are replaced by periods.

Word Wrap When a code line's length exceeds the length of the code window, it's automatically wrapped.

Comment Selection/Uncomment Selection Comments are lines you insert between your code's statements to document your application. Sometimes, we want to disable a few lines from our code, but not delete them (because we want to be able to restore them).

IntelliSense Submenu

The Edit ➢ IntelliSense menu item leads to a submenu with four options, which are described next. IntelliSense is a feature of the editor (and of other Microsoft applications) that displays as much information as possible, whenever possible.

List Members When this option is on, the editor lists all the members (properties, methods, **events, and argument list) in a drop-down list.**

TextBox1.

a list with the members of the TextBox control will appear (as seen in Figure 1.12). Select the Text property and then type the equal sign, followed by a string in quotes like the following:

TextBox1.Text = "Your User Name"

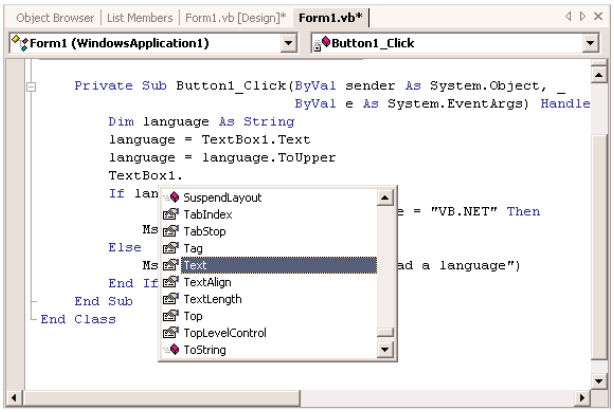
If you select a property that can accept a limited number of settings, you will see the names of the appropriate constants in a drop-down list. If you enter the following statement:

TextBox1.TextAlign =

you will see the constants you can assign to the property (as shown in Figure 1.13, they are the values HorizontalAlignment.Center, HorizontalAlignment.Right, and HorizontalAlignment.Left).

Parameter Info While editing code, you can move the pointer over a variable, method, or property and see its declaration in a yellow tooltip.

Figure - Viewing the members of a control in an IntelliSense dropdown list



Quick Info This is another IntelliSense feature that displays information about commands and functions. When you type the opening parenthesis following the name of a function, for example, the function's arguments will be displayed in a tooltip box (a yellow horizontal box).

View Menu

This menu contains commands to display any toolbar or window of the IDE. You have already seen the Toolbars menu (earlier, under "Starting a New Project"). The Other Windows command leads to submenu with the names of some standard windows, including the Output and Command windows.

The Output window is the console of the application. The compiler's messages, for example, are displayed in the Output window. The Command window allows you to enter and execute statements. When you debug an application, you can stop it and enter VB statements in the Command window.

Project Menu

This menu contains commands for adding items to the current project (an item can be a form, a file, a component, even another project). The last option in this menu is the Set AsStartUp Project command, which lets you specify which of the projects in a multiproject solution is the startup project (the one that will run when you press F5).

Build Menu

The Build menu contains commands for building (compiling) your project. The two basic commands in this menu are the Build and Rebuild All commands. The Build command compiles (builds the executable) of the entire solution, but it doesn't compile any components of the project that haven't changed since the last build. The Rebuild All command does the same, but it clears any existing files and builds the solution from scratch.

Debug Menu

This menu contains commands to start or end an application, as well as the basic debugging tools

Data Menu

This menu contains commands you will use with projects that access data.

Format Menu

The Format menu, which is visible only while you design a Windows or Web form, contains commands for aligning the controls on the form.

Tools Menu

This menu contains a list of tools, and most of them apply to C++. The Macros command of he Tools menu leads to a submenu with commands for creating macros. Just as you can create macros in an Office application to simplify many tasks, you can create macros to automate many of the repetitive tasks you perform in the IDE. I'm not going to discuss macros in this book, but once you familiarize yourself with the environment, you should look up the topic of writing macros in the documentation.

Window Menu

This is the typical Window menu of any Windows application. In addition to the list of open windows, it also contains the Hide command, which hides all Toolboxes and devotes the entire window of the IDE to the code editor or the Form Designer. The Toolboxes don't disappear completely. They're all retracted, and you can see their tabs on the left and right edges of the IDE window. To expand a Toolbox, just hover the mouse pointer over the corresponding tab.

Help Menu

This menu contains the various help options. The Dynamic Help command opens the Dynamic Help window, which is populated with topics that apply to the current operation. The Index command opens the Index window, where you can enter a topic and get help on the specific topic.

(OR)

b) (i) Explain in detail about types of variables in VB.NET with example.

Variables

A variable is nothing but a name given to a storage area that our programs can manipulate. Each variable in VB.Net has a specific type, which determines the size and layout of the variable's memory; the range of values that can be stored within that memory; and the set of operations that can be applied to the variable.

Declaring Variables

To declare a variable, use the Dim statement followed by the variable's name, the As keyword, and its type, as follows:

```
DimmetersAs                                                    Integer
Dim greetings As String
```

The first variable, meters, will store integers, such as 3 or 1,002; the second variable, greetings, will store text. You can declare multiple variables of the same or different type in the same line, as follows:

```
Dim QtyAs Integer, Amount As Decimal, CardNum As String
```

If you want to declare multiple variables of the same type, you need not repeat the type. Just separate all the variables of the same type with commas and set the type of the last variable:

```
Dim Length, Width, Height As Integer, Volume, Area As Double
```

This statement declares three Integer variables and two Double variables. Double variables hold fractional values (or floating-point values, as they're usually called) that are similar to the Single data type, except that they can represent noninteger values with greater accuracy.

Variable-Naming Conventions

When declaring variables, you should be aware of a few naming conventions. A variable's name

- Must begin with a letter, followed by more letters or digits.
- Can't contain embedded periods or other special punctuation symbols. The only special character that can appear in a variable's name is the underscore character.
- Mustn't exceed 255 characters.
- Must be unique within its scope. This means that you can't have two identically named variables in the same subroutine, but you can have a variable named counter in many different subroutines.

Variable names in VB 2008 are case-insensitive: myAge, myage, and MYAGE all refer to the same variable in your code. Actually, as you enter variable names, the editor converts their casing so that they match their declaration.

Variable Initialization

The general form of initialization is:

```
variable_name= value;
```

for example,

```
Dim pi AsDouble
pi=3.14159
```

You can initialize a variable at the time of declaration as follows:

```
DimStudentIDAsInteger=100
DimStudentNameAsString="Bill Smith"
```

Example

Try the following example which makes use of various types of variables:

```
ModulevariablesNdataypes
SubMain()
Dim a AsShort
Dim b AsInteger
Dim c AsDouble
a =10
    b =20
    c = a + b
Console.WriteLine("a = {0}, b = {1}, c = {2}", a, b, c)
Console.ReadLine()
EndSub
EndModule
```

When the above code is compiled and executed, it produces the following result:

```
a = 10, b = 20, c = 30
```

Types of Variables

Visual Basic recognizes the following five categories of variables:

- Numeric
- String
- Boolean
- Date
- Object

Data Type Identifier

Finally, you can omit the As clause of the Dim statement, yet create typed variables, with the variable declaration characters, or data type identifiers. These characters are special symbols that you append to the variable name to denote the variable's type. To create a string variable, you can use this statement:

Dim myText$

The dollar sign signifies a string variable. Notice that the name of the variable includes the dollar sign — it's myText$, not myText. To create a variable of a particular type, use one of the data declaration characters shown in the following table. (Not all data types have their own identifiers.)

Table 2.3 - Data Type Definition Characters

Symbol	Data Type	Example
$	String	A$, messageText$
%	Integer (Int32)	counter%, var%
&	Long (Int64)	population&, colorValue&
!	Single	distance!

Using type identifiers doesn't help to produce the cleanest and easiest-to-read code.

The Strict and Explicit options

The Visual Basic compiler provides three options that determine how it handles variables:

- The Explicit option indicates whether you will declare all variables.
- The Strict option indicates whether all variables will be of a specific type.
- The Infer option indicates whether the compiler should determine the type of a variable from its value.

To change the default behavior, you must insert the following statement at the beginning of the file:

Option Explicit Off

The Option Explicit statement must appear at the very beginning of the file. This setting affects the code in the current module, not in all files of your project or solution. You can turn on the Strict (as well as the Explicit) option for an entire solution. Open the solution's properties dialog box (right-click the solution's name in Solution Explorer and select Properties), select the Compile tab, and set the Strict and Explicit options accordingly, as shown in Figure

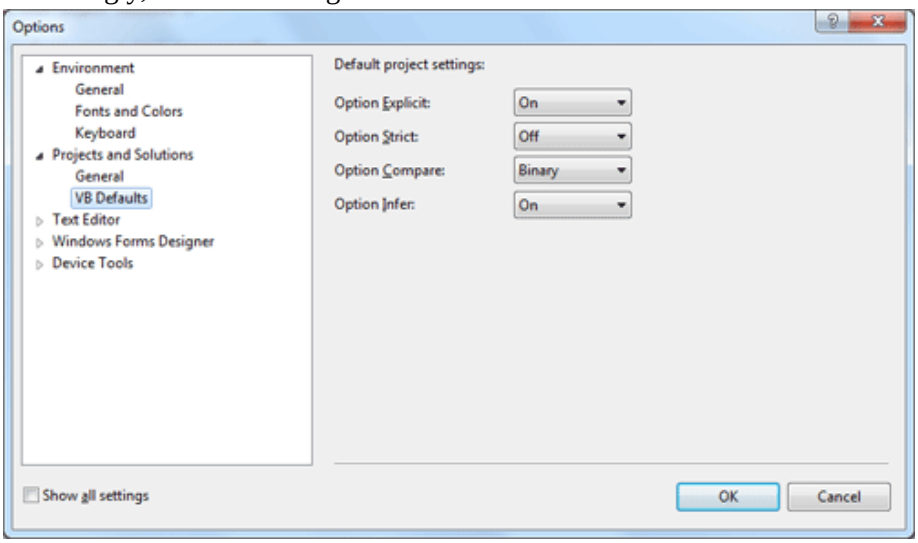


Figure - Setting the variable-related options in the Visual Studio Options dialog box

The Strict option requires that variables are declared with a specific type. In other words, the Strict option disallows the use of generic variables that can store any data type.

The default value of the Explicit statement is On. This is also the recommended value, and you should not make a habit of changing this setting. In the section "Reasons for Decalring Variables" later in this chapter, you will see an example of the pitfalls you'll avoid by declaring your variables. By setting the Explicit option to Off, you're telling VB that you intend to use variables without declaring them. As a consequence, VB can't make any assumption about the variable's type, so it uses a generic type of variable that can hold any type of information. These variables are called Object variables, and they're equivalent to the old variants.

While the option Explicit is set to Off, every time Visual Basic runs into an undeclared variable name, it creates a new variable on the spot and uses it. The new variable's type is Object, the generic data type that can accommodate all other data types. Using a new variable in your code is equivalent to declaring it without type. Visual Basic adjusts its type according to the value you assign to it. Create two variables, var1 and var2, by referencing them in your code with statements like the following ones:

Option Strict On

If you attempt to execute any of the last two code segments while the Strict option is on, the compiler will underline a segment of the statement to indicate an error. If you rest the pointer over the underlined segment of the code, the following error message will appear in a tip box:

Option strict disallows implicit conversions from String to Double
(or whatever type of conversion is implied by the statement).

When the Strict option is set to On, the compiler doesn't disallow all implicit conversions between data types. For example, it will allow you to assign the value of an integer to a Long, but not the opposite. The Long value might exceed the range of values that can be represented by an Integer variable.

Object Variables

Variants — variables without a fixed data type— were the bread and butter of VB programmers up to version 6. Variants are the opposite of strictly typed variables: They can store all types of values, from a single character to an object. If you're starting with VB 2008, you should use strictly typed variables. However, variants are a major part of the history of VB, and most applications out there (the ones you may be called to maintain) use them. I will discuss variants briefly in this section and show you what was so good (and bad) about them.

Variants, or object variables, were the most flexible data types because they could accommodate all other types. A variable declared as Object (or a variable that hasn't been declared at all) is handled by Visual Basic according to the variable's current contents. If you assign an integer value to an object variable, Visual Basic treats it as an integer. If you assign a string to an object variable, Visual Basic treats it as a string. Variants can also hold different data types in the course of the same program. Visual Basic performs the necessary conversions for you.

To declare a variant, you can turn off the Strict option and use the Dim statement without specifying a type, as follows:

```
Dim myVar
```

If you don't want to turn off the Strict option (which isn't recommended, anyway), you can declare the variable with the Object data type:

```
Dim myVar As Object
```

Every time your code references a new variable, Visual Basic will create an object variable. For example, if the variable validKey hasn't been declared, when Visual Basic runs into the following line, it will create a new object variable and assign the value 002-6abbgd to it:

```
validKey = "002-6abbgd"
```

You can use object variables in both numeric and string calculations. Suppose that the variable modemSpeed has been declared as Object with one of the following statements:

```
Dim modemSpeed ' with Option Strict = Off
Dim modemSpeed As Object ' with Option Strict = On
```

and later in your code you assign the following value to it:

```
modemSpeed = "28.8"
```

The modemSpeed variable is a string variable that you can use in statements such as the following:

```
MsgBox "We suggest a " &modemSpeed&" modem."
```

This statement displays the following message:

"We suggest a 28.8 modem."

Converting Variable Types

In many situations, you will need to convert variables from one type into another. Table 2.4 shows the methods of the Convert class that perform data-type conversions.

In addition to the methods of the Convert class, you can still use the data-conversion functions of VB (CInt() to convert a numeric value to an Integer, CDbl() to convert a numeric value to a Double, CSng() to convert a numeric value to a Single, and so on), which you can look up in the documentation. If you're writing new applications in VB 2008, use the new Convert class to convert between data types.

To convert the variable initialized as the following

```
Dim A As Integer
```

to a Double, use the ToDouble method of the Convert class:

```
DimBAsDouble
B = Convert.ToDouble(A)
```

Suppose that you have declared two integers, as follows:

```
DimAAsInteger,BAsInteger
A=23
B = 7
```
The result of the operation A / B will be a Double value. The following statement
```
Debug.Write(A / B)
```
displays the value 3.28571428571429. The result is a Double value, which provides the greatest possible accuracy. If you attempt to assign the result to a variable that hasn't been declared as Double, and the Strict option is on, then VB 2008 will generate an error message. No other data type can accept this value without loss of accuracy. To store the result to a Single variable, you must convert it explicitly with a statement like the following:
```
Convert.ToSingle(A / B)
```
You can also use the DirectCast() function to convert a variable or expression from one type to another. The DirectCast() function is identical to the CType() function. Let's say the variable A has been declared as String and holds the value 34.56. The following statement converts the value of the A variable to a Decimal value and uses it in a calculation:
```
DimAAsString="34.56"
DimBAsDouble
B = DirectCast(A, Double) / 1.14
```
The conversion is necessary only if the Strict option is on, but it's a good practice to perform your conversions explicitly. The following section explains what might happen if your code relies on implicit conversions.

Table 2.4 - The Data-Type Conversion Methods of the Convert Class

Method	Converts Its Argument To
ToBoolean	Boolean
ToByte	Byte
ToChar	Unicode character
ToDateTime	Date
ToDecimal	Decimal
ToDouble	Double
ToInt16	Short Integer (2-byte integer, Int16)
ToInt32	Integer (4-byte integer, Int32)
ToInt64	Long (8-byte integer, Int64)
ToSByte	Signed Byte
CShort	Short (2-byte integer, Int16)
ToSingle	Single
ToString	String

(ii) Explain in detail about Argument Passing Mechanism in functions with example.

Argument Passing Mechanisms

One of the most important topics in implementing your own procedures is the mechanism used to pass arguments. The examples so far have used the default mechanism: passing arguments by value. The other mechanism is passing them by reference. Although most programmers use the default mechanism, it's important to know the difference between the two mechanisms and when to use each.

- ✓ Passing arguments By Value
- ✓ Passing arguments by Reference
- ✓ Returning Multiple Values
- ✓ Passing Objects as Arguments

Passing arguments by value

This is the default mechanism for passing parameters to a method. In this mechanism, when a method is called, a new storage location is created for each value parameter. The values of the actual parameters are copied into them. So, the changes made to the parameter inside the method have no effect on the argument.

In VB.Net, you declare the reference parameters using the **ByVal** keyword. The following example demonstrates the concept:

```
ModuleparamByval
Subswap(ByVal x AsInteger,ByVal y AsInteger)
Dim temp AsInteger
temp= x ' save the value of x
    x = y    ' put y into x
    y = temp 'put temp into y
EndSub
SubMain()
' local variable definition
Dim a AsInteger=100
Dim b AsInteger=200
Console.WriteLine("Before swap, value of a : {0}", a)
Console.WriteLine("Before swap, value of b : {0}", b)
' calling a function to swap the values '
swap(a, b)
Console.WriteLine("After swap, value of a : {0}", a)
Console.WriteLine("After swap, value of b : {0}", b)
Console.ReadLine()
EndSub
EndModule
```

When the above code is compiled and executed, it produces following result:

```
Before swap, value of a :100
Before swap, value of b :200
After swap, value of a :100
After swap, value of b :200
```

It shows that there is no change in the values though they had been changed inside the function.

Passing Parameters by Reference

A reference parameter is a reference to a memory location of a variable. When you pass parameters by reference, unlike value parameters, a new storage location is not created for these

parameters. The reference parameters represent the same memory location as the actual parameters that are supplied to the method.

In VB.Net, you declare the reference parameters using the **ByRef** keyword. The following example demonstrates this:

```
ModuleparamByref
Subswap(ByRef x AsInteger,ByRef y AsInteger)
Dim temp AsInteger
temp= x ' save the value of x
    x = y    ' put y into x
    y = temp 'put temp into y
EndSub
SubMain()
' local variable definition
Dim a AsInteger=100
Dim b AsInteger=200
Console.WriteLine("Before swap, value of a : {0}", a)
Console.WriteLine("Before swap, value of b : {0}", b)
' calling a function to swap the values '
swap(a, b)
Console.WriteLine("After swap, value of a : {0}", a)
Console.WriteLine("After swap, value of b : {0}", b)
Console.ReadLine()
EndSub
EndModule
```

When the above code is compiled and executed, it produces following result:

```
Before swap, value of a : 100
Before swap, value of b : 200
After swap, value of a : 200
After swap, value of b : 100
```

Returning Multiple Values

If you want to write a function that returns more than a single result, you will most likely pass additional arguments by reference and set their values from within the function's code. The CalculateStatistics() function, calculates the basic statistics of a data set. The values of the data set are stored in an array, which is passed to the function by reference. The CalculateStatistics() function must return two values: the average and standard deviation of the data set. Here's the declaration of the CalculateStatistics() function:

Function CalculateStatistics(ByRef Data() As Double, ByRefAvg As Double, ByRefStDev As Double) As Integer

The function returns an integer, which is the number of values in the data set. The two important values calculated by the function are returned in the Avg and StDev arguments:

Function CalculateStatistics(ByRef Data() As Double, ByRefAvg As Double, ByRefStDev As Double) As Integer

Dim i As Integer, sum As Double, sumSqr As Double, points As Integer

points = Data.Length

For i = 0 To points - 1

sum = sum + Data(i)

sumSqr = sumSqr + Data(i) ^ 2

```
Next
Avg = sum / points
StDev = System.Math.Sqrt(sumSqr / points - Avg ^ 2)
Return(points)
End Function
```

To call the CalculateStatistics() function from within your code, set up an array of Doubles and declare two variables that will hold the average and standard deviation of the data set:

```
Dim Values(99) As Double
' Statements to populate the data set
Dim average, deviation As Double
Dim points As Integer
points = Stats(Values, average, deviation)
Debug.WriteLine points & " values processed."
Debug.WriteLine "The average is "& average & " and"
Debug.WriteLine "the standard deviation is " & deviation
```

Using ByRef arguments is the simplest method for a function to return multiple values. However, the definition of your functions might become cluttered, especially if youwant to returnmore than a few values. Another problem with this technique is that it's not clear whether an argument must be set before calling the function. As you will see shortly, it is possible for a function to return an array or a custom structure with fields for any number of values.

Passing Objects as Arguments

When you pass objects as arguments, they're passed by reference, even if you have specified the ByVal keyword. The procedure can access and modify the members of the object passed as an argument, and the new value will be visible in the procedure that made the call.

The following code segment demonstrates this. The object is an ArrayList, which is an enhanced form of an array. The ArrayList is discussed in detail later in the tutorial, but to follow this example all you need to know is that the Add method adds new items to the ArrayList, and you can access individual items with an index value, similar to an array's elements. In the Click event handler of a Button control, create a new instance of the ArrayList object and call the PopulateList() subroutine to populate the list. Even if the ArrayList object is passed to the subroutine by value, the subroutine has access to its items:

```
Private Sub Button1 Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Button1.Click

Dim aList As New ArrayList()
PopulateList(aList)
Debug.WriteLine(aList(0).ToString)
Debug.WriteLine(aList(1).ToString)
Debug.WriteLine(aList(2).ToString)

End Sub

Sub PopulateList(ByVal list As ArrayList)
list.Add("1")
list.Add("2")
list.Add("3")
End Sub
```

The same is true for arrays and all other collections. Even if you specify the ByVal keyword, they're passed by reference.

Passing unknown number of Arguments

VB 2008 supports the ParamArray keyword, which allows you to pass a variable number of arguments to a procedure.

Let's look at an example. Suppose that you want to populate a ListBox control with elements. To add an item to the ListBox control, you call the Add method of its Items collection as follows:

```
ListBox1.Items.Add("new item")
```

This statement adds the string new item to the ListBox1 control. If you frequently add multiple items to a ListBox control from within your code, you can write a subroutine that performs this task. The following subroutine adds a variable number of arguments to the ListBox1 control:

```
Sub AddNamesToList(ByValParamArrayNamesArray() As Object)
Dim x As Object
For Each x In NamesArray
ListBox1.Items.Add(x)
Next x
End Sub
```

This subroutine's argument is an array prefixed with the keyword ParamArray, which holds all the parameters passed to the subroutine. If the parameter array holds items of the same type, you can declare the array to be of the specific type (string, integer, and so on). To add items to the list, call the AddNamesToList() subroutine as follows:

```
AddNamesToList("Robert", "Manny", "Renee", "Charles", "Madonna")
```

If you want to know the number of arguments actually passed to the procedure, use the Length property of the parameter array. The number of arguments passed to the AddNamesToList() subroutine is given by the following expression:

```
NamesArray.Length
```

The following loop goes through all the elements of the NamesArray and adds them to the list:

```
Dim i As Integer
For i = 0 to NamesArray.GetUpperBound(0)
ListBox1.Items.Add(NamesArray(i))
Next i
```

VB arrays are zero-based (the index of the first item is 0), and the GetUpperBound method returns the index of the last item in the array.

A procedure that accepts multiple arguments relies on the order of the arguments. To omit some of the arguments, you must use the corresponding comma. Let's say you want to call such a procedure and specify the first, third, and fourth arguments. The procedure must be called as follows:

```
ProcName(arg1, , arg3, arg4)
```

The arguments to similar procedures are usually of equal stature, and their order doesn't make any difference. A function that calculates the mean or other basic statistics of a set of numbers, or a subroutine that populates a ListBox or ComboBox control, are prime candidates for implementing this technique. If the procedure accepts a variable number of arguments that aren't equal in stature, you should consider the technique described in the following section. If the function accepts a parameter array, this must the last argument in the list, and none of the other parameters can be optional.

Param Arrays

At times, while declaring a function or sub procedure you are not sure of the number of arguments passed as a parameter. VB.Net param arrays (or parameter arrays) come into help at these times.

The following example demonstrates this:

```
Modulemyparamfunc
FunctionAddElements(ParamArrayarrAsInteger())AsInteger
Dim sum AsInteger=0
DimiAsInteger=0
ForEachiInarr
sum+=i
Nexti
Return sum
EndFunction
SubMain()
Dim sum AsInteger
sum=AddElements(512,720,250,567,889)
Console.WriteLine("The sum is: {0}", sum)
Console.ReadLine()
EndSub
EndModule
```

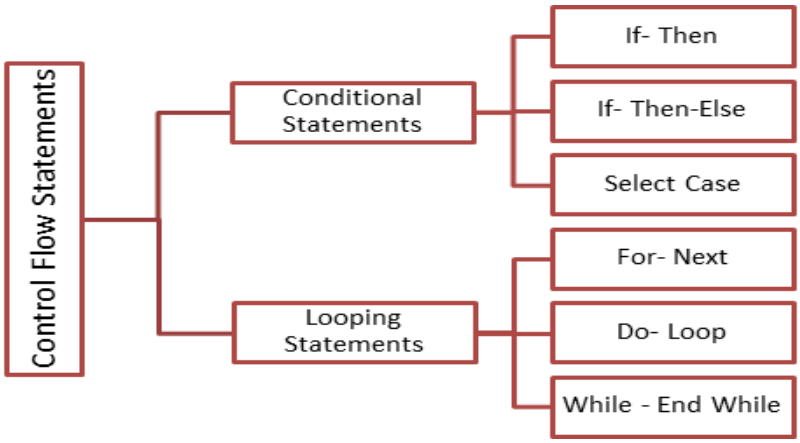
When the above code is compiled and executed, it produces following result:

```
The sum is: 2938
```

22. a) (i) Explain in detail about control flow statements with examples.

Flow Control statements

Decision making structures require that the programmer specify one or more conditions to be evaluated or tested by the program, along with a statement or statements to be executed if the condition is determined to be true, and optionally, other statements to be executed if the condition is determined to be false



Decision Statements

Applications need a mechanism to test conditions and take a different course of action depending on the outcome of the test. Visual Basic provides three such decision, or conditional, statements:

- If. . .Then
- If. . .Then. . .Else
- Select Case

Loop Statements

Loop statements allow you to execute one or more lines of code repetitively. Many tasks consist of operations that must be repeated over and over again, and loop statements are an important part of any programming language. Visual Basic supports the following loop statements:

- For. . .Next
- Do. . .Loop
- While. . .End While

Decision Statements

1) If Then Statement

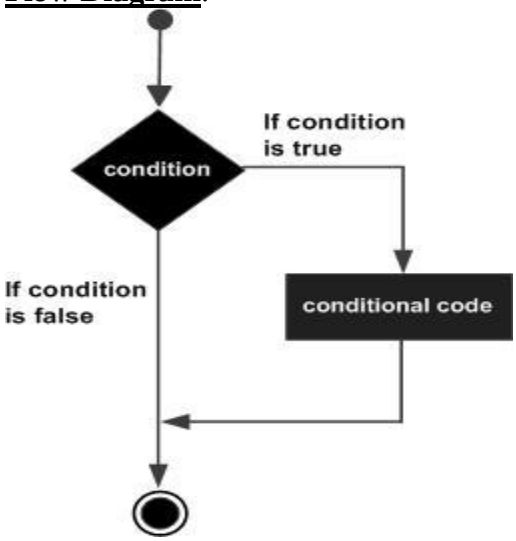
If Then statement is a control structure which executes a set of code only when the given condition is true.

Syntax:

If [Condition] Then
  [Statements]

In the above syntax when the **Condition** is true then the **Statements** after **Then** are executed.

Flow Diagram:



Example:

```
Private Sub Button1_Click_1(ByVal sender As System.Object,
ByVal e AsSystem.EventArgs) Handles Button1.Click
  If Val(TextBox1.Text) > 25 Then
     TextBox2.Text = "Eligible"
  End If
```

Description:

In the above If Then example the button click event is used to check if the age got using **TextBox1** is greater than **25**, if true a message is displayed in **TextBox2**

2) If Then Else Statement

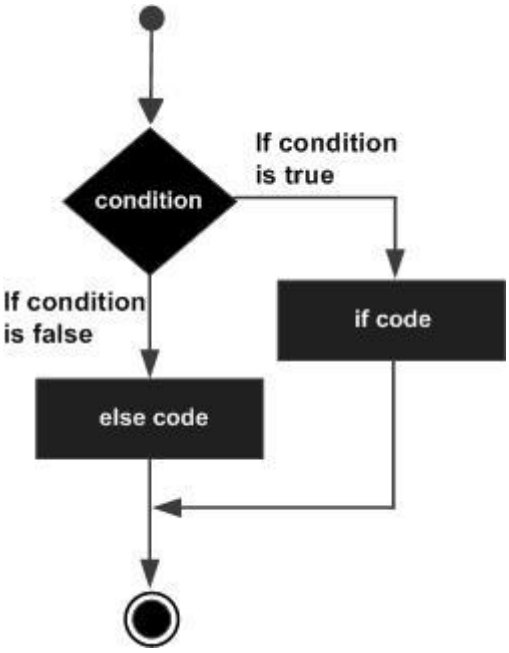
If Then Else statement is a control structure which executes different set of code statements when the given condition is true or false.

Syntax:

```
If [Condition] Then
  [Statements]
Else
  [Statements]
```

In the above syntax when the **Condition** is true, the **Statements** after **Then** are executed.If the condition is false then the statements after the **Else** part is executed.

Flow Diagram:



Example:

```
 Private Sub Button1_Click(ByVal sender As System.Object,
ByVal e AsSystem.EventArgs) Handles Button1.Click
   If Val(TextBox1.Text) >= 40 Then
MsgBox("GRADUATED")
       Else
MsgBox("NOT GRADUATED")
   End If
 End Sub
```

Description:

In the above If Then Else example the marks are entered in **TextBox1**.When a button is clicked a message **GRADUATED** is displayed if the condition (>40) is true and **NOT GRADUATED** if it is false.

3) Nested If Then Else Statement

Nested If..Then..Else statement is used to check multiple conditions using if then else statements nested inside one another.

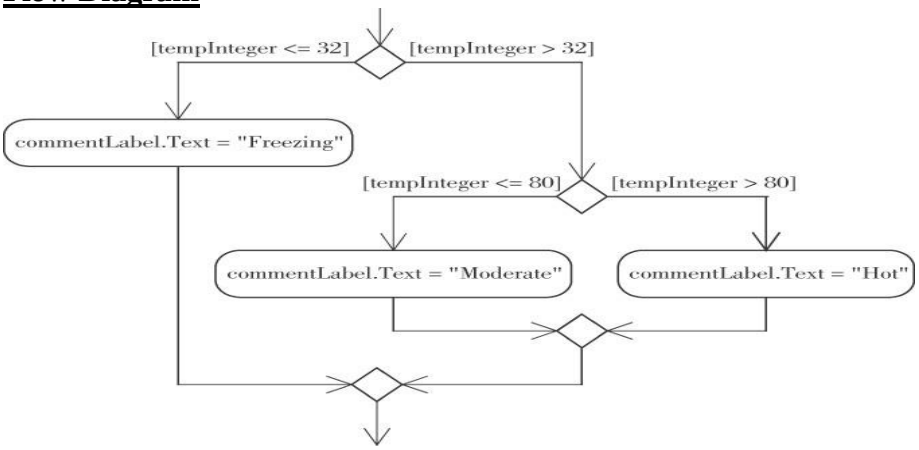
Syntax:

```
If [Condition] Then
  If [Condition] Then
    [Statements]
```

```
  Else
    [Statements]
Else
  [Statements]
```

In the above syntax when the **Condition** of the first if then else is true, the second if then else is executed to check another two conditions. If false the statements under the Else part of the first statement is executed.

Flow Diagram



Example:

```
 Private Sub Button1_Click(ByVal sender As System.Object,
ByVal e AsSystem.EventArgs) Handles Button1.Click
   If Val(TextBox1.Text) >= 40 Then
      If Val(TextBox1.Text) >= 60 Then
MsgBox("You have FIRST Class")
      Else
MsgBox("You have SECOND Class")
      End If
   Else
MsgBox("Check your Average marks entered")
   End If
 End Sub
```

Description:

In the above nested if then else statement example first the average mark is checked if it is more than 40, if true the second if then else control is used check for first or second class. If the first condition is false the statements under the else part is executed.

4) Select Case Statement

Select case statement is used when the expected results for a condition can be known previously so that different set of operations can be done based on each condition.

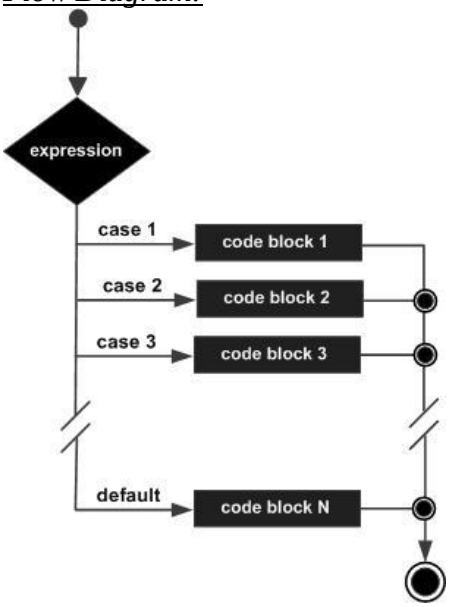
Syntax:

```
  Select Case Expression
    Case Expression1
      Statement1
    Case Expression2
      Statement2
    Case Expressionn
```

```
Statementn
    ...
  Case Else
    Statement
 End Select
```

In the above syntax, the value of the **Expression** is checked with **Expression1..n** to check if the condition is true. If none of the conditions are matched the statements under the **Case Else** is executed.

Flow Diagram:



Example:

```
 Private Sub Button1_Click(ByVal sender As System.Object,
ByVal e AsSystem.EventArgs) Handles Button1.Click
   Dim c As String
   c = TextBox1.Text
   Select c
   Case "Red"
MsgBox("Color code of Red is::#FF0000")
   Case "Green"
MsgBox("Color code of Green is::#808000")
   Case "Blue"
MsgBox("Color code of Blue is:: #0000FF")
   Case Else
MsgBox("Enter correct choice")
   End Select
 End Sub
```

Description:

In the above example based on the color input in **TextBox1**, the color code for RGB colors are displayed, if the color is different then the statement under **Case Else** is executed. Thus we can easily execute the select case statement.

Loop Statements

1) Do While Loop Statement

Do While Loop Statement is used to execute a set of statements only if the condition is satisfied. But the loop get executed once for a false condition once before exiting the loop. This is also know as **Entry Controlled**loop.

Syntax:

```
Do While [Condition]
  [Statements]
Loop
```

In the above syntax the **Statements** are executed till the **Condition** remains true.

Example:

```
Private Sub Form1_Load(ByVal sender As System.Object,
ByVal e AsSystem.EventArgs) Handles MyBase.Load
Dim a As Integer
  a = 1
Do While a < 100
    a = a * 2
MsgBox("Product is::" & a)
Loop
End Sub
```

Description:

In the above Do While Loop example the loop is continued after the value 64 to display 128 which is false according to the given condition and then the loop exits.

2) Do Loop While Statement

Do Loop While Statement executes a set of statements and checks the condition, this is repeated until the condition is true. .It is also known as an **Exit Control** loop

Syntax:

```
Do
  [Statements]
Loop While [Condition]
```

In the above syntax the **Statements** are executed first then the **Condition** is checked to find if it is true.

Example:

```
Private Sub Form1_Load(ByVal sender As System.Object,
ByVal e AsSystem.EventArgs) Handles MyBase.Load
Dim cnt As Integer

   Do
     cnt = 10
MsgBox("Value of cnt is::" &cnt)
    Loop While cnt<= 9
End Sub
```

Description:

In the above Do Loop While example, a message is displayed with a value 10 only after which the condition is checked, since it is not satisfied the loop exits.

3) For Next Loop Statement

For Next Loop Statement executes a set of statements repeatedly in a loop for the given initial, final value range with the specified step by step increment or decrement value.

Syntax:

```
For counter = start To end [Step]
  [Statement]
Next [counter]
```

In the above syntax the **Counter** is range of values specified using the **Start** ,**End** parameters. The **Step** specifies step increment or decrement value of the counter for which the statements are executed.

Example:

```
Private Sub Form1_Load(ByVal sender As System.Object,
ByVal e AsSystem.EventArgs) Handles MyBase.Load
Dim i As Integer
   Dim j As Integer
j = 0
   For i = 1 To 10 Step 1
    j = j + 1
MsgBox("Value of j is::" & j)
   Next i
End Sub
```

Description:

In the above For Next Loop example the counter value of i is set to be in the range of 1 to 10 and is incremented by 1. The value of j is increased by 1 for 10 times as the loop is repeated.

Nested Control Structures

You can place, or nest, control structures inside other control structures (such as an If. . .Then block within a For. . .Next loop). Control structures in Visual Basic can be nested in as many levels as you want. The editor automatically indents the bodies of nested decision and loop structures to make the program easier to read. When you nest control structures, you must make sure that they open and close within the same structure. In other words, you can't start a For. . .Next loop in an If statement and close the loop after the corresponding End If. The following code segment demonstrates how to nest several flow-control statements. (The curly brackets denote that regular statements should appear in their place and will not compile, of course.)

```
Fora=1To100
{statements}
Ifa=99Then
{statements}
EndIf
Whileb<a
{statements}
Iftotal<=0Then
{statements}
EndIf
EndWhile
Forc=1toa
{statements}
Nextc
Next a
```

Listing 3.7: Simple Nested If Statements

```
DimIncomeAsDecimal
Income=Convert.ToDecimal(InputBox("Enteryourincome"))
IfIncome>0Then
IfIncome>12000Then
MsgBox"You will pay taxes this year"
Else
MsgBox"You won't pay any taxes this year"
End If
Else
MsgBox"Bummer"
End If
```

The Exit Statement

The Exit statement allows you to exit prematurely from a block of statements in a control structure, from a loop, or even from a procedure. Suppose that you have a For. . .Next loop that calculates the square root of a series of numbers. Because the square root of negative numbers can't be calculated (the Math.Sqrt method will generate a runtime error

```
Fori=0ToUBound(nArray)
IfnArray(i)<0Then
MsgBox("Can'tcompletecalculations"&vbCrLf&_
"Item"&i.ToString&"isnegative!"
ExitFor
EndIf
nArray(i)=Math.Sqrt(nArray(i))
Next
```

If a negative element is found in this loop, the program exits the loop and continues with the statement following the Next statement.

There are similar Exit statements for the Do loop (Exit Do), the While loop (Exit While), the Select statement (Exit Select), and for functions and subroutines (Exit Function and Exit Sub). If the previous loop was part of a function, you might want to display an error and exit not only the loop, but also the function itself by using the Exit Function statement.

(ii) Discuss the following with examples (i) Constants(ii) Arrays

Constants

Some variables don't change value during the execution of a program. These variables are constants that appear many times in your code. For instance, if your program does math calculations, the value of pi (3.14159. . .) might appear many times. Instead of typing the value 3.14159 over and over again, you can define a constant, name it pi, and use the name of the constant in your code. The statement

```
circumference = 2 * pi * radius
```

is much easier to understand than the equivalent

```
circumference = 2 * 3.14159 * radius
```

You could declare pi as a variable, but constants are preferred for two reasons:

Constants don't change value. This is a safety feature. After a constant has been declared, you can't change its value in subsequent statements, so you can be sure that the value specified in the constant's declaration will take effect in the entire program.

Constants are processed faster than variables. When the program is running, the values of constants don't have to be looked up. The compiler substitutes constant names with their values, and the program executes faster.

```
' The following statements declare constants.
ConstmaxvalAsLong=4999
PublicConst message AsString="HELLO"
PrivateConstpiValueAsDouble=3.1415
```

Example

The following example demonstrates declaration and use of a constant value:

```
ModuleconstantsNenum
SubMain()
Const PI =3.14149
Dim radius, area AsSingle
radius=7
area= PI * radius * radius
Console.WriteLine("Area = "&Str(area))
Console.ReadKey()
EndSub
EndModule
```

When the above code is compiled and executed, it produces the following result:

```
Area = 153.933
```

Print and Display Constants in VB.Net

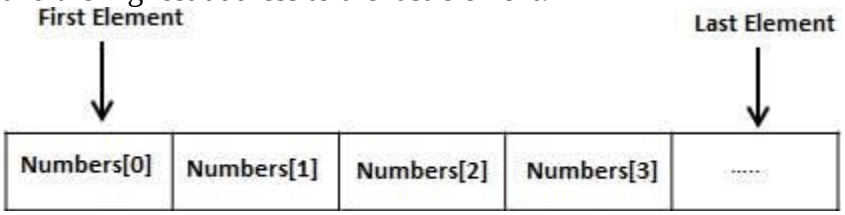
VB.Net provides the following print and display constants:

Constant	Description
vbCrLf	Carriage return/linefeed character combination.
vbCr	Carriage return character.
vbLf	Linefeed character.
vbNewLine	Newline character.
vbNullChar	Null character.
vbNullString	Not the same as a zero-length string (""); used for calling external procedures.
vbObjectError	Error number. User-defined error numbers should be greater than this value. For example: Err.Raise(Number) = vbObjectError + 1000
vbTab	Tab character.
vbBack	Backspace character.

Arrays

An array stores a fixed-size sequential collection of elements of the same type. An array is used to store a collection of data, but it is often more useful to think of an array as a collection of variables of the same type.

All arrays consist of contiguous memory locations. The lowest address corresponds to the first element and the highest address to the last element.



Creating Arrays in VB.Net

To declare an array in VB.Net, you use the Dim statement. For example,

```
DimintData(30)     ' an array of 31 elements
DimstrData(20)AsString      ' an array of 21 strings
DimtwoDarray(10,20)AsInteger          'a two dimensional array of integers
Dimranges(10,100)             'a two dimensional array
```

You can also initialize the array elements while declaring the array. For example,

```
DimintData()AsInteger={12,16,20,24,28,32}
Dimnames()AsString={"Karthik","Sandhya","Shivangi","Ashwitha","Somnath"}
DimmiscData()AsObject={"Hello World",12d,16ui,"A"c}
```

Initializing Arrays

Just as you can initialize variables in the same line in which you declare them, you can initialize arrays, too, with the following constructor (an array initializer, as it's called):

Dim arrayname() As type = {entry0, entry1, ... entryN}

Here's an example that initializes an array of strings:

Dim Names() As String = {"Joe Doe", "Peter Smack"}

This statement is equivalent to the following statements, which declare an array with two elements and then set their values:

DimNames(1)AsString
Names(0)="JoeDoe"
Names(1) = "Peter Smack"

Array Limits

The first element of an array has index 0. The number that appears in parentheses in the Dim statement is one fewer than the array's total capacity and is the array's upper limit (or upper bound). The index of the last element of an array (its upper bound) is given by the method GetUpperBound, which accepts as an argument the dimension of the array and returns the upper bound for this dimension.

The arrays we examined so far are one-dimensional and the argument to be passed to the GetUpperBound method is the value 0. The total number of elements in the array is given by the method GetLength, which also accepts a dimension as an argument. The upper bound of the following array is 19, and the capacity of the array is 20 elements:

Dim Names(19) As Integer

The first element is Names(0), and the last is Names(19). If you execute the following statements, the highlighted values will appear in the Output window:

Debug.WriteLine(Names.GetLowerBound(0))
0
Debug.WriteLine(Names.GetUpperBound(0))
19

To assign a value to the first and last element of the Names array, use the following statements:

Names(0)="Firstentry"
Names(19) = "Last entry"

If you want to iterate through the array's elements, use a loop like the following one:

```
DimiAsInteger,myArray(19)AsInteger
Fori=0TomyArray.GetUpperBound(0)
myArray(i)=i*1000
Next
```

The actual number of elements in an array is given by the expression myArray.GetUpperBound(0) + 1. You can also use the array's Length property to retrieve the count of elements. The following statement will print the number of elements in the array myArray in the Output window:

```
Debug.WriteLine(myArray.Length)
```

Dynamic Arrays

Dynamic arrays are arrays that can be dimensioned and re-dimensioned as par the need of the program. You can declare a dynamic array using the **ReDim** statement.

Syntax for ReDim statement:

```
ReDim [Preserve] arrayname(subscripts)
```

Where,

The **Preserve** keyword helps to preserve the data in an existing array, when you resize it.

arrayname is the name of the array to re-dimension.

subscripts specifies the new dimension.

```
ModulearrayApl
SubMain()
Dimmarks()AsInteger
ReDimmarks(2)
marks(0)=85
marks(1)=75
marks(2)=90
ReDimPreservemarks(10)
marks(3)=80
marks(4)=76
marks(5)=92
marks(6)=99
marks(7)=79
marks(8)=75
Fori=0To10
Console.WriteLine(i&vbTab& marks(i))
Nexti
Console.ReadKey()
EndSub
EndModule
```

Multi-Dimensional Arrays

VB.Net allows multidimensional arrays. Multidimensional arrays are also called rectangular arrays.

You can declare a 2-dimensional array of strings as:

```
DimtwoDStringArray(10,20)AsString
```

or, a 3-dimensional array of Integer variables:

```
DimthreeDIntArray(10,10,10)AsInteger
```

The following program demonstrates creating and using a 2-dimensional array:

```
ModulearrayApl
SubMain()
' an array with 5 rows and 2 columns
Dim a(,)AsInteger={{0,0},{1,2},{2,4},{3,6},{4,8}}
Dim i, j AsInteger
' output each array element's value '
Fori=0To4
For j =0To1
Console.WriteLine("a[{0},{1}] = {2}",i, j, a(i, j))
Next j
Nexti
Console.ReadKey()
EndSub
EndModule
```

Reinitializing Arrays

We can change the size of an array after creating them. The ReDim statement assigns a completely new array object to the specified array variable. You use ReDim statement to change the number of elements in an array. The following lines of code demonstrate that. This code reinitializes the Test array declared above.

```
Dim Test(10) as Integer
ReDimTest(25) as Integer
'Reinitializing the array
```

When using the Redim statement all the data contained in the array is lost. If you want to preserve existing data when reinitializing an array then you should use the Preserve keyword which looks like this:

```
Dim Test() as Integer={1,3,5}
'declares an array an initializes it with three members
ReDim Preserve Test(25)
'resizes the array and retains the the data in elements 0 to 2
```

(OR)

b) (i) Explain about Modular Coding with example.

MODULAR CODING

The idea of breaking a large application into smaller, more manageable sections is not new to computing. Few tasks, programming or otherwise, can be managed as a whole. The event handlers are just one example of breaking a large application into smaller tasks. Some event handlers may require a lot of code.

Subroutines

A subroutine is a block of statements that carries out a well-defined task. The block of statements is placed within a set of Sub. . .End Sub statements and can be invoked by name.

The following subroutine displays the current date in a message box and can be called by its name, ShowDate():

```
Sub ShowDate()
MsgBox(Now().ToShortDateString)
End Sub
```

Most procedures also accept and act upon arguments. The ShowDate() subroutine displays the current date in a message box. If you want to display any other date, you have to implement it differently and add an argument to the subroutine:

```
Sub ShowDate(ByValbirthDate As Date)
MsgBox(birthDate.ToShortDateString)
End Sub
```

birthDate is a variable that holds the date to be displayed; its type is Date. The ByVal keyword means that the subroutine sees a copy of the variable, not the variable itself. What this means practically is that the subroutine can't change the value of the variable passed by the calling application. To display the current date in a message box, you must call the ShowDate() subroutine as follows from within your program:

ShowDate() -To display any other date with the second implementation of the subroutine, use a statement like the following:

```
Dim myBirthDate = #2/9/1960#
ShowDate(myBirthDate)
```

Or, you can pass the value to be displayed directly without the use of an intermediate variable:

```
ShowDate(#2/9/1960#)
```

Functions

A function is similar to a subroutine, but a function returns a result. Because they return values, functions — like variables — have types. The value you pass back to the calling program from a function is called the return value, and its type must match the type of the function. Functions accept arguments, just like subroutines. The statements that make up a function are placed in a set of Function. . .End Function statement

A procedure is a group of statements that together perform a task, when called. After the procedure is executed, the control returns to the statement calling the procedure. VB.Net has two types of procedures:

- ✓ Functions
- ✓ Sub procedures or Subs

Functions return a value, where Subs do not return a value.

Defining a Function

The Function statement is used to declare the name, parameter and the body of a function. The syntax for the Function statement is:

```
[Modifiers] FunctionFunctionName[(ParameterList)]AsReturnType
   [Statements]
EndFunction
```

Where,

- ✓ ***Modifiers***: specifiy the access level of the function; possible values are: Public, Private, Protected, Friend, Protected Friend and information regarding overloading, overriding, sharing, and shadowing.
- ✓ ***FunctionName***: indicates the name of the function
- ✓ ***ParameterList***: specifies the list of the parameters
- ✓ ***ReturnType***: specifies the data type of the variable the function returns

Example

Following code snippet shows a function *FindMax* that takes two integer values and returns the larger of the two.

```
Function FindMax(ByVal num1 AsInteger,ByVal num2 AsInteger)AsInteger
```

```
' local variable declaration */
Dim result AsInteger
If(num1 > num2)Then
result= num1
Else
result= num2
EndIf
FindMax= result
EndFunction
```

Function Returning a Value

In VB.Net a function can return a value to the calling code in two ways:

- ✓ By using the return statement
- ✓ By assigning the value to the function name

The following example demonstrates using the *FindMax* function:

```
Modulemyfunctions
Function FindMax(ByVal num1 AsInteger,ByVal num2 AsInteger)AsInteger
' local variable declaration */
Dim result AsInteger
If(num1 > num2)Then
result= num1
Else
result= num2
EndIf
FindMax= result
EndFunction
SubMain()
Dim a AsInteger=100
Dim b AsInteger=200
Dim res AsInteger
res=FindMax(a, b)
Console.WriteLine("Max value is : {0}", res)
Console.ReadLine()
EndSub
EndModule
```

When the above code is compiled and executed, it produces following result:

```
Max value is : 200
```

More Types of Function Return Values

1) Functions returning Structures

Suppose you need a function that returns a customer's savings and checking account balances. So far, you've learned that you can return two or more values from a function by supplying arguments with the ByRef keyword. A more elegant method is to create a custom data type (a structure) and write a function that returns a variable of this type.

Here's a simple example of a function that returns a custom data type. This example outlines the steps you must repeat every time you want to create functions that return custom data types:

1. Create a new project and insert the declarations of a custom data type in the declarations section of the form:

```
Structure CustBalance
    Dim SavingsBalance As Decimal
    Dim CheckingBalance As Decimal
End Structure
```

2. Implement the function that returns a value of the custom type. In the function's body, you must declare a variable of the type returned by the function and assign the proper values to its fields. The following function assigns random values to the fields CheckingBalance and SavingsBalance. Then assign the variable to the function's name, as shown next:

```
Function GetCustBalance(ID As Long) As CustBalance
    Dim tBalance As CustBalance
    tBalance.CheckingBalance = CDec(1000 + 4000 * rnd())
    tBalance.SavingsBalance = CDec(1000 + 15000 * rnd())
    Return(tBalance)
End Function
```

3. Place a button on the form from which you want to call the function. Declare a variable of the same type and assign to it the function's return value. The example that follows prints the savings and checking balances in the Output window:

```
Private Sub Button1 Click(...) Handles Button1.Click
Dim balance As CustBalance
balance = GetCustBalance(1)
Debug.WriteLine(balance.CheckingBalance)
Debug.WriteLine(balance.SavingsBalance)
End Sub
```

The code shown in this section belongs to the Structures sample project. Create this project from scratch, perhaps by using your own custom data type, to explore its structure and experiment with functions that return custom data types.

2) Function Returning Arrays

In addition to returning custom data types, VB 2008 functions can also return arrays. This is an interesting possibility that allows you to write functions that return not only multiple values, but also an unknown number of values.

In this section, we'll write the Statistics() function, similar to the CalculateStatistics() function you saw a little earlier in this chapter. The Statistics() function returns the statistics in an array. Moreover, it returns not only the average and the standard deviation, but the minimum and maximum values in the data set as well. One way to declare a function that calculates all the statistics is as follows:

```
Function Statistics(ByRefDataArray() As Double) As Double()
```

This function accepts an array with the data values and returns an array of Doubles. To implement a function that returns an array, you must do the following:

1. Specify a type for the function's return value and add a pair of parentheses after the type's name. Don't specify the dimensions of the array to be returned here; the array will be declared formally in the function.
2. In the function's code, declare an array of the same type and specify its dimensions. If the function should return four values, use a declaration like this one:

   ```
   Dim Results(3) As Double
   ```

   The Results array, which will be used to store the results, must be of the same type as the function— its name can be anything.
3. To return the Results array, simply use it as an argument to the Return statement:

   ```
   Return(Results)
   ```
4. In the calling procedure, you must declare an array of the same type without dimensions:

Dim Statistics() As Double

5. Finally, you must call the function and assign its return value to this array:
   Stats() = Statistics(DataSet())

Here, DataSet is an array with the values whose basic statistics will be calculated by the Statistics() function. Your code can then retrieve each element of the array with an index value as usual.

(ii) Discuss in detail about loading and showing forms.

LOADING AND SHOWING FORMS

One of the operations you'll have to perform with multi-form applications is to load and manipulate forms from within other forms' code. For example, you may wish to display a second form to prompt the user for data specific to an application. You must explicitly load the second form, read the information entered by the user, and then close the form. Or, you may wish to maintain two forms open at once and let the user switch between them.. To show Form2 when an action takes place on Form1, first declare a variable that references Form2:

Dim frm As New Form2

This declaration must appear in Form1 and must be placed outside any procedure. (If you place it in a procedure's code, then every time the procedure is executed, a new reference to Form2 will be created. This means that the user can display the same form multiple times.

Then, to invoke Form2 from within Form1, execute the following statement:

frm.Show

This statement will bring up Form2 and usually appears in a button's or menu item's Click event handler. At this point, the two forms don't communicate with one another. However, they're both on the desktop and you can switch between them. There's no mechanism to move information from Form2 back to Form1, and neither form can access the other's controls or variables. The Show method opens Form2 in a modaless manner. The two forms are equal in stature on the desktop, and the user can switch between them. You can also display the second form in a modal manner, which means that users won't be able to return to the form from which they invoked it.

While a modal form is open, it remains on top of the desktop and you can't move the focus to the any other form of the same application (but you can switch to another application). To open a modal form, use the statement

frm.ShowDialog

The modal form is, in effect, a dialog box, like the Open File dialog box. You must first select a file on this form and click the Open button, or click the Cancel button, to close the dialog box and return to the form from which the dialog box was invoked.

The Startup Form

A typical application has more than a single form. When an application starts, the main form is loaded. You can control which form is initially loaded by setting the startup object in the Project Properties window. To open this, right-click the project's name in the Solution Explorer and select Properties. In the project's Property Pages, select the Startup Object from the drop-down list.

You can also start an application with a subroutine without loading a form. This subroutine must be called Main() and must be placed in a Module. Right-click the project's name in the Solution Explorer window and select the Add Item command. When the dialog box appears, select a Module. Name it StartUp (or anything you like; you can keep the default name Module1) and then insert the Main() subroutine in the module. The Main() subroutine usually contains initialization code and ends with a statement that displays one of the project's forms; to display the AuxiliaryForm object from within the Main() subroutine, use the following statements:

```
Module StartUpModule
  Sub Main()

  System.Windows.Forms.Application.Run(New _ AuxiliaryForm())
  End Sub
End Module
```

Then, you must open the Project Properties dialog box and specify that the project's startup object is the subroutine Main(). When you run the application, the form you specified in the Run method will be loaded.

Controlling One Form from within Another

Loading and displaying a form from within another form's code is fairly trivial. In some situations, this is all the interaction you need between forms. Each form is designed to operate independently of the others, but they can communicate via public variables (see, "Private & Public Variables"). In most situations, however, you need to control one form from within another's code. Controlling the form means accessing its controls and setting or reading values from within another form's code.

Example:

TextPad is a text editor that consists of the main form and an auxiliary form for the Find & Replace operation. All other operations on the text are performed with the commands of the menu you see on the main form. When the user wants to search for and/or replace a string, the program displays another form on which they specify the text to find, the type of search, and so on. When the user clicks one of the Find & Replace form's buttons, the corresponding code must access the text on the main form of the application and search for a word or replace a string with another. The Find & Replace dialog box not only interacts with the TextBox control on the main form, it also remains visible at all times while it's open, even if it doesn't have the focus, because its TopMost property was set to True. In the Properties window, you can specify which form is to be displayed when the application starts.

Forms Vs Dialog Boxes

A dialog box is simply a modal form. When we display forms as dialog boxes, we change the border of the forms to the setting FixedDialog and invoke them with the ShowDialog method. Modeless forms are more difficult to program, because the user may switch among them at any time. Not only that, but the two forms that are open at once must interact with one another. When the user acts on one of the forms, this may necessitate some changes in the other, and you'll see shortly how this is done.

23. a) (i) Discuss about some basic properties of Textbox Control

The TextBox Control

The TextBox control is the primary mechanism for displaying and entering text. It is a small text editor that provides all the basic text-editing facilities: inserting and selecting text, scrolling if the text doesn't fit in the control's area, and even exchanging text with other applications through the Clipboard.

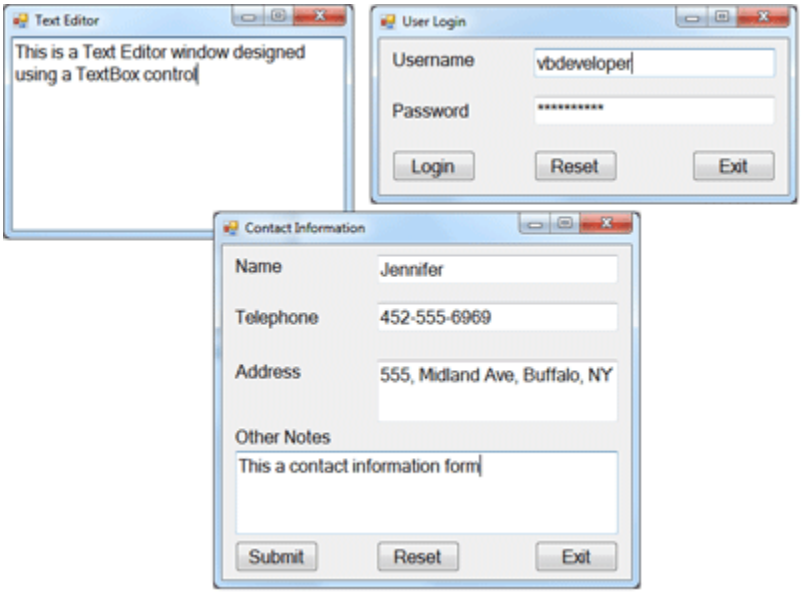


Figure 4.1 - TextBox Examples

Basic Properties of the TextBox Control

Let's start with the properties that specify the appearance and, to some degree, the functionality of the TextBox control; these properties are usually set at design time through the Propertieswindow.

TextAlign

This property sets (or returns) the alignment of the text on the control, and its value is a member of the HorizontalAlignment enumeration: Left, Right, or Center.

MultiLine

This property determines whether the TextBox control will hold a single line or multiple lines of text. Every time you place a TextBox control on your form, it's sized for a single line of text and you can change its width only. To change this behavior, set the MultiLine property to True. When creating multiline TextBoxes, you will most likely have to set one or more of the MaxLength, ScrollBars, and WordWrap properties in the Properties window.

MaxLength

This property determines the number of characters that the TextBox control will accept. Its default value is 32,767, which was the maximum number of characters the VB 6 version of the control could hold. Set this property to zero, so that the text can have any length, up to the control's capacity limit — 2,147,483,647 characters, to be exact.

ScrollBars

This property lets you specify the scroll bars you want to attach to the TextBox if the text exceeds the control's dimensions. Single-line text boxes can't have a scroll bar attached, even if the text exceeds the width of the control. Multiline text boxes can have a horizontal or a vertical scroll bar, or both.

WordWrap

This property determines whether the text is wrapped automatically when it reaches the right edge of the control. The default value of this property is True. If the control has a horizontal scroll bar, however, you can enter very long lines of text.

AcceptsReturn, AcceptsTab

These two properties specify how the TextBox control reacts to the Return (Enter) and Tab keys. The Enter key activates the default button on the form, if there is one. The default button is usually an OK button that can be activated with the Enter key, even if it doesn't have the focus.

The default value of the AcceptsReturn property is True, so pressing Enter creates a new line on the control. If you set it to False, users can still create new lines in the TextBox control, but they'll have to press Ctrl+Enter.

Likewise, the AcceptsTab property determines how the control reacts to the Tab key.Normally, the Tab key takes you to the next control in the Tab order, and we generally avoid changing the default setting of the AcceptsTab property.

CharacterCasing

This property tells the control to change the casing of the characters as they're entered by the user. Its default value is Normal, and characters are displayed as typed. You can set it to Upper or Lower to convert the characters to upper- or lowercase automatically.

PasswordChar

This property turns the characters typed into any character you specify. If you don't want to display the actual characters typed by the user (when entering a password, for instance), use this property to define the character to appear in place of each character the user types.

The default value of this property is an empty string, which tells the control to display the characters as entered. If you set this value to an asterisk (*), for example, the user sees an asterisk in the place of every character typed. This property doesn't affect the control's Text property, which contains the actual characters. If the **PasswordChar property of the TextBox control** is set to any character, the user can't copy or cut the text on the control.

ReadOnly, Locked

If you want to display text on a TextBox control but prevent users from editing it (such as for an agreement or a contract they must read, software installation instructions, and so on), you can set the ReadOnly property to True.WhenReadOnly is set to True, you can put text on the control from within your code, and users can view it, yet they can't edit it.

Text-Manipulation Properties

Most of the properties for manipulating text in a TextBox control are available at runtime only. This section presents a breakdown of each property.

Text

The most important property of the TextBox control is the Text property, which holds the control's text. You can set this property at design time to display some text on the control initially. Notice that there are two methods of setting the Text property at design time. For single-line TextBox controls, set the Text property to a short string, as usual. For multiline TextBox controls, open the Lines property and enter the text in the String Collection Editor window, which will appear.

```
Dim strLen As Integer = TextBox1.Text.Length
```

The IndexOf method of the String class will locate a specific string in the control's text. The following statement returns the location of the first occurrence of the string Visual in the text:

```
Dim location As Integer
location = TextBox1.Text.IndexOf("Visual")
```

Formore information on locating strings in a TextBox control, see the section "VB 2008 The TextPad Project" later in this chapter, where we'll build a text editor with search-and-replace capabilities. For a detailed discussion of the String class, see Chapter, "Handling Strings, Characters, and Dates."

To store the control's contents in a file, use a statement such as the following:

```
StrWriter.Write(TextBox1.Text)
```

Similarly, you can read the contents of a text file into a TextBox control by using a statement such as the following:

```
TextBox1.Text = StrReader.ReadToEnd
```

Listing 6.1: Locating All Instances of a String in a TextBox

```
Dim startIndex = -1
startIndex = TextBox1.Text.IndexOf("Basic", startIndex + 1)
```

```
While startIndex> 0
Console.WriteLine "String found at " &startIndex
startIndex = TextBox1.Text.IndexOf("Basic", startIndex + 1)
End While
```

The following statement appends a string to the existing text on the control:

```
TextBox1.Text = TextBox1.Text &newString
```

To append a string to a TextBox control, use the following statement:

```
TextBox1.AppendText(newString)
TextBox1.AppendText(newString&vbCrLf)
```

Lines

In addition to the Text property, you can access the text on the control by using the Lines property. The Lines property is a string array, and each element holds a paragraph of text. The first paragraph is stored in the element Lines(0), the second paragraph in the element Lines(1), and so on. You can iterate through the text lines with a loop such as the following:

```
Dim iLine As Integer
For iLine = 0 To TextBox1.Lines.GetUpperBound(0) - 1
{ process string TextBox1.Lines(iLine) }
Next
```

READONLY, LOCKED

If you want to display text on a TextBox control but prevent users from editing it (an agreement or a contract they must read, software installation instructions, and so on), you can set the ReadOnly property to True. When ReadOnly is set to True, you can put text on the control from within your code, and users can view it, yet they can't edit it

PASSWORDCHAR

Available at design time, this property turns the characters typed into any character you specify. If you don't want to display the actual characters typed by the user (when entering a password, for instance), use this property to define the character to appear in place of each character the user types.

The default value of this property is an empty string, which tells the control to display the characters as entered. If you set this value to an asterisk (*), for example, the user sees an asterisk in the place of every character typed.

Text-Selection Properties

The TextBox control provides three properties for manipulating the text selected by the user: SelectedText, SelectionStart, and SelectionLength. Users can select a range of text with a click-and-drag operation, and the selected text will appear in reverse color. You can access the selected text from within your code through the SelectedText property, and its location in the control's text through the SelectionStart and SelectionLength properties.

SelectedText

This property returns the selected text, enabling you to manipulate the current selection from within your code. For example, you can replace the selection by assigning a new value to the SelectedText property. To convert the selected text to uppercase, use the ToUpper method of the String class:

```
TextBox1.SelectedText = TextBox1.SelectedText.ToUpper
```

SelectionStart, SelectionLength

Use these two properties to read the text selected by the user on the control, or to select text from within your code. The SelectionStart property returns or sets the position of the first character of

the selected text, somewhat like placing the cursor at a specific location in the text and selecting text by dragging the mouse. The SelectionLength property returns or sets the length of the selected text.

```
Dim seekString As String = "Visual"
Dim strLocation As Long
strLocation = TextBox1.Text.IndexOf(seekString)
If strLocation> 0 Then
TextBox1.SelectionStart = strLocation
TextBox1.SelectionLength = seekString.Length
End If
TextBox1.ScrollToCaret()
```

(ii) Elucidate in detail about Scroll Bar and Track Bar Controls with example coding.

ScrollBars

This property lets you specify the scroll bars you want to attach to the TextBox if the text exceeds the control's dimensions. Single-line text boxes can't have a scroll bar attached, even if the text exceeds the width of the control. Multiline text boxes can have a horizontal or a vertical scroll bar, or both.

WordWrap

This property determines whether the text is wrapped automatically when it reaches the right edge of the control. The default value of this property is True. If the control has a horizontal scroll bar, however, you can enter very long lines of text.

AcceptsReturn, AcceptsTab

These two properties specify how the TextBox control reacts to the Return (Enter) and Tab keys. The Enter key activates the default button on the form, if there is one. The default button is usually an OK button that can be activated with the Enter key, even if it doesn't have the focus.

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```
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```
TextBox1.Text = StrReader.ReadToEnd
```

Listing 6.1: Locating All Instances of a String in a TextBox

```
Dim startIndex = -1
startIndex = TextBox1.Text.IndexOf("Basic", startIndex + 1)
While startIndex> 0
Console.WriteLine "String found at " &startIndex
startIndex = TextBox1.Text.IndexOf("Basic", startIndex + 1)
End While
```

The following statement appends a string to the existing text on the control:

```
TextBox1.Text = TextBox1.Text &newString
```

To append a string to a TextBox control, use the following statement:

```
TextBox1.AppendText(newString)
TextBox1.AppendText(newString&vbCrLf)
```

(OR)

b) Illustrate the Common Dialog controls and necessary diagram with example.

Common Dialog Controls

The common dialog controls are invisible at runtime, and they're not placed on your forms, because they're implemented as modal dialog boxes and they're displayed as needed. You simply add them to the project by double-clicking their icons in the Toolbox; a new icon appears in the components tray of the form, just below the Form Designer. The common dialog controls in the Toolbox are the following:

- **OpenFileDialog** - Lets users select a file to open. It also allows the selection of multiple files for applications that must process many files at once.
- **SaveFileDialog** - Lets users select or specify the path of a file in which the current document will be saved.
- **ColorDialog** - Lets users select a color from a list of predefined colors or specify custom colors. FontDialog Lets users select a typeface and style to be applied to the current text selection. The Font

dialog box has an Apply button, which you can intercept from within your code and use to apply the currently selected font to the text without closing the dialog box.

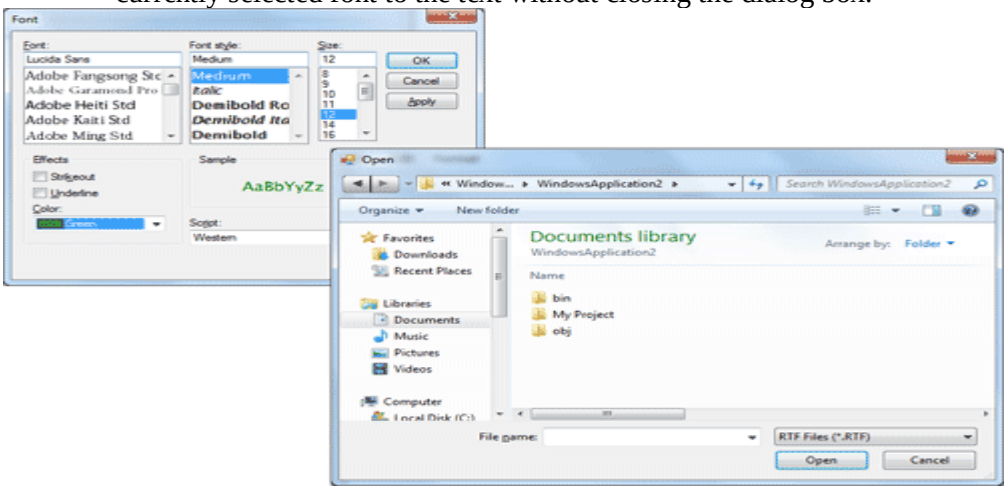

Figure 4.10 - Common Font and Open dialog controls

There are three more common dialog controls: the PrintDialog, PrintPreviewDialog, and PageSetupDialog controls. These controls are discussed in detail in Chapter, "Printing with Visual Basic 2008," in the context of VB's printing capabilities.

Using the Common Dialog Controls

To display any of the common dialog boxes from within your application, you must first add an instance of the appropriate control to your project. Then you must set some basic properties of the control through the Properties window. Most applications set the control's properties from within the code because common dialogs interact closely with the application. When you call the Color common dialog, for example, you should preselect a color from within your application and make it the default selection on the control. When prompting the user for the color of the text, the default selection should be the current setting of the control's ForeColor property. Likewise, the Save dialog box must suggest a filename when it first pops up (or the file's extension, at least).

Here is the sequence of statements used to invoke the Open common dialog and retrieve the selected filename:

```
If OpenFileDialog1.ShowDialog = Windows.Forms.DialogResult.OK Then
fileName = OpenFileDialog1.FileName
' Statements to open the selected file
End If
```

The ShowDialog method returns a value indicating how the dialog box was closed. You should read this value from within your code and ignore the settings of the dialog box if the operation was cancelled.

The variable fileName in the preceding code segment is the full pathname of the file selected by the user. You can also set the FileName property to a filename, which will be displayed when the Open dialog box is first opened:

```
OpenFileDialog1.FileName = "C:\WorkFiles\Documents\Document1.doc"
If OpenFileDialog1.ShowDialog = Windows.Forms.DialogResult.OK Then
fileName = OpenFileDialog1.FileName
' Statements to open the selected file
End If
```

Similarly, you can invoke the Color dialog box and read the value of the selected color by using the following statements:

```
ColorDialog1.Color = TextBox1.BackColor
If ColorDialog1.ShowDialog = DialogResult.OK Then
```

```
TextBox1.BackColor = ColorDialog1.Color
End If
```

The ShowDialog method is common to all controls. The Title property is also common to all controls and it's the string displayed in the title bar of the dialog box. The default title is the name of the dialog box (for example, Open, Color, and so on), but you can adjust it from within your code with a statement such as the following:

```
ColorDialog1.Title = "Select Drawing Color"
```

Color Dialog Box Control

The Color dialog box, shown in Figure 4.11, is one of the simplest dialog boxes. Its Color property returns the color selected by the user or sets the initially selected color when the user opens the dialog box.

The following statements set the initial color of the ColorDialog control, display the dialog box, and then use the color selected in the control to fill the form. First, place a ColorDialog control in the form and then insert the following statements in a button's Click event handler:

```
Private Sub Button1 Click(...) Handles Button1.Click
ColorDialog1.Color = Me.BackColor
If ColorDialog1.ShowDialog =
Windows.Forms.DialogResult.OK Then
Me.BackColor = ColorDialog1.Color
End If
End Sub
```

The following sections discuss the basic properties of the ColorDialog control.

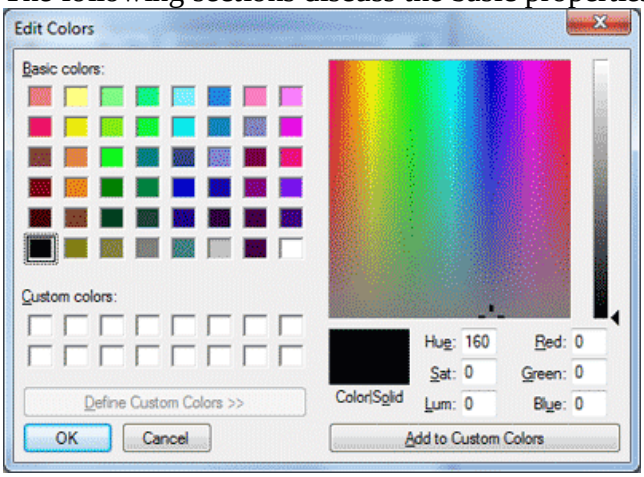

Figure 4.11 - The Color Dialog Box

AllowFullOpen

Set this property to True if you want users to be able to open the dialog box and define their own custom colors, like the one shown in Figure 8.2. The AllowFullOpen property doesn't open the custom section of the dialog box; it simply enables the Define Custom Colors button in the dialog box. Otherwise, this button is disabled.

AnyColor

This property is a Boolean value that determines whether the dialog box displays all available colors in the set of basic colors.

Color

This is the color specified on the control. You can set it to a color value before showing the dialog box to suggest a reasonable selection. On return, read the value of the same property to find out which color was picked by the user in the control:

```
ColorDialog1.Color = Me.BackColor
If ColorDialog1.ShowDialog = DialogResult.OK Then
Me.BackColor = ColorDialog1.Color
End If
```

CustomColors

This property indicates the set of custom colors that will be shown in the dialog box. The Color dialog box has a section called Custom Colors, in which you can display 16 additional custom colors. The CustomColors property is an array of integers that represent colors. To display three custom colors in the lower section of the Color dialog box, use a statement such as the following:

```
Dim colors() As Integer = {222663, 35453, 7888}
ColorDialog1.CustomColors = colors
```

You'd expect that the CustomColors property would be an array of Color values, but it's not. You can't create the array CustomColors with a statement such as this one:

```
Dim colors() As Color = {Color.Azure, Color.Navy, Color.Teal}
```

Because it's awkward to work with numeric values, you should convert color values to integer values by using a statement such as the following:

```
Color.Navy.ToArgb
```

The preceding statement returns an integer value that represents the color navy. This value, however, is negative because the first byte in the color value represents the transparency of the color. To get the value of the color, you must take the absolute value of the integer value returned by the previous expression. To create an array of integers that represent color values, use a statement such as the following:

```
Dim colors() As Integer = {Math.Abs(Color.Gray.ToArgb), Math.Abs(Color.Navy.ToArgb),
Math.Abs(Color.Teal.ToArgb)}
```

Now you can assign the colors array to the CustomColors property of the control, and the colors will appear in the Custom Colors section of the Color dialog box.

SolidColorOnly

This indicates whether the dialog box will restrict users to selecting solid colors only. This setting should be used with systems that can display only 256 colors. Although today few systems can't display more than 256 colors, some interfaces are limited to this number. When you run an application through Remote Desktop, for example, only the solid colors are displayed correctly on the remote screen, regardless of the remote computer's graphics card (and that's for efficiency reasons).

Font Dialog Box Control

The Font dialog box, shown in Figure 4.12, lets the user review and select a font and then set its size and style. Optionally, users can also select the font's color and even apply the current settings to the selected text on a control of the form without closing the dialog box, by clicking the Apply button.

```
FontDialog1.Font = TextBox1.Font
If FontDialog1.ShowDialog = DialogResult.OK Then
TextBox1.Font = FontDialog1.Font
End If
```

Use the following properties to customize the Font dialog box before displaying it.

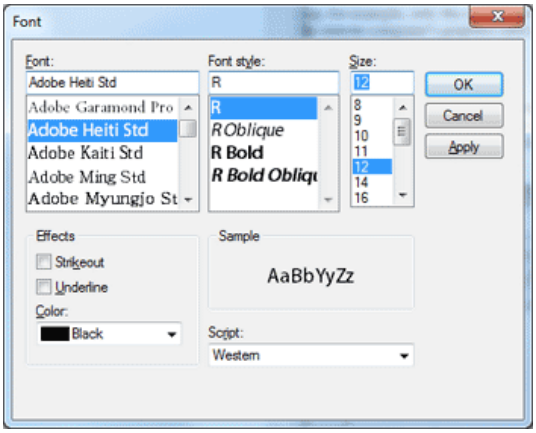

Figure 4.12 - The Font Dialog Control

AllowScriptChange

This property is a Boolean value that indicates whether the Script combo box will be displayed in the Font dialog box. This combo box allows the user to change the current character set and select a non-Western language (such as Greek, Hebrew, Cyrillic, and so on).

AllowVerticalFonts

This property is a Boolean value that indicates whether the dialog box allows the display and selection of both vertical and horizontal fonts. Its default value is False, which displays only horizontal fonts.

Color, ShowColor

The Color property sets or returns the selected font color. To enable users to select a color for the font, you must also set the ShowColor property to True.

FixedPitchOnly

This property is a Boolean value that indicates whether the dialog box allows only the selection of fixed-pitch fonts. Its default value is False, which means that all fonts (fixed- and variable-pitch fonts) are displayed in the Font dialog box. Fixed-pitch fonts, or monospaced fonts, consist of characters of equal widths that are sometimes used to display columns of numeric values so that the digits are aligned vertically.

Font

This property is a Font object. You can set it to the preselected font before displaying the dialog box and assign it to a Font property upon return. You've already seen how to preselect a font and how to apply the selected font to a control from within your application.

You can also create a new Font object and assign it to the control's Font property. Upon return, the TextBox control's Font property is set to the selected font:

```
Dim newFont As Font("Verdana", 12, FontStyle.Underline)
FontDialog1.Font = newFont
If FontDialog1.ShowDialog() = DialogResult.OK Then
TextBox1.ForeColor = FontDialog1.Color
End If
```

FontMustExist

This property is a Boolean value that indicates whether the dialog box forces the selection of an existing font. If the user enters a font name that doesn't correspond to a name in the list of available fonts, a warning is displayed. Its default value is True, and there's no reason to change it.

MaxSize, MinSize

These two properties are integers that determine the minimum and maximum point size the user can specify in the Font dialog box. Use these two properties to prevent the selection of extremely large or extremely small font sizes, because these fonts might throw off a well-balanced interface (text will overflow in labels, for example).

ShowApply

This property is a Boolean value that indicates whether the dialog box provides an Apply button. Its default value is False, so the Apply button isn't normally displayed. If you set this property to True, you must also program the control's Apply event — the changes aren't applied automatically to any of the controls in the current form.

The following statements display the Font dialog box with the Apply button:

```
Private Sub Button2 Click(...) Handles Button2.Click
FontDialog1.Font = TextBox1.Font
FontDialog1.ShowApply = True
If FontDialog1.ShowDialog = DialogResult.OK Then
TextBox1.Font = FontDialog1.Font
End If
End Sub
```

The FontDialog control raises the Apply event every time the user clicks the Apply button. In this event's handler, you must read the currently selected font and use it in the form, so that users can preview the effect of their selection:

```
Private Sub FontDialog1 Apply(...) Handles FontDialog1.Apply
TextBox1.Font = FontDialog1.Font
End Sub
```

ShowEffects

This property is a Boolean value that indicates whether the dialog box allows the selection of special text effects, such as strikethrough and underline. The effects are returned to the application as attributes of the selected Font object, and you don't have to do anything special in your application.

Open Dialog Box and Save Dialog Box Controls

Open and Save As, the two most widely used common dialog boxes (see Figure 4.13), are implemented by the OpenFileDialog and SaveFileDialog controls. Nearly every application prompts users for filenames, and the .NET Framework provides two controls for this purpose. The two dialog boxes are nearly identical, and most of their properties are common, so we'll start with the properties that are common to both controls.

When either of the two controls is displayed, it rarely displays all the files in any given folder. Usually the files displayed are limited to the ones that the application recognizes so that users can easily spot the file they want. The Filter property limits the types of files that will appear in the Open or Save As dialog box.

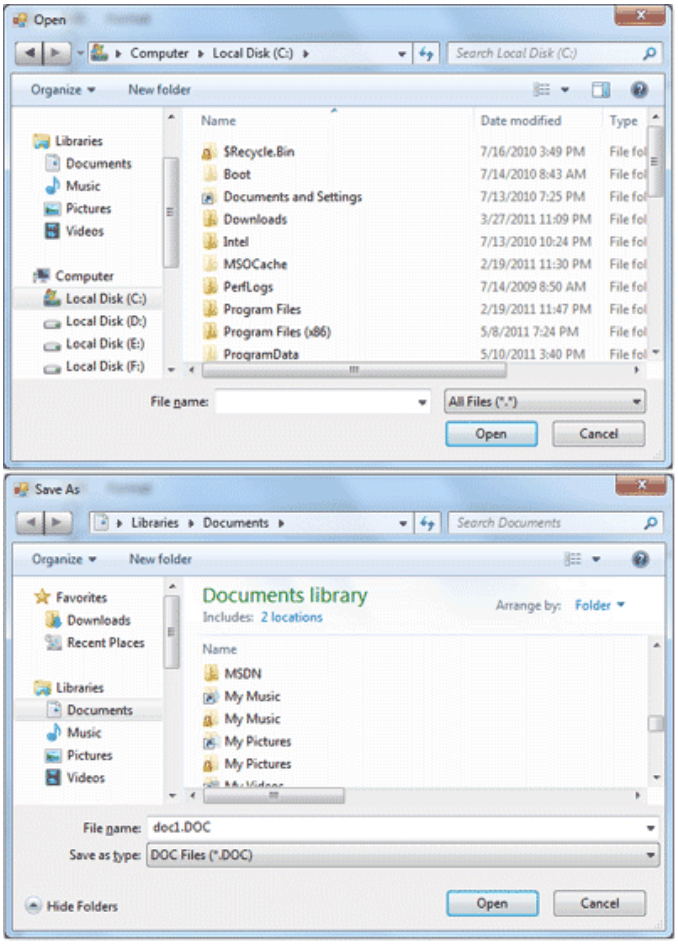

Figure 4.13 - The OpenDialog and SaveDialog controls

The extension of the default file type for the application is described by the DefaultExtension property, and the list of the file types displayed in the Save As Type box is determined by the Filter property.

To prompt the user for a file to be opened, use the following statements. The Open dialog box displays the files with the extension .bin only.

```
OpenFileDialog1.DefaultExt = ".bin"
OpenFileDialog1.AddExtension = True
OpenFileDialog1.Filter = "Binary Files|*.bin"
If OpenFileDialog1.ShowDialog() =
Windows.Forms.DialogResult.OK Then
Debug.WriteLine(OpenFileDialog1.FileName)
End If
```

The following sections describe the properties of the OpenFileDialog and SaveFileDialog controls.

AddExtension

This property is a Boolean value that determines whether the dialog box automatically adds an extension to a filename if the user omits it. The extension added automatically is the one specified by the DefaultExtension property, which you must set before calling the ShowDialog method. This is the default extension of the files recognized by your application.

CheckFileExists

This property is a Boolean value that indicates whether the dialog box displays a warning if the user enters the name of a file that does not exist in the Open dialog box, or if the user enters the name of a file that exists in the Save dialog box.

CheckPathExists

This property is a Boolean value that indicates whether the dialog box displays a warning if the user specifies a path that does not exist, as part of the user-supplied filename.

DefaultExt

This property sets the default extension for the filenames specified on the control. Use this property to specify a default filename extension, such as .txt or .doc, so that when a file with no extension is specified by the user, the default extension is automatically appended to the filename. You must also set the AddExtension property to True. The default extension property starts with the period, and it's a string — for example, .bin.

DereferenceLinks

This property indicates whether the dialog box returns the location of the file referenced by the shortcut or the location of the shortcut itself. If you attempt to select a shortcut on your desktop when the DereferenceLinks property is set to False, the dialog box will return to your application a value such as C:\WINDOWS\SYSTEM32\lnkstub.exe, which is the name of the shortcut, not the name of the file represented by the shortcut. If you set the DereferenceLinks property to True, the dialog box will return the actual filename represented by the shortcut, which you can use in your code.

FileName

Use this property to retrieve the full path of the file selected by the user in the control. If you set this property to a filename before opening the dialog box, this value will be the proposed filename. The user can click OK to select this file or select another one in the control. The two controls provide another related property, the FileNames property, which returns an array of filenames. To find out how to allow the user to select multiple files, see the discussion of the MultipleFiles and FileNames properties in ‘‘VB 2008 at Work: Multiple File Selection" at the end of this section.

Filter

This property is used to specify the type(s) of files displayed in the dialog box. To display text files only, set the Filter property to Text files|*.txt. The pipe symbol separates the description of the files (what the user sees) from the actual extension (how the operating system distinguishes the various file types).

If you want to display multiple extensions, such as .BMP, .GIF, and .JPG, use a semicolon to separate extensions with the Filter property. Set the Filter property to the string Images|*.BMP; *.GIF;*.JPG to display all the files of these three types when the user selects Images in the Save As Type combo box, under the box with the filename.

Don't include spaces before or after the pipe symbol because these spaces will be displayed on the dialog box. In the Open dialog box of an image-processing application, you'll probably provide options for each image file type, as well as an option for all images:

```
OpenFileDialog1.Filter =
"Bitmaps|*.BMP|GIF Images|*.GIF|" &
"JPEG Images|*.JPG|All Images|*.BMP;*.GIF;*.JPG"
```

FilterIndex

When you specify more than one file type when using the Filter property of the Open dialog box, the first file type becomes the default. If you want to use a file type other than the first one, use the FilterIndex property to determine which file type will be displayed as the default when the Open dialog box is opened. The index of the first type is 1, and there's no reason to ever set this property to 1. If you use the Filter property value of the example in the preceding section and set the FilterIndex property to 2, the Open dialog box will display GIF files by default.

InitialDirectory

This property sets the initial folder whose files are displayed the first time that the Open and Save dialog boxes are opened. Use this property to display the files of the application's folder or to specify a folder in which the application stores its files by default. If you don't specify an initial folder, the dialog

box will default to the last folder where the most recent file was opened or saved. It's also customary to set the initial folder to the application's path by using the following statement:

OpenFileDialog1.InitialDirectory = Application.ExecutablePath

The expression Application.ExecutablePath returns the path in which the application's executable file resides.

RestoreDirectory

Every time the Open and Save As dialog boxes are displayed, the current folder is the one that was selected by the user the last time the control was displayed. The RestoreDirectory property is a Boolean value that indicates whether the dialog box restores the current directory before closing. Its default value is False, which means that the initial directory is not restored automatically. The InitialDirectory property overrides the RestoreDirectory property.

The following four properties are properties of the OpenFileDialog control only: FileNames, MultiSelect, ReadOnlyChecked, and ShowReadOnly.

FileNames

If the Open dialog box allows the selection of multiple files (see the later section "VB 2008 at Work: Multiple File Selection"), the FileNames property contains the pathnames of all selected files. FileNames is a collection, and you can iterate through the filenames with an enumerator. This property should be used only with the OpenFileDialog control, even though the SaveFileDialog control exposes a FileNames property.

MultiSelect

This property is a Boolean value that indicates whether the user can select multiple files in the dialog box. Its default value is False, and users can select a single file. When the MultiSelect property is True, the user can select multiple files, but they must all come from the same folder (you can't allow the selection of multiple files from different folders). This property is unique to the OpenFileDialog control.

ReadOnlyChecked, ShowReadOnly

The ReadOnlyChecked property is a Boolean value that indicates whether the Read-Only check box is selected when the dialog box first pops up (the user can clear this box to open a file in read/write mode). You can set this property to True only if the ShowReadOnly property is also set to True. The ShowReadOnly property is also a Boolean value that indicates whether the Read-Only check box is available..

The OpenFile and SaveFile Methods

The OpenFileDialog control exposes the OpenFile method, which allows you to quickly open the selected file. Likewise, the SaveFileDialog control exposes the SaveFile method, which allows you to quickly save a document to the selected file.

OpenDialog and SaveDialog controls example: Multiple File Selection

The Open dialog box allows the selection of multiple files. This feature can come in handy when you want to process files en masse. You can let the user select many files, usually of the same type, and then process them one at a time. Or, you might want to prompt the user to select multiple files to be moved or copied.

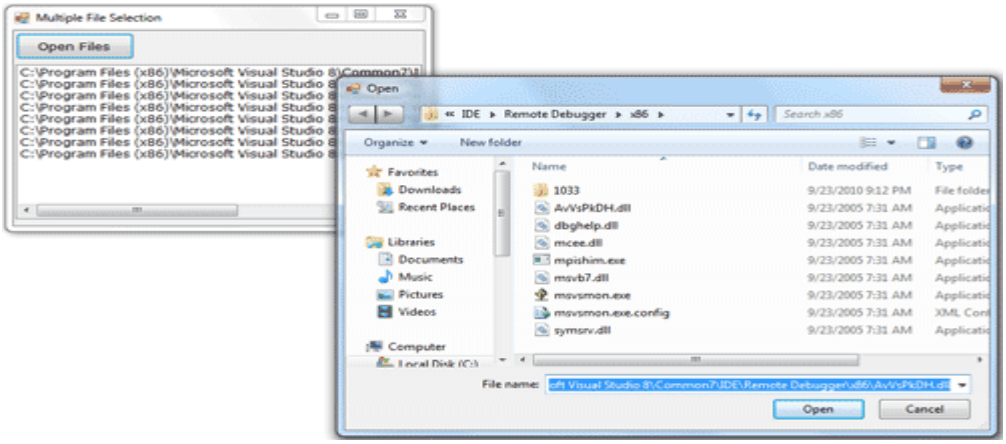

Figure 4.14 - Selecting multiple files in an open dialog box - Visual Basic

The code behind the Open Files button is shown in Listing 4.17. In this example, I used the array's enumerator to iterate through the elements of the FileNames array. You can use any of the methods discussed in the section "Arrays in Visual basic 2008" to iterate through the array.

Listing 4.17: Processing Multiple Selected Files

```
Private Sub bttnFileClick(...) Handles bttnFile.Click
OpenFileDialog1.Multiselect = True
OpenFileDialog1.ShowDialog()
Dim filesEnum As IEnumerator
ListBox1.Items.Clear()
filesEnum = OpenFileDialog1.FileNames.GetEnumerator()
While filesEnum.MoveNext
ListBox1.Items.Add(filesEnum.Current)
End While
End Sub
```

Print Dialog Box Control

A PrintDialog control is used to open the Windows Print Dialog and let user select the printer, set printer and paper properties and print a file. A typical Open File Dialog looks like Figure 1 where you select a printer from available printers, set printer properties, set print range, number of pages and copies and so on. Clicking on OK button sends the document to the printer.

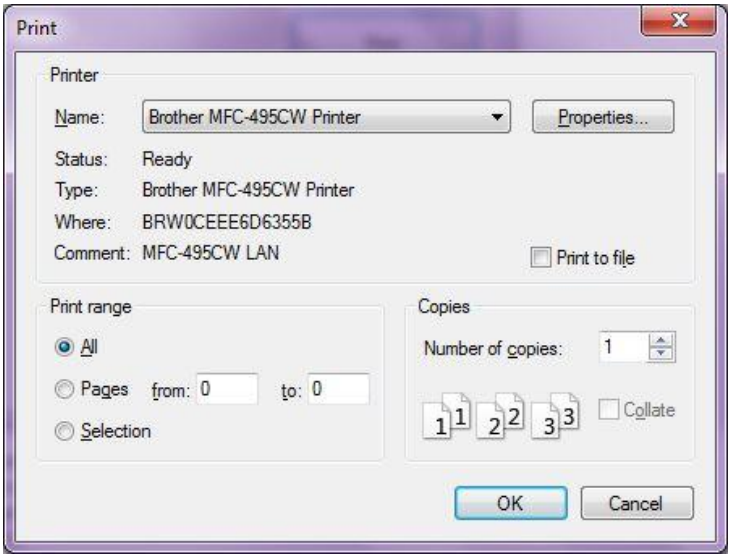

Figure 1

Creating a PrintDialog

We can create a PrintDialog at design-time as well as at run-time.

Design-time

To create a PrintDialog control at design-time, you simply drag and drop a PrintDialog control from Toolbox to a Form in Visual Studio. After you drag and drop a PrintDialog on a Form, the PrintDialog looks like Figure 2.

Figure 2

Run-time

Creating a PrintDialog control at run-time is simple. First step is to create an instance of PrintDialog class and then call the ShowDialog method. The following code snippet creates a PrintDialog control.

```
Dim PrintDialog1 AsNewPrintDialog()
PrintDialog1.ShowDialog()
```

Printing Documents

PrintDocument object represents a document to be printed. Once a PrintDocument is created, we can set the Document property of PrintDialog as this document. After that we can also set other properties. The following code snippet creates a PrintDialog and sends some text to a printer.

```
ImportsSystem.Drawing.Printing

PublicClassForm1

    PrivateSubPrintButton_Click(ByVal sender AsSystem.Object, ByVal e AsSystem.EventArgs)
HandlesPrintButton.Click
    DimprintDlgAsNewPrintDialog()
    DimprintDocAs  NewPrintDocument()
    printDoc.DocumentName = "Print Document"
    printDlg.Document = printDoc
    printDlg.AllowSelection = True
    printDlg.AllowSomePages = True
    If (printDlg.ShowDialog() = DialogResult.OK) Then
      printDoc.Print()
    EndIf
  EndSub
EndClass
```

Register Number: _____

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DEPARTMENT OF CS,CA & IT

SECOND INTERNAL EXAMINATION, AUGUST– 2017

Fifth Semester

Visual Programming

Date & Session: 07-08-2017 & AN **Duration: 2 Hours**

Marks : 50

PART-A(20*1=20 Marks)

(Answer ALL The Questions)

1. The ____ class represents the instrument for filling shapes
   a. Brush c. SolidBrush
   b. **HatchBrush** d.pathGradientBrush
2. The _____ method appends a base type to the current instance of the StringBuilder class,
   a.Append Format b. Append **c. both a&b** d.none
3. _____ class is used to store the string and also to manipulate the string
   a. The string class b.the char class c. stringbuilderclass **d. both a&b**
4. _____ brush Fills shapes with a gradient that has one starting color and many ending colors
   a. Brush **b. PathGradientBrush** c. HatchBrush d. SolidBrush
5. The tick property in DateTime Class, Each tick represents _____ nanoseconds
   a. **10** b.100 c.1000 d.none
6. The____ coordinate is its horizontal distance from the origin
   a. **Y** b. x c. (0,0) d. none
7. A _____ is a collection of colored pixels, arranged in rows and columns
   a. Colors **b.Bitmaps** d. images
   c.blending
8. The___method sets the current position in the file represented by the FileStream object
   a. Seekorigin **b. seek** c. seekoffset d. none
9. The ____ class is the channel through which you send data to a text file.
   a. StreamWriter b.FileStreamWriter c. FileWriter d. None
10. GDI stands for _____
    a. Global design interface c. Graphics design interface
    b. Graphical Device Interface d. Global data interchange
11. The ____ coordinate to top-left corner of the drawing surface.
    a. y b. x **c. (0,0)** d. none
12. Which object is used to draw gon the Graphics object surface?
    a. pencil c. image
    b. pen d. controls
13. Which method is used to draw a string in the specified font on the graphics surface
    a. **DrawString()** c.DrawLetters()
    b. DrawChar() d.DrawImage()

14. The _____ transformation changes the dimensions of a shape but not its basic form
    a. Rotation **c. scaling**
    b. Translation d. shape
15. _____Determines the style of the dashed lines drawn with the specific Pen
    a. DashCap **b. DashStyle** c. DashDot d. DashDotDo

16. To display the list as multiple columns in list box --------- property is used
    a. SelectionMode c. SelectedItem
    b. SelectedIndex d. MultiColumn
17. ____ Control, the user specify a magnitude by scrolling a sector between its min and max values.
    a. **ScrollBar** b. TrackBar c. VolumeBar d.Both A and B
18. The tab order command will appear in which menu
    a. File **c. View**
    b. Format d. Edit
19. _____The full name of the month

a. mm b. mmm **c. mmmm** d.m

20. How many parent form will be in MDI_____?
a.2 0 b. 1 c. many d.0

PART-B (3 X 10 = 30 Marks)

(Answer ALL The Questions)

21. a) Discuss in detail about Tree view and List view controls with example.

Tree View and List View Controls

The TreeView control implements a data structure known as a tree. A tree is the most appropriate structure for storing hierarchical information. The organizational chart of a company, for example, is a tree structure. Every person reports to another person above him or her, all the way to the president or CEO. Figure 4.21 depicts a possible organization of continents, countries, and cities as a tree. Every city belongs to a country, and every country to a continent. In the same way, every computer file belongs to a folder that may belong to an even bigger folder, and so on up to the drive level. You can't draw large tree structures on paper, but it's possible to create a similar structure in the computer's memory without size limitations.

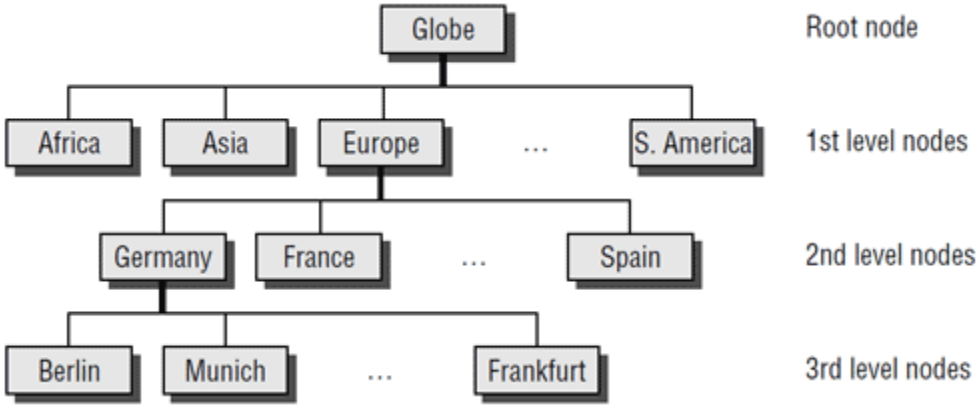


Figure 4.21 - The World View as Tree

Note: ***The items displayed on a TreeView control are just strings***. Moreover, the TreeView control doesn't require that the items be unique. You can have identically named nodes in the same branch — as unlikely as this might be for a real application. There's no property that makes a node unique in the tree structure or even in its own branch.

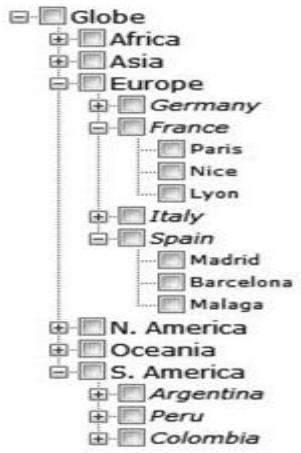


Figure 4.22 - The tree implemented with a TreeView control

The tree structure is ideal for data with parent-child relations (relations that can be described as belongs to or owns). The continents-countries-cities data is a typical example. The folder structure on a hard disk is another typical example. Any given folder is the child of another folder or the root folder.

The ListView control implements a simpler structure, known as a list. A list's items aren't structured in a hierarchy; they are all on the same level and can be traversed serially, one after the other. You can also think of the list as a multidimensional array, but the list offersmore features. A list item can have subitems and can be sorted according to any column. For example, you can set up a list of customer names (the list's items) and assign a number of subitems to each customer: a contact, an address, a phone number, and so on. Or you can set up a list of files with their attributes as subitems. Figure 4.23 shows a Windows folder mapped on a ListView control. Each file is an item, and its attributes are the subitems. As you already know, you can sort this list by filename, size, file type, and so on. All you have to do is click the header of the corresponding column.

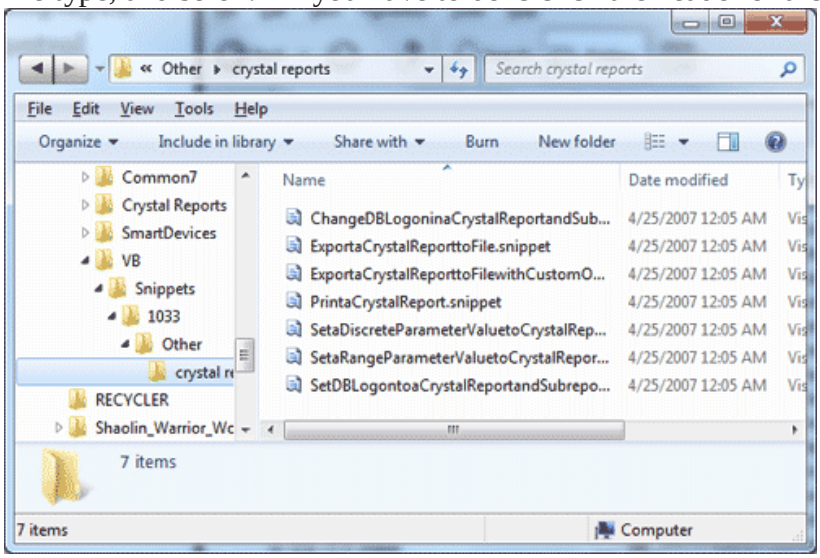


Figure 4.23 - A folder's files displayed in a ListView control (Details view)

The ListView control is a glorified ListBox control. If all you need is a control to store sorted objects, use a ListBox control. If you want more features, such as storing

multiple items per row, sorting them in different ways, or locating them based on any subitem's value, you must consider the ListView control. You can also look at the ListView control as a view-only grid.
The TreeView and ListView controls are commonly used along with the ImageList control. The ImageList control is a simple control for storing images so they can be retrieved quickly and used at runtime. You populate the ImageList control with the images you want to use on your interface, usually at design time, and then you recall them by an index value at runtime. Before we get into the details of the TreeView and ListView controls, a quick overview of the ImageList control is in order.

TreeView Control

Let's start our discussion of TreeView control with a few simple properties that you can set at design time. To experiment with the properties discussed in this section, open the TreeView Example project. The project's main form is shown in Figure 4.25. After setting some properties (they are discussed next), run the project and click the Populate button to populate the control. After that, you can click the other buttons to see the effect of the various property settings on the control.

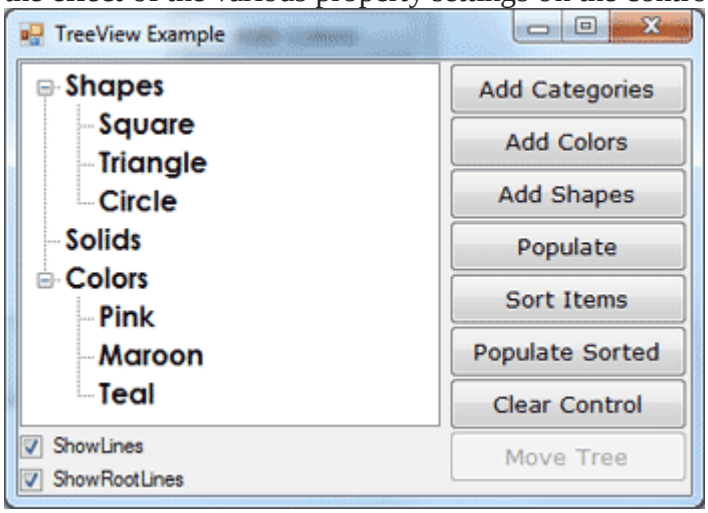


Figure 4.25 - The TreeView Example project demonstrates the basic properties and methods of the TreeView control.

Here are the basic properties that determine the appearance of the control:

- **ShowCheckBoxes -** If this property is True, a check box appears in front of each node. If the control displays check boxes, you can select multiple nodes; otherwise, you're limited to a single selection.
- **FullRowSelect** - This True/False value determines whether a node will be selected even if the user clicks outside the node's caption.
- **HideSelection** - This property determines whether the selected node will remain highlighted when the focus is moved to another control. By default, the selected node doesn't remain highlighted when the control loses the focus.
- **HotTracking** - This property is another True/False value that determines whether nodes are highlighted as the pointer hovers over them.When it's True, the TreeView control behaves like a web document with the nodes acting as

hyperlinks — they turn blue while the pointer hovers over them. Use the NodeMouseHover event to detect when the pointer hovers over a node.

- **Indent** - This property specifies the indentation level in pixels. The same indentation applies to all levels of the tree—each level is indented by the same number of pixels with respect to its parent level.
- **PathSeparator** - A node's full name is made up of the names of its parent nodes, separated by a backslash. To use a different separator, set this property to the desired symbol.
- **ShowLines** - The ShowLines property is a True/False value that determines whether the control's nodes will be connected to its parent items with lines. These lines help users visualize the hierarchy of nodes, and it's customary to display them.
- **ShowPlusMinus** - The ShowPlusMinus property is a True/False value that determines whether the plus/minus button is shown next to the nodes that have children. The plus button is displayed when the node is collapsed, and it causes the node to expand when clicked. Likewise, the minus sign is displayed when the node is expanded, and it causes the node to collapse when clicked. Users can also expand the current node by pressing the left-arrow button and collapse it with the right-arrow button.
- **ShowRootLines** - This is another True/False property that determines whether there will be lines between each node and root of the tree view. Experiment with the ShowLines and ShowRootLines properties to find out how they affect the appearance of the control.
- **Sorted** - This property determines whether the items in the control will be automatically sorted. The control sorts each level of nodes separately. In our Globe example, it will sort the continents, then the countries within each continent, and then the cities within each country.

Adding New Items at Design Time

Let's look now at the process of populating the TreeView control. Adding an initial collection of nodes to a TreeView control at design time is trivial. Locate the Nodes property in the Properties window, and you'll see that its value is Collection. To add items, click the ellipsis button, and the TreeNode Editor dialog box will appear, as shown in Figure 4.26. To add a root item, just click the Add Root button. The new item will be named Node0 by default. You can change its caption by selecting the item in the list and setting its Text property accordingly. You can also change the node's Name property, as well as the node's appearance by using the NodeFont, FontColor, and ForeColor properties.

To specify an image for the node, set the control's ImageList property to the name of an ImageList control that contains the appropriate images, and then set either the node's ImageKey property to the name of the image, or the node's ImageIndex property to the index of the desired image in the ImageList control. If you want to display a different image when the control is selected, set the `SelectedImageKey` or the `SelectedImageIndex` property accordingly.

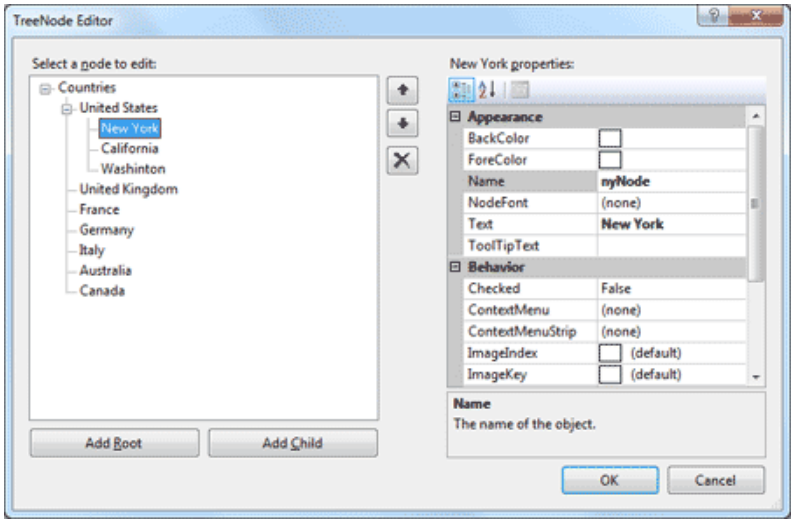


Figure 4.26 - The TreeNode Editor dialog box

Click the Add Root button first. A new node is added automatically to the list of nodes, and it is named Node0. Select it with the mouse, and its properties appear in the right pane of the TreeNode Editor window. Here you can change the node's Text property to Countries. You can specify the appearance of each node by setting its font and fore/background colors.

Adding New Items at Runtime

Adding items to the control at runtime is a bit more involved. All the nodes belong to the control's Nodes collection, which is made up of TreeNode objects. To access the **Nodes** collection, use the following expression, where TreeView1 is the control's name and **Nodes** is a collection of TreeNode objects:

TreeView1.Nodes

This expression returns a collection of TreeNode objects and exposes the proper members for accessing and manipulating the individual nodes. The control's **Nodes** property is the collection of all root nodes.

To access the first node, use the expression **TreeView.Nodes(0)** (this is the Globe node in our example). The Text property returns the node's value, which is a string. **TreeView1.Nodes(0).Text** is the caption of the root node on the control. The caption of the second node on the same level is **TreeView1.Nodes(1).Text**, and so on.

The following statements print the strings shown highlighted below them (these strings are not part of the statements; they're the output that the statements produce):

Debug.WriteLine(TreeView1.Nodes(0).Text)

Countries

Debug.WriteLine(TreeView1.Nodes(0).Nodes(0).Text)

UnitedStates

Debug.WriteLine(TreeView1.Nodes(0).Nodes(0).Nodes(1).Text)

New York

Let's take a closer look at these expressions. **TreeView1.Nodes(0)** is the first root node, the Countries node. Under this node, there is a collection of nodes, the **TreeView1.Nodes(0).Nodes**

collection. Each node in this collection is a country name. The first node in this collection is United States, and you can access it with the expression **TreeView1.Nodes(0).Nodes(0)**. If you want to change the appearance of the node United States, type a period after the preceding expression to access its properties (the NodeFont property to set its font, the ForeColor property to set it color, the ImageIndex property, and so on). Likewise, this node has its own Nodes collection, which contains the states under the specific country.

Adding New Nodes

The Add method adds a new node to the Nodes collection. The Addmethod accepts as an argument a string or a TreeNode object. The simplest form of the Add method is

```
newNode = Nodes.Add(nodeCaption)
```

where **nodeCaption** is a string that will be displayed on the control. Another form of the Add method allows you to add a TreeNode object directly (**nodeObj** is a properly initialized TreeNode variable):

```
newNode = Nodes.Add(nodeObj)
```

To use this form of the method, you must first declare and initialize a TreeNode object:

```
Dim nodeObj As New TreeNode
nodeObj.Text = "Tree Node"
nodeObj.ForeColor = Color.BlueViolet
TreeView1.Nodes.Add(nodeObj)
```

The last overloaded form of the Add method allows you to specify the index in the current Nodes collection, where the node will be added:

```
newNode = Nodes.Add(index, nodeObj)
```

The nodeObj TreeNode object must be initialized as usual. To add a child node to the root node, use a statement such as the following:

```
TreeView1.Nodes(0).Nodes.Add("United States")
```

To add a state under United States, use a statement such as the following:

```
TreeView1.Nodes(0).Nodes(1).Nodes.Add("New York")
```

The expressions can get quite lengthy. The proper way to add child items to a node is to create a TreeNode variable that represents the parent node, under which the child nodes will be added. Let's say that the CountryNode variable in the following example represents the node United States:

```
Dim CountryNode As TreeNode
CountryNode = TreeView1.Nodes(0).Nodes(2)
```

Then you can add child nodes to the ContinentNode node:

```
CountryNode.Nodes.Add("New York")
CountryNode.Nodes.Add("California")
```

To add yet another level of nodes, the city nodes, create a new variable that represents a specific state. The Add method actually returns a TreeNode object that represents the newly added node, so you can add a state and a few cities by using statements such as the following:

```
Dim StateNode As TreeNode
StateNode = CountryNode.Nodes.Add("New York")
StateNode.Nodes.Add("Alberny")
```

```
StateNode.Nodes.Add("Amsterdam")
StateNode.Nodes.Add("Auburn")
```
Then you can continue adding states under another country as follows:
```
StateNode = CountryNode.Nodes.Add("United Kingdom")
StateNode.Nodes.Add("London")
StateNode.Nodes.Add("Manchester")
```

The ListView Control

The ListView control is similar to the ListBox control except that it can display its items in many forms, along with any number of subitems for each item. To use the ListView control in your project, place an instance of the control on a form and then set its basic properties, which are described in the following list.

View and Arrange - Two properties determine how the various items will be displayed on the control: the View property, which determines the general appearance of the items, and the Arrange property, which determines the alignment of the items on the control's surface. The View property can have one of the values shown in Table 4.8.

Table 4.8: Settings of the View Property of VB.NET ListView Control

Setting	Description
LargeIcon (Default)	Each item is represented by an icon and a caption below the icon.
SmallIcon	Each item is represented by a small icon and a caption that appears to the right of the icon.
List	Each item is represented by a caption.
Details	Each item is displayed in a column with its subitems in adjacent columns.
Tile	Each item is displayed with an icon and its subitems to the right of the icon. This view is available only on Windows XP and Windows Server 2003.

The Arrange property can have one of the settings shown in Table 4.9.

Table 4.9: Settings of the Arrange Property of VB.NET ListView Control

Setting	Description
Default	When an item is moved on the control, the item remains where it is dropped.
Left	Items are aligned to the left side of the control.
SnapToGrid	Items are aligned to an invisible grid on the control. When the user moves an item, the item moves to the closest grid point on the control.
Top	Items are aligned to the top of the control.

HeaderStyle - This property determines the style of the headers in Details view. It has no meaning when the View property is set to anything else, because only the Details view has columns. The possible settings of the HeaderStyle property are shown in Table 4.10.

Table 4.10: Settings of the HeaderStyle Property of VB.NET ListView Control

Setting	Description
Clickable	Visible column header that responds to clicking
Nonclickable (Default)	Visible column header that does not respond to clicking
None	No visible column header

AllowColumnReorder - This property is a True/False value that determines whether the user can reorder the columns at runtime, and it's meaningful only in Details view. If this property is set to True, the user can move a column to a new location by dragging its header with the mouse and dropping it in the place of another column.

Activation - This property, which specifies how items are activated with the mouse, can have one of the values shown in Table 4.11.

Table 4.11: Settings of the Activation Property of VB.NET ListView Control

Setting	Description
OneClick	Items are activated with a single click. When the cursor is over an item, it changes shape, and the color of the item's text changes.
Standard (Default)	Items are activated with a double-click. No change in the selected item's text color takes place.
TwoClick	Items are activated with a double-click, and their text changes color as well.

FullRowSelect - This property is a True/False value, indicating whether the user can select an entire row or just the item's text, and it's meaningful only in Details view. When this property is False, only the first item in the selected row is highlighted.

GridLines - Another True/False property. If True, grid lines between items and subitems are drawn. This property is meaningful only in Details view.

Group - The items of the ListView control can be grouped into categories. To use this feature, you must first define the groups by using the control's Group property, which is a collection of strings. You can add as many members to this collection as you want.

LabelEdit - The LabelEdit property lets you specify whether the user will be allowed to edit the text of the items. The default value of this property is False. Notice that the LabelEdit property applies to the item's Text property only; you can't edit the subitems (unfortunately, you can't use the ListView control as an editable grid).

MultiSelect - A True/False value, indicating whether the user can select multiple items from the control. To select multiple items, click them with the mouse while holding down the Shift or Ctrl key. If the control's ShowCheckboxes property is set to True, users can select multiple items by marking the check box in front of the corresponding item(s).

Scrollable - A True/False value that determines whether the scroll bars are visible. Even if the scroll bars are invisible, users can still bring any item into view. All they have to do is select an item and then press the arrow keys as many times as needed to scroll the desired item into view.

Sorting - This property determines how the items will be sorted, and its setting can be None, Ascending, or Descending. To sort the items of the control, call the Sort method,

which sorts the items according to their caption. It's also possible to sort the items according to any of their subitems, as explained in the section "Sorting the ListView Control" later in this chapter.

DESIGNING MENUS

The MenuStrip class is the foundation of menus functionality in Windows Forms. If you have worked with menus in .NET 1.0 and 2.0, you must be familiar with the MainMenu control. In .NET 3.5 and 4.0, the MainMenu control is replaced with the MenuStrip control.

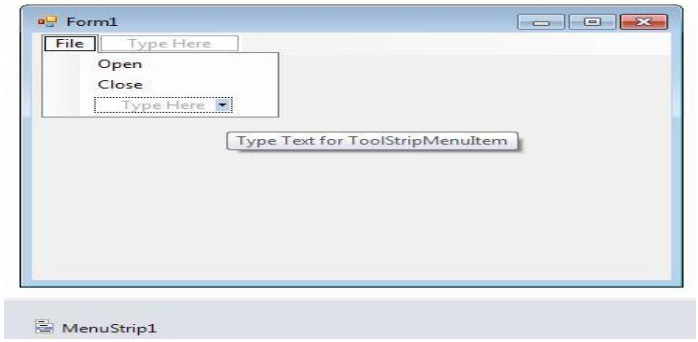
Menu Editor

Menus can be attached only to forms, and they're implemented through the MenuStrip control. The items that make up the menu are ToolStripMenuItem objects. As you will see, the MenuStrip control and ToolStripMenuItem objects give you absolute control over the structure and appearance of the menus of your application. The MenuStrip control is a variation of the Strip control, which is the base of menus, toolbars, and status bars.

We can create a MenuStrip control using a Forms designer at design-time or using the MenuStrip class in code at run-time or dynamically. To create a MenuStrip control at design-time, you simply drag and drop a MenuStrip control from Toolbox to a Form in Visual Studio. After you drag and drop a MenuStrip on a Form, the MenuStrip1 is added to the Form and looks like Figure below. Once a MenuStrip is on the Form, you can add menu items and set its properties and events.

Creating a MenuStrip control at run-time is merely a work of creating an instance of MenuStrip class, set its properties and adds MenuStrip class to the Form controls.

First step to create a dynamic MenuStrip is to create an instance of MenuStrip class. The following code snippet creates a MenuStrip control object.



VB.NET Code:

```
Dim MainMenu As New MenuStrip()
```

In the next step, you may set properties of a MenuStrip control. The following code snippet sets background color, foreground color, Text, Name, and Font properties of a MenuStrip.

```
MainMenu.BackColor = Color.OrangeRed
MainMenu.ForeColor = Color.Black
MainMenu.Text = "File Menu"
MainMenu.Font = New Font("Georgia", 16)
```

Once the MenuStrip control is ready with its properties, the next step is to add the MenuStrip to a Form. To do so, first we set MainMenuStrip property and then use Form.Controls.Add method that adds MenuStrip control to the Form controls and displays on the Form based on the location and size of the control. The following code snippet adds a MenuStrip control to the current Form.

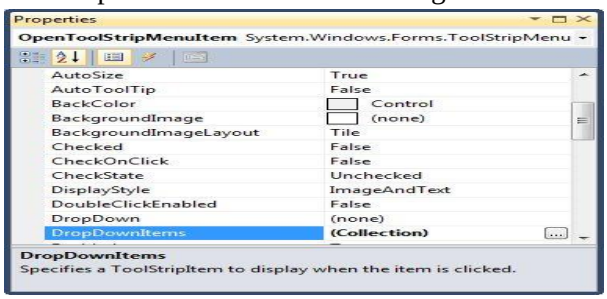
```
Me.MainMenuStrip = MainMenu
Controls.Add(MainMenu)
```

Setting MenuStrip Properties

After you place a MenuStrip control on a Form, the next step is to set properties.

The easiest way to set properties is from the Properties Window. You can open Properties window by pressing F4 or right click on a control and select Properties menu item.

The Properties window looks like Figure below.



Name

Name property represents a unique name of a MenuStrip control. It is used to access the control in the code. The following code snippet sets and gets the name and text of a MenuStrip control.

```
MainMenu.Name = "MailMenu"
```

Positioning a MenuStrip

The Dock property is used to set the position of a MenuStrip. It is of type DockStyle that can have values Top, Bottom, Left, Right, and Fill. The following code snippet sets Location, Width, and Height properties of a MenuStrip control.

```
MainMenu.Dock = DockStyle.Left
```

Font

Font property represents the font of text of a MenuStrip control. If you click on the Font property in Properties window, you will see Font name, size and other font options. The following code snippet sets Font property at run-time.

```
MainMenu.Font = new Font("Georgia", 16)
```

Background and Foreground

BackColor and ForeColor properties are used to set background and foreground color of a MenuStrip respectively. If you click on these properties in Properties window, the Color Dialog pops up.

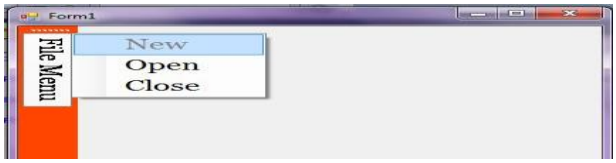
Alternatively, you can set background and foreground colors at run-time. The following code snippet sets

BackColor and ForeColor properties.

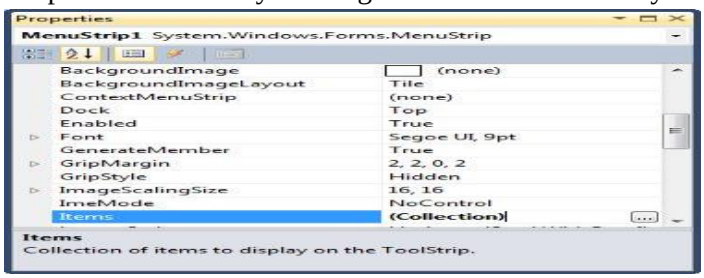
MainMenu.BackColor = System.Drawing.Color.OrangeRed

MainMenu.ForeColor = System.Drawing.Color.Black

Then the MenuStrip looks like Figure below.



MenuStrip Items A Menu control is nothing without menu items. The Items property is used to add and work with items in a MenuStrip. We can add items to a MenuStrip at design-time from Properties Window by clicking on Items Collection as you can see in Figure below.



When you click on the Collections, the String Collection Editor window will pop up where you can type strings. Each line added to this collection will become a MenuStrip item. (See the Figure below.)

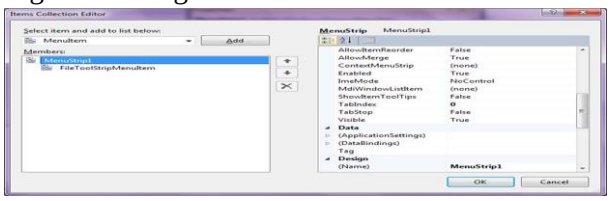
A ToolStripMenuItem represents a menu items. The following code snippet creates a menu item and sets its properties.

```
Dim FileMenu As New ToolStripMenuItem("File")
FileMenu.BackColor = Color.OrangeRed
FileMenu.ForeColor = Color.Black
FileMenu.Text = "File Menu"
FileMenu.Font = New Font("Georgia", 16)

FileMenu.TextAlign = ContentAlignment.BottomRight
FileMenu.TextDirection =  ToolStripTextDirection.Vertical90

FileMenu.ToolTipText = "Click Me"
```

Figure showing Menu Item Collection

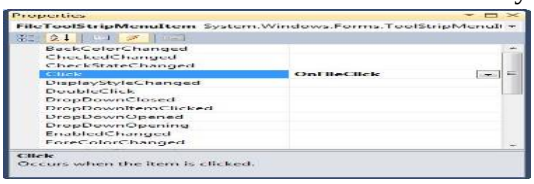


Once a menu item is created, we can add it to the main menu by using MenuStrip.Items.Add method. The following code snippet adds FileMenu item to the MainMenu.

```
MainMenu.Items.Add(FileMenu)
```

Adding Menu Item Click Event Handler

The main purpose of a menu item is to add a click event handler and write code that we need to execute on the menu item click event handler. For example, on File >> New menu item click event handler, we may want to create a new file. To add an event handler, you go to Events window and double click on Click and other as you can see in Figure below.



We can also define and implement an event handler dynamically. The following code snippet defines and implements these events and their respective event handlers.

```
Dim NewMenuItem As New ToolStripMenuItem("New", Nothing, New EventHandler(AddressOf NewMenuItemClick))

Private Sub NewMenuItemClick(ByVal sender As Object, ByVal e As EventArgs)
MessageBox.Show("New menu item clicked!")
End Sub
```

Manipulating Menu's at Runtime

Dynamic menus change at runtime to display more or fewer commands, depending on the current status of the program. This section explores two techniques for implementing dynamic menus:

- Creating short and long versions of the same menu
- Adding and removing menu commands at runtime

Iterating a Menu's Items

The last menu-related topic in this chapter demonstrates how to iterate through all the items of a menu structure, including their submenus, at any depth. The main menu of an application can be accessed by the expression Me.MenuStrip1 (assuming that you're using the default names). This is a reference to the top-level commands of the menu, which appear in the form's menu bar. Each command, in turn, is represented by a ToolStripMenuItem object. All the items under a menu command form a ToolStripMenuItems collection, which you can scan to retrieve the individual commands.
The first command in a menu is accessed with the expression Me.MenuStrip1.Items(0); this is the File command in a typical application. The expression Me.MenuStrip1.Items(1) is the second command on the same level as the File command (typically, the Edit menu).
To access the items under the first menu, use the DropDownItems collection of the top command. The first command in the File menu can be accessed by this expression:
Me.MenuStrip1.Items(0).DropDownItems(0)
The same items can be accessed by name as well, and this is how you should manipulate the menu items from within your code. In unusual situations, or if you're using dynamic

menus to which you add and subtract commands at runtime, you'll have to access the menu items through the DropDownItems collection.

(OR)

b) Explain in detail about RichTextbox controls and Overview of MDI in VB.NET with example.

The RichTextBox Control

The **RichTextBox** control is the core of a full-blown word processor. It provides all the functionality of a TextBox control; it can handle multiple typefaces, sizes, and attributes, and offers precise control over the margins of the text (see Figure 4.16). You can even place images in your text on a RichTextBox control (although you won't have the kind of control over the embedded images that you have with Microsoft Word).

The fundamental property of the **RichTextBox** control is its Rtf property. Similar to the Text property of the TextBox control, this property is the text displayed on the control. Unlike the Text property, however, which returns (or sets) the text of the control but doesn't contain formatting information, the Rtf property returns the text along with any formatting information.

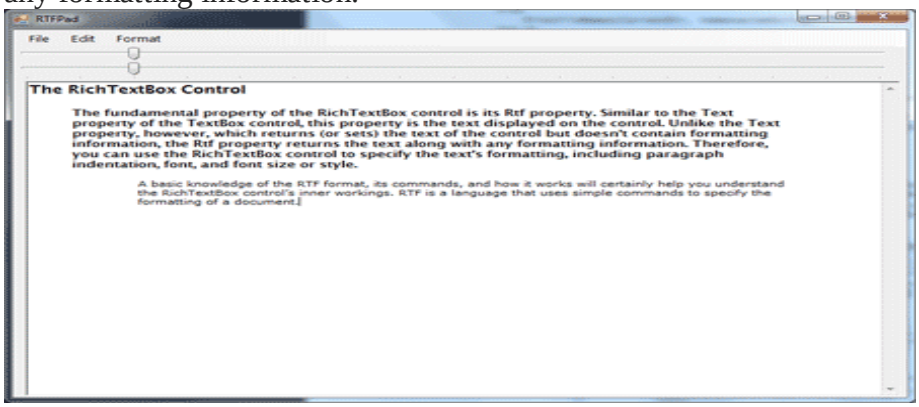


Figure 4.16 - A word processor based on the functionality of the RichTextBox control

The RTF Language

A basic knowledge of the RTF format, its commands, and how it works will certainly help you understand the RichTextBox control's inner workings. RTF is a language that uses simple commands to specify the formatting of a document. These commands, or tags, are ASCII strings, such as \par (the tag that marks the beginning of a new paragraph) and \b (the tag that turns on the bold style). And this is where the value of the RTF format lies. RTF documents don't contain special characters and can be easily exchanged among different operating systems and computers, as long as there is an RTF-capable application to read the document. Let's look at an RTF document in action.

Open the WordPad application (choose *Start* > *Programs* > *Accessories* > *WordPad*) and enter a few lines of text (see Figure 4.17). Select a few words or sentences, and format them in different ways with any of WordPad's formatting

commands. Then save the document in RTF format: Choose *File > Save As*, select Rich Text Format, and then save the file as Document.rtf. If you open this file with a text editor such as Notepad, you'll see the actual RTF code that produced the document. A section of the RTF file for the document shown in Figure 4.17 is shown in Listing 4.20.

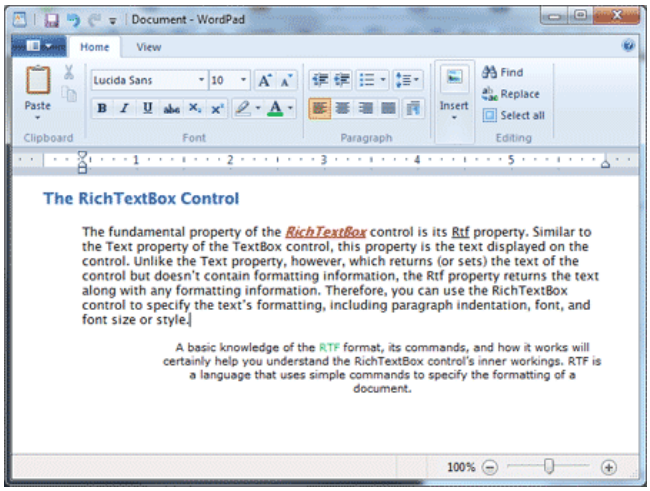


Figure 4.17 - The formatting applied to the text by using WordPad's commands is stored along with the text in RTF format.

Listing 4.20: The RTF Code for the First Paragraph of the Document in Figure 4.17

```
{\rtf1\ansi\ansicpg1252\deff0\deflang1033
{\fonttbl{\f0\fnil\fcharset0 Verdana;}{\f1\fswiss\fcharset0 Arial;}}
\viewkind4\uc1\pard\nowidctlpar\fi720 \b\f0\fs18 RTF
\b0 stands for \i Rich Text Format\i0 ,
which is a standard for storing formatting
information along with the text. The beauty
of the RichTextBox control for programmers
is that they don\rquote t need to supply the
formatting codes. The control provides simple
properties that turn the selected text into bold,
change the alignment of the current paragraph, and so on.\par
```

RTF is similar to Hypertext Markup Language (HTML), and if you're familiar with HTML, a few comparisons between the two standards will provide helpful hints and insight into the RTF language. Like HTML, RTF was designed to create formatted documents that could be displayed on different systems. The following RTF segment displays a sentence with a few words in italics:

```
\bRTF\b0 (which stands for Rich Text Format) is a \i
document formatting language\i0 that uses simple
commands to specify the formatting of the document.
```

The following is the equivalent HTML code:

```
<b>RTF</b> (which stands for Rich Text Format) is a
<i>document formatting language</i> that uses simple
commands to specify the formatting of the document.
```

The `<b>` and `<i>` tags of HTML, for example, are equivalent to the `\b` and `\i` tags of RTF. The closing tags in RTF are `\b0` and `\i0`, respectively.

The RichTextBox's Properties

The **RichTextBox** control provides properties for manipulating the selected text on the control. The names of these properties start with the Selection or Selected prefix, and the most commonly used ones are shown in Table 4.5. Some of these properties are discussed in further detail in following sections.

SelectedText

The `SelectedText` property represents the selected text, whether it was selected by the user via the mouse or from within your code. To assign the selected text to a variable, use the following statement:

```
selText=RichTextbox1.SelectedText
```

You can also modify the selected text by assigning a new value to the `SelectedText` property. The following statement converts the selected text to uppercase:

```
RichTextbox1.SelectedText =
RichTextbox1.SelectedText.ToUpper
```

You can assign any string to the `SelectedText` property. If no text is selected at the time, the statement will insert the string at the location of the pointer.

Table 4.5 - RichTextBox Properties for Manipulating Selected Text

Property	What It Manipulates
SelectedText	The selected text
SelectedRtf	The RTF code of the selected text
SelectionStart	The position of the selected text's first character
SelectionLength	The length of the selected text
SelectionFont	The font of the selected text
SelectionColor	The color of the selected text
SelectionBackColor	The background color of the selected text
SelectionAlignment	The alignment of the selected text
SelectionIndent, SelectionRightIndent, SelectionHangingIndent	The indentation of the selected text
RightMargin	The distance of the text's right margin from the left edge of the control
SelectionTabs	An array of integers that sets the tab stop positions in the control
SelectionBullet	Whether the selected text is bulleted
BulletIndent	The amount of bullet indent for the selected text

SelectionStart, SelectionLength

+

electionLength, report (or set) the position of the first selected character in the text and the length of the selection, respectively, regardless of the formatting of the selected text. One obvious use of these properties is to select (and highlight) some text on the control:

```
RichTextBox1.SelectionStart = 0
RichTextBox1.SelectionLength = 100
```

You can also use the **Select** method, which accepts as arguments the starting location and the length of the text to be selected.

SelectionAlignment

Use this property to read or change the alignment of one or more paragraphs. This property's value is one of the members of the **HorizontalAlignment** enumeration: Left, Right, and Center. Users don't have to select an entire paragraph to align it; just placing the pointer anywhere in the paragraph will do the trick, because you can't align part of the paragraph.

SelectionIndent, SelectionRightIndent, SelectionHangingIndent

These properties allow you to change the margins of individual paragraphs. The **SelectionIndent** property sets (or returns) the amount of the text's indentation from the left edge of the control. The **SelectionRightIndent** property sets (or returns) the amount of the text's indentation from the right edge of the control. The **SelectionHangingIndent** property indicates the indentation of each paragraph's first line with respect to the following lines of the same paragraph. All three properties are expressed in pixels.

The **SelectionHangingIndent** property includes the current setting of the **SelectionIndent** property. If all the lines of a paragraph are aligned to the left, the **SelectionIndent** property can have any value (this is the distance of all lines from the left edge of the control), but the **SelectionHangingIndent** property must be zero. If the first line of the paragraph is shorter than the following lines, the **SelectionHangingIndent** has a negative value. Figure 4.18 shows several differently formatted paragraphs. The settings of the **SelectionIndent** and **SelectionHangingIndent** properties are determined by the two sliders at the top of the form.

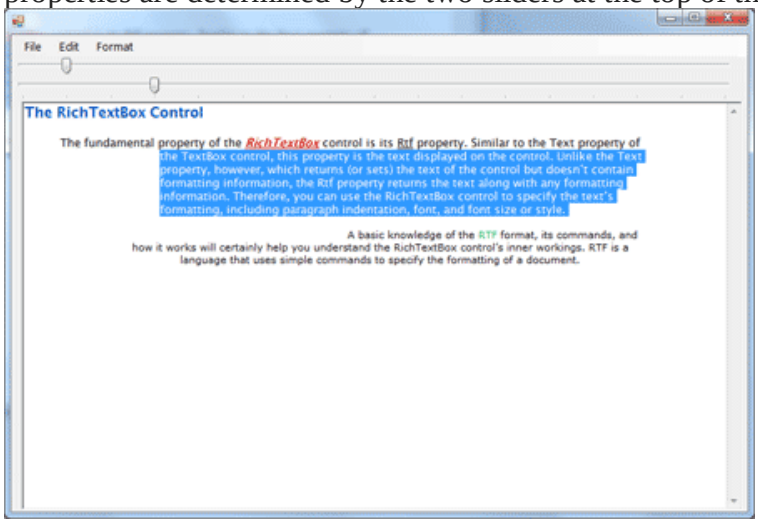


Figure 4.18 - Various combinations of the ***SelectionIndent*** *and* ***SelectionHangingIndent*** *properties produce all possible paragraph styles.*

SelectionBullet, BulletIndent

You use these properties to create a list of bulleted items. If you set the **SelectionBullet** property to True, the selected paragraphs are formatted with a bullet style, similar to the **<ul>** tag in HTML. To create a list of bulleted items, select them from within your code and assign the value True to the **SelectionBullet** property. To change a list of bulleted items back to normal text, make the same property False.

The paragraphs formatted as bullets are also indented from the left by a small amount. To set the amount of the indentation, use the **BulletIndent** property, which is also expressed in pixels.

SelectionTabs

Use this property to set the tab stops in the RichTextBox control. The Selection tab should be set to an array of integer values, which are the absolute tab positions in pixels. Use this property to set up a RichTextBox control for displaying tab-delimited data.

Methods Of the RichTextBox control

The first two methods of the RichTextBox control you need to know are **SaveFile** and **LoadFile**. The **SaveFile** method saves the contents of the control to a disk file, and the **LoadFile** method loads the control from a disk file.

SaveFile

The syntax of the SaveFile method is as follows:

RichTextBox1.SaveFile(path, filetype)

where path is the path of the file in which the current document will be saved. By default, the SaveFile method saves the document in RTF format and uses the .RTF extension. You can specify a different format by using the second optional argument, which can take on the value of one of the members of the RichTextBoxStreamType enumeration, described in Table 4.6.

Table 4.6 - The RichTextBoxStreamType Enumeration

Format	Effect
PlainText	Stores the text on the control without any formatting
RichNoOLEObjs	Stores the text without any formatting and ignores any embedded OLE objects
RichText	Stores the text in RTF format (text with embedded RTF commands)
TextTextOLEObjs	Stores the text along with the embedded OLE objects
UnicodePlainText	Stores the text in Unicode format

LoadFile

Similarly, the **LoadFile** method loads a text or RTF file to the control. Its syntax is identical to the syntax of the SaveFile method:

RichTextBox1.LoadFile(path, filetype)
The filetype argument is optional and can have one of the values of the **RichTextBoxStreamType** enumeration. Saving and loading files to and from disk files is as simple as presenting a Save or Open common dialog to the user and then calling one of the **SaveFile** or **LoadFile** methods with the filename returned by the common dialog box.

Select, SelectAll

The **Select** method selects a section of the text on the control, similar to setting the **SelectionStart** and **SelectionLength** properties. The **Select** method accepts two arguments: the location of the first character to be selected and the length of the selection:

RichTextBox1.Select(start, length)

The SelectAll method accepts no arguments and it selects all the text on the control.

22. a) Explain in detail about Handling dates in VB.NET with suitable examples.

Handling Dates

The Date Time Class

The DateTime class is used for storing date and time values, and it's one of the Framework's base data types. Date and time values are stored internally as Double numbers. The integer part of the value corresponds to the date, and the fractional part corresponds to the time. To convert a DateTime variable to a Double value, use the method ToOADateTime, which returns a value that is an OLE (Object Linking and Embedding) Automation-compatible date. The value 0 corresponds to midnight of December 30, 1899.

To initialize a DateTime variable, supply a date value enclosed in a pair of pound symbols. If the value contains time information, separate it from the date part by using a space:

```
Dim date1 As Date = #4/15/2007#
Dim date2 As Date = #4/15/2007 2:01:59#
```

Properties

The DateTime class exposes the following properties, which are straightforward.

Date, TimeOfDay

The Date property returns the date from a date/time value and sets the time to midnight. The TimeOfDay property returns the time part of the date. The following statements

```
Dim date1 As DateTime
date1 = Now()
Debug.WriteLine(date1)
Debug.WriteLine(date1.Date)
Debug.WriteLine(date1.TimeOfDay)
```

will print something like the following values in the Output window:

```
8/5/2007 9:41:55 AM
8/5/2007 12:00:00 AM
09:41:55.5296000
```

DayOfWeek, DayOfYear

Hour, Minute, Second, Millisecond

These properties return the corresponding time part of the date value passed as an argument. If the current time is 9:47:24 p.m., the three properties of the DateTime class will return the integer values 9, 47, and 24 when applied to the current date and time:

```
Debug.WriteLine("The current time is " & Date.Now.ToString)
Debug.WriteLine("The hour is " & Date.Now.Hour)
Debug.WriteLine("The minute is " & Date.Now.Minute)
Debug.WriteLine("The second is " & Date.Now.Second)
```

Day, Month, Year

These three properties return the day of the month, the month, and the year of a DateTime value, respectively. The Day and Month properties are numeric values, but you can convert them to the appropriate string (the name of the day or month) with the WeekDayName() and MonthName() functions.

Ticks

This property returns the number of ticks from a date/time value. Each tick is 100 nanoseconds (or 0.0001 milliseconds). To convert ticks to milliseconds, multiply them by 10,000 (or use the TimeSpan object's TicksPerMillisecond property.

Methods

The DateTime class exposes several methods for manipulating dates. The most practical methods add and subtract time intervals to and from an instance of the DateTime class.

Compare

Compare is a shared method that compares two date/time values and returns an integer value indicating the relative order of the two values. The syntax of the Compare method is the following, where date1 and date2 are the two values to be compared:

```
order = System.DateTime.Compare(date1, date2)
```

DaysInMonth

This shared method returns the number of days in a specific month. Because February contains a variable number of days depending on the year, the DaysInMonth method accepts as arguments both the month and the year:

```
monDays = DateTime.DaysInMonth(year, month)
```

FromOADate

This shared method creates a date/time value from an OLE Automation-compatible date.

```
newDate = DateTime.FromOADate(dtvalue)
```

The argument dtvalue must be a Double value in the range from −657,434 (first day of year 100) to 2,958,465 (last day of year 9999).

IsLeapYear

This shared method returns a True/False value that indicates whether the specified year is a leap year:

```
Dim leapYear As Boolean = DateTime.IsLeapYear(year)
```

Add

This method adds a TimeSpan object to the current instance of the DateTime class.

```
Dim TS As New TimeSpan()
Dim thisMoment As Date = Now()
TS = New TimeSpan(3, 6, 2, 50)
Debug.WriteLine(thisMoment)
Debug.WriteLine(thisMoment.Add(TS))
```

The values printed in the Output window when I tested this code segment were as follows:

```
9/1/2007 10:10:49 AM
9/4/2007 4:13:39 PM
```

Subtract

This method is the counterpart of the Add method; it subtracts a TimeSpan object from the current instance of the DateTime class and returns another Date value.

Adding Intervals to Dates

Various methods add specific intervals to a date/time value. Each method accepts the number of intervals to add (days, hours, milliseconds, and so on) to the current instance of the DateTime class. These methods are the following: AddYears, AddMonths, AddDays, AddHours, AddMinutes, AddSeconds, AddMilliseconds, and AddTicks.

To add 3 years and 12 hours to the current date, use the following statements:

```
Dim aDate As Date
aDate = Now()
aDate = aDate.AddYears(3)
aDate = aDate.AddHours(12)
```

If the argument is a negative value, the corresponding intervals are subtracted from the current instance of the class.

ToString

This method converts a date/time value to a string, using a specific format. The DateTime class recognizes numerous format patterns, which are listed in the following two tables. Table lists the standard format patterns, and Table lists the characters that can format individual parts of the date/time value. You can combine the custom format characters to format dates and times in any way you wish.

The syntax of the ToString method is the following, where formatSpec is a format specification:

```
aDate.ToString(formatSpec)
```

The D named date format, for example, formats a date value as a long date; the following statement will return the highlighted string shown below the statement:

```
Debug.Writeline(#9/17/2010#.ToString("D"))
Friday, September 17, 2010
```

Table 9.1 lists the named formats for the standard date and time patterns. The format characters are case-sensitive — for example, g and G represent slightly different patterns.

Named Format	Output	Format Name
d	MM/dd/yyyy	ShortDatePattern
D	dddd, MMMM dd, yyyy	LongDatePattern
F	dddd, MMMM dd, yyyy HH:mm:ss.mmm	FullDateTimePattern (long date and long time)
f	dddd, MMMM dd, yyyy HH:mm.ss	FullDateTimePattern (long date and short time)
g	MM/dd/yyyy HH:mm	general (short date and short time)
G	MM/dd/yyyy HH:mm:ss	General (short date and long time)
M	m MMMM dd	MonthDayPattern (month and day)
r, R	ddd, dd MMM yyyy HH:mm:ss GMT	RFC1123Pattern

Table 9.2: Date Format Specifier

Format Character	Description
d	The date of the month
dd	The day of the month with a leading zero for single-digit days
ddd	The abbreviated name of the day of the week (a member of the AbbreviatedDayNames enumeration)
dddd	The full name of the day of the week (a member of the DayNamesFormat enumeration)
M	The number of the month
MM	The number of the month with a leading zero for single-digit months
MMM	The abbreviated name of the month (a member of the AbbreviatedMonthNames enumeration)
MMMM	The full name of the month

The following examples format the current date by using all the format patterns listed in Table 13.1. An example of the output produced by each statement is shown under each statement, indented and highlighted.

```
Debug.WriteLine(now().ToString("d"))
6/1/2008
Debug.WriteLine(now().ToString("D"))
Sunday, June 01, 2008
Debug.WriteLine(now().ToString("f"))
Sunday, June 01, 2008 10:29 AM
Debug.WriteLine(now().ToString("F"))
Sunday, June 01, 2008 10:29:35 AM
Debug.WriteLine(now().ToString("g"))
6/1/2008 10:29 AM
Debug.WriteLine(now().ToString("G"))
6/1/2008 10:29:35 AM
```

To display the full month name and the day in the month, for instance, use the following statement:
Debug.WriteLine(now().ToString("MMMM d")).

Date Conversion Methods
The DateTime class supports methods for converting a date/time value to many of the other base types, which are presented here briefly.

ToFileTime, FromFileTime
The ToFileTime method converts the value of the current Date instance to the format of the local system file time. There's also an equivalent FromFileTime method, which converts a file time value to a Date value.

ToLongDateString, ToShortDateString
These two methods convert the date part of the current DateTime instance to a string with the long (or short) date format. The following statement will return a value like the one highlighted, which is the long date format:
Debug.WriteLine(Now().ToLongDateString)
Tuesday, July 15, 2008

ToLongTimeString, ToShortTimeString
These two methods convert the time part of the current instance of the Date class to a string with the long (or short) time format. The following statement will return a value like the one highlighted:

```
Debug.WriteLine(Now().ToLongTimeString)
6:40:53 PM
```

ToOADate
This method converts the DateTime instance into an OLE Automation-compatible date (a long value).

ToUniversalTime, ToLocalTime

ToUniversalTime converts the current instance of the DateTime class into universal coordinated time (UCT). The method ToLocalTime converts a UCT time value to local time.

Dates as Numeric Values

The Date type encapsulates complicated operations, and it's worth taking a look at the inner workings of the classes that handle dates and times. Let's declare two variables to experiment a little with dates: a Date variable, which is initialized to the current date, and a Double variable.

```
Dim Date1 As Date = Now()
Dim dbl As Double
```

Insert a couple of statements to convert the date to a Double value and print it:

```
dbl = Date1.ToOADate
Debug.WriteLine(dbl)
```

The TimeSpan Class

The last class discussed in this chapter is the TimeSpan class, which represents a time interval and can be expressed in many different units — from ticks and milliseconds to days. The TimeSpan is usually the difference between two date/time values, but you can also create a TimeSpan for a specific interval and use it in your calculations.

To use the TimeSpan variable in your code, just declare it with a statement such as the following:

```
Dim TS As New TimeSpan
```

You can initialize an instance of the TimeSpan object by creating two date/time values and getting their difference, as in the following statements:

```
Dim TS As New TimeSpan
Dim date1 As Date = #4/11/1985#
Dim date2 As Date = Now()
TS = date2.Subtract(date1)
Debug.WriteLine(TS)
```

Depending on the day on which you execute these statements, they will print something like the following in the Output window:

```
8086.15:37:01.6336000
```

Properties

The TimeSpan type exposes the properties described in the following sections. Most of these properties are shared.

Field Properties

TimeSpan exposes the simple properties shown in Table 13.3, which are known as fields and are all shared.

Table 9.3: The Fields of the TimeSpan Object

Property	Returns
Empty	An Empty TimeSpan object
MaxValue	The largest interval you can represent with a TimeSpan object
MinValue	The smallest interval you can represent with a TimeSpan object
TicksPerDay	The number of ticks in a day
TicksPerHour	The number of ticks in an hour
TicksPerMillisecond	The number of ticks in a millisecond
TicksPerMinute	The number of ticks in one minute
TicksPerSecond	The number of ticks in one second
Zero	A TimeSpan object of zero duration

Interval Properties

In addition to the fields, the TimeSpan class exposes two more groups of properties that return the various intervals in a TimeSpan value (shown in Tables 13.4 and 13.5). The members of the first group of properties return the number of specific intervals (days, hours, and so on) in a TimeSpan value. The second group of properties returns the entire TimeSpan's duration in one of the intervals recognized by the TimeSpan method.

Table 9.4: The Intervals of a TimeSpan Value

Property	Returns
Days	The number of whole days in the current TimeSpan.
Hours	The number of whole hours in the current TimeSpan.
Milliseconds	The number of whole milliseconds in the current TimeSpan. The largest value of this property is 999.
Minutes	The number of whole minutes in the current TimeSpan. The largest value of this property is 59.
Seconds	The number of whole seconds in the current TimeSpan. The largest value of this property is 59.
Ticks	The number of whole ticks in the current TimeSpan.

Table 9.5: The Total Intervals of a TimeSpan Value

Property	Returns
TotalDays	The number of days in the current TimeSpan

TotalHours	The number of hours in the current TimeSpan
TotalMilliseconds	The number of whole milliseconds in the current TimeSpan
TotalMinutes	The number of whole minutes in the current TimeSpan

Duration

This property returns the duration of the current instance of the TimeSpan class. The duration is expressed as the number of days followed by the number of hours, minutes, seconds, and milliseconds. The following statements create a TimeSpan object of a few seconds (or minutes, if you don't mind waiting) and print its duration in the Output window.

```
Dim T1, T2 As DateTime
T1 = Now
MsgBox("Click OK to continue")
T2 = Now
Dim TS As TimeSpan
TS = T2.Subtract(T1)
Debug.WriteLine("Total duration = " & TS.Duration.ToString)
Debug.WriteLine("Minutes = " & TS.Minutes.ToString)
Debug.WriteLine("Seconds = " & TS.Seconds.ToString)
Debug.WriteLine("Ticks = " & TS.Ticks.ToString)
Debug.WriteLine("Milliseconds = " & TS.TotalMilliseconds.ToString)
Debug.WriteLine("Total seconds = " & TS.TotalSeconds.ToString)
```

If you place these statements in a button's Click event handler and execute them, you'll see a series of values like the following in the Immediate window:

```
Total duration = 00:01:34.2154752
Minutes = 1
Seconds = 34
Ticks = 942154752
Milliseconds = 94215,4752
Total seconds = 94,2154752
```

Methods

There are various methods for creating and manipulating instances of the TimeSpan class, and they're described in the following sections.

Interval Methods

The methods in Table 13.6 create a new TimeSpan object of a specific duration. The TimeSpan's duration is specified as a number of intervals, accurate to the nearest millisecond.

All methods accept a single argument, which is a Double value that represents the number of the corresponding intervals (days, hours, and so on).

Parse(string)

This method creates a new TimeSpan object from a string with the TimeSpan format (days;followed by a period; followed by the hours, minutes, and seconds separated by colons). The following statements create a new TimeSpan variable with a duration of 3 days, 12 hours, 20 minutes, 30 seconds, and 500 milliseconds:

```
Dim SP As New TimeSpan()
SP = TimeSpan.Parse("3.12:20:30.500")
Debug.WriteLine(SP)
3.12:20:30.5000000
```

(OR)

b) Discuss the following with examples

(i) Displaying Images.

Display and size images. - The most appropriate control for displaying images is the PictureBox control. You can assign an image to the control through its Image property, either at design time or at runtime. To display a user-supplied image at runtime, call the DrawImage method of the control's Graphics object.

Generate graphics by using the drawing methods. - Every object you draw on, such as forms and PictureBox controls, exposes the CreateGraphics method, which returns a Graphics object. The Paint event's e argument also exposes the Graphics object of the control or form. To draw something on a control, retrieve its Graphics object and then call the Graphics object's drawing methods.

Display text in various ways, including gradient fills. - The Graphics object provides the DrawString method, which prints a user-supplied string on a control. You can also specify the coordinates of the string's upper-left corner and its font. To position the string, you need to know its dimensions..

(ii) Bitmaps.

Bitmaps

Specifying Colors

The model of designing colors based on the intensities of their RGB components is called the RGB model, and it's a fundamental concept in computer graphics. If you aren't familiar with this model, this section is well worth reading. Nearly every color you can imagine can be constructed by mixing the appropriate percentages of the three basic colors.

Defining Colors

To manipulate colors, use the Color class of the Framework. This is a shared class, and you need not create new Color objects; just call the appropriate property or method of the Color class. The Color class exposes 128 predefined colors as properties, which you can access by name, and additional members for specifying custom colors. For

example, you can define colors by using the FromARGB method of the Color class. This method accepts three arguments, which are the components of the primary colors in the desired color:

```
Color.FromARGB(Red, Green, Blue)
```

The method returns a Color value, which you can assign to a variable of the same type, or use it directly as the value of a Color property. To change the form's background color to yellow, you can assign the value returned by the FromARGB method to the BackColor property of a form or control:

```
Form1.BackColor = FromARGB(255, 128, 128)
```

Alpha Blending

Besides the red, green, and blue components, a Color value might also contain a transparency component. This value determines whether the color is opaque (255) or transparent (0). In the case of transparent colors, you can specify the degree of transparency. This component is the alpha component. The following statement creates a new color value, which is yellow and 25 percent transparent:

```
Dim trYellow As Color
trYellow = Color.FromARGB(192, Color.Yellow)
```

The preceding statements print the logo at two locations on the image of the PictureBox1 control with different colors, as shown in Figure 15.2.

Figure 15.2 - Watermarking an image with a semitransparent string

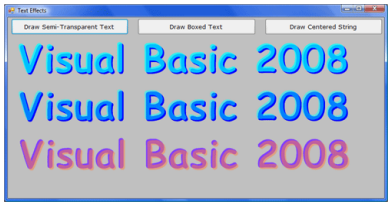


Figure 15.3 - Creating a 3D effect by superimposing transparency on an opaque and a semitransparent string

The code behind the Draw Semi-Transparent Text button is quite simple, really. First it draws the string with the solid blue brush:

```
brush = New SolidBrush(Color.FromARGB(255, 0, 0, 255))
```

Processing Bitmaps

A bitmap is a two-dimensional array of color values. These values are stored in disk files, and when an image is displayed on a PictureBox or Form control, each of its color values is mapped to a pixel on the PictureBox or form. This is true when the image isn't resized, of course.

Refreshing the Image

When you draw on a bitmap, which is associated with the Image property of a PictureBox control, the image on the control isn't refreshed every time the bitmap is modified. Instead, the image is modified when the Paint event has a chance to be serviced. The processing is implemented with two nested loops that iterate through the bitmap's rows and columns, as in the following code:

```
For pxlCol As Integer = 0 To PictureBox1.Image.Height - 1
For pxlRow As Integer = 0 To PictureBox1.Image.Width - 1
' statements to process current pixel:
' (pxlRow, pxlCol)
Next
Next
```

The image on the control won't be refreshed until the outer loop has finished. As a result, users can't see the progress of the operation; they will see the new image after all its pixels have been processed.
To force the PictureBox control to refresh its image, you must call the Refresh method.

iii) Write note on GDI.

Drawing with GDI+

The most recent version on GDI is called GDI+.One of the basic characteristics of GDI is that it's stateless. This means that each graphics operation is totally independent of the previous one and can't affect the following one. To draw a line, you must specify a Pen object and the two endpoints of the line.

The GDI+ classes reside in the following namespaces, and you must import one or more of them in your projects: System.Drawing, System.Drawing2D, System.Drawing.Imaging, and System.Drawing.Text. This chapter explores all three aspects of GDI+ — namely vector drawing, imaging, and typography.

Here are the statements to draw a line on the form:

```
Dim redPen As Pen = New Pen(Color.Red, 2)
Dim point1 As Point = New Point(10,10)
Dim point2 As Point = New Point(120,180)
Me.CreateGraphics.DrawLine(redPen, point1, point2)
```

The Basic Drawing Objects

This is a good point to introduce some of the objects we'll be using all the time when drawing. No matter what you draw or which drawing instrument you use, one or more of the objects discussed in this section will be required.

The Graphics Object

The Graphics object is the drawing surface — your canvas. All the controls you can draw on expose a Graphics property, which is an object, and you can retrieve it with the CreateGraphics method. Start by declaring a variable of the Graphics type and initialize it to the Graphics object returned by the control's CreateGraphics method:

```
Dim G As Graphics
G = PictureBox1.CreateGraphics
```

DpiX, DpiY - These two properties return the horizontal and vertical resolutions of the drawing surface, respectively. Resolution is expressed in pixels per inch (or dots per inch, if the drawing surface is your printer). On an average monitor, these two properties return a resolution of 96 dots per inch (dpi).

PageUnit - This property determines the units in which you want to express the coordinates on the Graphics object; its value can be a member of the GraphicsUnit enumeration

TextRenderingHint - This property specifies how the Graphics object will render text; its value is one of the members of the TextRenderingHint enumeration: AntiAlias, AntiAliasGrid- Fit, ClearTypeGridFit, SingleBitPerPixel, SingleBitPerPixelGridFit, and SystemDefault.

SmoothingMode - This property is similar to the TextRenderingHint, but it applies to shapes drawn with the Graphics object's drawing methods. Its value is one of the members of the SmoothingMode enumeration: AntiAlias, Default, HighQuality, HighSpeed, Invalid, and None.

The Point Class

The Point class represents a point on the drawing surface and is expressed as a pair of (x, y) coordinates. The x-coordinate is its horizontal distance from the origin, and the y-coordinate is its vertical distance from the origin. The origin is the point with coordinates (0, 0), and this is the top-left corner of the drawing surface.

The Rectangle Class

Another class that is often used in drawing is the Rectangle class. The Rectangle object is used to specify areas on the drawing surface. Its constructor accepts as arguments the coordinates of the rectangle's top-left corner and its dimensions:

Dim box As Rectangle
box = New Rectangle(X, Y, width, height)

The following statement creates a rectangle whose top-left corner is 1 pixel to the right and 1 pixel down from the origin, and its dimensions are 100 by 20 pixels:
box = New Rectangle(1, 1, 100, 20)

23. a) Discuss about File Accessing methods in VB.NET with suitable examples.

Accessing Files

There are two types of files: text files and binary files. To access a file, you must first set up a Stream object. Stream objects are created by the various methods that open or create files, as you have seen in the previous sections, and they return information about the file they're connected to.

Using Streams

Another benefit of using streams is that you can combine them. The typical example is that of encrypting and decrypting data. Data is encrypted through a special type of Stream, the CryptoStream.

The FileStream Class

The Stream class is an abstract one, and you can't use it directly in your code. To prepare your application to write to a file, you must set up a FileStream object, which is the channel between your application and the file. The methods for writing and reading data are provided by the StreamReader/StreamWriter or BinaryReader/BinaryWriter classes, which are created on top of the FileStream object.

Properties

You can use the following properties of the FileStream object to retrieve information about the underlying file.

Length

This read-only property returns the length of the file associated with the FileStream current object in bytes.

Position

This property gets or sets the current position within the stream. You can compare the Position property to the Length property to find out whether you have reached the end of an existing file. When these two properties are equal, there are no more data to read.

Methods

The FileStream object exposes a fewmethods, which are discussed here. Themethods for accessing a file's contents are discussed in the following section.

Lock

This method allows you to lock the file you're accessing, or part of it. The syntax of the Lock method is the following, where position is the starting position and length is the length of the range to be locked:

Lock(position, length)

To lock the entire file, use this statement:

FileStream.Lock(1, FileStream.Length)

Seek

This method sets the current position in the file represented by the FileStream object:

FileStream.Seek(offset, origin)

The new position is offset bytes from the origin. In place of the origin argument, use one of he SeekOrigin enumeration members, listed in Table 11.6.

Table 11.6: SeekOrigin Enumeration

Value	Effect
Begin	The offset is relative to the beginning of the file.
Current	The offset is relative to the current position in the file.
End	The offset is relative to the end of the file.

SetLength

This method sets the length of the file represented by the FileStream object. Use this method after you have written to an existing file to truncate its length. The syntax of the SetLength method is this:

FileStream.SetLength(newLength)

The StreamWriter Class

The StreamWriter class is the channel through which you send data to a text file. To create a new StreamWriter object, declare a variable of the StreamWriter type. The first overloaded form of the constructor accepts a file's path as an argument and creates a new StreamWriter object for the file:

Dim SW As New StreamWriter(path)

NewLine Property

The StreamWriter object provides a handy property, the NewLine property, which allows you to change the string used to terminate each line in the file. This terminator is written to the text file by the WriteLine method, following the text. The default line-terminator string is a carriage return followed by a line feed (\r\n). The StreamReader object doesn't provide a similar property. It reads lines terminated by the carriage return (\r), line feed (\n), or carriage return/line feed (\r\n) characters only.

Methods

To send information to the underlying file, use the following methods of the StreamWriter object.

AutoFlush

This property is a True/False value that determines whether the methods that write to the file (the Write and WriteString methods) will also flush their buffer. If you set this property to False, the buffer will be flushed when the operating system gets a chance, when the Flush method is called, or when you close the FileStream object. When AutoFlush is True, the buffer is flushed with every write operation.

Close

This method closes the StreamWriter object and releases the resources associated with it to the system. Always call the Close method after you finish using the StreamWriter object. If you have created the StreamWriter object on top of a FileStream object, you must also close the underlying stream too.

Flush

This method writes any data in the buffer to the underlying file.

WriteLine(data)

This method is identical to the Write method, but it appends a line break after saving the data to the file. You will find examples on using the StreamWriter class after we discuss the methods of the StreamReader class.

The StreamReader Class

The StreamReader class provides the necessary methods for reading from a text file and exposes methods that match those of the StreamWriter class (the Write and WriteLine methods). The StreamReader class's constructor is overloaded. You can specify the FileStream object it will use to read data from the file, the encoding scheme, and the buffer size. The simplest form of the constructor is the following:

```
Dim SR As New StreamReader(FS)
```

Methods

The StreamReader class provides the following methods for writing data to the underlying file.

Close

The Close method closes the current instance of the StreamReader class and releases any system resources associated with this object.

Peek

The Peek method returns the next character as an integer value, without actually removing it from the input stream. The Peek method doesn't change the current position in the stream. If there are no more characters left in the stream, the value −1 is returned. The Peek method will also return −1 if the current stream doesn't allow peeking.

Read

This method reads a number of characters from the StreamReader class to which it's applied and returns the number of characters read. The syntax of the Read method is as follows, where count is the number of characters to be read, starting at the startIndex location in the file:

```
charsRead = SR.Read(chars, startIndex, count)
```

ReadBlock

This method reads a number of characters from a text file and stores them in an array of characters. It accepts the same arguments as the Read method and returns the number of characters read.

```
Dim chars(count - 1) As Char
charsRead = SR.Read(chars, startIndex, count)
```

ReadLine

This method reads the next line from the text file associated with the StreamReader class and returns a string. If you're at the end of the file, the method returns the Null value. The syntax of the ReadLine method is the following:

```
Dim txtLine As String
txtLine = SR.ReadLine()
```

ReadToEnd

The last method for reading characters from a text file reads all the characters from the current position to the end of the file. We usually call this method once to read the entire file with a single statement and store its contents to a string variable. The syntax of the ReadToEnd method is as follows:

```
allText = SR.ReadToEnd()
```

The BinaryWriter Class

To prepare your application to write to a binary file, you must set up a BinaryWriter object, with the statement shown here, where FS is a properly initialized FileStream object:

```
Dim BW As New BinaryWriter(FS)
```

To specify the encoding of the text in the binary file, use the following form of the method:

```
Dim BW As New BinaryWriter(FS, encoding)
Dim BW As New BinaryWriter(path, encoding)
```

Methods

The BinaryWriter class exposes the following methods for manipulating binary files.

Close
This method flushes and closes the current BinaryWriter and releases any system resources associated with it.

Flush
This method clears all buffers for the current writer and writes all buffered data to the underlying file.

Seek
This method sets the position within the current stream. Its syntax is the following, where origin is a member of the SeekOrigin enumeration and offset is the distance from the origin:
Seek(offset, origin)

Write
The Write method writes a value to the current stream. This method is heavily overloaded, but it accepts a single argument, which is the value to be written to the file. The data type of its argument determines how it will be written. The Write method can save all the base types to the file in their native format, unlike the Write method of the TextWriter class, which stores them as strings.

WriteString
Whereas all other data types can be written to a binary file with the Write method, strings must be written with the WriteString method. This method writes a length-prefixed string to the file and advances the current position by the appropriate number of bytes. The string is encoded by the current encoding scheme, and the default value is UTF8Encoding.

The BinaryReader Class

The BinaryReader class provides the methods you need to read data from a binary file. As you have seen, binary files might also hold text, and the BinaryReader class provides the ReadString method to read strings written to the file by the WriteString method.

To use the methods of the BinaryReader class in your code, you must first create an instance of the class. The BinaryReader object must be associated with a FileStream object, and the simplest form of its constructor is the following, where streamObj is the FileStream object:
Dim BR As New BinaryReader(streamObj)
.

Methods
The BinaryReader class exposes the following methods for accessing the contents of a binary file.

Close

This method is the same as the Close method of the StreamReader class. It closes the current reader and releases the underlying stream.

PeekChar

This method returns the next available character from the streamwithout repositioning the current pointer. The character read is returned as an integer, or −1 if there are no more characters to be read from the stream.

(OR)

b) Explain the following with example. i) Designing Menus. ii) String Handling in VB.Net

Handling String and Characters

The Char Class

The Char data type stores characters as individual, double-byte (16-bit), Unicode values; and it exposes methods for classifying the character stored in a Char variable. You can use methods such as IsDigit and IsPunctuation on a Char variable to determine its type, and other similar methods that can simplify your string validation code.

To use a character variable in your application, you must declare it with a statement such as the following one:

```
Dim ch As Char
ch = Convert.ToChar("A")
```

Properties

The Char class provides two trivial properties: MaxValue and MinValue. They return the largest and smallest character values you can represent with the Char data type.

Methods

The Char data type exposes several useful methods for handling characters. All the methods described here have the same syntax: They accept either a single argument, which is the character they act upon, or a string and the index of a character in the string on which they act.

GetNumericValue

This method returns a positive numeric value if called with an argument that is a digit, and the value −1 otherwise. If you call the GetNumericValue with the argument 5, it will return the numeric value 5. If you call it with the symbol @, it will return the value −1.

GetUnicodeCategory

This method returns a numeric value that is a member of the UnicodeCategory enumeration and identifies the Unicode group to which the character belongs. The Unicode groups characters into categories such as math symbols, currency symbols, and quotation marks. Look up the UnicodeCategory enumeration in the documentation for more information.

IsLetter, IsDigit, IsLetterOrDigit

These methods return a True/False value indicating whether their argument, which is a character, is a letter, decimal digit, or letter/digit, respectively. You can write an event handler by using the IsDigit method to accept numeric keystrokes and to reject letters and punctuation symbols.

IsLower, IsUpper

These methods return a True/False value indicating whether the specified character is lowercase or uppercase, respectively.

IsNumber

This method returns a True/False value indicating whether the specified character is a number. The IsNumber method takes into consideration hexadecimal digits (the characters 0123456789-ABCDEF) in the same way as the IsDigit method does for decimal numbers.

IsPunctuation, IsSymbol, IsControl

These methods return a True/False value indicating whether the specified character is a punctuation mark, symbol, or control character, respectively. The Backspace and Esc keys, for example, are ISO (International Organization for Standardization) control characters.

IsSeparator

This method returns a True/False value indicating whether the character is categorized as a separator (space, new-line character, and so on).

IsWhiteSpace

This method returns a True/False value indicating whether the specified character is white space. Any sequence of spaces, tabs, line feeds, and form feeds is considered white space. Use this method along with the IsPunctuation method to remove all characters in a string that are not words.

ToLower, ToUpper

These methods convert their argument to a lowercase or uppercase character, respectively, and return it as another character.

ToString

This method converts a character to a string. It returns a single-character string, which you can use with other string-manipulation methods or functions.

The String Class

The String class implements the String data type, which is one of the richest data types in terms of the members it exposes. We have used strings extensively in earlier chapters, but this is a formal discussion of the String data type and all of the functionality it exposes.

To create a new instance of the String class, you simply declare a variable of the String type. You can also initialize it by assigning to the corresponding variable a text value:

```
Dim title As String = "Visual Basic 2008 Tutorial"
```

The Replace method, like all other methods of the String class, doesn't operate directly on the string to which it's applied. Instead, it creates a new string and returns it as a new string. You can also use Visual Basic's string-manipulation functions to work with strings. For example, you can replace the string VB with Visual Basic by using the following statement:

```
newTitle = Replace(title, "VB", "Visual Basic")
```

Like the methods of the String class, the string-manipulation functions don't act on the original string; they return a new string.

Properties

The String class exposes only two properties, the Length and Chars properties, which return a string's length and its characters, respectively. Both properties are read-only.

Length

The Length property returns the number of characters in the string and is read-only. To find out the number of characters in a string variable, use the following statement:

```
chars = myString.Length
```

Chars

The Chars property is an array of characters that holds all the characters in the string.

Methods

All the functionality of the String class is available through methods, which are described next. They are all shared methods: They act on a string and return a new string with the modified value.

Compare

This method compares two strings and returns a negative value if the first string is less than the second, a positive value if the second string is less than the first, and zero if the two strings are equal. Of course, the simplest method of comparing two strings is to use the comparison operators, as shown here:

```
If name1 < name 2 Then
' name1 is alphabetically smaller than name 2
Else If name 1 > name 2 Then
' name2 is alphabetically smaller than name 1
Else
' name1 is the same as name2
End If
```

CompareOrdinal

The CompareOrdinal method compares two strings similar to the Compare method, but it doesn't take into consideration the current locale. This method returns zero if the two strings are the same, and a positive or negative value if they're different. These values, however, are not 1 and −1; they represent the numeric difference between the Unicode values of the first two characters that are different in the two strings.

Concat

This method concatenates two or more strings (places them one after the other) and forms a new string. The simpler form of the Concat method has the following syntax and it is equivalent to the & operator:

```
newString = String.Concat(string1, string2)
```

This statement is equivalent to the following:

```
newString = string1 & string2
```

Copy

The Copy method copies the value of one string variable to another. Notice that the value to be copied must be passed to the method as an argument. The Copy method doesn't apply to the current instance of the String class. Most programmers will use the assignment operator and will never bother with the Copy method.

EndsWith, StartsWith

These two methods return True if their argument ends or starts with a user-supplied substring. The syntax of these methods is as follows:

```
found = str.EndsWith(string)
found = str.StartsWith(string)
```

These two methods are equivalent to the Left() and Right() functions, which extract a given number of characters from the left or right end of the string, respectively.

IndexOf, LastIndexOf

These two methods locate a substring in a larger string. The IndexOf method starts searching from the beginning of the string, and the LastIndexOf method starts searching from the end of the string. Both methods return an integer, which is the order of the substring's first character in the larger string (the order of the first character is zero).

To locate a string within a larger one, use the following forms of the IndexOf method:

```
pos = str.IndexOf(searchString)
pos = str.IndexOf(SearchString, startIndex)
pos = str.IndexOf(SearchString, startIndex, endIndex)
```

The startIndex and the endIndex arguments delimit the section of the string where the search will take place, and pos is an integer variable.
The last three overloaded forms of the IndexOf method search for an array of characters in the string:

```
str.IndexOf(Char())
str.IndexOf(Char(), startIndex)
str.IndexOf(Char(), startIndex, endIndex)
```

IndexOfAny

This is an interesting method that accepts as an argument an array of arguments and returns the first occurrence of any of the array's characters in the string. The syntax of the IndexOfAny method is

```
Dim pos As Integer = str.IndexOfAny(chars)
```

where chars is an array of characters.

This method attempts to locate the first instance of any member of the chars array in the string. If the character is found, its index is returned. If not, the process is repeated with the second character, and so on until an instance is found or the array has been exhausted.

Insert

The Insert method inserts one or more characters at a specified location in a string and returns the new string. The syntax of the Insert method is as follows:

```
newString = str.Insert(startIndex, subString)
```

startIndex is the position in the str variable, where the string specified by the second argument will be inserted.

Join

This method joins two or more strings and returns a single string with a separator between the original strings. Its syntax is the following, where separator is the string that will be used as the separator, and strings is an array with the strings to be joined:

```
newString = String.Join(separator, strings)
```

Split

Just as you can join strings, you can split a long string into smaller ones by using the Split method, whose syntax is the following, where delimiters is an array of characters and str is the string to be split:

```
strings() = String.Split(delimiters, str)
```

The string is split into sections that are separated by any one of the delimiters specified with the first argument. These strings are returned as an array of strings.

Splitting Strings with Multiple Separators

The delimiters array allows you to specify multiple delimiters, which makes it a great tool for isolating words in a text. You can specify all the characters that separate words in text (spaces, tabs, periods, exclamation marks, and so on) as delimiters and pass them along with the text to be parsed to the Split method.

The statements in Listing 9.3 isolate the parts of a path, which are delimited by a backslash character.

Listing 9.3: Extracting a Path's Components

```
Dim path As String = "c:\My Documents\Business\Expenses"
Dim delimiters() As Char = {"\"c}
Dim parts() As String
parts = path.Split(delimiters)
Dim iPart As IEnumerator
iPart = parts.GetEnumerator
While iPart.MoveNext
Debug.WriteLine(iPart.Current.tostring)
End While
```

Remove

The Remove method removes a given number of characters from a string, starting at a specific location, and returns the result as a new string. Its syntax is the following, where startIndex is the index of the first character to be removed in the str string variable and count is the number of characters to be removed:

```
newSrting = str.Remove(startIndex, count)
```

Replace

This method replaces all instances of a specified character (or substring) in a string with a new one. It creates a new instance of the string, replaces the characters as specified by its arguments, and returns this string. The syntax of this method is

```
newString = str.Replace(oldChar, newChar)
```

where oldChar is the character in the str variable to be replaced, and newChar is the character to replace the occurrences of oldChar.

You can change the last statement to replace tabs with a specific number of spaces — usually three, four, or five spaces.

```
Dim txt, newTxt As String
Dim vbTab As String = vbCrLf
txt = "some text with two tabs"
newTxt = txt.Replace(vbTab, " ")
```

PadLeft, PadRight

These two methods align the string left or right in a specified field and return a fixed-length string with spaces to the right (for right-padded strings) or to the left (for left-padded strings). After the execution of these statements

```
Dim LPString, RPString As String
RPString = "[" & "Learning VB".PadRight(20) & "]"
LPString = "[" & "Learning VB".PadLeft(20) & "]"
```

the values of the LPString and RPString variables are as follows:

```
[Mastering VB         ]
[         Mastering VB]
```

There are eight spaces to the left of the left-padded string and eight spaces to the right of the right-padded string.

The StringBulider Class

The StringBuilder class stores dynamic strings and exposes methods to manipulate them much faster than the String class. As you will see, the StringBuilder class is extremely fast, but it uses considerably more memory than the string it holds. To use the StringBuilder class in an application, you must import the System.Text namespace (unless you want to fully qualify each instance of the StringBuilder class in your code). Assuming that you have imported the System.Text class in your code module, you can create a new instance of the class via the following statement:

```
Dim txt As New StringBuilder
```

To create a new instance of the StringBuilder class, you can call its constructor without any arguments, or pass the initial string as an argument:

```
Dim txt As New StringBuilder("some string")
```

Properties

You have already seen the two basic properties of the StringBuilder class: the Capacity and MaxCapacity properties. In addition, the StringBuilder class provides the Length and Chars properties, which are the same as the corresponding properties of the String class. The Length property returns the number of characters in the current instance of the StringBuilder class, and the Chars property is an array of characters. Unlike the Chars property of the String class, this one is read/write.

Methods

Many of the methods of the StringBuilder class are equivalent to the methods of the String class, but they act directly on the string to which they're applied, and they don't return a new string.

Append

The Append method appends a base type to the current instance of the StringBuilder class, and its syntax is the following, where the value argument can be a single character, a string, a date, or any numeric value:

```
SB.Append(value)
```

When you append numeric values to a StringBuilder, they're converted to strings; the value appended is the string returned by the type's ToString method. You can also

append an object to the StringBuilder — the actual string that will be appended is the value of the object's ToString property.

AppendFormat

The AppendFormat method is similar to the Append method. Before appending the string, however, AppendFormat formats it. The string to be appended contains format specifications and the appropriate values. The syntax of the AppendFormat method is as follows:

SB.AppendFormat(string, values)

The first argument is a string with embedded format specifications, and values is an array with values (objects, in general

Insert

This method inserts a string into the current instance of the StringBuilder class, and its syntax is as follows:

SB.Insert(index, value)

The index argument is the location where the new string will be inserted in the current instance of the StringBuilder, and value is the string to be inserted.

Remove

This method removes a number of characters from the current StringBuilder, starting at a specified location; its syntax is the following, where startIndex is the position of the first character to be removed from the string, and count is the number of characters to be removed:

SB.Remove(startIndex, count)

Replace

This method replaces all instances of a string in the current StringBuilder object with another string. The syntax of the Replace method is the following, where the two arguments can be either strings or characters:

SB.Replace(oldValue, newValue)

Unlike the String class, the replacement takes place in the current instance of the StringBuilder class and the method doesn't return another string.

ToString

Use this method to convert the StringBuilder instance to a string and assign it to a String variable. The ToString method returns the string represented by the