MBA (General Management) **2018-2019**

Semester – II

18MBAP206 **RESEARCH METHODOLOGY FOR MANAGEMENT** **4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **40** External: **60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives:

- To understand the research concepts.
- To help students to understand the process of research and research techniques which help them to do their research project efficiently.

Course Outcomes (Cos):

1. Students will be able to design and conduct an in-depth interview study, an oral history interview study, a focus group study, ethnography, a qualitative content analysis study, a qualitative case study, and a mixed-method study.
2. Students will be able to code and interpret qualitative data.
3. Students will be able to write a qualitative methods and findings section, as for a qualitative research article.
4. Students will be able to connect what they are learning in the sociology program and/or classes with educational and career options.

Unit - I

Introduction to Research: Meaning of research; Types of research- Exploratory research, Conclusive research; The process of research; Research applications in social and business sciences; Features of a Good research study. Defining the Research problem; Management Decision Problem vs Management Research Problem; Problem identification process; Components of the research problem; Formulating the research hypothesis- Types of Research hypothesis; Writing a research proposal- Contents of a research proposal and types of research proposals.

Unit - II

Research Design: Meaning of Research Designs; Nature and Classification of Research Designs; Exploratory Research Designs: Secondary Resource analysis, Case study Method, Expert opinion survey, Focus group discussions; Descriptive Research Designs: Cross-sectional studies and Longitudinal studies; Experimental Designs, Errors affecting Research Design.

Sampling: Sampling concepts- Sample vs Census, Sampling vs Non Sampling error; Sampling Design- Probability and Non Probability Sampling design; Determination of Sample size- Sample size for estimating population mean, Determination of sample size for estimating the population proportion.

Unit - III

Primary and Secondary Data: Classification of Data; Secondary Data: Uses, Advantages, Disadvantages, Types and sources; Primary Data Collection: Observation method, Focus Group Discussion, Personal Interview method. Attitude Measurement and Scaling: Types of Measurement Scales; Attitude; Classification of Scales: Single item vs Multiple Item scale, Comparative vs Non-Comparative scales, Measurement Error, Criteria for Good Measurement. Questionnaire Design: Questionnaire method; Types of Questionnaires; Process of Questionnaire Designing; Advantages and Disadvantages of Questionnaire Method. Data Processing: Data Editing- Field Editing, Centralized in house editing; Coding- Coding Closed ended structured Questions, Coding open ended structured Questions; Classification and Tabulation of Data.

Unit - IV

Univariate and Bivariate Analysis of Data: Descriptive vs Inferential Analysis, Descriptive Analysis of Univariate data- Analysis of Nominal scale data with only one possible response, Analysis of Nominal scale data with multiple category responses, Analysis of Ordinal Scaled Questions, Measures of Central Tendency, Measures of Dispersion; Descriptive Analysis of Bivariate data. Testing of Hypotheses: Concepts in Testing of Hypothesis – Steps in testing of hypothesis, Test Statistic for testing hypothesis about population mean; Tests concerning Means- the case of single population; Tests for Difference between two population means; Tests concerning population proportion- the case of single population; Tests for difference between two population proportions. Chi-square Analysis: Chi square test for the Goodness of Fit; Chi square test for the independence of variables; Chi square test for the equality of

more than two population proportions. Analysis of Variance: Completely randomized design in a one-way ANOVA; Randomized block design in two way ANOVA; Factorial design. Multivariate Analysis : Factor Analysis, Discriminate analysis, Cluster analysis

Unit - V

Research Report Writing: Types of research reports – Brief reports and Detailed reports; Report writing: Structure of the research report- Preliminary section, Main report, Interpretations of Results and Suggested Recommendations; Report writing: Formulation rules for writing the report: Guidelines for presenting tabular data, Guidelines for visual Representations. Ethics in Research: Meaning of Research Ethics; Clients Ethical code; Researchers Ethical code; Ethical Codes related to respondents; Responsibility of ethics in research

Note: Case study (20 Marks) and Theory 80 Marks

Chapter 4 – Theory will be covered here and practically applied using SPSS Practical

Suggested Readings:

Text Books:

1. Paneerselvam, R. (2014).*Research Methodology*. New Delhi: Prentice Hall of India Pvt Ltd.
2. Kothari, C.R. (2008). *Research Methodology: Methods and Techniques.* New Delhi: New Age International Pvt Ltd.
3. Deepak Chawala and Neena Sondhi. (2011). *Research Methodology Concepts and Cases.* New Delhi: Vikas Publishing House Pvt Ltd.

References:

1. Donald R. Cooper and Pamela S. Schindler. (2010). *Business Research Methods* (12th edition). Tata McGraw Hill.
2. Bill Taylor. (2007).*Research Methodology: A Guide for Researchers in Management and Social Science.* New Delhi: Prentice Hall of India Pvt Ltd.
3. William Zikmund. (2013). *Business Research Methods*. Mason: South Western Publishers.
4. Uma Sekaran. (2010). *Research Methods for Business*. New Delhi: Wiley India.

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Coimbatore – 641 021.

LECTURE PLAN
DEPARTMENT OF MANAGEMENT

STAFF NAME : Dr.M.S.SIBI
SUBJECT NAME: RESEARCH METHODOLOGY FOR MANAGEMENT
SUB.CODE: 18MBAP206
SEMESTER : II **CLASS: I MBA**

Sl No.	Lecture Duration (Hour)	Topics to be Covered	Support Materials
		UNIT-1	
1	1	Introduction to Research: Meaning of research; Types of research- Exploratory research, Conclusive research	T2: pp.1-4 W1
2	1	The process of research; Research applications in social and business sciences; Features of a Good research study.	T2: pp.10-20
3	1	Defining the Research problem; Management Decision Problem vs Management Research Problem	T2: pp.24-26 W1
4	1	Problem identification process; Components of the research problem	T2: pp.24-26 W1
5	1	the research hypothesis- Types of Research hypothesis	T2: 184-185
6	1	Writing a research proposal	R4: pp.339 W2
7	1	Contents of a research proposal and types of research proposals	W1 W2
8	1	Recapitulation and Important Questions Discussion	
Total No .of Hours for Unit I			**8Hours**
		UNIT-II	
1	1	Research Design: Meaning of Research Designs; Nature and Classification of Research Designs; Exploratory Research Designs	T2: pp.10-19 R1:pp.28-31
2	1	Secondary Resource analysis, Case study Method, Expert opinion survey	T2: pp.111-113

3	1	Focus group discussions; Descriptive Research Designs	W3 T2: pp.35-39
4	1	Cross-sectional studies and Longitudinal studies	T2: pp. 6-8
5	1	Experimental Designs, Errors affecting Research Design. Sampling: Sampling concepts- Sample vs Census, Sampling vs Non Sampling error	R2: pp. 121-142 T2:pp.55-67
6	1	Sampling Design- Probability and Non Probability Sampling design	T2:pp.55-67
7	1	Determination of Sample size- Sample size for estimating population mean	T2:pp.174-175
8	1	Determination of sample size for estimating the population proportion	T2:pp.174-175
9	1	Recapitulation and Important Questions Discussion	
Total No .of Hours for Unit II			**9Hours**
UNIT-III			
1	1	Primary and Secondary Data: Classification of Data; Secondary Data: Uses, Advantages, Disadvantages	T2:pp.95-106
2	1	Types and sources; Primary Data Collection: Observation method, Focus Group Discussion, Personal Interview method	T2:pp.95-106
3	1	Attitude Measurement and Scaling: Types of Measurement Scales; Attitude; Classification of Scales	T2: pp.69-82
4	1	Single item vs Multiple Item scale, Comparative vs Non-Comparative scales, Measurement Error	T2: pp.69-82
5	1	Criteria for Good Measurement. Questionnaire Design: Questionnaire method	T2: pp.69-82 T2: pp.100-104
6	1	Types of Questionnaires; Process of Questionnaire Designing; Advantages and Disadvantages of Questionnaire Method	T2:pp.95-106
7	1	Data Processing: Data Editing- Field Editing, Centralized in house editing	T2:pp.122-123
8	1	Coding- Coding Closed ended structured Questions, Coding open ended structured Questions; Classification and Tabulation of Data	T2:pp.266 T2:pp.18-19 W3
9	1	Recapitulation and Important Questions Discussion	
Total No .of Hours for Unit III			**9 Hours**
UNIT-1V			
1	1	Univariate and Bivariate Analysis of Data: Descriptive vs Inferential Analysis, Descriptive Analysis of Univariate data	R4:pp.393-425
2	1	Analysis of Nominal scale data with only one possible response, Analysis of Nominal scale data with multiple category responses	T3:pp.112-115 R4:pp.393-425

3	1	Analysis of Ordinal Scaled Questions, Measures of Central Tendency, Measures of Dispersion	R4:pp.393-425
4	1	Descriptive Analysis of Bivariate data. Testing of Hypotheses: Concepts in Testing of Hypothesis – Steps in testing of hypothesis, Test Statistic for testing hypothesis about population mean	R4:pp.393-425
5	1	Tests concerning Means- the case of single population; Tests for Difference between two population means; Tests concerning population proportion- the case of single population	R4:pp.393-425
6	1	Tests for difference between two population proportions. Chi-square Analysis: Chi square test for the Goodness of Fit; Chi square test for the independence of variables; Chi square test for the equality of more than two population proportions	R4:pp.393-425 T2:pp.256-264
7	1	Analysis of Variance: Completely randomized design in a one-way ANOVA; Randomized block design in two way ANOVA	T2:pp.256-264
8	1	Factorial design. Multivariate Analysis : Factor Analysis, Discriminate analysis, Cluster analysis	T2:pp.298-300
9	1	Recapitulation and Important Questions Discussion	
Total No .of Hours for Unit IV			**8 Hours**
UNIT-V			
1	1	Research Report Writing: Types of research reports – Brief reports and Detailed reports; Report writing	R4: pp. 338-355
2	1	Structure of the research report- Preliminary section, Main report, Interpretations of Results and Suggested Recommendations; Report writing: Formulation rules for writing the report	R4: pp. 338-355 336-339
3	1	Guidelines for presenting tabular data, Guidelines for visual Representations. Ethics in Research	R4: pp.17,55 W3
4	1	Meaning of Research Ethics; Clients Ethical code; Researchers Ethical code	R4: pp. 338-355
5	1	Ethical Codes related to respondents; Responsibility of ethics in research	R4: pp.17 W4
6	1	Recapitulation and Important Questions Discussion	
7	1	Discussion on Previous ESE Question Paper	
8	1	Discussion on Previous ESE Question Paper	
9	1	Discussion on Previous ESE Question Paper	
Total No .of Hours for Unit V			**9 Hours**
Total No. of Hours			**44 Hours**

REFERENCES

Text Books:

1. Paneerselvam, R. (2014).*Research Methodology*. New Delhi: Prentice Hall of India Pvt Ltd.
2. Kothari, C.R. (2008). *Research Methodology: Methods and Techniques.* New Delhi: New Age International Pvt Ltd.
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1. Donald R. Cooper and Pamela S. Schindler. (2010). *Business Research Methods* (12th edition). Tata McGraw Hill.
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3. William Zikmund. (2013). *Business Research Methods*. Mason: South Western Publishers.
4. Uma Sekaran. (2010). *Research Methods for Business*. New Delhi: Wiley India.

Websites Reference

1. W1:https://research-methodology.net/research-methodology/research-types/
2. W2:http://www.nhcc.edu/student-resources/library/doinglibraryresearch/basic
3. W3:http://www.statstutor.ac.uk/resources/uploaded/13samplingtechniques.pdf
4. W4:https://xisspm.files.wordpress.com/2011/02/scaling.pdf

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INTRODUCTION TO RESEARCH

UNIT-I

Introduction to Research: Meaning of research; Types of research- Exploratory research, Conclusive research; The process of research; Research applications in social and business sciences; Features of a Good research study. Defining the Research problem; Management Decision Problem vs Management Research Problem; Problem identification process; Components of the research problem; Formulating the research hypothesis- Types of Research hypothesis; Writing a research proposal- Contents of a research proposal and types of research proposals.

MEANING OF RESEARCH

Research is an endeavour to discover, develop and verify knowledge. It is an intellectual act that begins with the asking of questions and progressiveness through the critical examination of evidence that is both relevant and reliable to the revelation of truth. Research can be defined as the search for knowledge, or as any systematic investigation, with an open mind, to establish novel facts, solve new or existing problems, prove new ideas, or develop new theories, usually using a scientific method. The primary purpose of research is discovering, interpreting, and the development of methods and systems for the advancement of human knowledge on a wide variety of scientific matters of our world and the universe.

DEFINITIONS OF RESEARCH

Webster's New International Dictionary: "Research is careful critical enquiry or examination in seeking facts or principles, diligent investigation in order to ascertain something.

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John W. Best: Research may be defined as the systematic and objective analysis and recording to controlled observations that may lead to the development of generalization, principles of theories resulting in prediction and possible ultimate control of events

Robert Ross: Research is essentially an investigation, a recording and an analysis of evidence too the purpose of gaining knowledge

Clifford Woody: Research comprises of defining and redefining problems, formulating hypothesis or suggested solutions, collecting, organizing and evaluating data making deduction and reaching conclusion and at last carefully testing conclusions to determine whether they fit in formulating hypothesis.

John Dewey: Research is considered to be the formal, systematic, intensive process of carrying on the scientific method of analysis. It involves a more systematic structure of investigation, usually in some sort of formal record of procedures and a report of result or conclusions.

Fred Kerlinger: Research is an organized enquiry designed and carried out to provide information for solving a problem.

Redman and Mory: Systematized effort to gain new knowledge

PURPOSE OF RESEARCH

The purpose of research is to discover answers to questions through the application of scientific procedures. The main aim of research is to find out the truth which is hidden and which has not been discovered as yet.

1. To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as *exploratory* or *formulative* research studies);
2. To portray accurately the characteristics of a particular individual, situation or a group (studies with this object in view are known as *descriptive* research studies);
3. To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as

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diagnostic research studies);

4. To test a hypothesis of a causal relationship between variables (such studies are known as *hypothesis-testing* research studies).

TYPES OF RESEARCH

1) Descriptive Research

A descriptive study may be simple or complex. It determines who, what, where and how of a topic. It is concerned with describing the characteristics (e.g., the extent to which libraries are used) estimating the proportion of the people in a specified population who hold certain views or attitudes (e.g., how many favour the abolition of capital punishment?) predicting specifically (e.g., how may will cash their government bonds during a given period?) and discovering or testing whether certain variables are associated (e.g., people who spend a good deal of time for reading, go to movies often with each other)

Descriptive study may employ any of or all the methods of data collection such as interview, questionnaire, observation, tests and cumulative record cards. In the descriptive study the researcher must be careful to make a note of the bias and extravagance that may creep in at every stage of the study – formulating the objectives of the study; designing the methods of data collection; selecting the sample; collecting, processing and analyzing the data; and reporting the findings.

1) Analytical Research

Analytical study makes use of available information by analyzing and doing critical evaluation. Analytical study makes use of higher level statistical tools which are not commonly used.

2) Applied Research

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Applied research aims at finding a solution for an immediate problem faced by any business organization. This research deals with real life situations. Example: "Why have sales decreased during the last quarter"? Market research is an example of applied research. Applied research has a practical problem-solving emphasis. It brings out many new facts.

Examples:

1. Use of fibre glass body for cars instead of metal.
2. To develop a new market for the product.

3) Fundamental Research

This is otherwise known as basic research or fundamental research. Gathering knowledge for knowledge's sake is known as fundamental research. It does not have any commercial potential. It is not connected to any practical problem. e.g. Theory of Relativity. It is only for the enrichment of the knowledge.

4) Quantitative Research

Quantitative researches are based on the measurements of quantity or amounts. It means that these type of researches deals with items which are expressed in numbers.

5) Qualitative Research

Qualitative researches deals with the qualitative phenomena. i.e. anything which cannot be expressed in numerical terms. Motivation research is an example of qualitative research.

6) Conceptual Research

Conceptual research is that related to some abstract idea(s) or theory. It is generally used by philosophers and thinkers to develop new concepts or to reinterpret existing ones.

7) Empirical Research

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Empirical research relies on experience or observation alone, often without due regard for system and theory. It is data-based research, coming up with conclusions which are capable of being verified by observation or experiment. We can also call it as experimental type of research. In such a research it is necessary to get at facts firsthand, at their source, and actively to go about doing certain things to stimulate the production of desired information. In such a research, the researcher must first provide himself with a working hypothesis or guess as to the probable results. He then works to get enough facts (data) to prove or disprove his hypothesis. He then sets up experimental designs which he thinks will manipulate the persons or the materials concerned so as to bring forth the desired information. Such research is thus characterized by the experimenter's control over the variables under study and his deliberate manipulation of one of them to study its effects. Empirical research is appropriate when proof is sought that certain variables affect other variables in some way. Evidence gathered through experiments or empirical studies is today considered to be the most powerful support possible for a given hypothesis.

8) One-time research or Longitudinal Research

In the former case the research is confined to a single time-period, whereas in the latter case the research is carried on over several time-periods.

2) Field Method

Field study is a scientific enquiry aimed at discovering the relations and interactions among sociological, physiological and educational variables in real social structures and life situations like communities, schools, factories, organizations and institutions. Hence, it is called field study.

3) Exploratory Research

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Explanatory research is carried, when the reason for a problem is not clear. In exploratory research, all possible reasons which are very obvious are eliminated, thereby directing the research to proceed further with limited options.

Example for Exploratory Research

Sales decline in a company may be due to:

- Inefficient service
- Improper price
- Inefficient sales force
- Ineffective promotion
- Improper quality

4) Formalized Research

Formalized research studies are those with substantial structure and with specific hypotheses to be tested.

5) Historical Research

This research is the induction of principles through research into the past and social forces which have shaped the present. Its aim is to apply reflective thinking to unsolved social problems by discovering past trends of events, facts and attitudes, and by tracing lines of development in human thought and action.

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6) Decision Oriented Research

Decision-oriented research is always for the need of a decision maker and the researcher in this case is not free to embark upon research according to his own inclination.

1) Individual and Group Research

The research undertaken by an individual is called individual research. The bulk of research activities in universities, and colleges are made by the individual. The individual research is done on the basis of one's own judgement, interest and capacity.

Group research is undertaken by several researchers. Their activities are coordinated by a director, Research conducted by a firm, trade association and government agency is performed by a team of researchers under a project director. Research in colleges and universities financed by grants is done on a group basis.

2) Operations Research

This method of research has been done for solving problems by using scientific methods and quantitative techniques. While the researchers care to study the development of methods, the industrial operations researcher evinces interest in the applications of methods to solve the pressing or critical problems of their firm.

Research can also be classified as conclusion-oriented and decision-oriented. While doing conclusion-oriented research a researcher is free to pick up a problem, redesign the enquiry and is free to conceptualize as he wishes. Decision-oriented research always implies taking a rational decision. Operational research is an example of decision-oriented research.

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SIGNIFICANCE OF RESEARCH

"All progress is born of inquiry. Doubt is often better than overconfidence, for it leads to inquiry, and inquiry leads to invention" is a famous Hudson Maxim in context of which the significance of research can well be understood. Increased amounts of research make progress possible. Research inculcates scientific and inductive thinking and it promotes the development of logical habits of thinking and organisation.

The role of research in several fields of applied economics, whether related to business or to the economy as a whole, has greatly increased in modern times. Theincreasingly complex nature of business and government has focused attention on the use of research in solving operational problems. Research, as an aid to economic policy, has gained added importance, both for government and business.

1) Research provides the basis for nearly all Government Policies in our Economic System

For instance, government's budgets rest in part on an analysis of the needs and desires of the people and on the availability of revenues to meet these needs. The cost of needs has to be equated to probable revenues and this is a field where research is most needed. Through research we can devise alternative policies and can as well examine the consequences of each of these alternatives. Decision-making may not be a part of research, but research certainly facilitates the decisions of the policy maker. Government has also to chalk out programmes for dealing with all facets of the country's existence and most of these will be related directly or indirectly to economic conditions. The plight of cultivators, the problems of big

and small business and industry, working conditions, trade union activities, the problems of distribution, even the size and nature of defense services are matters requiring research. Thus, research is considered necessary with regard to the allocation of nation's resources. Another area in government, where research is necessary, is collecting information on the economic and social structure of the nation. Such information indicates what is happening in the economy and what changes are taking place. Collecting such statistical information is by no means a routine task, but it involves a variety of research problems. These days nearly all governments maintain large staff of research technicians or experts to carry on this work. Thus, in the context of government, research as a tool to economic policy has three distinct phases of operation, viz., (i) investigation of economic structure through continual compilation of facts; (ii) diagnosis of events that are taking place and the analysis of the forces underlying them; and (iii) the prognosis, i.e., the prediction of future developments.

2) Research has its Special Significance in Solving various Operational and Planning Problems of Business and Industry

Operations research and market research, along with motivational research, are considered crucial and their results assist, in more than one way, in taking businessdecisions. Market research is the investigation of the structure and development of a market for the purpose of formulating efficient policies for purchasing, production and sales. Operations research refers to the application of mathematical, logical and analytical techniques to the solution of business problems of cost minimization or of profit maximization or what can be termed as optimization problems. Motivational research of determining why people behave as they do is mainly concerned with market characteristics. In other words, it is concerned with the determination of motivations underlying the consumer (market) behaviour. All these are of great help to people in business and industry who are responsible for taking

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business decisions. Research with regard to demand and market factors has great utility in business. Given knowledge of future demand, it is generally not difficult for a firm, or for an industry to adjust its supply schedule within the limits of its projected capacity. Market analysis has become an integral tool of business policy these days. Business budgeting, which ultimately results in a projected profit and loss account, is based mainly on sales estimates which in turn depend on business research. Once sales forecasting is done, efficient production and investment programmes can be set up around which are grouped the purchasing and financing plans. Research, thus, replaces intuitive business decisions by more logical and scientific decisions.

3) Research is equally important for social scientists in studying social relationships and in seeking answers to various social problems.

It provides the intellectual satisfaction of knowing a few things just for the sake of knowledge and also has practical utility for the social scientist to know for the sake of being able to do something better or in a more efficient manner. Research in social sciences is concerned both with knowledge for its own sake and with knowledge for what it can contribute to practical concerns. "This double emphasis is perhaps especially appropriate in the case of social science. On the one hand, its responsibility as a science is to develop a body of principles that make possible the understanding and prediction of the whole range of human interactions. On the other hand, because of its social orientation, it is increasingly being looked to for practical guidance In addition to what has been stated above, the significance of research can also be understood keeping in view the following points:

a) To those students who are to write a master's or Ph.D. thesis, research may mean careerism or a way to attain a high position in the social structure;
b) To professionals in research methodology, research may mean a source of livelihood;

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c) To philosophers and thinkers, research may mean the outlet for new ideas and insights;
d) To literary men and women, research may mean the development of new styles and creative work;
e) To analysts and intellectuals, research may mean the generalizations of new theories.

Thus, research is the fountain of knowledge for the sake of knowledge and an important source of providing guidelines for solving different business, governmental and social problems. It is a sort of formal training which enables one to understand the new developments in one's field in a better way.

QUALITIES OF GOOD RESEARCH

1) Good research is Systematic

It means that research is structured with specified steps to be taken in a specified sequence in accordance with the well defined set of rules. Systematic characteristic of the research does not rule out creative thinking but it certainly does reject the use of guessing and intuition in arriving at conclusions.

2) Good research is Logical

This implies that research is guided by the rules of logical reasoning and the logical process of induction and deduction are of great value in carrying out research. Induction is the process of reasoning from a part to the whole whereas deduction is the process of reasoning from some premise to a conclusion which follows from that very premise.

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3) Good research is Empirical

It implies that research is related basically to one or more aspects of a real situation and deals with concrete data that provides a basis for external validity to research results.

1) Good research is Replicable

This characteristic allows research results to be verified by replicating the study and thereby building a sound basis for decisions.

QUALITIES OF A GOOD RESEARCHER

A) General Qualities

1) Scientific Attitude

The first essential Quality of a successful research worker is that he must possess a scientific (systematic) frame (structure) of mind. He must have the determination (willpower / strength of mind) and ability to get the naked (hidden) facts and not to be influenced by one's own wishes.

As human beings he has certain praises (admiration) and prejudices (bias). He has also certain precarceived notions (ideas) about the problems being researched. He should keep all these things with him.

2) Imagination and Insight

Researcher must possess high degree of imagination. He should be able to go deeper and deeper into the realm (area) of abstract social phenomena (fact / event) and visualize the intangible aspects (features) of the society

3) Perseverance

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Work of scientific research requires steady of mind. Researcher should not get easily discouraged. It is equally possible that he might subsequently feel that the choice of the problem was wrong. Inspite of all this he must have more courage to face the difficulties and work patiently and continuously over long periods

4) Quick Grasping Power

The researcher should possess the power to grasp the significance of things quickly

1) Clarity of Thinking

A good researcher should have clear idea about the terminology that he is going to use.

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B) Specific Qualities

1) Knowledge of the Subject

The researcher should be enough knowledge in his area of research. Such knowledge helps him in preparing questionnaire and schedule to get proper information. He can enter into face to face discussion and remove any doubts arising the minds of the people regarding the study

2) Knowledge of the technique of Research

Researcher should have basic idea on tools used in his research

3) Personal Taste in the Study

A personal taste in the study will inspire him and keep his morale (confidence) in times of difficulties. A forced work is often monotonous and very tiresome

4) Familiarity about the Information

The researcher should be familiar with the people whom he is studying. Familiarity will help him to get intimate (close) information

5) Unbiased Attitude

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The researcher should have no preconceptions (idea / bias) about the subject under study. He should go to his research with absolutely a clean state. He should maintain an open mind and look for data which would substantiate (validate / verify) and give his theory a new meaning

STEPS IN RESEARCH PROCESS

Research process consists of series of actions or steps necessary to effectively carry out research and the desired sequencing of these steps.

1. Formulating the Research Problem;
2. Extensive literature survey;
3. Developing the Hypothesis;
4. Preparing the Research Design;
5. Determining Sample Design;
6. Collecting the Data;
7. Execution of the Project;
8. Analysis of Data;
9. Hypothesis testing;
10. Generalizations and Interpretation, and
11. Preparation of the Report or Presentation of the Results

1) Formulating the Research Problem

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There are two types of research problems, viz., those which relate to states of nature and those which relate to relationships between variables. At the very outset the researcher must single out the problem he wants to study, i.e., he must decide the general area of interest or aspect of a subject-matter that he would like to inquire into. Initially the problem may be stated in a broad general way and then the ambiguities, if any, relating to the problem be resolved. Then, the feasibility of a particular solution has to be considered before a working formulation of the problem can be set up. The formulation of a general topic into a specific research problem, thus, constitutes the first step in a scientific enquiry. Essentially two steps are involved in formulating the research problem, viz., understanding the problem thoroughly, and rephrasing the same into meaningful terms from an analytical point of view.

The best way of understanding the problem is to discuss it with one's own colleagues or with those having some expertise in the matter. In an academic institution the researcher can seek the help from a guide who is usually an experienced man and has several research problems in mind. Often, the guide puts forth the problem in general terms and it is up to the researcher to narrow it down and phrase the problem in operational terms. In private business units or in governmental organisations, the problem is usually earmarked by the administrative agencies with whom the researcher candiscuss as to how the problem originally came about and what considerations are involved in its possible solutions.

The researcher must at the same time examine all available literature to get himself acquainted with the selected problem. He may review two types of literature the conceptual literature concerning the concepts and theories, and the empirical literature consisting of

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studies made earlier which are similar to the one proposed. The basic outcome of this review will be the knowledge as to what data and other materials are available for operational purposes which will enable the researcher to specify his own research problem in a meaningful context. After this the researcher rephrases the problem into analytical or operational terms i.e., to put the problem in as specific terms as possible. This task of formulating, or defining, a research problem is a step of greatest importance in the entire research process. The problem to be investigated must be defined unambiguously for that will help discriminating relevant data from irrelevant ones. Care must, however, be taken to verify the objectivity and validity of the background facts concerning the problem. Professor W.A. Neiswanger correctly states that the statement of the objective is of basic importance because it determines the data which are to be collected, the characteristics of the data which are relevant, relations which are to be explored, the choice of techniques to be used in these explorations and the form of the final report. If there are certain pertinent terms, the same should be clearly defined along with the task of formulating the problem. In fact, formulation of the problem often follows a sequential pattern where a number of formulations are set up, each formulation more specific than the preceding one, each one phrased in more analytical terms, and each more realistic in terms of the available data and resources.

1) Extensive Literature Survey

Once the problem is formulated, a brief summary of it should be written down. It is compulsory for a research worker writing a thesis for a Ph.D. degree to write a synopsis of the topic and submit it to the necessary Committee or the Research Board for approval. At this juncture the researcher should undertake extensive literature survey connected with the problem. For this purpose, the abstracting and indexing journals and published or unpublished bibliographies are the first place to go to. Academic journals,

conference proceedings, government reports, books etc., must be tapped depending on the nature of the problem. In this process, it should be remembered that one source will lead to another. The earlier studies, if any, which are similar to the study in hand should be carefully studied. A good library will be a great help to the researcher at this stage.

1) Developing the Hypothesis

After extensive literature survey, researcher should state in clear terms the working hypothesis or hypotheses. Working hypothesis is tentative assumption made in order to draw out and test its logical or empirical consequences. As such the manner in which research hypotheses are developed is particularly important since they provide the focal point for research. They also affect the manner in which tests must be conducted in the analysis of data and indirectly the quality of data which is required for the analysis. In most types of research, the development of working hypothesis plays an important role. Hypothesis should be very specific and limited to the piece of research in hand because it has to be tested. The role of the hypothesis is to guide the researcher by delimiting the area of research and to keep him on the right track. It sharpens his thinking and focuses attention on the more important facets of the problem. It also indicates the type of data required and the type of methods of data analysis to be used.

How does one go about developing working hypotheses? The answer is by using the following approach:

a) Discussions with colleagues and experts about the problem, its origin and the objectives in seeking a solution;
b) Examination of data and records, if available, concerning the problem for possible

trends, peculiarities and other clues;

c) Review of similar studies in the area or of the studies on similar problems; and

d) Exploratory personal investigation which involves original field interviews on a limited scale with interested parties and individuals with a view to secure greater insight into the practical aspects of the problem.

Thus, working hypotheses arise as a result of a-priori thinking about the subject, examination of the available data and material including related studies and the counsel of experts and interested parties. Working hypotheses are more useful when stated in precise and clearly defined terms. It may as well be remembered that occasionally we may encounter a problem where we do not need working hypotheses, specially in the case of exploratory or formulative researches which do not aim at testing the hypothesis. But as a general rule, specification of working hypotheses in another basic step of the research process in most research problems.

1) Preparing the Research Design

The research problem having been formulated in clear cut terms, the researcher will be required to prepare a research design, i.e., he will have to state the conceptual structure within which research would be conducted. The preparation of such a design facilitates research to be as efficient as possible yielding maximal information. In other words, the function of research design is to provide for the collection of relevant evidence with minimal expenditure of effort, time and money. But how all these can be achieved depends mainly on the research purpose. Research purposes may be grouped into four categories, viz., (i) Exploration, (ii) Description, (iii) Diagnosis, and (iv) Experimentation. A flexible research design which provides opportunity for considering many different aspects of a problem is considered appropriate if the purpose of the research study is that of exploration. But when the purpose happens to be an accurate description of a situation or of an association

between variables, the suitable design will be one that minimises bias and maximises the reliability of the data collected and analysed.

There are several research designs, such as, experimental and non-experimental hypothesis testing. Experimental designs can be either informal designs (such as before- and-after without control, after-only with control, before-and-after with control) or formal designs (such as completely randomized design, randomized block design, Latin square design, simple and complex factorial designs), out of which the researcher must select one for his own project.

The preparation of the research design, appropriate for a particular research problem, involves usually the consideration of the following:

a) The means of obtaining the information;

b) The availability and skills of the researcher and his staff (if any);

c) Explanation of the way in which selected means of obtaining information will be organized and the reasoning leading to the selection;

d) The time available for research; and

e) The cost factor relating to research, i.e., the finance available for the purpose.

2) Determining Sample Design

All the items under consideration in any field of inquiry constitute a 'universe' or 'population'. A complete enumeration of all the items in the 'population' is known as a census inquiry. It can be presumed that in such an inquiry when all the items are covered no

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element of chance is left and highest accuracy is obtained. But in practice this may not be true. Even the slightest element of bias in such an inquiry will get larger and larger as the number of observations increases. Moreover, there is no way of checking the element of bias or its extent except through a resurvey or use of sample checks. Besides, this type of inquiry involves a great deal of time, money and energy. Not only this, census inquiry is not possible in practice under many circumstances. For instance, blood testing is done only on sample basis. Hence, quite often we select only a few items from the universe for our study purposes. The items so selected constitute what is technically called a sample.

The researcher must decide the way of selecting a sample or what is popularly known as the sample design. In other words, a sample design is a definite plan determined before any data are actually collected for obtaining a sample from a given population. Thus, the plan to select 12 of a city's 200 drugstores in a certain way constitutes a sample design. Samples can be either probability samples or non-probability samples. With probability samples each element has a known probability of being included in the sample but the non-probability samples do not allow the researcher to determine this probability. Probability samples are those based on simple random sampling, systematic sampling, stratified sampling, cluster/area sampling whereas non- probability samples are those based on convenience sampling, judgement sampling and quota sampling techniques. A brief mention of the important sample designs is as follows:

a) **Deliberate Sampling**

Deliberate sampling is also known as purposive or non-probability sampling. This sampling method involves purposive or deliberate selection of particular units of the universe for constituting a sample which represents the universe. When population elements are selected

for inclusion in the sample based on the ease of access, it can be called convenience sampling. If a researcher wishes to secure data from, say, gasoline buyers, he may select a fixed number of petrol stations and may conduct interviews at these stations. This would be an example of convenience sample of gasoline buyers. At times such a procedure may give very biased results particularly when the population is not homogeneous. On the other hand, in judgement sampling the researcher's judgement is used for selecting items which he considers as representative of the population. For example, a judgement sample of college students might be taken to secure reactions to a new method of teaching. Judgement sampling is used quite frequently in qualitative research where the desire happens to be to develop hypotheses rather than to generalise to larger populations.

b) **Simple Random Sampling**

This type of sampling is also known as chance sampling or probability sampling where each and every item in the population has an equal chance of inclusion in the sample and each one of the possible samples, in case of finite universe, has the same probability of being selected. For example, if we have to select a sample of 300 items from a universe of 15,000 items, then we can put the names or numbers of all the 15,000 items on slips of paper and conduct a lottery. Using the random number tables is another method of random sampling. To select the sample, each item is assigned a number from 1 to 15,000. Then, 300 five digit random numbers are selected from the table. To do this we select some random starting point and then a systematic pattern is used in proceeding through the table. We might start in the 4th row, second column and proceed down the column to the bottom of the table and then move to the top of the next column to the right. When a number exceeds the limit of the numbers in the frame, in our case over 15,000, it is simply passed over and the next number selected that does fall within the

relevant range. Since the numbers were placed in the table in a completely random fashion, the resulting sample is random. This procedure gives each item an equal probability of being selected. In case of infinite population, the selection of each item in a random sample is controlled by the same probability and that successive selections are independent of one another.

a) **Systematic Sampling**

In some instances the most practical way of sampling is to select every 15th name on a list, every 10th house on one side of a street and so on. Sampling of this type is known as systematic sampling. An element of randomness is usually introduced into this kind of sampling by using random numbers to pick up the unit with which to start. This procedure is useful when sampling frame is available in the form of a list. In such a design the selection process starts by picking some random point in the list and then every nth element is selected until the desired number is secured.

b) **Stratified Sampling**

If the population from which a sample is to be drawn does not constitute a homogeneous group, then stratified sampling technique is applied so as to obtain a representative sample. In this technique, the population is stratified into a number of non-overlapping subpopulations or strata and sample items are selected from each stratum. If the items selected from each stratum is based on simple random sampling the entire procedure, first stratification and then simple random sampling, is known as stratified random sampling.

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c) **Quota Sampling**

In stratified sampling the cost of taking random samples from individual strata is often so expensive that interviewers are simply given quota to be filled from different strata, the actual selection of items for sample being left to the interviewer's judgement. This is called quota sampling. The size of the quota for each stratum is generally proportionate to the size of that stratum in the population. Quota sampling is thus an important form of non-probability sampling. Quota samples generally happen to be judgement samples rather than random samples.

a) **Cluster Sampling and Area Sampling**

Cluster sampling involves grouping the population and then selecting the groups or the clusters rather than individual elements for inclusion in the sample. Suppose some departmental store wishes to sample its credit card holders. It has issued its cards to 15,000 customers. The sample size is to be kept say 450. For cluster sampling this list of 15,000 card holders could be formed into 100 clusters of 150 card holders each. Three clusters might then be selected for the sample randomly. The sample size must often be larger than the simple random sample to ensure the same level of accuracy because is cluster sampling procedural potential for order bias and other sources of error is usually accentuated. The clustering approach can, however, make the sampling procedure relatively easier and increase the efficiency of field work, specially in the case of personal interviews.

Area sampling is quite close to cluster sampling and is often talked about when the total geographical area of interest happens to be big one. Under area sampling we first divide the

total area into a number of smaller non-overlapping areas, generally called geographical clusters, then a number of these smaller areas are randomly selected, and all units in these small areas are included in the sample. Area sampling is specially helpful where we do not have the list of the population concerned. It also makes the field interviewing more efficient since interviewer can do many interviews at each location.

b) **Multi-stage Sampling**

This is a further development of the idea of cluster sampling. This technique is meant for big inquiries extending to a considerably large geographical area like an entire country. Under multi-stage sampling the first stage may be to select large primary sampling units such as states, then districts, then towns and finally certain families within towns. If the technique of random-sampling is applied at all stages, the sampling procedure is described as multi-stage random sampling.

c) **Sequential Sampling**

This is somewhat a complex sample design where the ultimate size of the sample is not fixed in advance but is determined according to mathematical decisions on the basis of information yielded as survey progresses. This design is usually adopted under acceptance sampling plan in the context of statistical quality control.

In practice, several of the methods of sampling described above may well be used in the same study in which case it can be called mixed sampling. It may be pointed out here that normally one should resort to random sampling so that bias can be eliminated and sampling error can be estimated. But purposive sampling is considered desirable when the universe

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happens to be small and a known characteristic of it is to be studied intensively. Also, there are conditions under which sample designs other than random sampling may be considered better for reasons like convenience and low costs. The sample design to be used must be decided by the researcher taking into consideration the nature of the inquiry and other related factors.

1) Collecting the Data

In dealing with any real life problem it is often found that data at hand are inadequate, and hence, it becomes necessary to collect data that are appropriate. There are several ways of collecting the appropriate data which differ considerably in context of money costs, time and other resources at the disposal of the researcher.

Primary data can be collected either through experiment or through survey. If the researcher conducts an experiment, he observes some quantitative measurements, or the data, with the help of which he examines the truth contained in his hypothesis. But in the case of a survey, data can be collected by any one or more of the following ways:

a) **By Observation**

This method implies the collection of information by way of investigator's own observation, without interviewing the respondents. The information obtained relates to what is currently happening and is not complicated by either the past behaviour or future intentions or attitudes of respondents. This method is no doubt an expensive method and

the information provided by this method is also very limited. As such this method is not suitable in inquiries where large samples are concerned.

a) **Through Personal Interview**

The investigator follows a rigid procedure and seeks answers to a set of pre- conceived questions through personal interviews. This method of collecting data is usually carried out in a structured way where output depends upon the ability of the interviewer to a large extent.

b) **Through Telephone Interview**

This method of collecting information involves contacting the respondents on telephone itself. This is not a very widely used method but it plays an important role in industrial surveys in developed regions, particularly, when the survey has to be accomplished in a very limited time.

c) **By Mailing of Questionnaire**

The researcher and the respondents do come in contact with each other if this method of survey is adopted. Questionnaires are mailed to the respondents with a request to return after completing the same. It is the most extensively used method in various economic and business surveys. Before applying this method, usually a Pilot Study for testing the questionnaire is conduced which reveals the weaknesses, if any, of the questionnaire.

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Questionnaire to be used must be prepared very carefully so that it may prove to be effective in collecting the relevant information.

d) **Through Schedules**

Under this method the enumerators are appointed and given training. They are provided with schedules containing relevant questions. These enumerators go to respondents with these schedules. Data are collected by filling up the schedules by enumerators on the basis of replies given by respondents. Much depends upon the capability of enumerators so far as this method is concerned. Some occasional field checks on the work of the enumerators may ensure sincere work.

The researcher should select one of these methods of collecting the data taking into consideration the nature of investigation, objective and scope of the inquiry, financial resources, available time and the desired degree of accuracy. Though he should pay attention to all these factors but much depends upon the ability and experience of the researcher. In this context Dr A.L Bowley very aptly remarks that in collection of statistical data commonsense is the chief requisite and experience the chief teacher.

1) Execution of the Project

Execution of the project is a very important step in the research process. If the execution of the project proceeds on correct lines, the data to be collected would be adequate and dependable. The researcher should see that the project is executed in a systematic manner and in time. If the survey is to be conducted by means of structured questionnaires, data can be readily machine-processed. In such a situation, questions as well as the possible answers may be coded. If the data are to be collected through interviewers, arrangements

should be made for proper selection and training of the interviewers. The training may be given with the help of instruction manuals which explain clearly the job of the interviewers at each step. Occasional field checks should be made to ensure that the interviewers are doing their assigned job sincerely and efficiently. A careful watch should be kept for unanticipated factors in order to keep the survey as much realistic as possible. This, in other words, means that steps should be taken to ensure that the survey is under statistical control so that the collected information is in accordance with the pre-defined standard of accuracy. If some of the respondents do not cooperate, some suitable methods should be designed to tackle this problem. One method of dealing with the non-response problem is to make a list of the non-respondents and take a small sub-sample of them, and then with the help of experts vigorous efforts can be made for securing response.

2) Analysis of Data

After the data have been collected, the researcher turns to the task of analyzing them. The analysis of data requires a number of closely related operations such as establishment of categories, the application of these categories to raw data through

coding, tabulation and then drawing statistical inferences. The unwieldy data should necessarily be condensed into a few manageable groups and tables for further analysis. Thus, researcher should classify the raw data into some purposeful and usable categories. Coding operation is usually done at this stage through which the categories of data are transformed into symbols that may be tabulated and counted. Editing is the procedure that improves the quality of the data for coding. With coding the stage is ready for tabulation. Tabulation is a part of the technical procedure wherein the classified data are put in the form of tables. The mechanical devices can be made use of at this juncture. A great deal of

data, specially in large inquiries, is tabulated by computers. Computers not only save time but also make it possible to study large number of variables affecting a problem simultaneously.

Analysis work after tabulation is generally based on the computation of various percentages, coefficients, etc., by applying various well defined statistical formulae. In the process of analysis, relationships or differences supporting or conflicting with original or new hypotheses should be subjected to tests of significance to determine with what validity data can be said to indicate any conclusion(s). For instance, if there are two samples of weekly wages, each sample being drawn from factories in different parts of the same city, giving two different mean values, then our problem may be whether the two mean values are significantly different or the difference is just a matter of chance. Through the use of statistical tests we can establish whether such a difference is a real one or is the result of random fluctuations. If the difference happens to be real, the inference will be that the two samples come from different universes and if the difference is due to chance, the conclusion would be that the two samples belong to the same universe. Similarly, the technique of analysis of variance can help us in analysing whether three or more varieties of seeds grown on certain fields yield significantly different results or not. In brief, the researcher can analyse the collected data with the help of various statistical measures.

1) Hypothesis Testing

After analysing the data as stated above, the researcher is in a position to test the hypotheses, if any, he had formulated earlier. Do the facts support the hypotheses or they happen to be contrary? This is the usual question which should be answered while testing

hypotheses. Various tests, such as Chi square test, t-test, F-test, have been developed by statisticians for the purpose. The hypotheses may be tested through the use of one or more of such tests, depending upon the nature and object of research inquiry. Hypothesis-testing will result in either accepting the hypothesis or in rejecting it. If the researcher had no hypotheses to start with, generalisations established on the basis of data may be stated as hypotheses to be tested by subsequent researches in times to come.

3) Generalizations and Interpretation

If a hypothesis is tested and upheld several times, it may be possible for the researcher to arrive at generalisation, i.e., to build a theory. As a matter of fact, the real value of research lies in its ability to arrive at certain generalisations. If the researcher had no hypothesis to start with, he might seek to explain his findings on the basis of some theory. It is known as interpretation. The process of interpretation may quite often trigger off new questions which in turn may lead to further researches.

4) Preparation of the Report or Presentation of the Results

Finally, the researcher has to prepare the report of what has been done by him. Writing of report must be done with great care keeping in view the following:

1) The layout of the report should be as follows: (i) the preliminary pages; (ii) the main text, and (iii) the end matter.

In its preliminary pages the report should carry title and date followed by acknowledgements

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and foreword. Then there should be a table of contents followed by a list of tables and list of graphs and charts, if any, given in the report.

The main text of the report should have the following parts:

a) **Introduction:** It should contain a clear statement of the objective of the research and an explanation of the methodology adopted in accomplishing the research. The scope of the study along with various limitations should as well be stated in this part.

b) **Summary of Findings**: After introduction there would appear a statement of findings and recommendations in non-technical language. If the findings are extensive, they should be summarised.

c) **Main Report**: The main body of the report should be presented in logical sequence and broken-down into readily identifiable sections.

d) **Conclusion**: Towards the end of the main text, researcher should again put down the results of his research clearly and precisely. In fact, it is the final summing up.

At the end of the report, appendices should be enlisted in respect of all technical data. Bibliography, i.e., list of books, journals, reports, etc., consulted, should also be given in the end. Index should also be given specially in a published research report.

2) Report should be written in a concise and objective style in simple language avoiding vague expressions such as 'it seems,' 'there may be', and the like.

3) Charts and illustrations in the main report should be used only if they present the information more clearly and forcibly.

4) Calculated 'confidence limits' must be mentioned and the various constraints experienced in conducting research operations may as well be stated.

RESEARCH DESIGN

The formidable problem that follows the task of defining the research problem is the preparation of the design of the research project, popularly known as the "research design". Decisions regarding what, where, when, how much, by what means concerning an inquiry or a research study constitute a research design. "A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure."1 In fact, the research design is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data. As such the design includes an outline of what the researcher will do from writing the hypothesis and its operational implications to the final analysis of data. More explicitly, the desing decisions happen to be in respect of:

1. What is the study about?
2. Why is the study being made?
3. Where will the study be carried out?
4. What type of data is required?
5. Where can the required data be found?

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6. What periods of time will the study include?
7. What will be the sample design?
8. What techniques of data collection will be used?
9. How will the data be analyzed?
10. In what style will the report be prepared?

Keeping in view the above stated design decisions, one may split the overall research design into the following parts:

a) the sampling design which deals with the method of selecting items to be observed for the given study;
b) the observational design which relates to the conditions under which the observations are to be made;
c) the statistical design which concerns with the question of how many items are to be observed and how the information and data gathered are to be analysed; and
d) the operational design which deals with the techniques by which the procedures specified in the sampling, statistical and observational designs can be carried out.

From what has been stated above, we can state the important features of a research design as under:

i) It is a plan that specifies the sources and types of information relevant to the research problem.
ii) It is a strategy specifying which approach will be used for gathering and analysing the data.
iii) It also includes the time and cost budgets since most studies are done under these

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two constraints.

In brief, research design must, at least, contain—(a) a clear statement of the research problem; (b) procedures and techniques to be used for gathering information;
(c) the population to be studied; and (d) methods to be used in processing and analyzing data.

COMPONENTS OF RESEARCH DESIGN

1) Title of the Study

Enough information should be given in the title, to identify the study. The researcher should consider the following while selecting a title

- The title should be specific to the area of the study
- The title should indicate the topic of the study
- The language of the title should be professional in nature but not pedantic (dull)
- The title should be as brief as possible

2) Introduction

Under this heading a brief explanation of the genesis of the problem should be given.

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3) Statement of the Problem

After a brief introduction explaining the genesis of the problem, the researcher should state the problem. While stating the problem use of clear, simple and concise statement is preferable

4) Review of Previous Studies

Under this head the researcher presents what is so far known about the problem under consideration. All related studies need not be discussed. The researcher may describe the most important ones. A review of the previous studies enables the researcher to know the different areas covered by various studies, to concentrate on the areas where little research has been carried out, to look into various merits and shortcomings of certain studies already completed and to verify the present findings with that of the previous ones

1) Scope of the Study

This heading gives an idea about the extend of the study. The scope of the study is dependent on several factors such as the time and money available with the investigator, availability of the sample, co-operation of the respondents and the like

2) Objectives of the Study

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The task of the researcher is to lay down the objectives precisely. The objectives enlighten the researcher's own mind and lead to more efficient enquiry. Once the objectives are selected, the study can be undertaken with required accuracy and within the given resources. The objectives mentioned should be well within the scope of the study

3) Hypothesis to be Tested

Hypothesis is a proposition, condition or principle which is assumed, perhaps without belief in order to draw logical conclusions. Hypotheses are formulated to explain observed facts, conditions, or behaviours and to serve as a guide in the research process. Each hypothesis is individually tested to determine whether it is tenable (reasonable) or not. Hypothesis should be stated in clear, concise and understandable language

4) Operational Definition of Concepts

All terms that might be ambiguous should be clarified. A clear understanding of the terms used in the study is important. It is necessary to identify and label the variables. The variables can be labeled as independent variable and dependent variable. An independent variable is the factor which is measured, manipulated or selected by the experiments. A dependent variable is that factor which is measured to determine the effect of independent variable

1) Geographical Area to be Covered

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Under this head the area to be covered by the study is mentioned

2) Reference Period

The period of study can be mentioned under this heading

3) Methodology

The researcher should first determine the kind of information needed to answer the research questions. Secondly he must know the sources of data and finally he must know the means by which he will gather information which is known as methodology

4) Sampling

Sampling involves taking a portion of population, making observation on this smaller group and then generalizing the findings to be applied to a large population. The small group that is observed is called the sample and the large group is called population. The sample is the portion of the population and it must be representative of the population. If the sample is biased, the findings of the study cannot be generalized

5) Tools for Collection of Data

The choice of method for collecting the data is governed by the subject matter, the unit of enquiry and the scale of the study. A study of the behavior of a group would call for

observational techniques, for a simple enquiry among the cross section of population, a questionnaire is adequate. A survey of general population entailing many complicated questions would call for personal interviewing

6) Plan of Analysis

Once the data have been collected, they must be reduced to meaningful results by statistical analysis so that the conclusions for generalization can be drawn from them. The researcher should describe how he plans to organize the data. He should decide the statistical treatment. The appropriateness of the technique should be discussed. He must discuss the procedure for treating the data

5) Research Report

The results should be communicated. The format consists of three parts

- Part I Preliminary Pages, which contain title page, approval sheet, preface (if any), table of contents, list of tables (if any) and list of figures (if any)
- Part II Body of the report, which covers content chapters
- Part III Supplementary pages which included bibliography appendix (if any) and index (if any)

6) Time Schedule

The researcher has to work out a time schedule for his research work. The time required

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includes the following:

- Time to be used for preparing the theoretical background
- Time to be used for preparing the data gathering devices such as questionnaire, interview schedule, record sheet, interviewer's manual and time and expenses sheets
- Time to be used for data collection
- Time to be used for processing the data
- Time to be used for writing the report
- Time to be used for submitting the thesis

7) Financial Budget

It is desirable to work out the budget which gives an idea about the money needed to complete the project. The cost estimates of the project will include stationery, printing, sample selection, field work, mailing, processing, tabulating, preparation of report and overheads.

The research design will differ depending on the research purpose. The research purposes may purport to gain familiarity with a phenomenon, portray accurately the characteristics of a particular individual, situation or group, determine the frequency with which something occurs and test a hypothesis of casual relationship between variables. In practice, these different types of studies are not always sharply distinguishable. The research design will be more or less the same for any type of study

In research process, the first and foremost step happens to be that of selecting and properly defining a research problem.* A researcher must find the problem and formulate it so that it becomes susceptible to research. Like a medical doctor, a researcher must examine all the symptoms

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(presented to him or observed by him) concerning a problem before he can diagnose correctly. To define a problem correctly, a researcher must know: what a problem is?

WHAT IS A RESEARCH PROBLEM?

A research problem, in general, refers to some difficulty which a researcher experiences in the context of either a theoretical or practical situation and wants to obtain a solution for the same. Usually we say that a research problem does exist if the following conditions are met with:

(i) There must be an individual (or a group or an organisation), let us call it '*I*,' to whom the problem can be attributed. The individual or the organisation, as the case may be, occupies an environment, say '*N*', which is defined by values of the uncontrolled variables, Y_j.

(ii) There must be at least two courses of action, say C_1 and C_2, to be pursued. A course of action is defined by one or more values of the controlled variables. For example, the number
of items purchased at a specified time is said to be one course of action.

(iii) There must be at least two possible outcomes, say O_1 and O_2, of the course of action, of which one should be preferable to the other. In other words, this means that there must be at least one outcome that the researcher wants, i.e., an objective.

(iv) The courses of action available must provides some chance of obtaining the objective, but they cannot provide the same chance, otherwise the choice would not matter. Thus, if $P(O_j \mid I, C_j, N)$ represents the probability that an outcome O_j will occur, if *I* select C_j in *N*,

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then $P(O_1 \mid I, C_1, N) \neq P(O_1 \mid I, C_2, N)$. In simple words, we can say that the choices

must have unequal efficiencies for the desired outcomes.

Over and above these conditions, the individual or the organisation can be said to have the problem only if '*I*' does not know what course of action is best, i.e., '*I*', must be in doubt about the solution. Thus, an individual or a group of persons can be said to have a problem which can be technically described as a research problem, if they (individual or the group), having one or more desired outcomes, are confronted with two or more courses of action that have some but not equal efficiency for the desired objective(s) and are in doubt about which course of action is best.

We can, thus, state the components[1] of a research problem as under:

(i) There must be an individual or a group which has some difficulty or the problem.

(ii) There must be some objective(s) to be attained at. If one wants nothing, one cannot have a problem.

(iii) There must be alternative means (or the courses of action) for obtaining the objective(s) one wishes to attain. This means that there must be *at least two means* available to a researcher for if he has no choice of means, he cannot have a problem.

(iv) There must remain some doubt in the mind of a researcher with regard to the selection of alternatives. This means that research must answer the question concerning the relative efficiency of the possible alternatives.

(v) There must be some environment(s) to which the difficulty pertains.

Thus, a research problem is one which requires a researcher to find out the best solution for the given problem, i.e., to find out by which course of action the objective can be attained optimally in the context of a given environment. There are several factors which may result in

making the problem complicated. For instance, the environment may change affecting the efficiencies of the courses of action or the values of the outcomes; the number of alternative courses of action may be very large; persons not involved in making the decision may be affected by it and react to it favourably or unfavourably, and similar other factors. All such elements (or at least the important ones) may be thought of in context of a research problem.

SELECTING THE PROBLEM

The research problem undertaken for study must be carefully selected. The task is a difficult one, although it may not appear to be so. Help may be taken from a research guide in this connection. Nevertheless, every researcher must find out his own salvation for research problems cannot be borrowed. A problem must spring from the researcher's mind like a plant springing from its own seed. If our eyes need glasses, it is not the optician alone who decides about the number of the lens we require. We have to see ourselves and enable him to prescribe for us the right number by cooperating with him. Thus, a research guide can at the most only help a researcher choose a subject. However, the following points may be observed by a researcher in selecting a research problem or a subject for research:

(i) Subject which is overdone should not be normally chosen, for it will be a difficult task to throw any new light in such a case.

(ii) Controversial subject should not become the choice of an average researcher.

(iii) Too narrow or too vague problems should be avoided.

(iv) The subject selected for research should be familiar and feasible so that the related research material or sources of research are within one's reach. Even then it is quite difficult to supply definitive ideas concerning how a researcher should obtain ideas for his research. For this purpose, a researcher should contact an expert or a professor in the University who is already engaged in research. He may as well

read articles published in current literature available on the subject and may think how the techniques and ideas discussed therein might be applied to the solution of other problems. He may discuss with others what he has in mind concerning a problem. In this way he should make all possible efforts in selecting a problem.

(v) The importance of the subject, the qualifications and the training of a researcher, the costs involved, the time factor are few other criteria that must also be considered in selecting a problem. In other words, before the final selection of a problem is done, a researcher must ask himself the following questions:

(a) Whether he is well equipped in terms of his background to carry out the research?

(b) Whether the study falls within the budget he can afford?

(c) Whether the necessary cooperation can be obtained from those who must participate in research as subjects?

If the answers to all these questions are in the affirmative, one may become sure so far as the practicability of the study is concerned.

(vi) The selection of a problem must be preceded by a preliminary study. This may not be necessary when the problem requires the conduct of a research closely similar to one that has already been done. But when the field of inquiry is relatively new and does not have available a set of well developed techniques, a brief feasibility study must always be undertaken.

If the subject for research is selected properly by observing the above mentioned points, the research will not be a boring drudgery, rather it will be love's labour. In fact, zest for work is a must. The subject or the problem selected must involve the researcher and must have an upper most place in his mind so that he may undertake all pains needed for the study.

NECESSITY OF DEFINING THE PROBLEM

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Quite often we all hear that a problem clearly stated is a problem half solved. This statement signifies the need for defining a research problem. The problem to be investigated must be defined unambiguously for that will help to discriminate relevant data from the irrelevant ones. A proper definition of research problem will enable the researcher to be on the track whereas an ill-defined problem may create hurdles. Questions like: What data are to be collected? What characteristics of data are relevant and need to be studied? What relations are to be explored. What techniques are to be used for the purpose? and similar other questions crop up in the mind of the researcher who can well plan his strategy and find answers to all such questions only when the research problem has been well defined. Thus, defining a research problem properly is a prerequisite for any study and is a step of the highest importance. In fact, formulation of a problem is often more essential than its solution. It is only on careful detailing the research problem that we can work out the research design and can smoothly carry on all the consequential steps involved while doing research.

TECHNIQUE INVOLVED IN DEFINING A PROBLEM

Let us start with the question: What does one mean when he/she wants to define a research problem? The answer may be that one wants to state the problem along with the bounds within which it is to be studied. In other words, defining a problem involves the task of laying down boundaries within which a researcher shall study the problem with a pre-determined objective in view.

How to define a research problem is undoubtedly a herculean task. However, it is a task that must be tackled intelligently to avoid the perplexity encountered in a research operation. The usual approach is that the researcher should himself pose a question (or in case someone else wants the researcher to carry on research, the concerned individual, organisation or an authority should pose the question to the researcher) and set-up techniques and procedures for throwing light on the question concerned for formulating or defining the research problem. But such an approach generally does not produce definitive results because the question

phrased in such a fashion is usually in broad general terms and as such may not be in a form suitable for testing.

Defining a research problem properly and clearly is a crucial part of a research study and must in no case be accomplished hurriedly. However, in practice this a frequently overlooked which causes a lot of problems later on. Hence, the research problem should be defined in a systematic manner, giving due weightage to all relating points. The technique for the purpose involves the undertaking of the following steps generally one after the other: (i) statement of the problem in a general way; (ii) understanding the nature of the problem; (iii) surveying the available literature (iv) developing the ideas through discussions; and (v) rephrasing the research problem into a working proposition.

A brief description of all these points will be helpful.

(i) Statement of the problem in a general way: First of all the problem should be stated in a broad general way, keeping in view either some practical concern or some scientific or intellectual interest. For this purpose, the researcher must immerse himself thoroughly in the subject matter concerning which he wishes to pose a problem. In case of social research, it is considered advisable to do some field observation and as such the researcher may undertake some sort of preliminary survey or what is often called *pilot survey*. Then the researcher can himself state the problem or he can seek the guidance of the guide or the subject expert in accomplishing this task. Often, the guide puts forth the problem in general terms, and it is then up to the researcher to narrow it down and phrase the problem in operational terms. In case there is some directive from an organisational authority, the problem then can be stated accordingly. The problem stated in a broad general way may contain various ambiguities which must be resolved by cool thinking and rethinking over the problem. At the same time the feasibility of a particular solution has to be considered and the same should be kept in view while stating the problem.

(ii) Understanding the nature of the problem: The next step in defining the problem is

to understand its origin and nature clearly. The best way of understanding the problem is to discuss it with those who first raised it in order to find out how the problem originally came about and with what objectives in view. If the researcher has stated the problem himself, he should consider once again all those points that induced him to make a general statement concerning the problem. For a better understanding of the nature of the problem involved, he can enter into discussion with those who have a good knowledge of the problem concerned or similar other problems. The researcher should also keep in view the environment within which the problem is to be studied and understood.

(iii) Surveying the available literature: All available literature concerning the problem at hand must necessarily be surveyed and examined before a definition of the research problem is given. This means that the researcher must be well-conversant with relevant theories in the field, reports and records as also all other relevant literature. He must devote sufficient time in reviewing of research already undertaken on related problems. This is done to find out what data and other materials, if any, are available for operational purposes. "Knowing what data are available often serves to narrow the problem itself as well as the technique that might be used."[2]. This would also help a researcher to know if there are certain gaps in the theories, or whether the existing theories applicable to the problem under study are inconsistent with each other, or whether the findings of the different studies do not follow a pattern consistent with the theoretical expectations and so on. All this will enable a researcher to take new strides in the field for furtherance of knowledge i.e., he can move up starting from the existing premise. Studies on related problems are useful for indicating the type of difficulties that may be encountered in the present study as also the possible analytical shortcomings. At times such studies may also suggest useful and even new lines of approach to the present problem.

(iv) Developing the ideas through discussions: Discussion concerning a problem often produces useful information. Various new ideas can be developed through such an exercise.

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Hence, a researcher must discuss his problem with his colleagues and others who have enough experience in the same area or in working on similar problems. This is quite often known as an *experience survey*. People with rich experience are in a position to enlighten the researcher on different aspects of his proposed study and their advice and comments are usually invaluable to the researcher. They help him sharpen his focus of attention on specific aspects within the field. Discussions with such persons should not only be confined to the formulation of the specific problem at hand, but should also be concerned with the general approach to the given problem, techniques that might be used, possible solutions, etc.

(v) Rephrasing the research problem: Finally, the researcher must sit to rephrase the research problem into a working proposition. Once the nature of the problem has been clearly understood, the environment (within which the problem has got to be studied) has been defined, discussions over the problem have taken place and the available literature has been surveyed and examined, rephrasing the problem into analytical or operational terms is not a difficult task. Through rephrasing, the researcher puts the research problem in as specific terms as possible so that it may become operationally viable and may help in the development of working hypotheses.

In addition to what has been stated above, the following points must also be observed while defining a research problem:

(a) Technical terms and words or phrases, with special meanings used in the statement of the problem, should be clearly defined.

(b) Basic assumptions or postulates (if any) relating to the research problem should be clearly stated.

(c) A straight forward statement of the value of the investigation (i.e., the criteria for the selection of the problem) should be provided.

(d) The suitability of the time-period and the sources of data available must also be considered by the researcher in defining the problem.

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(e) The scope of the investigation or the limits within which the problem is to be studied must be mentioned explicitly in defining a research problem.

Research hypothesis: When a prediction or a hypothesised relationship is to be tested by scientific methods, it is termed as research hypothesis. The research hypothesis is a predictive statement that relates an independent variable to a dependent variable. Usually a research hypothesis must contain, at least, one independent and one dependent variable. Predictive statements which are not to be objectively verified or the relationships that are assumed but not to be tested, are not termed research hypotheses.

WHAT IS A HYPOTHESIS?

Ordinarily, when one talks about hypothesis, one simply means a mere assumption or some supposition to be proved or disproved. But for a researcher hypothesis is a formal question that he intends to resolve. Thus a hypothesis may be defined as a proposition or a set of proposition set forth as anexplanation for the occurrence of some specified group of phenomena either asserted merely as aprovisional conjecture to guide some investigation or accepted as highly probable in the light of established facts. Quite often a research hypothesis is a predictive statement, capable of being tested by scientific methods, that relates an independent variable to some dependent variable. For example, consider statements like the following ones:

"Students who receive counselling will show a greater increase in creativity than students not receiving counselling" Or"the automobile A is performing as well as automobile B."These are hypotheses capable of being objectively verified and tested. Thus, we may conclude that a hypothesis states what we are looking for and it is a proposition which can be put to a test to determine its validity.

Characteristics of hypothesis:

Hypothesis must possess the following characteristics:

(i) Hypothesis should be clear and precise. If the hypothesis is not clear and precise, the inferences drawn on its basis cannot be taken as reliable.

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(ii)Hypothesis should be capable of being tested. In a swamp of untestable hypotheses, manya time the research programmes have bogged down. Some prior study may be done by researcher in order to make hypothesis a testable one. A hypothesis "is testable if other deductions can be made from it which, in turn, can be confirmed or disproved by observation."

(iii) Hypothesis should state relationship between variables, if it happens to be a relational hypothesis.

(iv) Hypothesis should be limited in scope and must be specific. A researcher must remember that narrower hypotheses are generally more testable and he should develop such hypotheses.

(v) Hypothesis should be stated as far as possible in most simple terms so that the same is easily understandable by all concerned. But one must remember that simplicity of hypothesis has nothing to do with its significance.

(VI)Hypothesis should be consistent with most known facts i.e., it must be consistent with a substantial body of established facts. In other words, it should be one which judges accept as being the most likely.

(vii)Hypothesis should be amenable to testing within a reasonable time. One should not use even an excellent hypothesis, if the same cannot be tested in reasonable time for one cannot spend a life-time collecting data to test it.

(viii)Hypothesis must explain the facts that gave rise to the need for explanation. This means that by using the hypothesis plus other known and accepted generalizations, one should be able to deduce the original problem condition. Thus hypothesis must actually explain what it claims to explain; it should have empirical reference.

TYPES OF RESEARCH HYPOTHESIS

Basic concepts in the context of testing of hypotheses need to be explained.

(a) Null hypothesis and alternative hypothesis:

In the context of statistical analysis, we often talk about null hypothesis and alternative hypothesis. If we are to compare method A with method B about its superiority and if we proceed on the assumption that both methods are equally good, then this assumption is termed as

the null hypothesis. As against this, we may think that the method A is superior or the method B is inferior, we are then stating what is termed as alternative hypothesis. The null hypothesis is generally symbolized as H0 and the alternative hypothesis as Ha.

The null hypothesis and the alternative hypothesis are chosen before the sample is drawn (the researcher must avoid the error of deriving hypotheses from the data that he collects and then testing the hypotheses from the same data). In the choice of null hypothesis, the following considerations are usually kept in view:

(a) Alternative hypothesis is usually the one which one wishes to prove and the null hypothesis is the one which one wishes to disprove. Thus, a null hypothesis represents the hypothesis we are trying to reject, and alternative hypothesis represents all other possibilities.

(b) If the rejection of a certain hypothesis when it is actually true involves great risk, it is taken as null hypothesis because then the probability of rejecting it when it is true is α (the level of significance) which is chosen very small.

(c) Null hypothesis should always be specific hypothesis i.e., it should not state about or approximately a certain value.

RESEARCH PROPOSAL

A research proposal is a written account that should make this all clear, not only to yourself, but to your supervisor, client or pro- moter. I therefore give some useful guidance about how to formulate and structure the proposal. The written report, paper, dissertation or thesis that marks the end of the research is an essential part of the research process. After all, what is the point of doing research if no one is told of the outcomes? I explain the art and science of writing up the account of the project, and provide some useful advice on the techniques you can use to make this process easier.

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POSSIBLE QUESTIONS

PART-B (2 Marks)

1. Define Research
2. Describe on Descriptive Research.
3. What do you mean by Analytical Research?
4. Briefly narrate on Analytical Research.
5. What do you mean by Research Design?
6. Briefly explain on Applied Research.
7. What do you understand by Fundamental Research?
8. Describe on (i) Quantitative Research and (ii) Qualitative Research
9. Briefly explicate on Empirical Research.
10. What is Conceptual Research?
11. Discuss on (i) One-time and (ii) Longitudinal Research
12. What is Historical Research?
13. What do you mean by Research Process?
14. What is Hypothesis?
15. Define Sampling.

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Part–C (8 Marks)

1. Elucidate on various components of Research Design.
2. Explain in detail on various kinds of research.
3. Define Research. Explain its significance in modern times.
4. Explain in detail on Qualities required for a Good Researcher.
5. Explain in detail on different steps involved in a research process.
6. Describe some of the important research designs used in experimental hypothesis-testing research study.
7. Describe in detail on different types of research.
8. Discuss in detail on the procedures involved in carrying out a research work.
9. Explain in detail on the significance of research.
10. Elucidate in detail on various methods of research design.

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Karpagam Academy of Higher Education
Department of Management
Research Methodology for Management – 18MBAP206
Unit I
Multiple Choice Questions - Each Question Carries ONE Mark

S.No.	Questions	Option 1	Option 2	Option 3	Option 4	Answer
1	_____is an endeavour to discover, develop and verify knowledge	Hypothesis	Research	Character	Sample	Research
2	study may be simple or complex	Descriptive	Analytical	Applied	Fundamental	Descriptive
3	_____study makes use of available information by analyzing and doing critical evaluation	Qualitative	Quantitative	Analytical	Applied	Analytical
4	_____research aims at finding a solution for an immediate problem	Applied	Analytical	Longitudinal	Case Study	Applied
5	_____research is an example of applied research	Production	Market	Operations	Business	Market
6	___research is otherwise known as basic research	Fundamental	Operations	Individual	Decision Oriented	Fundamental
7	_____research are based on the measurements of quantity or amounts	Qualitative	Conceptual	Empirical	Quantitative	Quantitative
8	____research, is concerned with qualitative phenomenon	Quantitative	Qualitative	Conceptual	Empirical	Qualitative
9	___research is an important type of qualitative research.	Basic	Motivation	Pure	Decision Oriented	Motivation
10	____research is that related to some abstract idea or theory	Empirical	Conceptual	Field Method	Exploratory	Conceptual
11	__research relies on experience or observation alone, often without due regard for system and theory	Empirical	Conceptual	Field Method	Exploratory	Empirical
12	___research is confined to a single time-period	One time	Longitudinal	Descriptive	Analytical	One time
13	___research is carried on over several time-periods	One time	Longitudinal	Descriptive	Analytical	Longitudinal

14	__research depends upon the environment in which it is to be carried out.	Field Setting	Exploratory	Formalized	Historical	Field Setting
15	__research studies are those with substantial structure and with specific hypotheses to be tested	Exploratory	Formalized	Historical	Decision Oriented	Formalized
16	___research is carried, when the reason for a problem is not clear	Exploratory	Formalized	Historical	Decision Oriented	Exploratory
17	__research is the induction of principles through research into the past and social forces which have shaped the present	Formalized	Historical	Decision Oriented	Exploratory	Historical
18	__research is always for the need of a decision maker	Decision oriented	Qualitative	Historical	Conceptual	Decision oriented
19	___research is done on the basis of one's own judgement, interest and capacity	Descriptive	Analytical	Group	Individual	Individual
20	___research is undertaken by several researchers	Group	Descriptive	Analytical	Applied	Group
21	___research has been done for solving problems by using scientific methods and quantitative techniques	Quantitative	Applied	Descriptive	Operations	Operations
22	__research is the investigation of the structure and development of a market for the purpose of formulating efficient policies for purchasing, production and	Market	Motivation	Operations	Production	Market
23	__consists of series of actions or steps necessary to effectively carry out research and the desired sequencing of these steps	Planning	Research Process	Research Process	Transcription	Research Process
24	__determines the data which are to be collected	Objective of Study	Research Design	Review of Literature	Hypothesis	Objective of Study
25	___is nothing but an assumption	Research	Hypothesis	Editing	Transcription	Hypothesis
26	is a blue print of research	Research Process	Objectives of the Study	Research Design	Hypothesis	Research Design
27	A research design is considered appropriate if the purpose of the research study is that of exploration	Flexible	Rigid	Experimental	Non-experimental	Flexible

28	When the purpose happens to be an accurate description of a situation or of an association between variables, the suitable design will be____research design	Latin	Rigid	Complex	Factorial	Rigid
29	A complete enumeration of all the items in the 'population' is known as____	Probability Sample	Non-Probability	Census	Cluster	Census
30	___is a very important step in the research process	Review of Literature	Data Collection	Analysis work	Execution of the Project	Execution of the Project
31	__requires a number of closely related operations such as establishment of categories, the application of these categories to raw data through coding, tabulation and then drawing statistical inferences	Analysis of Data	Data Verification	Transcription	Classification	Analysis of Data
32	___operation where the categories of data are transformed into symbols that may be tabulated and counted	Editing	Coding	Tabulation	Analysis of Data	Coding
33	__is the procedure that improves the quality of the data for coding	Editing	Coding	Tabulation	Analysis of Data	Editing
34	___is a part of the technical procedure wherein the classified data are put in the form of tables	Analysis of Data	Editing	Coding	Tabulation	Tabulation
35	The process of may quite often trigger off new questions which in turn may lead to further researches	Generalization	Interpretation	Hypothesis Testing	Analysis of Data	Interpretation
36	____is a blue print of research	Research Design	Research Process	Objectives of the Study	Hypothesis	Research Design
37	__is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure	Research Process	Objectives of the Study	Hypothesis	Research Design	Research Design

38	___gives an idea about the extend of the study	Scope of Study	Objectives of the Study	Hypothesis of the Study	Operational Definitions of the Study	Scope of Study
39	____research studies are also termed as formulative research studies	Exploratory	Descriptive	Analytical	Applied	Exploratory
40	_____is careful critical enquiry or examination in seeking facts or principles, diligent investigation in order to ascertain something	Enquiry	Inquiry	Research	Investigation	Research
41	____research is mainly concerned with generalisations and with the formulation of a theory.	Fundamental	Operations	Individual	Decision Oriented	Fundamental
42	___research has a practical problem-solving emphasis	Applied	Exploratory	Formalized	Group	Applied
43	__is the process of induction and deduction are of great value in carrying out research	Systematic	Logical	Empirical	Replicable	Logical
44	___research is structured with specified steps to be taken in a specified sequence in accordance with the well defined set of rules	Systematic	Logical	Empirical	Replicable	Systematic
45	__research implies that research is related basically to one or more aspects of a real situation and deals with concrete data that provides a basis for external validity to research results	Systematic	Logical	Replicable	Empirical	Empirical
46	___characteristic allows research results to be verified by replicating the study and thereby building a sound basis for decisions	Systematic	Logical	Replicable	Empirical	Replicable
47	__contain a clear statement of the objective of the research and an explanation of the methodology adopted in accomplishing the research	Introduction Chapter	Review of Literature Chapter	Analysis and Interpretation Chapter	Summary of Findings Chapter	Introduction Chapter

48	____should be very specific and limited to the piece of research in hand because it has to be tested	Transcription	Classification	Hypothesis	Sample Design	Hypothesis
49	____research is appropriate when proof is sought that certain variables affect other variables in some way	Formalized	Historical	Empirical	Individual	Empirical
50	__research of determining why people behave as they do is mainly concerned with market characteristics	Production	Market	Motivation	Operations	Motivation
51	___literature concerning the concepts and theories	Conceptual	Empirical	Historical	Theoretical	Conceptual
52	___literature consisting of studies made earlier which are similar to the one proposed	Conceptual	Empirical	Historical	Theoretical	Empirical
53	_____is discovering, interpreting, and the development of methods and systems for the advancement of human knowledge on a wide variety of scientific matters of our world and the universe	Interpretation	Investigation	Enquiry	Research	Research
54	Gathering knowledge for knowledge's sake is known as____research	Applied	Analytical	Descriptive	Fundamental	Fundamental
55	__research refers to the application of mathematical, logical and analytical techniques for cost minimization or of profit maximization	Production	Market	Motivation	Operations	Operations
56	is the focal point for research	Observation	Questionnaire	Objectives of the Study	Hypothesis	Hypothesis
57	___should be confined to those justified by the data of the research and limited to those for which the data provide an adequate basis	Introduction	Review of Literature	Conclusion	Analysis and Interpretation	Conclusion
58	Drawing of inferences for statistical computations is known as ____	Interpretation	Generalization	Hypothesis Testing	Analysis of Data	Interpretation

59	___is to provide for the collection of relevant evidence with minimal expenditure of effort, time and money	Hypothesis	Research Process	Objectives of the Study	Research Design	Research Design
60	__research discovers or tests whether certain variables are associated	Historical	One time	Conceptual	Descriptive	Descriptive

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RESEARCH AND SAMPLING DESIGN

UNIT-II

Research Design: Meaning of Research Designs; Nature and Classification of Research Designs; Exploratory Research Designs: Secondary Resource analysis, Case study Method, Expert opinion survey, Focus group discussions; Descriptive Research Designs: Cross-sectional studies and Longitudinal studies; Experimental Designs, Errors affecting Research Design.

Sampling: Sampling concepts- Sample vs Census, Sampling vs Non Sampling error; Sampling Design- Probability and Non Probability Sampling design; Determination of Sample size- Sample size for estimating population mean, Determination of sample size for estimating the population proportion.

METHODS OF RESEARCH DESIGN

Different research designs can be conveniently described if we categorize them as: (1) research design in case of exploratory research studies; (2) research design in case of descriptive and diagnostic research studies, and (3) research design in case of hypothesis-testing research studies.

1) Research design in case of exploratory research studies

Exploratory research studies are also termed as formulative research studies. The main purpose of such studies is that of formulating a problem for more precise (accurate) investigation or of developing the working hypotheses from an operational point of view. The major emphasis in such studies is on the discovery of ideas and insights. As such the research design appropriate for such studies must be flexible enough to provide opportunity for considering different aspects of a problem under study. Inbuilt flexibility in research design is needed because the research problem, broadly defined initially, is transformed into one with more precise meaning in exploratory studies, which fact may necessitate changes in the research procedure for gathering relevant data. Generally, the following three methods in the context of research design for such studies are talked about: (a) the survey of concerning literature; (b) the experience survey and (c) the analysis of 'insight-stimulating' examples.

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The survey of concerning literature happens to be the most simple and fruitful method of formulating precisely the research problem or developing hypothesis. Hypotheses stated by earlier workers may be reviewed and their usefulness be evaluated as a basis for further research. It may also be considered whether the already stated hypotheses suggest new hypothesis. In this way the researcher should review and build upon the work already done by others, but in cases where hypotheses have not yet been formulated, his task is to review the available material for deriving the relevant hypotheses from it.

Besides, the bibliographical survey of studies, already made in one's area of interest may as well as made by the researcher for precisely formulating the problem. He should also make an attempt to apply concepts and theories developed in different research contexts to the area in which he is himself working. Sometimes the works of creative writers also provide a fertile ground for hypothesis-formulation and as such may be looked into by the researcher.

Experience survey means the survey of people who have had practical experience with the problem to be studied. The object of such a survey is to obtain insight into the relationships between variables and new ideas relating to the research problem. For such a survey people who are competent and can contribute new ideas may be carefully selected as respondents to ensure a representation of different types of experience. The respondents so selected may then be interviewed by the investigator. The researcher must prepare an interview schedule for the systematic questioning of informants. But the interview must ensure flexibility in the sense that the respondents should be allowed to raise issues and questions which the investigator has not previously considered. Generally, the experience-collecting interview is likely to be long and may last for few hours. Hence, it is often considered desirable to send a copy of the questions to be discussed to the respondents well in advance. This will also give an opportunity to the respondents for doing some advance thinking over the various issues involved so that, at the time of interview, they may be able to contribute effectively. Thus, an experience

RESEARCH AND SAMPLING DESIGN

survey may enable the researcher to define the problem more concisely (briefly) and help in the formulation of the research hypothesis. This survey may as well provide information about the practical possibilities for doing different types of research.

Analysis of 'insight-stimulating' examples is also a fruitful method for suggesting hypotheses for research. It is particularly suitable in areas where there is little experience to serve as a guide. This method consists of the intensive study of selected instances of the phenomenon in which one is interested. For this purpose the existing records, if any, may be examined, the unstructured interviewing may take place, or some other approach may be adopted. Attitude of the investigator, the intensity of the study and the ability of the researcher to draw together diverse information into a unified interpretation are the main features which make this method an appropriate procedure for evoking insights.

Now, what sort of examples is to be selected and studied? There is no clear cut answer to it. Experience indicates that for particular problems certain types of instances

are more appropriate than others. One can mention few examples of 'insight-stimulating' cases such as the reactions of strangers, the reactions of marginal individuals, the study of individuals who are in transition from one stage to another, the reactions of individuals from different social strata and the like. In general, cases that provide sharp contrasts or have striking features are considered relatively more useful while adopting this method of hypotheses formulation.

Thus, in an exploratory of formulative research study which merely leads to insights or hypotheses, whatever method or research design outlined above is adopted, the only thing essential is that it must continue to remain flexible so that many different facets of a problem may be considered as and when they arise and come to the notice of the researcher.

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RESEARCH AND SAMPLING DESIGN

1) Research design in case of descriptive and diagnostic research studies

a. Descriptive research studies are those studies, which are concerned with describing the characteristics of a particular individual, or of a group, whereas diagnostic research studies determine the frequency with which something occurs or its association with something else. The studies concerning whether certain variables are associated are examples of diagnostic research studies. As against this, studies concerned with specific predictions, with narration of facts and characteristics concerning individual, group or situation are all examples of descriptive research studies. Most of the social research comes under this category. From the point of view of the research design, the descriptive as well as diagnostic studies share common requirements and as such we may group together these two types of research studies. In descriptive as well as in diagnostic studies, the researcher must be able to define clearly, what he wants to measure and must find adequate methods for measuring it along with a clear cut definition of 'population' he wants to study. Since the aim is to obtain complete and accurate information in the said studies, the procedure to be used must be carefully planned. The research design must make enough provision for protection against bias and must maximize reliability, with due concern for the economical completion of the research study. The design in such studies must be rigid and not flexible and must focus attention on the following: Formulating the objective of the study (what the study is about and why is it being made?)
b. Designing the methods of data collection (what techniques of gathering data will be adopted?)
c. Selecting the sample (how much material will be needed?)
d. Collecting the data (where can the required data be found and with what time period should the data be related?)

e. Processing and analyzing the data.

f. Reporting the findings.

In a descriptive/diagnostic study the first step is to specify the objectives with sufficient precision (accuracy) to ensure that the data collected are relevant. If this is not done carefully, the study may not provide the desired information.

Then comes the question of selecting the methods by which the data are to be obtained. In other words, techniques for collecting the information must be devised. Several methods (viz., observation, questionnaires, interviewing, examination of records, etc.), with their merits and limitations, are available for the purpose and the researcher may user one or more of these methods which have been discussed in detail in later chapters. While designing data-collection procedure, adequate safeguards against bias and unreliability must be ensured. Whichever method is selected, questions must be well examined and be made unambiguous; interviewers must be instructed not to express their own opinion; observers must be trained so that they uniformly record a given item of behaviour. It is always desirable to pretest the data collection instruments before they are finally used for the study purposes. In other words, we can say that "structured instruments" are used in such studies.

In most of the descriptive/diagnostic studies the researcher takes out sample(s) and then wishes to make statements about the population on the basis of the sample analysis or analyses. More often than not, sample has to be designed. Here we may only mention that the problem of designing samples should be tackled in such a fashion that the samples may yield accurate information with a minimum amount of research effort. Usually one or more forms of probability sampling, or what is often described as random sampling, are

used.

To obtain data free from errors introduced by those responsible for collecting them, it is necessary to supervise closely the staff of field workers as they collect and record information. Checks may be set up to ensure that the data collecting staff perform their duty honestly and without prejudice. "As data are collected, they should be examined for completeness, comprehensibility, consistency and reliability."

The data collected must be processed and analysed. This includes steps like coding the interview replies, observations, etc.; tabulating the data; and performing several statistical computations. To the extent possible, the processing and analysing procedure should be planned in detail before actual work is started. This will prove economical in the sense that the researcher may avoid unnecessary labour such as preparing tables for which he later finds he has no use or on the other hand, re-doing some tables because he failed to include relevant data. Coding should be done carefully to avoid error in coding and for this purpose the reliability of coders needs to be checked. Similarly, the accuracy of tabulation may be checked by having a sample of the tables re-done. In case of mechanical tabulation the material (i.e., the collected data or information) must be entered on appropriate cards, which is usually done by punching holes corresponding to a given code. The accuracy of punching is to be checked and ensured. Finally, statistical computations are needed and as such averages, percentages and various coefficients must be worked out. Probability and sampling analysis may as well be used. The appropriate statistical operations, along with the use of appropriate tests of significance should be carried out to safeguard the drawing of conclusions concerning the study.Last of all comes the question of reporting the findings. This is the task of communicating the findings to others and the researcher must do it in an efficient manner. The layout of the report needs to be well planned so that all things relating to the research study may be well presented in simple and effective style.Thus, the

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research design in case of descriptive/diagnostic studies is a comparative design throwing light on all points narrated above and must be prepared keeping in view the objective(s) of the study and the resources available. However, it must ensure the minimisation of bias and maximisation of reliability of the evidence collected. The said design can be appropriately referred to as a *survey design* since it takes into account all the steps involved in a survey concerning a phenomenon to be studied.

2) Research design in case of hypothesis-testing research studies

Hypothesis-testing research studies (generally known as experimental studies) are those where the researcher tests the hypotheses of causal relationships between variables. Such studies require procedures that will not only reduce bias and increase reliability, but will permit drawing inferences about causality. Usually experiments meet this requirement. Hence, when we talk of research design in such studies, we often mean the design of experiments.

Professor R.A. Fisher's name is associated with experimental designs. Beginning of such designs was made by him when he was working at Rothamsted Experimental Station (Centre for Agricultural Research in England). As such the study of experimental designs has its origin in agricultural research. Professor Fisher found that by dividing agricultural fields or plots into different blocks and then by conducting experiments in each of these blocks, whatever information is collected and inferences drawn from them, happens to be more reliable. This fact inspired him to develop certain experimental designs for testing hypotheses concerning scientific investigations. Today, the experimental designs are being used in researches relating to phenomena of several disciplines. Since experimental designs originated in the context of agricultural

operations, we still use, though in a technical sense, several terms of agriculture (such as treatment, yield, plot, block etc.) in experimental designs..

CENSUS

All items in any field of inquiry constitute a 'Universe' or 'Population.' A complete enumeration of all items in the 'population' is known as a census inquiry. It can be presumed that in such an inquiry, when all items are covered, no element of chance is left and highest accuracy is obtained. But in practice this may not be true. Even the slightest element of bias in such an inquiry will get larger and larger as the number of observation increases. Moreover, there is no way of checking the element of bias or its extent except through a resurvey or use of sample checks. Besides, this type of inquiry involves a great deal of time, money and energy. Therefore, when the field of inquiry is large, this method becomes difficult to adopt because of the resources involved. At times, this method is practically beyond the reach of ordinary researchers. Perhaps, government is the only institution which can get the complete enumeration carried out. Even the government adopts this in very rare cases such as population census conducted once in a decade. Further, many a time it is not possible to examine every item in the population, and sometimes it is possible to obtain sufficiently accurate results by studying only a part of total population. In such cases there is no utility of census surveys. Then, the researcher may make use of Sampling.

SAMPLING

Sampling is nothing but a proportion of Population. However, it needs to be emphasised that when the universe is a small one, it is no use resorting to a sample survey. When field studies are undertaken in practical life, considerations of time and cost almost invariably lead to a selection of respondents i.e., selection of only a few items. The respondents selected should be as representative of the total population as possible in order to produce a miniature cross-section. The selected respondents constitute what is technically called a 'sample' and the selection process is called 'sampling technique.' The

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survey so conducted is known as 'sample survey'. Algebraically, let the population size be N and if a part of size n (which is < N) of this population is selected according to some rule for studying some characteristic of the population, the group consisting of these n units is known as 'sample'. Researcher must

prepare a sample design for his study i.e., he must plan how a sample should be selected and of what size such a sample would be.

CHARACTERISTICS OF A GOOD SAMPLE PLAN

1. Sample design must result in a truly representative sample.
2. Sample design must be such which results in a small sampling error.
3. Sample design must be viable in the context of funds available for the research study.
4. Sample design must be such so that systematic bias can be controlled in a better way.
5. Sample should be such that the results of the sample study can be applied, in general, for the universe with a reasonable level of confidence.

STEPS IN SAMPLING

1) Type of Universe

The first step in developing any sample design is to clearly define the set of objects, technically called the universe, to be studied. The universe can be finite or infinite. In finite universe the number of items is certain, but in case of an infinite universe the number of items is infinite, i.e. we cannot have any idea about the total number of items. The population of a city, the number of workers in a factory and the like are examples of finite universes, whereas the number of stars in the sky, listeners of a specific radio programme, throwing a dice etc. are examples of infinite universes.

2) Sampling Unit

A decision has to be taken concerning a sampling unit before selecting sample. Sampling unit may be a geographical one such as state, district, village, etc., or a construction

unit such as a house, flat, etc., or it may be a social unit such as family, club, school, etc., or it may be an individual. The researcher will have to decide one or more of such units that he has to select for his study.

3) Source List

It is also known as 'sampling frame' from which sample is to be drawn. It contains the names of all items of universe. If source list is not available, researcher has to prepare it.

Such a list should be comprehensive, correct, reliable and appropriate. It is extremely important for the source list to be as representative of the population as possible.

4) Size of Sample

This refers to the number of items to be selected from the universe to constitute a sample. This is a major problem before a researcher. The size of sample should neither be excessively large, nor too small. It should be optimum. An optimum sample is one which fulfills the requirements of efficiency, representativeness, reliability and flexibility. While deciding the size of sample, researcher must determine the desired precision as also an acceptable confidence level for the estimate. The size of population variance needs to be considered as in case of larger variance usually a bigger sample is needed. The size of population must be kept in view for this also limits the sample size. The parameters of interest in a research study must be kept in view, while deciding the size of sample. Costs too dictate the size of sample that we can draw. As such, budgetary constraint must invariably be taken into consideration when we decide the sample size.

5) Parameters of Interest

In determining the sample design, one must consider the question of the specific population parameters which are of interest. For instance, we may be interested in estimating

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the proportion of persons with some characteristics in the population or we may be interested in knowing some average or the other measure concerning the population. There may be important sub-groups in the population about whom we would like to make estimates. All this has a strong impact upon the sample design we would accept.

6) Budgetary Constraint

Cost considerations, from practical point of view, have a major impact upon decisions relating to not only the size of the sample but also to the type of sample. This fact can even lead to the use of a non-probability sample.

7) Sampling Procedure

Finally, the researcher must decide the type of sample he will use i.e. he must decide about the technique to be used in selecting the items for the sample. In fact, this technique or procedure stands for the sample design itself. There are several sample designs out of which the researcher must choose one for his study. Obviously, he must select that design which, for a given sample size and for a given cost, has a smaller sampling error.

RANDOM SAMPLING PROCEDURES

The importance of randomness in sampling needs no emphasis, It is a means for securing a representative sample. How can a random sample be drawn? The layman tends to think that random sampling means picking out units "at random", i.e., in a haphazard or hit-and-miss way. Experience shows that the human being is an extremely poor instrument for the conduct of a random selection. To ensure true randomness the method of selection must be independent of human judgement. There are basic procedures.

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1) Lottery Method

This is the simplest and most familiar procedure of random sampling. If a sample of 10 students is to be drawn out of a list of 50 students in a section, take 50 equal size chips or slips of paper; number them from 1 to 50 each bearing only one number. Roll each slip. Put the rolled slips in a global container and thoroughly shuffle or mix them. Take 10 chips from the container one after another. Each time before drawing a chip, mix the chips in the container thoroughly. The units bearing the numbers of chips drawn constitute the random sample.

(i) Sampling with Replacement

After a number is selected by draw, it may be replaced and consequently it has a chance of being selected again. Such method is known as sampling with replacement. This is usually referred to as unrestricted random sampling.

(ii) Sampling without Replacement

Selected numbers is set aside, and so in subsequent draws, it does not get a chance of being selected again. This type of sampling is known as sampling without replacement. This is a form of restricted sampling.

2) Use of Table o Random Numbers

This is a less cumbersome, but equally valid procedure of sample selection. Tables of random numbers have been developed by Kendall and Smith (1939), Fisher and Yates (1963) and Tippett (1927). To select a random sample out of a given frame, one should simply start to read numbers from a Table of Random Numbers at any randomly selected point and pick out numbers within the range of the frame. Let us suppose that random sample of 50

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is to be selected from a College populations of 500 Commerce Students. We can use any table of random numbers.

10	09	73	25	33	76	52	01
37	54	20	48	05	64	89	47
08	42	26	89	53	19	64	50
09	01	90	25	29	09	37	67
12	80	79	99	70	80	15	73
66	06	57	47	17	34	07	27
31	06	01	08	05	45	57	18
85	26	97	76	02	02	05	16
63	57	33	21	35	05	32	54
73	79	64	57	53	03	52	96

Let us suppose, we start at the top of the left hand second column. As the population consists of a three-digit figure, read three-digit columns, i.e., read 097, 542, 422, 019 and so on. All the numbers within the range of 1 to 500 may be picked out. Then the sample will consist of:

097, 422, 019, 065. 060, 269 and so on. In the above reading, 542, 807, 573, etc., are rejected because they are over 500.

When the researcher reaches the bottom of a column, he can simply move one digit to the right and start at the top of the column again, and read numbers in three- digits: 973, 420, 226, 190, 079 and so on.

The main advantage of the use of a Table of Random Numbers are: Easy to use and ready accessibility

The Table of Random numbers is ideal for obtaining a random sample from

relatively small populations. When populations are quite large say lakhs or crores, drawing numbers from the table becomes tedious.

3) Use of Computer

If the population is very large and if computer facilities are available, a computer may be used for drawing a random sample. The computer can be programmed to print out a series of random numbers as the researcher desires.

TYPES OF SAMPLING

1) Probability Sampling

In probability sample, every unit in the population has equal chances for being selected as a sample unit.

2) Non–probability Sampling

In non probability sampling, units in the population has unequal or zero chances for being selected as a sample unit.

A) Probability Sampling

1) Simple Random Sampling

This sampling technique gives each element an equal and independent chance of being selected. An equal chance means equal probability of selection, e.g., in a population of 300, each element theoretically has $1/300^{th}$ chance of being selected. In a population of 1000, each element has $1/1000^{th}$ chance of being selected. Equal probability selection method is described as Epsem sampling. An independent choice

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means that the draw of one element will not affect the chances of other elements being selected.

Where some elements are purposely excluded from the sample, the resulting sample is not a random one, Hence, all elements should be included in the sample frame to draw a random sample.

Merits

1. All elements in the population have an equal chance of being selected
2. Of all the probability sampling techniques, simple random sampling is the easiest to apply
3. It is the most simple type of probability sampling to understand
4. It does not required a prior knowledge of the true composition of the population
5. The amount of sampling error associated with any sample drawn can easily be computed

Demerits

1. It is often impractical, because of non-availability of population list, or of difficulty in enumerating the population. For example, it is difficult to get a current accurate list of households in a city of a list of landless rural agricultural labourers who migrate from area to area in search of employment or a list of households of a nomadic tribe
2. The use of simple random sampling may be wasteful because we fail to use all of the known information about the population
3. This technique does not ensure proportionate representation to various groups constituting the population
4. The sampling error in this sampling is greater than that in other probability samples of the

same size, because it is less precise than other methods

5. The size of the sample required to ensure its representativeness is equally larger under this type of sampling than under other random sampling techniques
6. A simple random design may be expensive in time and money

2) Stratified Random Sampling

This is an improved type of random sampling. In this method, the population is sub-divided into homogenous groups or strata, and from each stratum, random sample is drawn. For example university students may be divided on the basis of discipline, and each discipline group may again be divided into juniors and seniors; and the employees of a business undertaking may be divided into managers and non-managers and each of those two groups may be sub-divided into salary-grade wise strata.

a) Proportionate Stratified Sampling

This sampling involves drawing a sample from each stratum in proportion to the latter's share in the total population.

Specialization	No. of Students	Proportion of Each Stream
Production	40	0.4
Finance	20	0.2
Marketing	30	0.3
Rural Development	10	0.1
Total	100	1.0

Merits

1. It enhances the representativeness of the sample by giving proper representation to all sub-groups in the population

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2. It gives higher statistical efficiency that the given by simple random sampling for a given sample size
3. It is easy to carry out this sample method
4. This method gives a self-weighing sample, the population mean can be estimated simply by calculating the sample mean

Demerits

1. A prior knowledge of the composition of the population and the distribution of the population characteristics are required to adopt this method
2. This method is very expensive in time and money. Of course its greater efficiency may offset the additional cost
3. The identification of the strata might lead to classification errors. Some elements maybe included into the wrong strata. This may vitiate the interpretation of survey results.

b) Disproportionate Stratified Sampling

This method does not give proportionate representation to strata (group). It necessarily involves giving over representation to some strata and under representation to others. There may be several disproportionate schemes. All strata may be given equal weight, even though their shares in the total population vary. Alternatively some substrata may be given greater weight and others lesser weight. When is such disproportionate weighing preferable? **Example :** Drawing one per cent as sample irrespective on the numbers of members in the sample

Merits

1. It is less time consuming compared with proportionate sampling, because the researcher is not necessarily concerned about the proportionate representativeness of his resulting sample

as in the latter method

2. It facilitates giving appropriate weighting to particular groups, which are small but more important

Demerits

1. This method does not give each stratum proportionate representation. Hence, the resulting sample may be less representative
2. This method requires a prior knowledge of the composition of the population, which is not always possible
3. This method is also subject to classification errors. It is possible that the researcher may misclassify certain elements
4. Though disproportionate sampling is a means for developing an optimal stratification scheme, its practical feasibility is doubtful because one generally does not know the relative variability in the strata nor the relative costs

3) Systematic Sampling

This method of sampling is an alternative to random sampling. It consists of taking every K^{th} item in the population after a random start with an item form 1 to K. **For example**, suppose it is desired to select a sample of 20 students, from a list of 300 students, divide the population total of 300 by 20, the quotient is 15. Select a number at random between 1 and 15, using lottery method or a table of random numbers. Suppose the selected number is 9. Then the students numbered 9, 24, 39 are selected as the sample.

As the interval between sample units is fixed, this method is also known as fixed interval method.

Merits

1. It is much simpler than random sampling. It is easy to use
2. It is easy to instruct to field investigators to use this method

3. This method may require less time. A researcher operating on a limited time schedule will prefer this method
4. This method is cheaper than simple random sampling
5. It is easier to check whether every 'k'th has been included in the sample
6. Sample is spread evenly over the population
7. It is statistically more efficient than a simple random sample when population elements are ordered chronologically, by size, class, etc., Then systematic sampling gives a better representative sample

Demerits

1. This method ignores all elements between two 'k'th elements selected. Further, except the first element, other selected elements are not chosen at random. Hence, this sampling cannot be considered to be a probably sampling in the strict sense of the term
2. As each element does not have an equal chance of being selected, the resulting sample is not a random one. For studies aiming at estimation or generalizations, this disadvantage would be serious one

3. This method may sometimes give a biased sample. If by chance, several 'k' th elements chosen represent a particular group, that group would be over-represented in the sample

4) Cluster Sampling

Where the population elements are scattered over a wider area and a list of population elements is not readily available, the use of simple or stratified random sampling method would be too expensive and time consuming. In such cases cluster sampling is usually adopted.

Cluster sampling means random selection of sampling units consisting of population elements. Each such sampling unit is a cluster of population elements. Then from each selected sampling unit, a sample of population elements is drawn by either simple random

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selection or stratified random selection.

Example: Suppose a researcher wants to select a random sample of 1000 households out of 40000 estimated households in a city for a survey. A direct sample of individual households would be difficult to select, because a list of households does not exist and would be too costly to prepare. Instead, he can select a random sample of a few blocks / wards. The number of blocks to be selected depends upon the average number of estimated households per block. Suppose the average number of households per block is 200, then 5 blocks comprise the sample. Since the number of households per block varies, the actual sample size depends on the block which happen to be selected. Alternatively, he can draw a sample of more blocks and from each blocks a certain number of households may be selected by systematic sampling.

Merits

1. This method is much easier and more convenient to apply when large populations are studied or large geographical areas are covered. Even a ready list of population elements is not necessary. A researcher can simply draw a random sample of geographical sections and adopt single or multistage sampling depending on the vastness of the area covered by the study
2. The cost of this method is much less when compared with other sampling methods
3. This method promotes the convenience of field work at it could be done in compact places
4. Sampling under this method does not require more time
5. Units of study can be readily substituted for other units within the same random section
6. This method is flexible. Where it involves multistage sampling, it is possible to employ different types of sampling in successive stages

Demerits

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1. The cluster size may vary and this variation could increase the bias of the resulting sample. For example, if the researcher were to interview all adults in households in each selected street the number of adults would vary from house to house. There would be certain bias resulting from the large coverage of big families
2. The sampling error in this method of sampling is greater. Thus, this method is statistically less efficient than other probability sampling methods
3. Adjacent units of study (e.g. households) tend to have more similar characteristics than do units distantly apart. This affects the 'representativeness' of the sample and this effect is reflected in a greater sampling error.

5) Area Sampling

This is an important form of cluster sampling. In larger field surveys, clusters consisting of specific geographical areas like districts, taluks, villages or blocks in a city are randomly drawn. As the geographical areas are selected as sampling units in such cases, their sampling is called area sampling. It is not a separate method of sampling, but forms a part of cluster sampling.

In a country like India where a state (previously known as province) is divided into districts, districts into talukas and talukas into towns and villages, area sampling is done on the basis of these administrative units in multi-stages.

6) Multi-stage Sampling

In this method, sampling is carried out in two or more stages. The population is regarded as being composed of a number of first stage sampling units. Each of them is made up of a number of second stage units and so forth. That is, at each stage, a sampling unit is a cluster of the sampling units of the subsequent stage. First, a sample of the first stage sampling units is drawn, then from each of the selected first stage sampling unit, a sample of

the second stage sampling units is drawn. The procedure continues down to the final sampling units or population elements. Appropriate random sampling method is adopted at each stage.

Merits

It results in concentration of fieldwork in compact small areas and consequently in a saving of time, labour and money

1. It is more convenient, efficient and flexible than single-stage sampling
2. It obviates the necessity of having a sampling frame covered the entire population

Demerits

The major disadvantage of the multi-stage sampling is that the procedure of estimating sampling error and cost advantage is complicated. It is difficult for a non-statistician to follow estimation procedure.

B. Non-Probability Sampling

1) Convenience Sampling

This is non-probability sampling. It means selecting sample units in a just 'hit an miss' fashion. E.g. Interviewing people whom we happen to meet. This sampling also means selecting whatever sampling units are conveniently available e.g. a teacher may select students in his class. This method is also known as accidental sampling because the respondents whom the researcher meets accidentally are included in the sample.

Merits

1. Cheapest and simplest

2. It does not require a list of population
3. It does not require any statistical expertise

Demerits

1. Convenience sampling is highly biased, because of the researcher's subjectivity, and so it does not yield a representative sample
2. It is the least reliable sampling method. There is no way of estimating the representativeness of the sample
3. The findings cannot be generalized

2) Purposed or Judgement Sampling

This method means deliberate selection of sample units that conform to some pre-determined criteria. This is known as judgement sampling. This involves selection of cases which we judge as the most appropriate ones for the given study. It is based on the judgement of the researcher or some expert. It does not aim at securing a cross section of a population.

The chance that a particular case be selected for the sample depends on the subjective judgement of the researcher. For example, A researcher may deliberately choose industrial undertakings in which quality circles are believed to be functioning successfully and undertakings in which quality circles are believed to be a total failure

Merits

1. It is less costly and more convenient
2. It guarantees inclusion of relevant elements in the sample. Probability sampling plans cannot give such guarantee

Demerits

1. This does not ensure the representativeness of the sample

2. This is less efficient for generalizing when compared with random sampling
3. This method requires more prior extensive information about the population one studies. Without such information, it is not possible to adjudge the suitability of the sample items to be selected

4. The method does not lend itself for using inferential statistics, because, this sampling does not satisfy the underlying assumption of randomness.

3) Quota Sampling

This is a form of convenient sampling involving selection of quota groups of accessible sampling units by traits such as sex, age, social class etc., when the population is known to consist of various categories by sex, age, religion, social class, etc., in specific proportions, each investigator may be given an assignment of quota groups specified by the pre-determined traits in specific proportions. He can then select accessible persons, belonging to those quota groups in the area assigned to him.

Example

Sex	**Numbers**	**Age**		**Social Class**	
Male	11	20-40	5	Higher	3
Female	9	41-50	8	Middle	10
	20	51-60	4	Lower	7
		Above 60	3		**20**
			20		

Merits

1. It is considerably less costly than probability sampling
2. It takes less time
3. There is no need for a list of population. Thus, quota sampling is a suitable method of sampling a population for which no suitable frame is available
4. Field work can easily be organized. Strict supervision need not be required

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Demerits

1. It may not yield a precise representative sample, and it is impossible to estimate sampling error. The findings, therefore, are not generalizable to any significant extent
2. Interviewers may tent to choose the most accessible persons; they may ignore slums or areas difficult to reach. Thus, they may fail to secure a representative sample within their quota groups
3. Strict control of field work is difficult
4. quota of sampling is subject to higher degree of classification error, because the investigators are likely to base their classification of respondents' social status and economic status mostly on their impressions about them
5. It is difficult for sampling on more than three variable dimensions. This is because the number of categories to be selected is a multiplication of the number of values in each variable. For instances, if we want to sample proportionate number of persons by sex, social status and age and these variables consist of two, three and three categories respectively.

4) Snowball Sampling

This is the colourful name for a technique of building up a list or a sample of a special population by using an initial set of its members as informants. For example, if a researcher wants to study the problem faced by Indians through some source like Indian Embassy. Then he can ask each one of them to supply names of other Indians known to them, and continue this procedure until he gets an exhaustive list from which he can draw a sample or make a census survey.

This sampling technique may also be used in socio-metric studies. For example, the members of a social group may be asked to name the persons with whom they have social

contacts, each one of the persons so named may also be asked to do so, and so on. The researcher may thus get a constellation of associates and analyse it.

Merits

1. It is very useful in studying social groups, informal group in a formal organization, and diffusion of information among professionals of various kinds
2. It is useful for smaller populations for which no frames are readily available

Demerits

1. The major disadvantages of snowball sampling is that it does not allow the use of probability statistical methods. Elements included are dependent on the subjective choice of the original selected respondents
2. It is difficult to apply this method when the population is large
3. It does not ensure the inclusion of all elements in the lists

CONCEPT OF STANDARD ERROR

The standard deviation of sampling distribution of a statistic is known as its standard error (S.E) and is considered the key to sampling theory. The utility of the concept of standard error in statistical induction arises on account of the following reasons:

1. The standard error helps in testing whether the difference between observed and expected frequencies could arise due to chance. The criterion usually adopted is that if a difference is less than 3 times the S.E., the difference is supposed to exist as a matter of chance and if the difference is equal to or more than 3 times the S.E., chance fails to account for it, and we conclude the difference as significant difference. This criterion is based on the fact that at $X \pm 3$ (S.E.) the normal curve covers an area of 99.73 per cent. Sometimes the criterion of 2 S.E. is also used in place of 3 S.E. Thus the standard error is an important measure in significance tests or in examining hypotheses. If the estimated parameter differs from the calculated statistic by more than 1.96 times the S.E., the difference is taken as significant at 5 per cent level of significance. This, in other words, means that the difference is outside the limits i.e., it lies in the 5 per cent area (2.5

per cent on both sides) outside the 95 per cent area of the sampling distribution. Hence we can say with 95 per cent confidence that the said difference is not due to fluctuations of sampling. In such a situation our hypothesis that there is no difference is rejected at 5 per cent level of significance. But if the difference is less than 1.96 times the S.E., then it is considered not significant at 5 per cent level and we can say with 95 per cent confidence that it is because of the fluctuations of sampling. In such a situation our null hypothesis stands true. 1.96 is the critical value at 5 per cent level. The product of the critical value at a certain level of significance and the S.E. is often described as 'Sampling Error' at that particular level of significance. We can test the difference at certain other levels of significance as well depending upon our requirement. The following table gives some idea about the criteria at various levels for judging the significance of the difference between observed and expected values:

ESTIMATING THE POPULATION MEAN

( )

μ

So far as the point estimate is concerned, the sample mean

X

is the best estimator of the population mean,

μ

, and its sampling distribution, so long as the sample is sufficiently large, approximates the normal distribution. If we know the sampling distribution of

X

, we can make statements about any estimate that we may make from the sampling information. Assume that we take a sample of 36 students and find that the sample yields an arithmetic mean of 6.2 i.e.,

X

=

62

.

. Replace these

student names on the population list and draw another sample of 36 randomly and let us assume that
we get a mean of 7.5 this time. Similarly a third sample may yield a mean of 6.9; fourth a mean of 6.7,
and so on. We go on drawing such samples till we accumulate a large number of means of samples
of 36. Each such sample mean is a separate point estimate of the population mean. When such
means are presented in the form of a distribution, the distribution happens to be quite close to normal.
This is a characteristic of a distribution of sample means (and also of other sample statistics). Even
if the population is not normal, the sample means drawn from that population are dispersed around
the parameter in a distribution that is generally close to normal; the mean of the distribution of sample
means is equal to the population mean.This is true in case of large samples as per the dictates of the central limit theorem.

ESTIMATING POPULATION PROPORTION

So far as the point estimate is concerned, the sample proportion (
p
) of units that have a particular
characteristic is the best estimator of the population proportion
$
p
bg
and its sampling distribution, so
long as the sample is sufficiently large, approximates the normal distribution. Thus, if we take a
random sample of 50 items and find that 10 per cent of these are defective i.e.,
p
= .10, we can use
this sample proportion (
p
= .10) as best estimator of the population proportion

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$
.
pp
==
10
bg
. In
case we want to construct confidence interval to estimate a population poportion, we should use the
binomial distribution with the mean of population
μ
bg
=.
np
, where
n
= number of trials,
p
=
probability of a success in any of the trials and population standard deviation
=
npq
. As the
sample size increases, the binomial distribution approaches normal distribution which we can use for
our purpose of estimating a population proportion. The mean of the sampling distribution of the
proportion of successes
()
μ
p
is taken as equal to p and the standard deviation for the proportion of successes, also known as the standard error of proportion, is taken as equal to pq n.

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DATA COLLECTION

The task of data collection begins after a research problem has been defined and research design/ plan chalked out. While deciding about the method of data collection to be used for the study, the researcher should keep in mind two types of data viz., primary and secondary. The primary data are those which are collected afresh and for the first time, and thus happen to be original in character. The secondary data, on the other hand, are those which have already been collected by someone else and which have already been passed through the statistical process. The researcher would have to decide which sort of data he would be using (thus collecting) for his study and accordingly he will have to select one or the other method of data collection. The methods of collecting primary and secondary data differ since primary data are to be originally collected, while in case of secondary data the nature of data collection work is merely that of compilation.

1) Primary Data

Data directly collected by the researcher, with respect to problem under study, is known as primary data. Primary data is also the first hand data collected by the researcher for the immediate purpose of the study.

2) Secondary Data

Secondary data are statistics that already exists. They have been gathered not for immediate use. This may be described as "Those data that have been compiled by some agency other than the user".

METHODS OF COLLECTING DATA OBSERVATION

The observation method is the most commonly used method specially in studies relating to behavioural sciences. In a way we all observe things around us, but this sort of

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observation is not scientific observation. Observation becomes a scientific tool and the method of data collection for the researcher, when it serves a formulated research purpose, is systematically planned and recorded and is subjected to checks and controls on validity and reliability. Under the observation method, the information

way of investigator's own direct observation without asking from the respondent. For instance, in a study relating to consumer behaviour, the investigator instead of asking the brand of wrist watch used by the respondent, may himself look at the watch.

Advantages of Observation

1. The main advantage of this method is that subjective bias is eliminated, if observation is done accurately.
2. Secondly, the information obtained under this method relates to what is currently happening; it is not complicated by either the past behaviour or future intentions or attitudes.
3. Thirdly, this method is independent of respondents' willingness to respond and as such is relatively less demanding of active cooperation on the part of respondents as happens to be the case in the interview or the questionnaire method.
4. This method is particularly suitable in studies which deal with subjects (i.e., respondents) who are not capable of giving verbal reports of their feelings for one reason or the other

Limitations of Observation

1. Firstly, it is an expensive method.
2. Secondly, the information provided by this method is very limited.
3. Thirdly, sometimes unforeseen factors may interfere with the observational task.
4. At times, the fact that some people are rarely accessible to direct observation creates obstacle for this method to collect data effectively.

Precautions before Adopting Observation Method of Data Collection

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- While using this method, the researcher should keep in mind things like:
- What should be observed?
- How the observations should be recorded? Or
- How the accuracy of observation can be ensured?

Types of Observation

1) Structured Observation

In case the observation is characterised by a careful definition of the units to be observed, the style of recording the observed information, standardised conditions of observation and the selection of pertinent data of observation, then the observation is called as structured observation. Structured observation is considered appropriate in descriptive studies

2) Unstructured Observation

But when observation is to take place without these characteristics to be thought of in advance, the same is termed as unstructured observation. Whereas in an exploratory study the observational procedure is most likely to be relatively unstructured.

3) Participant Observation

We often talk about participant and non-participant types of observation in the context of studies, particularly of social sciences. This distinction depends upon the observer's sharing or not sharing the life of the group he is observing. If the observer observes by making himself, more or less, a member of the group he is observing so that he can experience what the members of the group experience, the observation is called as the

participant observation.

Merits of Participant Observation

1. The researcher is enabled to record the natural behaviour of the group.
2. The researcher can even gather information which could not easily be obtained if he observes in a disinterested fashion.
3. The researcher can even verify the truth of statements made by informants in the context of a questionnaire or a schedule.

D emerits of Participant Observation

- The observer may lose the objectivity to the extent he participates emotionally; the problem of observation-control is not solved; and it may narrow-down the researcher's range of experience.

4) Non-Participant Observation

But when the observer observes as a detached emissary without any attempt on his part to experience through participation what others feel, the observation of this type is often termed as non-participant observation. (When the observer is observing in such a manner that his presence may be unknown to the people he is observing, such an observation is described as disguised observation.)

5) Uncontrolled Observation

If the observation takes place in the natural setting, it may be termed as uncontrolled observation, In non-controlled observation, no attempt is made to use precision instruments. The major aim of this type of observation is to get a spontaneous picture of life and persons. It has a tendency to supply naturalness and completeness of behaviour, allowing sufficient

time for observing it. The main pitfall of non-controlled observation is that of subjective interpretation. There is also the danger of having the feeling that we know more about the observed phenomena than we actually do. Uncontrolled observation is resorted to in case of exploratory researches.

6) Controlled Observation

When observation takes place according to definite pre-arranged plans, involving experimental procedure, the same is then termed controlled observation. But in controlled observation, we use mechanical (or precision) instruments as aids to accuracy and standardisation. Such observation has a tendency to supply formalised data upon which generalisations can be built with some degree of assurance. Generally, controlled observation takes place in various experiments that are carried out in a laboratory or under controlled conditions

INTERVIEW SCHEDULE

The interview method of collecting data involves presentation of oral-verbal stimuli and reply in terms of oral-verbal responses. This method can be used through personal interviews and, if possible, through telephone interviews. Interview is one of the popular methods of data collection. The term interview can be dissected into two terms as, 'inter' and 'view.'. The essence of interview is that one mind tries to read the other. The interviewer tries to assess the interviewed in terms of the aspects studied or issues analysed.

Personal interview method requires a person known as the interviewer asking questions generally in a face-to-face contact to the other person or persons. (At times the interviewee may also ask certain questions and the interviewer responds to these, but usually the interviewer initiates the interview and collects the information.) This sort of interview may be in the form of direct personal investigation or it may be indirect oral investigation. In the case of direct personal investigation the interviewer has to collect the information personally from the sources concerned. He has to be on the spot and has to meet people from whom data have to be collected. This method is particularly suitable for intensive

investigations.

But in certain cases it may not be possible or worthwhile to contact directly the persons concerned or on account of the extensive scope of enquiry, the direct personal investigation technique may not be used. In such cases an indirect oral examination can be conducted under which the interviewer has to cross-examine other persons who are supposed to have knowledge about the problem under investigation and the information, obtained is recorded. Most of the commissions and committees appointed by government to carry on investigations make use of this method.

Types of Interview

1) Structured Interview

The method of collecting information through personal interviews is usually carried out in a structured way. As such we call the interviews as structured interviews.Such interviews involve the use of a set of predetermined questions and of highly standardised techniques of recording. Thus, the interviewer in a structured interview follows a rigid procedure laid down, asking questions in a form and order prescribed. But in case of descriptive studies, we quite often use the technique of structured interview because of its being more economical, providing a safe basis for generalisation and requiring relatively lesser skill on the part of the interviewer.

2) Unstructured Interview

As against it, the unstructured interviews are characterised by a flexibility of approach to questioning. Unstructured interviews do not follow a system of pre- determined questions and standardised techniques of recording information. In a non- structured interview, the interviewer is allowed much greater freedom to ask, in case of need, supplementary questions or at times he may omit certain questions if the situation so requires. He may even change the sequence of questions. He has relatively greater freedom while recording the responses to include some aspects and exclude others. But this sort of

flexibility results in lack of comparability of one interview with another and the analysis of unstructured responses becomes much more difficult and time-consuming than that of the structured responses obtained in case of structured interviews. Unstructured interviews also demand deep knowledge and greater skill on the part of the interviewer. Unstructured interview, however, happens to be the central technique of collecting information in case of exploratory or formulative research studies.

3) Focused Interview

Focussed interview is meant to focus attention on the given experience of the respondent and its effects. Under it the interviewer has the freedom to decide the manner and sequence in which the questions would be asked and has also the freedom to explore reasons and motives. The main task of the interviewer in case of a focussed interview is to confine the respondent to a discussion of issues with which he seeks conversance. Such interviews are used generally in the development of hypotheses and constitute a major type of unstructured interviews.

4) Clinical Interview

The clinical interview is concerned with broad underlying feelings or motivations or with the course of individual's life experience. The method of eliciting information under it is generally left to the interviewer's discretion.

5) Non-directive Interview

In case of non-directive interview, the interviewer's function is simply to encourage the respondent to talk about the given topic with a bare minimum of direct questioning. The interviewer often acts as a catalyst to a comprehensive expression of the respondents' feelings and beliefs and of the frame of reference within which such feelings and beliefs take

on personal significance.

Merits of Interview

1. More information and that too in greater depth can be obtained.
2. Interviewer by his own skill can overcome the resistance, if any, of the respondents; the interview method can be made to yield an almost perfect sample of the general population.
3. There is greater flexibility under this method as the opportunity to restructure questions is always there, specially in case of unstructured interviews.
4. Observation method can as well be applied to recording verbal answers to various questions.
5. Personal information can as well be obtained easily under this method.
6. Samples can be controlled more effectively as there arises no difficulty of the missing returns; non-response generally remains very low.
7. The interviewer can usually control which person(s) will answer the questions. This is not possible in mailed questionnaire approach. If so desired, group discussions may also be held.
8. The interviewer may catch the informant off-guard and thus may secure the most spontaneous reactions than would be the case if mailed questionnaire is used.
9. The language of the interview can be adopted to the ability or educational level of the person interviewed and as such misinterpretations concerning questions can be avoided.
10. The interviewer can collect supplementary information about the respondent's personal characteristics and environment which is often of great value in interpreting results.

Demerits or Weakness of Interview

1. It is a very expensive method, specially when large and widely spread geographical sample is taken.
2. There remains the possibility of the bias of interviewer as well as that of the respondent; there

also remains the headache of supervision and control of interviewers.

3. Certain types of respondents such as important officials or executives or people in high income groups may not be easily approachable under this method and to that extent the data may prove inadequate.
4. This method is relatively more-time-consuming, specially when the sample is large and recalls upon the respondents are necessary.
5. The presence of the interviewer on the spot may over-stimulate the respondent, sometimes even to the extent that he may give imaginary information just to make the interview interesting.
6. Under the interview method the organisation required for selecting, training and supervising the field-staff is more complex with formidable problems.
7. Interviewing at times may also introduce systematic errors.
8. Effective interview presupposes proper rapport with respondents that would facilitate free and frank responses. This is often a very difficult requirement.

Pre-requisites and Basic Tenets of Interviewing

1. For successful implementation of the interview method, interviewers should be carefully selected, trained and briefed.
2. They should be honest, sincere, hardworking, impartial and must possess the technical competence and necessary practical experience.
3. Occasional field checks should be made to ensure that interviewers are neither cheating, nor deviating from instructions given to them for performing their job efficiently.
4. In addition, some provision should also be made in advance so that appropriate action may be taken if some of the selected respondents refuse to cooperate or are not available when an interviewer calls upon them.
5. In fact, interviewing is an art governed by certain scientific principles. Every effort should be made to create friendly atmosphere of trust and confidence, so that respondents may feel at

ease while talking to and discussing with the interviewer.

6. The interviewer must ask questions properly and intelligently and must record the responses accurately and completely. At the same time, the interviewer must answer legitimate question(s), if any, asked by the respondent and must clear any doubt that the latter has.
7. The interviewers approach must be friendly, courteous, conversational and unbiased.
8. The interviewer should not show surprise or disapproval of a respondent's answer but he must keep the direction of interview in his own hand, discouraging irrelevant conversation and must make all possible effort to keep the respondent on the track.

QUESTIONNAIRE

This method of data collection is quite popular, particularly in case of big enquiries. It is being adopted by private individuals, research workers, private and public organisations and even by governments. In this method a questionnaire is sent (usually by post) to the persons concerned with a request to answer the questions and return the questionnaire. A questionnaire consists of a number of questions printed or typed in a definite order on a form or set of forms. The questionnaire is mailed to respondents who are expected to read and understand the questions and write down the reply in the space meant for the purpose in the questionnaire itself. The respondents have to answer the questions on their own.

The method of collecting data by mailing the questionnaires to respondents is most extensively employed in various economic and business surveys

Merits of Questionnaire

1. There is low cost even when the universe is large and is widely spread geographically.
2. It is free from the bias of the interviewer; answers are in respondents' own words.
3. Respondents have adequate time to give well thought out answers.

4. Respondents, who are not easily approachable, can also be reached conveniently.
5. Large samples can be made use of and thus the results can be made more dependable and reliable.

Demerits of Questionnaire

1. Low rate of return of the duly filled in questionnaires; bias due to no-response is often indeterminate.
2. It can be used only when respondents are educated and cooperating.
3. The control over questionnaire may be lost once it is sent.
4. There is inbuilt inflexibility because of the difficulty of amending the approach once questionnaires have been despatched.
5. There is also the possibility of ambiguous replies or omission of replies altogether to certain questions; interpretation of omissions is difficult.
6. It is difficult to know whether willing respondents are truly representative.
7. This method is likely to be the slowest of all.

Before using this method, it is always advisable to conduct 'pilot study' (Pilot Survey) for testing the questionnaires. In a big enquiry the significance of pilot survey is felt very much. Pilot survey is infact the replica and rehearsal of the main survey. Such a survey, being conducted by experts, brings to the light the weaknesses (if any) of the questionnaires and also of the survey techniques. From the experience gained in this way, improvement can be effected.

Main Aspects of a Questionnaire

Quite often questionnaire is considered as the heart of a survey operation. Hence it should be very carefully constructed. If it is not properly set up, then the survey is bound

to fail. This fact requires us to study the main aspects of a questionnaire viz., the general form, question sequence and question formulation and wording. Researcher should note the following with regard to these three main aspects of a questionnaire:

1) General form

So far as the general form of a questionnaire is concerned, it can either be structured or unstructured questionnaire. Structured questionnaires are those questionnaires in which there are definite, concrete and pre-determined questions. The questions are presented with exactly the same wording and in the same order to all respondents. Resort is taken to this sort of standardisation to ensure that all respondents reply to the same set of questions. The form of the question may be either closed (i.e., of the type 'yes' or 'no') or open (i.e., inviting free response) but should be stated in advance and not constructed during questioning. Structured questionnaires may also have fixed alternative questions in which responses of the informants are limited to the stated alternatives. Thus a highly structured questionnaire is one in which all questions and answers are specified and comments in the respondent's own words are held to the minimum. When these characteristics are not present in a questionnaire, it can be termed as unstructured or non-structured questionnaire. More specifically, we can say that in an unstructured questionnaire, the interviewer is provided with a general guide on the type of information to be obtained, but the exact question formulation is largely his own responsibility and the replies are to be taken down in the respondent's own words to the extent possible; in some situations tape recorders may be used to achieve this goal.

Structured questionnaires are simple to administer and relatively inexpensive to analyse. The provision of alternative replies, at times, helps to understand the meaning of the question clearly. But such questionnaires have limitations too. For instance, wide range of data and that too in respondent's own words cannot be obtained with structured

questionnaires. They are usually considered inappropriate in investigations where the aim happens to be to probe for attitudes and reasons for certain actions or feelings. They are equally not suitable when a problem is being first explored and working hypotheses sought. In such situations, unstructured questionnaires may be used effectively. Then on the basis of the results obtained in pretest (testing before final use) operations from the use of unstructured questionnaires, one can construct a structured questionnaire for use in the main study.

2) Question Sequence

In order to make the questionnaire effective and to ensure quality to the replies received, a researcher should pay attention to the question-sequence in preparing the questionnaire. A proper sequence of questions reduces considerably the chances of individual questions being misunderstood. The question-sequence must be clear and smoothly-moving, meaning thereby that the relation of one question to another should be readily apparent to the respondent, with questions that are easiest to answer being put in the beginning. The first few questions are particularly important because they are likely to influence the attitude of the respondent and in seeking his desired cooperation. The opening questions should be such as to arouse human interest. The following type of questions should generally be avoided as opening questions in a questionnaire:

- Questions that put too great a strain on the memory or intellect of the respondent;
- Questions of a personal character
- Questions related to personal wealth, etc.

Following the opening questions, we should have questions that are really vital to the research problem and a connecting thread should run through successive questions. Ideally, the question-sequence should conform to the respondent's way of thinking. Knowing what

information is desired, the researcher can rearrange the order of the questions (this is possible in case of unstructured questionnaire) to fit the discussion in each particular case. But in a structured questionnaire the best that can be done is to determine the question-sequence with the help of a Pilot Survey which is likely to produce good rapport with most respondents. Relatively difficult questions must be relegated (tranfered) towards the end so that even if the respondent decides not to answer such questions, considerable information would have already been obtained. Thus, question-sequence should usually go from the general to the more specific and the researcher must always remember that the answer to a given question is a function not only of the question itself, but of all previous questions as well. For instance, if one question deals with the price usually paid for coffee and the next with reason for preferring that particular brand, the answer to this latter question may be couched (understood) largely in terms of price-differences.

3) Question Formulation and Wording

With regard to this aspect of questionnaire, the researcher should note that each question must be very clear for any sort of misunderstanding can do irreparable harm to a survey. Question should also be impartial in order not to give a biased picture of the true state of affairs. Questions should be constructed with a view to their forming a logical part of a well thought out tabulation plan. In general, all questions should meet the following standards—(a) should be easily understood; (b) should be simple i.e., should convey only one thought at a time; (c) should be concrete and should conform as much as possible to the respondent's way of thinking. (For instance, instead of asking. "How many razor blades do you use annually?" The more realistic question would be to ask, "How many razor blades did you use last week?"

Multiple Choice Question and the Open-End Questions. In the former the respondent selects one of the alternative possible answers put to him, whereas in the latter he has to

supply the answer in his own words. The question with only two possible answers (usually 'Yes' or 'No') can be taken as a special case of the multiple choice question, or can be named as a 'closed question.' There are some advantages and disadvantages of each possible form of question. Multiple choice or closed questions have the advantages of easy handling, simple to answer, quick and relatively inexpensive to analyse. They are most amenable to statistical analysis. Sometimes, the provision of alternative replies helps to make clear the meaning of the question. But the main drawback of fixed alternative questions is that of "putting answers in people's mouths" i.e., they may force a statement of opinion on an issue about which the respondent does not infact have any opinion. They are not appropriate when the issue under consideration happens to be a complex one and also when the interest of the researcher is in the exploration of a process. In such situations, open-ended questions which are designed to permit a free response from the respondent rather than one limited to certain stated alternatives are considered appropriate. Such questions give the respondent considerable latitude in phrasing a reply. Getting the replies in respondent's own words is, thus, the major advantage of open-ended questions. But one should not forget that, from an

analytical point of view, open-ended questions are more difficult to handle, raising problems of interpretation, comparability and interviewer bias.

In practice, one rarely comes across a case when one questionnaire relies on one form of questions alone. The various forms complement each other. As such questions of different forms are included in one single questionnaire. For instance, multiple-choice questions constitute the basis of a structured questionnaire, particularly in a mail survey. But even there, various open-ended questions are generally inserted to provide a more complete picture of the respondent's feelings and attitudes.

Researcher must pay proper attention to the wordings of questions since reliable and

meaningful returns depend on it to a large extent. Since words are likely to affect responses, they should be properly chosen. Simple words, which are familiar to all respondents, should be employed. Words with ambiguous meanings must be avoided. Similarly, danger words, catch-words or words with emotional connotations should be avoided. Caution must also be exercised in the use of phrases which reflect upon the prestige of the respondent. Question wording, in no case, should bias the answer. In fact, question wording and formulation is an art and can only be learnt by practice.

Essentials of Good Questionnaire

1. To be successful, questionnaire should be comparatively short and simple i.e., the size of the questionnaire should be kept to the minimum
2. Questions should proceed in logical sequence moving from easy to more difficult questions
3. Personal and intimate questions should be left to the end
4. Technical terms and vague expressions capable of different interpretations should be avoided in a questionnaire
5. Questions may be dichotomous (yes or no answers), multiple choice (alternative answers listed) or open-ended. The latter type of questions are often difficult to analyse and hence should be avoided in a questionnaire to the extent possible
6. There should be some control questions in the questionnaire which indicate the reliability of the respondent. For instance, a question designed to determine the onsumption of particular material may be asked first in terms of financial expenditure and later in terms of weight. The control questions, thus, introduce a cross-check to see whether the information collected is correct or not
7. Questions affecting the sentiments of respondents should be avoided
8. Adequate space for answers should be provided in the questionnaire to help editing and tabulation

9. There should always be provision for indications of uncertainty, e.g., "do not know," "no preference" and so on
10. Brief directions with regard to filling up the questionnaire should invariably be given in the questionnaire itself
11. Finally, the physical appearance of the questionnaire affects the cooperation the researcher receives from the recipients and as such an attractive looking questionnaire, particularly in mail surveys, is a plus point for enlisting cooperation.
12. The quality of the paper, along with its colour, must be good so that it may attract the attention of recipients

Types of Questionnaire

1) Structured non disguised Questionnaire

Here, questions are structured so as to get the facts. The interviewer will ask the questions strictly as per the pre arranged order. Structured, non disguised is widely used in market research. Questions are presented with exactly the same wording and same order to all the respondents. The reason for standardizing question is, to ensure that all respondents reply the same question. The purpose of the question is clear. The researcher wants the respondent to choose one of the five options given above. This type of questionnaire is easy to administer. The respondents have no difficulty in answering. Because it is structured, the frame of reference is obvious. In a non-disguised type, the purpose of the questionnaire is known to the respondent.

2) Structured disguised Questionnaire

This type of questionnaire is least used in Marketing research. This type of Questionnaire is used to find, peoples' attitude, when a direct undisguised question produces a bias. In this type of questionnaire what comes out is "What does the respondent know rather than what he feels". Therefore attempt in this method is to find the respondent's attitude.

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3) Non-Structured and disguised Questionnaire

The main objective is to conceal the topic of enquiry by using a disguised stimulus. Though the stimulus is standardized by researcher, respondent is allowed to answer in an unstructured manner. The assumption made here is that individuals reaction is an indication of respondent's basic perception. Projective techniques are examples of Non structured disguised technique. The techniques involve the use of a vague stimulus, that an individual is asked to expand or describe or build a story, three common types under this category are (a) Word association (b) Sentence completion (c) Story telling.

4) Non structured - Non disguised Questionnaire

Here the purpose of the study is clear, but the responses to the question is open ended. Example: "How do you feel about the cyber law currently in practice and its need for further modification"? The initial part of the question is constant. After presenting the initial question, the interview becomes very unstructured as the interviewer probes more deeply. Respondents subsequent answer determines the direction the interviewer takes next. The question asked by interviewer varies from person to person. This method is called "Depth interview". The major advantage of this method is freedom permitted to the interviewer. By not restricting the respondents for a set of replies, the experienced interviewers will be above to get the information from the respondent fairly and accurately. The main disadvantage of this method of interviewing is that, it takes time, and respondents may not co-operate. Another disadvantage is that coding of open ended question may pose a challenge. E.g.: When a researcher asked the respondent "Tell me something about your experience in this hospital". The answer may be "Well, the nurses are "slow" to attend and Doctor is "rude". 'Slow' and 'rude' are different qualities needing separate coding. This type of interviewing is extremely helpful in exploratory studies.

SCHEDULES

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This method of data collection is very much like the collection of data through questionnaire, with little difference which lies in the fact that schedules (proforma containing a set of questions) are being filled in by the enumerators who are specially appointed for the purpose. These enumerators along with schedules, go to respondents, put to them the questions from the proforma in the order the questions are listed and record the replies in the space meant for the same in the proforma.

In certain situations, schedules may be handed over to respondents and enumerators may help them in recording their answers to various questions in the said schedules. Enumerators explain the aims and objects of the investigation and also remove the difficulties which any respondent may feel in understanding the implications of a particular question or the definition or concept of difficult terms. This method requires the selection of enumerators for filling up schedules or assisting respondents to fill up schedules and as such enumerators should be very carefully selected

The enumerators should be trained to perform their job well and the nature and scope of the investigation should be explained to them thoroughly so that they may well understand the implications of different questions put in the schedule. Enumerators should be intelligent and must possess the capacity of cross-examination in order to find out the truth. Above all, they should be honest, sincere, hardworking and should have patience and perseverance. This method of data collection is very useful in extensive enquiries and can lead to fairly reliable results. It is, however, very expensive and is usually adopted in investigations conducted by governmental agencies or by some big organisations. Population census all over the world is conducted through this method.

DIFFERENCE BETWEEN QUESTIONNAIRE AND INTERVIEW SCHEDULE

1. The questionnaire is generally sent through mail to informants to be answered as

specified in a covering letter, but otherwise without further assistance from the sender. The schedule is generally filled out by the research worker or the enumerator, who can interpret questions when necessary.

2. To collect data through questionnaire is relatively cheap and economical since we have to spend money only in preparing the questionnaire and in mailing the same to respondents. Here no field staff required. To collect data through schedules is relatively more expensive since considerable amount of money has to be spent in appointing enumerators and in importing training to them. Money is also spent in preparing schedules.
3. Non-response is usually high in case of questionnaire as many people do not respond and many return the questionnaire without answering all questions. Bias due to non- response often remains indeterminate. As against this, non-response is generally very low in case of schedules because these are filled by enumerators who are able to get answers to all questions. But there remains the danger of interviewer bias and cheating.
4. In case of questionnaire, it is not always clear as to who replies, but in case of schedule the identity of respondent is known.
5. The questionnaire method is likely to be very slow since many respondents do not return the questionnaire in time despite several reminders, but in case of schedules the information is collected well in time as they are filled in by enumerators.
6. Personal contact is generally not possible in case of the questionnaire method as questionnaires are sent to respondents by post who also in turn return the same by post. But in case of schedules direct personal contact is established with respondents.
7. Questionnaire method can be used only when respondents are literate and cooperative, but in case of schedules the information can be gathered even when the respondents happen to be illiterate.
8. Wider and more representative distribution of sample is possible under the questionnaire method, but in respect of schedules there usually remains the difficulty in sending

enumerators over a relatively wider area.

9. Risk of collecting incomplete and wrong information is relatively more under the questionnaire method, particularly when people are unable to understand questions properly. But in case of schedules, the information collected is generally complete and accurate as enumerators can remove the difficulties, if any, faced by respondents in correctly understanding the questions. As a result, the information collected through schedules is relatively more accurate than that obtained through questionnaires.
10. The success of questionnaire method lies more on the quality of the questionnaire itself, but in the case of schedules much depends upon the honesty and competence of enumerators.
11. In order to attract the attention of respondents, the physical appearance of questionnaire must be quite attractive, but this may not be so in case of schedules as they are to be filled in by enumerators and not by respondents.
12. Along with schedules, observation method can also be used but such a thing is not possible while collecting data through questionnaires.

SECONDARY DATA

Secondary data means data that are already available i.e., they refer to the data which have already been collected and analysed by someone else. When the researcher utilises secondary data, then he has to look into various sources from where he can obtain them. In this case he is certainly not confronted with the problems that are usually associated with the collection of original data.

Secondary data may either be published data or unpublished data. Usually published data are available in: (a) various publications of the central, state are local governments; (b) various publications of foreign governments or of international bodies and their subsidiary organisations; (c) technical and trade journals; (d) books, magazines and newspapers; (e) reports and publications of various associations connected with business and industry, banks, stock exchanges, etc.; (f) reports prepared by research scholars,

universities, economists, etc. in different fields; and (g) public records and statistics, historical documents, and other sources of published information.

The sources of unpublished data are many; they may be found in diaries, letters, unpublished biographies and autobiographies and also may be available with scholars and research workers, trade associations, labour bureaus and other public/ private individuals and organisations. Researcher must be very careful in using secondary data. He must make a minute scrutiny because it is just possible that the secondary data may be unsuitable or may be inadequate in the context of the problem which the researcher wants

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to study. In this connection Dr. A.L. Bowley very aptly observes that it is never safe to take published statistics at their face value without knowing their meaning and limitations and it is always necessary to criticise arguments that can be based on them.

SOURCES OF SECONDARY DATA

Secondary data are obtained from personal documents and public documents.

1) Personal Documents

These documents are recorded by the individuals. An individual may record his views and thoughts about various problems and without knowing for these documents at a latter data so formed a subject or source of study.

Kinds of Personal Documents: Personal documents may be categorised or divided under the following heads for the convenience of the study; (i) Life History, (ii) Dairy, (iii) Letters, and (iv) Memoirs.

a) Life History

Life history, generally speaking contains all kinds of biographical, material, from the point of view of personal documents only an autobiography which contains description and views about social and personal events is a life history. It may be further classified under the following three sub-heads: Spontaneous Autobiography, Voluntary Autobiography of self record, and Compiled life history.

b) Diaries

Many people keep diaries in which they record the daily events of their life and their feelings and reactions relating to those events. Some of the diaries are also published later on.

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Diaries are the most important source of knowing the life history of a person. If they have been written continuously over long periods.

c) Letters

Letters also provide useful and reliable material on many social problems. They throw light upon more intimate aspects of an event, and clarity the stand taken by a person regarding it. They are helpful in giving an idea of the attitudes of a person and the trend of his mind. The validity of letters is beyond all doubt and they should be accepted as prima facie proof of the attitude of the writer. In such social problems as love, marriage or divorce the letters can supply much revealing information.

d) Memoirs

Some people write memoirs of their travels, important events of their life and other significant phenomena that they come across. These memoirs provide useful material in the study of many a social phenomena. Memoirs are different from dairies in the sense that they describe only some events and are more elaborate than the dairy. Memoirs of travelers have provided us with useful information regarding the language, social customs, religious faiths, culture and many other social aspects of the people they visited.

2. Public Documents

Public documents are quite different from personal documents. They deal with the matters of different interest. Public' documents may be divided into the following two categories: (i) Unpublished Records, (ii) Published Records.

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a) Unpublished Records

Unpublished records give matters of public interest not available to people in published form. Everybody cannot have access to them. Proceedings of the meetings, noting on the files and memoranda etc., form the category of unpublished records. It is said that these records are reliable. Since there is no fear of their being made public the writers give out their views clearly.

b) Published Records

Published records are available to people for investigation and perusal. Survey, reports, report of survey enquiries and such other documents fall under this category. The data contained in these documents are considered by some people as quite reliable because the collecting agency knows that it shall be difficult to test, while others are of the view that if the data are to be published the collecting or publishing agency does some window dressing, as a result of which the accuracy is sometimes postulated.

Now most of the information that is available to people and researchers in regard to social problems is to be found in form of reports. The reports published by Government are considered as more dependable. On the other hand some people think that the reports that are published by certain individuals and agencies are more dependable and reliable.

Journals and Magazines**:** Journals and magazines are important public documents including a wide variety of information which .can be usefully utilised in social research. Most of these information are very much reliable. Letters to the editors published in various magazines and journals are an important source of information.

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c) Newspapers

Newspapers publish news, discussion on contemporary issues, reports of meetings and conferences, essays and articles on living controversies and the letters of the readers to the editors. All this is an important source of formation for different kinds of social research.

d) Other Sources

Besides the above mentioned public documents, film, television, radio and public speeches etc., are other important sources of information. They supply useful information - about contemporary issues. The investigator, however, should be capable of sorting out the reliable material and distinguishing it from the unreliable material advanced by these sources.

PRECAUTIONS WHILE USING SECONDARY DATA

Since secondary data have already been obtained, it is highly desirable that a proper scrutiny of such data is made before they are used by the investigator. In fact the user has to be extra-cautious while using secondary data. In this context Prof. Bowley rightly points out that "Secondary data should not be accepted at their face value." The reason being that data may be erroneous (mistaken / wrong) in many respects due to bias, inadequate size of the sample, substitution, errors of definition, arithmetical errors etc.

Even if there is no error such data may not be suitable and adequate for the purpose of the enquiry.

Prof. Simon Kuznet's view in this regard is also of great importance. According to him, "The degree of reliability of secondary source is to be assessed from the source, the

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compiler and his capacity to produce correct statistics and the users also, for the most part, tend to accept a series particularly one issued by a government agency at its face value without enquiring its reliability".

Therefore, before using the secondary data the investigators should consider the following factors:

1) Reliability of Data

The reliability can be tested by finding out such things about the said data: (a) Who collected the data? (b) What were the sources of data? (c) Were they colleted by using proper methods? (d) At what time were they collected?(e) Was there any bias of the compiler? (f) What level of accuracy was desired? Was it achieved?

2) Suitability of Data

The data that are suitable for one enquiry may not necessarily be found suitable in another enquiry. Hence, if the available data are found to be unsuitable, they should not be used by the researcher. In this context, the researcher must very carefully scrutinize the definition of various terms and units of collection used at the time of collecting the data from the primary source originally. Similarly, the object, scope and nature of the original enquiry must also be studied. If the researcher finds differences in these, the data will remain unsuitable for the present enquiry and should not be used

3) Adequacy of Data

If the level of accuracy achieved in data is found inadequate for the purpose of the present enquiry, they will be considered as inadequate and should not be used by the researcher. The data will also be considered inadequate, if they are related to an area which may be either narrower or wider than the area of the present enquiry. It is not enough to have baskets of data in hand. In

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fact, data in a raw form are nothing but a handful of raw material waiting for proper processing so that they can become useful.

from primary or secondary source, the next step in a statistical investigation is to edit the data i.e. to scrutinize the same. The chief objective of editing is to detect possible errors and irregularities. The task of editing is a highly specialized one and requires great

POSSIBLE QUESTIONS

PART-B (2 Marks)

1. Define Sampling.
2. Explain the term 'Census',
3. What do you mean by Probability Sampling?
4. What do you mean by Random Sampling?
5. Explain the term 'Non-probability Sampling'.
6. What do you understand by Non Random Sampling?
7. Briefly explain on Stratified Random Sampling.
8. What is Systematic Sampling?
9. Briefly narrate on Cluster Sampling.
10. What is Convenience Sampling?
11. What do you understand by 'Snowball Sampling'?
12. What is Primary Data and Secondary Data?
13. What do you mean by Structured and Unstructured observation?
14. Describe on Interview.
15. What do you understand by Focused and Non-directive interview?
16. What do you mean by Questionnaire?
17. What is Structured and Unstructured Questionnaire?

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PART C (6 MARKS)

1. Define Sample. Explain its types.
2. How Questionnaire method differs from Interview Schedule method?
3. Explain the steps involved in Sampling.
4. Differentiate between Questionnaire and Interview Schedule.
5. Elucidate in detail on various techniques on Probability Sampling.
6. Explain in detail on various types of observation.
7. Explicate in detail on various Non-Probability Sampling Techniques.
8. Explain the sources through which secondary data is collected.
9. Elucidate on important aspects to be considered, while constructing a Questionnaire.
10. Explain in details on various types of Questionnaire.

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Karpagam Academy of Higher Education

Department of Management

Research Methodology for Management - 18MBAP206

Unit II

Multiple Choice Questions - Each Question Carries ONE Mark

S.No.	Questions	Option 1	Option 2	Option 3	Option 4	Answer
1	__is a blue print of research	Research Process	Objectives of the Study	Research Design	Hypothesis	Research Design
2	Identify the correct statement from the following –	a logical and systematic representation of the	keeps the researcher in action.	cannot be concerned with data availability.	has to be kept within manageable limits.	has to be kept within manageable limits.
3	While defining a problem, the next steps in the process after developing a title are –	conceptual model and defining the study objectives	conditions and training investigators	details and verifying evidence	and analysing variables in the problem	conceptual model and defining the study objectives
4	The research problem should define in a ____manner.	Statement of the problem in general way.	Understanding the nature of the problem.	available literature and developing ideas	All the stated Manner	All the stated Manner
5	_____is the conceptual structure within which the research is conducted	Research Process	Objectives of the Study	Research Design	Hypothesis	Research Design
6	_____deals with the method of selecting items to be observed for the given study	Sampling design	observational design	operational design	statistical design	Sampling design
7	Design which relates to the conditions under which the observations are made	Sampling design	observational design	operational design	statistical design	observational design

8	Studying only a part of total population in known as ____	Sampling	Census	Field Enquiry	Observation	Sampling
9	___contains the names of all items of universe	Source List	Sampling Unit	Sample Design	Census Data	Source List
10	Source list otherwise known as ____	Sampling Unit	Sample Design	Census Data	Sampling Frame	Sampling Frame
11	___refers to the number of items to be selected from the universe to constitute a sample	Size of Sample	Parameters of Interest	Source List	Sampling Unit	Size of Sample
12	In____sample, every unit in the population has equal chances for being selected as a sample unit	Probability	Non-Probability	Area	Judgement	Probability
13	The design which_____and maximizes the reliability of the data collected is considered a good design	minimises bias	maximisies bias	have no bias	minimum information	minimises bias
14	A research plan_____.	Should be detailed	Should be given to others for review and	Sets out the rationale for a research study	Definite	Definite
15	_____is the arrangement of conditions for collection and analysis of data.	Research design.	Research methods.	Research analysis.	Operational research.	Research analysis.
16	A number calculated with complete population data and quantifies a characteristic of the population is called	A parameter	A datum	A statistic	A population	A parameter
17	Which of the following group that does not receive the experimental treatment condition?	Control group	Experimental group	Treatment group	Independent group.	Control group

18	The group that receives the experimental treatment condition is the_____.	Experimental group	Control group	Participant group	Independent group	Experimental group
19	control techniques available to the researcher controls for both known and unknown variables?	Building the extraneous variable into the design	Matching	Random assignment	Analysis of covariance	Random assignment
20	A cell is a combination of two or more _____in a factorial design.	Research designs	Research measurements	Dependent variables	Independent variables	Independent variables
21	In_____, the researcher attempts to control and/ or manipulate the variables in the study.	Experiment	Hypothesis	Theoretical framework	Research design	Experiment
22	_____refers to the influence of a single independent variable.	Interaction effect	Reactive effect	Main effect	Proactive effect	Main effect
23	A measure is reliable if it provides consistent_____.	Hypothesis	Results	Procedure	Sensitivity	Results
24	This type of design is one where all participants participate in all experimental treatment conditions.	Factorial design	Repeated measures design	Replicated design	Pretest-posttest control-group design	Repeated measures design
25	In an experimental research study, the primary goal is to isolate and identify the effect produced by the_____.	Dependent variable	Extraneous variable	Independent variable	Confounding variable	Independent variable
26	Experimental design is the only appropriate design where_____ relationship can be established.	Strong	Linear	Weak	Cause and Effect	Cause and Effect
27	Which of the following statement is wrong about the data of the Descriptive Research?	It may be qualitative, in verbal symbols	quantitative, in mathematical symbols.	It may be qualitative and quantitative both	It is only qualitative, never quantitative.	It is only qualitative, never quantitative.
28	Exploratory research addresses which of the following types of question?	If	How	Why	What	What

29	Stability means -	Accurate	Broad	Consistency	Depth	Consistency
30	A deductive theory is one that:	Involves testing an explicitly defined hypothesis	Allows theory to emerge out of the data	Allows for findings to feed back into the	Uses qualitative methods whenever possible	Involves testing an explicitly defined hypothesis
31	In sampling, units in the population has unequal or zero chances for being selected as a sample unit.	Probability	Non-Probability	Area	Judgement	Non-Probability
32	___is often called the root means square error	Sampling error	Total error	Non-Sampling error	Bias	Total error
33	The errors which arise because of studying only a part of the total population are called errors	Non-Sampling	Sampling	Bias	Total	Sampling
34	Qualitative observation is usually done for exploratory purposes; it is also called _____observation.	Structured	Naturalistic	Complete	Probed	Naturalistic
35	___may arise if some sections of the population are not available / refuse to cooperate	Bias	Sampling error	Non-Sampling error	Non-Sampling bias	Bias
36	___errors which arise from sources other than sampling	Sampling	Non-Sampling	Sampling Bias	Non-Sampling bias	Sampling
37	Errors of observation, Errors of measurement and Errors of responses leads to ____	Bias	Sampling error	Non-Sampling error	Non-Sampling bias	Non-Sampling error
38	__is a result biases of observation and non-observation, response biases and process biases	Non-Sampling error	Non-Sampling Bias	Sampling Error	Sampling Bias	Non-Sampling Bias
39	Collecting data by reference through reference is known as ____	Quota Sampling	Snowball Sampling	Convenient Sampling	Judgement Sampling	Snowball Sampling

40	involving selection of quota groups of accessible sampling units by traits such as sex, age, social class etc.,	Judgement Sampling	Quota Sampling	Snowball Sampling	Multistage Sampling	Quota Sampling
41	___method means deliberate selection of sample units that conform to some pre-determined criteria	Judgement Sampling	Quota Sampling	Snowball Sampling	Multistage Sampling	Judgement Sampling
42	___method means deliberate selection of sample units that conform to some pre-determined criteria	Purposive Sampling	Quota Sampling	Snowball Sampling	Multistage Sampling	Purposive Sampling
43	___means selecting sample units in a just 'hit an miss' fashion	Quota Sampling	Snowball Sampling	Convenient Sampling	Judgement Sampling	Convenient Sampling
44	In____sampling, sampling is carried out in two or more stages	Multi-stage	Cluster	Proportionate	Random	Multi-stage
45	__sampling is an important form of cluster sampling	Area	Multi-stage	Proportionate	Systematic	Area
46	Grouping of population based on some common characteristics is known as ___ sampling	Cluster	Area	Multi-stage	Random	Cluster
47	___method is also known as fixed interval method	Systematic Sampling	Cluster Sampling	Snowball Sampling	Disproportionate Sampling	Systematic Sampling
48	involves giving over representation to some strata and under representation to others	Stratified Sampling	Sampling with Replcaement	Sampling without Replacement	Disproportionate Stratified Sampling	Disproportionate Stratified Sampling
49	___sampling involves drawing a sample from each stratum in proportion to the latter's share in the total population	Proportionate	Disproportionate	Sampling with Replcaement	Sampling without Replacement	Proportionate
50	divided into homogenous groups or strata, and from each stratum, random sample is drawn	Random Sampling	Stratified Random Sampling	Multi-stage Sampling	Purposive Sampling Method	Stratified Random Sampling

51	Lottery method is an example of ____ method of sampling	Simple Random	Stratified Random	Systematic	Cluster	Simple Random
52	What is the advantage of random sample?	It is free of errors in classification	It is free from bias and prejudice	It is simple to use	widely dispersed the selection of sample becomes	widely dispersed the selection of sample becomes
53	When we try to explain the relationships among variables, the study is called	Exploratory study	Longitudinal study	Causal study	Cross sectional study	Causal study
54	Which of the following does not determine the size of a sample?	Nature of population	Type of sampling design	The degree of precision	Knowledge of sampling	Knowledge of sampling
55	What is not essential about a research problem?	It should be amenable to research	It should be significant	It should lead to new knowledge	It should lead to theory building	It should lead to theory building
56	Deliberate sampling is also known as _____.	Purposive sampling.	Convenience sampling.	Simple random sampling.	Quota sampling.	Purposive sampling.
57	Simple random sampling is also known as_____.	Probability sampling .	Quota sampling.	Convenience sampling.	Purposive sampling.	Probability sampling .
58	_____has practical application in research.	Analytical work.	Chemical work.	Physical work.	Applied work	Applied work
59	A random sample is collected from the population and its statistics is_____. design.	Two-group.	One-group .	Matched-pair data analysis .	Multiple-group.	One-group .
60	Sampling in qualitative research is similar to which type of sampling in quantitative research?	Simple random sampling	Systematic sampling	Quota sampling	Purposive sampling	Purposive sampling

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UNIT: III
PRIMARY AND SECONDARY DATA

UNIT – III

Primary and Secondary Data: Classification of Data; Secondary Data: Uses, Advantages, Disadvantages, Types and sources; Primary Data Collection: Observation method, Focus Group Discussion, Personal Interview method. Attitude Measurement and Scaling: Types of Measurement Scales; Attitude; Classification of Scales: Single item vs Multiple Item scale, Comparative vs Non-Comparative scales, Measurement Error, Criteria for Good Measurement. Questionnaire Design: Questionnaire method; Types of Questionnaires; Process of Questionnaire Designing; Advantages and Disadvantages of Questionnaire Method. Data Processing: Data Editing- Field Editing, Centralized in house editing; Coding- Coding Closed ended structured Questions, Coding open ended structured Questions; Classification and Tabulation of Data.

METHODS OF COLLECTING DATA OBSERVATION

The observation method is the most commonly used method specially in studies relating to behavioural sciences. In a way we all observe things around us, but this sort of observation is not scientific observation. Observation becomes a scientific tool and the method of data collection for the researcher, when it serves a formulated research purpose, is systematically planned and recorded and is subjected to checks and controls on validity and reliability. Under the observation method, the information is sought by way of investigator's own direct observation without asking from the respondent. For instance, in a study relating to consumer behaviour, the investigator instead of asking the brand of wrist watch used by the respondent, may himself look at the watch.

Advantages of Observation

1. The main advantage of this method is that subjective bias is eliminated, if observation is done accurately.
2. Secondly, the information obtained under this method relates to what is currently happening; it is not complicated by either the past behaviour or future intentions or attitudes.

3. Thirdly, this method is independent of respondents' willingness to respond and as such is relatively less demanding of active cooperation on the part of respondents as happens to be the case in the interview or the questionnaire method.
4. This method is particularly suitable in studies which deal with subjects (i.e., respondents) who are not capable of giving verbal reports of their feelings for one reason or the other

Limitations of Observation

1. Firstly, it is an expensive method.
2. Secondly, the information provided by this method is very limited.
3. Thirdly, sometimes unforeseen factors may interfere with the observational task.
4. At times, the fact that some people are rarely accessible to direct observation creates obstacle for this method to collect data effectively.

Precautions before Adopting Observation Method of Data Collection

While using this method, the researcher should keep in mind things like:
What should be observed?
How the observations should be recorded? Or
How the accuracy of observation can be ensured?

Types of Observation

1) Structured Observation

In case the observation is characterised by a careful definition of the units to be observed, the style of recording the observed information, standardised conditions of observation and the selection of pertinent data of observation, then the observation is called as structured observation. Structured observation is considered appropriate in descriptive studies

2) Unstructured Observation

But when observation is to take place without these characteristics to be thought of in advance, the same is termed as unstructured observation. Whereas in an exploratory study the observational procedure is most likely to be relatively unstructured.

3) Participant Observation

We often talk about participant and non-participant types of observation in the context of studies, particularly of social sciences. This distinction depends upon the observer's sharing or not sharing the life of the group he is observing. If the observer observes by making himself, more or less, a member of the group he is observing so that he can experience what the members of the group experience, the observation is called as the participant observation.

Merits of Participant Observation

1. The researcher is enabled to record the natural behaviour of the group.
2. The researcher can even gather information which could not easily be obtained if he observes in a disinterested fashion.
3. The researcher can even verify the truth of statements made by informants in the context of a questionnaire or a schedule.

Demerits of Participant Observation

- The observer may lose the objectivity to the extent he participates emotionally; the problem of observation-control is not solved; and it may narrow-down the researcher's range of experience.

4) Non-Participant Observation

But when the observer observes as a detached emissary without any attempt on his part to experience through participation what others feel, the observation of this type is often termed as non-participant observation. (When the observer is observing in such a manner that his presence may be unknown to the people he is observing, such an observation is described as disguised observation.)

5) Uncontrolled Observation

If the observation takes place in the natural setting, it may be termed as uncontrolled observation, In non-controlled observation, no attempt is made to use precision instruments. The major aim of this type of observation is to get a spontaneous picture of life and persons. It has a tendency to supply naturalness and completeness of behaviour, allowing sufficient time for observing it. The main pitfall of non-controlled observation is that of subjective interpretation. There is also the danger of having the feeling that we know more about the observed phenomena than we actually do. Uncontrolled observation is resorted to in case of exploratory researches.

6) Controlled Observation

When observation takes place according to definite pre-arranged plans, involving experimental procedure, the same is then termed controlled observation. But in controlled observation, we use mechanical (or precision) instruments as aids to accuracy and standardisation. Such observation has a tendency to supply formalised data upon which generalisations can be built with some degree of assurance. Generally, controlled observation takes place in various experiments that are carried out in a laboratory or under controlled conditions

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PRIMARY AND SECONDARY DATA

INTERVIEW SCHEDULE

The interview method of collecting data involves presentation of oral-verbal stimuli and reply in terms of oral-verbal responses. This method can be used through personal interviews and, if possible, through telephone interviews. Interview is one of the popular methods of data collection. The term interview can be dissected into two terms as, 'inter' and 'view.'. The essence of interview is that one mind tries to read the other. The interviewer tries to assess the interviewed in terms of the aspects studied or issues analysed.

Personal interview method requires a person known as the interviewer asking questions generally in a face-to-face contact to the other person or persons. (At times the interviewee may also ask certain questions and the interviewer responds to these, but usually the interviewer initiates the interview and collects the information.) This sort of interview may be in the form of direct personal investigation or it may be indirect oral investigation. In the case of direct personal investigation the interviewer has to collect the information personally from the sources concerned. He has to be on the spot and has to meet people from whom data have to be collected. This method is particularly suitable for intensive investigations.

But in certain cases it may not be possible or worthwhile to contact directly the persons concerned or on account of the extensive scope of enquiry, the direct personal investigation technique may not be used. In such cases an indirect oral examination can be conducted under which the interviewer has to cross-examine other persons who are supposed to have knowledge about the problem under investigation and the information, obtained is recorded. Most of the commissions and committees appointed by government to carry on investigations make use of this method.

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PRIMARY AND SECONDARY DATA

Types of Interview

1) Structured Interview

The method of collecting information through personal interviews is usually carried out in a structured way. As such we call the interviews as structured interviews.

Such interviews involve the use of a set of predetermined questions and of highly standardised techniques of recording. Thus, the interviewer in a structured interview follows a rigid procedure laid down, asking questions in a form and order prescribed. But in case of descriptive studies, we quite often use the technique of structured interview because of its being more economical, providing a safe basis for generalisation and requiring relatively lesser skill on the part of the interviewer.

1) Unstructured Interview

As against it, the unstructured interviews are characterised by a flexibility of approach to questioning. Unstructured interviews do not follow a system of pre- determined questions and standardised techniques of recording information. In a non- structured interview, the interviewer is allowed much greater freedom to ask, in case of need, supplementary questions or at times he may omit certain questions if the situation so requires. He may even change the sequence of questions. He has relatively greater freedom while recording the responses to include some aspects and exclude others. But this sort of flexibility results in lack of comparability of one interview with another and the analysis of unstructured responses becomes much more difficult and time-consuming than that of the structured responses obtained in case of structured interviews. Unstructured interviews also demand deep knowledge and greater skill on the part of the interviewer. Unstructured interview, however, happens to be the central technique of collecting information in case of exploratory or formulative research studies.

2) Focused Interview

Focussed interview is meant to focus attention on the given experience of the respondent and its effects. Under it the interviewer has the freedom to decide the manner and sequence in which the questions would be asked and has also the freedom to explore reasons and motives. The main task of the interviewer in case of a focussed interview is to confine the respondent to a discussion of issues with which he seeks conversance. Such interviews are used generally in the development of hypotheses and constitute a major type of unstructured interviews.

2) Clinical Interview

The clinical interview is concerned with broad underlying feelings or motivations or with the course of individual's life experience. The method of eliciting information under it is generally left to the interviewer's discretion.

3) Non-directive Interview

In case of non-directive interview, the interviewer's function is simply to encourage the respondent to talk about the given topic with a bare minimum of direct questioning. The interviewer often acts as a catalyst to a comprehensive expression of the respondents' feelings and beliefs and of the frame of reference within which such feelings and beliefs take on personal significance.

Merits of Interview

1. More information and that too in greater depth can be obtained.
2. Interviewer by his own skill can overcome the resistance, if any, of the respondents; the interview method can be made to yield an almost perfect sample of the general population.

3. There is greater flexibility under this method as the opportunity to restructure questions is always there, specially in case of unstructured interviews.
4. Observation method can as well be applied to recording verbal answers to various questions.
5. Personal information can as well be obtained easily under this method.
6. Samples can be controlled more effectively as there arises no difficulty of the missing returns; non-response generally remains very low.
7. The interviewer can usually control which person(s) will answer the questions. This is not possible in mailed questionnaire approach. If so desired, group discussions may also be held.
8. The interviewer may catch the informant off-guard and thus may secure the most spontaneous reactions than would be the case if mailed questionnaire is used.

The language of the interview can be adopted to the ability or educational level of the person interviewed and as such misinterpretations concerning questions can be avoided.

9. The interviewer can collect supplementary information about the respondent's personal characteristics and environment which is often of great value in interpreting results.

Demerits or Weakness of Interview

1. It is a very expensive method, specially when large and widely spread geographical sample is taken.
2. There remains the possibility of the bias of interviewer as well as that of the respondent; there also remains the headache of supervision and control of interviewers.
3. Certain types of respondents such as important officials or executives or people in high income groups may not be easily approachable under this method and to that extent the data may prove inadequate.
4. This method is relatively more-time-consuming, specially when the sample is large and recalls upon the respondents are necessary.

5. The presence of the interviewer on the spot may over-stimulate the respondent, sometimes even to the extent that he may give imaginary information just to make the interview interesting.
6. Under the interview method the organisation required for selecting, training and supervising the field-staff is more complex with formidable problems.
7. Interviewing at times may also introduce systematic errors.
8. Effective interview presupposes proper rapport with respondents that would facilitate free and frank responses. This is often a very difficult requirement.

Pre-requisites and Basic Tenets of Interviewing

1. For successful implementation of the interview method, interviewers should be carefully selected, trained and briefed.
2. They should be honest, sincere, hardworking, impartial and must possess the technical competence and necessary practical experience.
3. Occasional field checks should be made to ensure that interviewers are neither cheating, nor deviating from instructions given to them for performing their job efficiently.
4. In addition, some provision should also be made in advance so that appropriate action may be taken if some of the selected respondents refuse to cooperate or are not available when an interviewer calls upon them.
5. In fact, interviewing is an art governed by certain scientific principles. Every effort should be made to create friendly atmosphere of trust and confidence, so that respondents may feel at ease while talking to and discussing with the interviewer.
6. The interviewer must ask questions properly and intelligently and must record the responses accurately and completely. At the same time, the interviewer must answer legitimate question(s), if any, asked by the respondent and must clear any doubt that the latter has.

7. The interviewers approach must be friendly, courteous, conversational and unbiased.
8. The interviewer should not show surprise or disapproval of a respondent's answer but he must keep the direction of interview in his own hand, discouraging irrelevant conversation and must make all possible effort to keep the respondent on the track.

QUESTIONNAIRE

This method of data collection is quite popular, particularly in case of big enquiries. It is being adopted by private individuals, research workers, private and public organisations and even by governments. In this method a questionnaire is sent (usually by post) to the persons concerned with a request to answer the questions and return the questionnaire. A questionnaire consists of a number of questions printed or typed in a definite order on a form or set of forms. The questionnaire is mailed to respondents who are expected to read and understand the questions and write down the reply in the space meant for the purpose in the questionnaire itself. The respondents have to answer the questions on their own.

The method of collecting data by mailing the questionnaires to respondents is most extensively employed in various economic and business surveys

Merits of Questionnaire

1. There is low cost even when the universe is large and is widely spread geographically.
2. It is free from the bias of the interviewer; answers are in respondents' own words.
3. Respondents have adequate time to give well thought out answers.
4. Respondents, who are not easily approachable, can also be reached conveniently.
5. Large samples can be made use of and thus the results can be made more dependable and reliable.

Demerits of Questionnaire

1. Low rate of return of the duly filled in questionnaires; bias due to no-response is often indeterminate.
2. It can be used only when respondents are educated and cooperating.
3. The control over questionnaire may be lost once it is sent.
4. There is inbuilt inflexibility because of the difficulty of amending the approach once questionnaires have been despatched.
5. There is also the possibility of ambiguous replies or omission of replies altogether to certain questions; interpretation of omissions is difficult.
6. It is difficult to know whether willing respondents are truly representative.
7. This method is likely to be the slowest of all.

Before using this method, it is always advisable to conduct 'pilot study' (Pilot Survey) for testing the questionnaires. In a big enquiry the significance of pilot survey is felt very much. Pilot survey is infact the replica and rehearsal of the main survey. Such a survey, being conducted by experts, brings to the light the weaknesses (if any) of the questionnaires and also of the survey techniques. From the experience gained in this way, improvement can be effected.

Main Aspects of a Questionnaire

Quite often questionnaire is considered as the heart of a survey operation. Hence it should be very carefully constructed. If it is not properly set up, then the survey is bound to fail. This fact requires us to study the main aspects of a questionnaire viz., the general form, question sequence and question formulation and wording. Researcher should note the following with regard to these three main aspects of a questionnaire:

1) General form

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So far as the general form of a questionnaire is concerned, it can either be structured or unstructured questionnaire. Structured questionnaires are those questionnaires in which there are definite, concrete and pre-determined questions. The questions are presented with exactly the same wording and in the same order to all respondents. Resort is taken to this sort of standardisation to ensure that all respondents reply to the same set of questions. The form of the question may be either closed (i.e., of the type 'yes' or 'no') or open (i.e., inviting free response) but should be stated in advance and not constructed during questioning. Structured questionnaires may also have fixed alternative questions in which responses of the informants are limited to the stated alternatives. Thus a highly structured questionnaire is one in which all questions and answers are specified and comments in the respondent's own words are held to the minimum. When these characteristics are not present in a questionnaire, it can be termed as unstructured or non-structured questionnaire. More specifically, we can say that in an unstructured questionnaire, the interviewer is provided with a general guide on the type of information to be obtained, but the exact question formulation is largely his own responsibility and the replies are to be taken down in the respondent's own words to the extent possible; in some situations tape recorders may be used to achieve this goal.

Structured questionnaires are simple to administer and relatively inexpensive to analyse. The provision of alternative replies, at times, helps to understand the meaning of the question clearly. But such questionnaires have limitations too. For instance, wide range of data and that too in respondent's own words cannot be obtained with structured questionnaires. They are usually considered inappropriate in investigations where the aim happens to be to probe for attitudes and reasons for certain actions or feelings. They are equally not suitable when a problem is being first explored and working hypotheses sought. In such situations, unstructured questionnaires may be used effectively. Then on the basis of the results obtained in pretest (testing before final use) operations from the use of unstructured questionnaires, one can construct a structured questionnaire for use in the main

study.

2) Question Sequence

In order to make the questionnaire effective and to ensure quality to the replies received, a researcher should pay attention to the question-sequence in preparing the questionnaire. A proper sequence of questions reduces considerably the chances of individual questions being misunderstood. The question-sequence must be clear and smoothly-moving, meaning thereby that the relation of one question to another should be readily apparent to the respondent, with questions that are easiest to answer being put in the beginning. The first few questions are particularly important because they are likely to influence the attitude of the respondent and in seeking his desired cooperation. The opening questions should be such as to arouse human interest. The following type of questions should generally be avoided as opening questions in a questionnaire:

- Questions that put too great a strain on the memory or intellect of the respondent;
- Questions of a personal character
- Questions related to personal wealth, etc.

Following the opening questions, we should have questions that are really vital to the research problem and a connecting thread should run through successive questions. Ideally, the question-sequence should conform to the respondent's way of thinking. Knowing what information is desired, the researcher can rearrange the order of the questions (this is possible in case of unstructured questionnaire) to fit the discussion in each particular case. But in a structured questionnaire the best that can be done is to determine the question-sequence with the help of a Pilot Survey which is likely to produce good rapport with most respondents. Relatively difficult questions must be relegated (tranfered) towards the end so that even if the respondent decides not to answer such questions, considerable information would have already been obtained. Thus, question-sequence should usually go from the

general to the more specific and the researcher must always remember that the answer to a given question is a function not only of the question itself, but of all previous questions as well. For instance, if one question deals with the price usually paid for coffee and the next with reason for preferring that particular brand, the answer to this latter question may be couched (understood) largely in terms of price-differences.

3) Question Formulation and Wording

With regard to this aspect of questionnaire, the researcher should note that each question must be very clear for any sort of misunderstanding can do irreparable harm to a survey. Question should also be impartial in order not to give a biased picture of the true state of affairs. Questions should be constructed with a view to their forming a logical part of a well thought out tabulation plan. In general, all questions should meet the following standards—(a) should be easily understood; (b) should be simple i.e., should convey only one thought at a time; (c) should be concrete and should conform as much as possible to the respondent's way of thinking. (For instance, instead of asking. "How many razor blades do you use annually?" The more realistic question would be to ask, "How many razor blades did you use last week?"

Multiple Choice Question and the Open-End Questions. In the former the respondent selects one of the alternative possible answers put to him, whereas in the latter he has to supply the answer in his own words. The question with only two possible answers (usually 'Yes' or 'No') can be taken as a special case of the multiple choice question, or can be named as a 'closed question.' There are some advantages and disadvantages of each possible form of question. Multiple choice or closed questions have the advantages of easy handling, simple to answer, quick and relatively inexpensive to analyse. They are most amenable to statistical analysis. Sometimes, the provision of alternative replies helps to make clear the meaning of the question. But the main drawback of fixed alternative questions is that of "putting answers in people's mouths" i.e., they may force a statement of

opinion on an issue about which the respondent does not infact have any opinion. They are not appropriate when the issue under consideration happens to be a complex one and also when the interest of the researcher is in the exploration of a process. In such situations, open-ended questions which are designed to permit a free response from the respondent rather than one limited to certain stated alternatives are considered appropriate. Such questions give the respondent considerable latitude in phrasing a reply. Getting the replies in respondent's own words is, thus, the major advantage of open-ended questions. But one should not forget that, from an analytical point of view, open-ended questions are more difficult to handle, raising problems of interpretation, comparability and interviewer bias.

In practice, one rarely comes across a case when one questionnaire relies on one form of questions alone. The various forms complement each other. As such questions of different forms are included in one single questionnaire. For instance, multiple-choice questions constitute the basis of a structured questionnaire, particularly in a mail survey. But even there, various open-ended questions are generally inserted to provide a more complete picture of the respondent's feelings and attitudes.

Researcher must pay proper attention to the wordings of questions since reliable and meaningful returns depend on it to a large extent. Since words are likely to affect responses, they should be properly chosen. Simple words, which are familiar to all respondents, should be employed. Words with ambiguous meanings must be avoided. Similarly, danger words, catch-words or words with emotional connotations should be avoided. Caution must also be exercised in the use of phrases which reflect upon the prestige of the respondent. Question wording, in no case, should bias the answer. In fact, question wording and formulation is an art and can only be learnt by practice.

Essentials of Good Questionnaire

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1. To be successful, questionnaire should be comparatively short and simple i.e., the size of the questionnaire should be kept to the minimum
2. Questions should proceed in logical sequence moving from easy to more difficult questions
3. Personal and intimate questions should be left to the end
4. Technical terms and vague expressions capable of different interpretations should be avoided in a questionnaire
5. Questions may be dichotomous (yes or no answers), multiple choice (alternative answers listed) or open-ended. The latter type of questions are often difficult to analyse and hence should be avoided in a questionnaire to the extent possible
6. There should be some control questions in the questionnaire which indicate the reliability of the respondent. For instance, a question designed to determine the consumption of particular material may be asked first in terms of financial expenditure and later in terms of weight. The control questions, thus, introduce a cross-check to see whether the information collected is correct or not
7. Questions affecting the sentiments of respondents should be avoided
8. Adequate space for answers should be provided in the questionnaire to help editing and tabulation
9. There should always be provision for indications of uncertainty, e.g., "do not know," "no preference" and so on
10. Brief directions with regard to filling up the questionnaire should invariably be given in the questionnaire itself
11. Finally, the physical appearance of the questionnaire affects the cooperation the researcher receives from the recipients and as such an attractive looking questionnaire, particularly in mail surveys, is a plus point for enlisting cooperation.
12. The quality of the paper, along with its colour, must be good so that it may attract the attention of recipients

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Types of Questionnaire

1) Structured non disguised Questionnaire

Here, questions are structured so as to get the facts. The interviewer will ask the questions strictly as per the pre arranged order. Structured, non disguised is widely used in market research. Questions are presented with exactly the same wording and same order to all the respondents. The reason for standardizing question is, to ensure that all respondents reply the same question. The purpose of the question is clear. The researcher wants the respondent to choose one of the five options given above. This type of questionnaire is easy to administer. The respondents have no difficulty in answering. Because it is structured, the frame of reference is obvious. In a non-disguised type, the purpose of the questionnaire is known to the respondent.

2) Structured disguised Questionnaire

This type of questionnaire is least used in Marketing research. This type of Questionnaire is used to find, peoples' attitude, when a direct undisguised question produces a bias. In this type of questionnaire what comes out is "What does the respondent know rather than what he feels". Therefore attempt in this method is to find the respondent's attitude.

1) Non-Structured and disguised Questionnaire

The main objective is to conceal the topic of enquiry by using a disguised stimulus. Though the stimulus is standardized by researcher, respondent is allowed to answer in an unstructured manner. The assumption made here is that individuals reaction is an indication of respondent's basic perception. Projective techniques are examples of Non structured disguised technique. The techniques involve the use of a vague stimulus, that an individual is asked to expand or describe or build a story, three common types under this category are

(a) Word association (b) Sentence completion (c) Story telling.

2) Non structured - Non disguised Questionnaire

Here the purpose of the study is clear, but the responses to the question is open ended. Example: "How do you feel about the cyber law currently in practice and its need for further modification"? The initial part of the question is constant. After presenting the initial question, the interview becomes very unstructured as the interviewer probes more deeply. Respondents subsequent answer determines the direction the interviewer takes next. The question asked by interviewer varies from person to person. This method is called "Depth interview". The major advantage of this method is freedom permitted to the interviewer. By not restricting the respondents for a set of replies, the experienced interviewers will be above to get the information from the respondent fairly and accurately. The main disadvantage of this method of interviewing is that, it takes time, and respondents may not co-operate. Another disadvantage is that coding of open ended question may pose a challenge. E.g.: When a researcher asked the respondent "Tell me something about your experience in this hospital". The answer may be "Well, the nurses are "slow" to attend and Doctor is "rude". 'Slow' and 'rude' are different qualities needing separate coding. This type of interviewing is extremely helpful in exploratory studies.

SCHEDULES

This method of data collection is very much like the collection of data through questionnaire, with little difference which lies in the fact that schedules (proforma containing a set of questions) are being filled in by the enumerators who are specially appointed for the purpose. These enumerators along with schedules, go to respondents, put to them the questions from the proforma in the order the questions are listed and record the replies in the space meant for the same in the proforma.

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In certain situations, schedules may be handed over to respondents and enumerators may help them in recording their answers to various questions in the said schedules. Enumerators explain the aims and objects of the investigation and also remove the difficulties which any respondent may feel in understanding the implications of a particular question or the definition or concept of difficult terms. This method requires the selection of enumerators for filling up schedules or assisting respondents to fill up schedules and as such enumerators should be very carefully selected

The enumerators should be trained to perform their job well and the nature and scope of the investigation should be explained to them thoroughly so that they may well understand the implications of different questions put in the schedule. Enumerators should be intelligent and must possess the capacity of cross-examination in order to find out the truth. Above all, they should be honest, sincere, hardworking and should have patience and perseverance. This method of data collection is very useful in extensive enquiries and can lead to fairly reliable results. It is, however, very expensive and is usually adopted in investigations conducted by governmental agencies or by some big organisations. Population census all over the world is conducted through this method.

DIFFERENCE BETWEEN QUESTIONNAIRE AND INTERVIEW SCHEDULE

1. The questionnaire is generally sent through mail to informants to be answered as specified in a covering letter, but otherwise without further assistance from the sender. The schedule is generally filled out by the research worker or the enumerator, who can interpret questions when necessary.
2. To collect data through questionnaire is relatively cheap and economical since we have to spend money only in preparing the questionnaire and in mailing the same to respondents. Here no field staff required. To collect data through schedules is relatively more expensive since considerable amount of money has to be spent in

appointing enumerators and in importing training to them. Money is also spent in preparing schedules.

3. Non-response is usually high in case of questionnaire as many people do not respond and many return the questionnaire without answering all questions. Bias due to non-response often remains indeterminate. As against this, non-response is generally very low in case of schedules because these are filled by enumerators who are able to get answers to all questions. But there remains the danger of interviewer bias and cheating.
4. In case of questionnaire, it is not always clear as to who replies, but in case of schedule the identity of respondent is known.
5. The questionnaire method is likely to be very slow since many respondents do not return the questionnaire in time despite several reminders, but in case of schedules the information is collected well in time as they are filled in by enumerators.
6. Personal contact is generally not possible in case of the questionnaire method as questionnaires are sent to respondents by post who also in turn return the same by post. But in case of schedules direct personal contact is established with respondents.
7. Questionnaire method can be used only when respondents are literate and cooperative, but in case of schedules the information can be gathered even when the respondents happen to be illiterate.
8. Wider and more representative distribution of sample is possible under the questionnaire method, but in respect of schedules there usually remains the difficulty in sending enumerators over a relatively wider area.
9. Risk of collecting incomplete and wrong information is relatively more under the questionnaire method, particularly when people are unable to understand questions properly. But in case of schedules, the information collected is generally complete and accurate as enumerators can remove the difficulties, if any, faced by respondents in correctly understanding the questions. As a result, the information collected through schedules is relatively more accurate than that obtained through questionnaires.

10. The success of questionnaire method lies more on the quality of the questionnaire itself, but in the case of schedules much depends upon the honesty and competence of enumerators.
11. In order to attract the attention of respondents, the physical appearance of questionnaire must be quite attractive, but this may not be so in case of schedules as they are to be filled in by enumerators and not by respondents.
12. Along with schedules, observation method can also be used but such a thing is not possible while collecting data through questionnaires.

SECONDARY DATA

Secondary data means data that are already available i.e., they refer to the data which have already been collected and analysed by someone else. When the researcher utilises secondary data, then he has to look into various sources from where he can obtain them. In this case he is certainly not confronted with the problems that are usually associated with the collection of original data.

Secondary data may either be published data or unpublished data. Usually published data are available in: (a) various publications of the central, state are local governments; (b) various publications of foreign governments or of international bodies and their subsidiary organisations; (c) technical and trade journals; (d) books, magazines and newspapers; (e) reports and publications of various associations connected with business and industry, banks, stock exchanges, etc.; (f) reports prepared by research scholars, universities, economists, etc. in different fields; and (g) public records and statistics, historical documents, and other sources of published information.

The sources of unpublished data are many; they may be found in diaries, letters, unpublished biographies and autobiographies and also may be available with scholars and research workers, trade associations, labour bureaus and other public/ private individuals and

organisations. Researcher must be very careful in using secondary data. He must make a minute scrutiny because it is just possible that the secondary data may be unsuitable or may be inadequate in the context of the problem which the researcher wants to study. In this connection Dr. A.L. Bowley very aptly observes that it is never safe to take published statistics at their face value without knowing their meaning and limitations and it is always necessary to criticise arguments that can be based on them.

SOURCES OF SECONDARY DATA

Secondary data are obtained from personal documents and public documents.

1) Personal Documents

These documents are recorded by the individuals. An individual may record his views and thoughts about various problems and without knowing for these documents at a latter data so formed a subject or source of study.

Kinds of Personal Documents: Personal documents may be categorised or divided under the following heads for the convenience of the study; (i) Life History, (ii) Dairy, (iii) Letters, and (iv) Memoirs.

a) Life History

Life history, generally speaking contains all kinds of biographical, material, from the point of view of personal documents only an autobiography which contains description and views about social and personal events is a life history. It may be further classified under the following three sub-heads: Spontaneous Autobiography, Voluntary Autobiography of self record, and Compiled life history.

b) Diaries

Many people keep diaries in which they record the daily events of their life and their

feelings and reactions relating to those events. Some of the diaries are also published later on. Diaries are the most important source of knowing the life history of a person. If they have been written continuously over long periods.

c) Letters

Letters also provide useful and reliable material on many social problems. They throw light upon more intimate aspects of an event, and clarity the stand taken by a person regarding it. They are helpful in giving an idea of the attitudes of a person and the trend of his mind. The validity of letters is beyond all doubt and they should be accepted as prima facie proof of the attitude of the writer. In such social problems as love, marriage or divorce the letters can supply much revealing information.

d) Memoirs

Some people write memoirs of their travels, important events of their life and other significant phenomena that they come across. These memoirs provide useful material in the study of many a social phenomena. Memoirs are different from dairies in the sense that they describe only some events and are more elaborate than the dairy. Memoirs of travelers have provided us with useful information regarding the language, social customs, religious faiths, culture and many other social aspects of the people they visited.

2. Public Documents

Public documents are quite different from personal documents. They deal with the matters of different interest. Public' documents may be divided into the following two categories: (i) Unpublished Records, (ii) Published Records.

a) Unpublished Records

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Unpublished records give matters of public interest not available to people in published form. Everybody cannot have access to them. Proceedings of the meetings, noting on the files and memoranda etc., form the category of unpublished records. It is said that these records are reliable. Since there is no fear of their being made public the writers give out their views clearly.

b) Published Records

Published records are available to people for investigation and perusal. Survey, reports, report of survey enquiries and such other documents fall under this category. The data contained in these documents are considered by some people as quite reliable because the collecting agency knows that it shall be difficult to test, while others are of the view that if the data are to be published the collecting or publishing agency does some window dressing, as a result of which the accuracy is sometimes postulated.

Now most of the information that is available to people and researchers in regard to social problems is to be found in form of reports. The reports published by Government are considered as more dependable. On the other hand some people think that the reports that are published by certain individuals and agencies are more dependable and reliable.

Journals and Magazines**:** Journals and magazines are important public documents including a wide variety of information which .can be usefully utilised in social research. Most of these information are very much reliable. Letters to the editors published in various magazines and journals are an important source of information.

c) Newspapers

Newspapers publish news, discussion on contemporary issues, reports of meetings and conferences, essays and articles on living controversies and the letters of the readers to the

editors. All this is an important source of formation for different kinds of social research.

d) Other Sources

Besides the above mentioned public documents, film, television, radio and public speeches etc., are other important sources of information. They supply useful information - about contemporary issues. The investigator, however, should be capable of sorting out the reliable material and distinguishing it from the unreliable material advanced by these sources.

PRECAUTIONS WHILE USING SECONDARY DATA

Since secondary data have already been obtained, it is highly desirable that a proper scrutiny of such data is made before they are used by the investigator. In fact the user has to be extra-cautious while using secondary data. In this context Prof. Bowley rightly points out that "Secondary data should not be accepted at their face value." The reason being that data may be erroneous (mistaken / wrong) in many respects due to bias, inadequate size of the sample, substitution, errors of definition, arithmetical errors etc.

Even if there is no error such data may not be suitable and adequate for the purpose of the enquiry.

Prof. Simon Kuznet's view in this regard is also of great importance. According to him, "The degree of reliability of secondary source is to be assessed from the source, the compiler and his capacity to produce correct statistics and the users also, for the most part, tend to accept a series particularly one issued by a government agency at its face value without enquiring its reliability".

Therefore, before using the secondary data the investigators should consider the

following factors:

1) Reliability of Data

The reliability can be tested by finding out such things about the said data: (a) Who collected the data? (b) What were the sources of data? (c) Were they colleted by using proper methods? (d) At what time were they collected?(e) Was there any bias of the compiler? (f) What level of accuracy was desired? Was it achieved?

2) Suitability of Data

The data that are suitable for one enquiry may not necessarily be found suitable in another enquiry. Hence, if the available data are found to be unsuitable, they should not be used by the researcher. In this context, the researcher must very carefully scrutinize the definition of various terms and units of collection used at the time of collecting the data from the primary source originally. Similarly, the object, scope and nature of the original enquiry must also be studied. If the researcher finds differences in these, the data will remain unsuitable for the present enquiry and should not be used

3) Adequacy of Data

If the level of accuracy achieved in data is found inadequate for the purpose of the present enquiry, they will be considered as inadequate and should not be used by the researcher. The data will also be considered inadequate, if they are related to an area which may be either narrower or wider than the area of the present enquiry. It is not enough to have baskets of data in hand. In fact, data in a raw form are nothing but a handful of raw material waiting for proper processing so that they can become useful. Once data have been obtained

from primary or secondary source, the next step in a statistical investigation is to edit the data i.e. to scrutinize the same. The chief objective of editing is to detect possible errors and irregularities. The task of editing is a highly specialized one and requires great

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EDITING

Editing is a process of examining the collected data to detect errors and omissions and to correct these when possible. As a matter of fact, editing involves a careful scrutiny of the completed questionnaire / schedules. Editing is done to assure that the data are accurate, consistent (constant), uniformly entered (Male=1, Female=2), as completed as possible and have been well arranged to facilitate coding and tabulation

Types of Editing

A) Field Editing

1. Field Editing – is the review of the reporting forms by the investigator for completing (translating or rewriting) what the latter has written in abbreviated or illegible (unreadable) form at the time of recording the respondent's responses
2. This type of editing is necessary in view of the fact that individual writing styles often can be difficult for others to decipher (read)
3. This sort of editing should be done as soon as possible after the interview, preferably on the very day or on the next day
4. While doing field editing, the investigator must restrain (control) himself and must not correct error of omission by simply guessing what the informant would have said if the question had been asked

B) Central Editing

1. Central Editing – should take place when all forms of schedules have been completed and returned to the office
2. This type of editing implies that all forms should get a through editing by a single editor in a small study and by a team of editors in case of large enquiry

3. Editor may correct the obvious (noticeable) errors (ex.) entry in the wrong place, entry recorded in the months when it should have been recorded in weeks,
4. In case of inappropriate (Wrong) on missing replies, the editor can sometimes determine the proper answer by reviewing the other information in the schedule
5. At times, the respondent can be contacted for clarification
6. The editor must strike out the answer if the same is inappropriate and he has no basis for determining the correct answer or the response. In such a case an editing entry of 'No answer' is called for
7. All wrong replies, which are quite obvious (unclear) must be dropped from the final results

Points to be Considered by Editor While Editing of Data

1. They should be familiar with instructions given to the interviewers and coders as well as with the editing instructions supplied to them for the purpose
2. They must make entries on the form in some distinctive (unique) and that too in a standardized form
3. They should initial all answers which they change or supply
4. Editor's initials and the date of editing should be placed on each completed form or schedule
5. While crossing-out (removing or deleting) an original entry for one reason or another, they should just draw a single line on it so that the same may remain legible

CODING

Coding refers to the process of assigning numerals or other symbols to answers so that responses can be put into a limited number of categories or classes. Such classes should be appropriate to the research problem under consideration. They must also possess the characteristics of exhaustiveness and also that of mutual exclusively which means that a specific answers can be placed in one and only one cell in a given category set. Another rule to be observed is that of unidimensionality by which is meant that every class is defined in terms of

only one concept

Coding is necessary for efficient analysis and through it the several replies may be reduced to a small number of classes which contain the critical information required for analysis. Coding decisions should usually be taken at the designing stage or the questionnaire. This makes it possible to precode the questionnaire choices and which in turn is helpful for computer tabulation as one can straight forward key punch from the original questionnaire. But in case of hand coding some standard method may be used. One such standard method is to code in the margin with a colored pencil. The other method can be to transcribe the data from the questionnaire to a coding sheet. Whatever method is adopted, one should see that coding errors are altogether eliminated or reduced to the minimum level.

CLASSIFICATION

Most research studies result in a large volume of raw data which must be reduced into homogeneous groups if we are to get meaningful relationships. This fact necessitates classification of data which happens to be the process of arranging data in groups or classes on the basis of common characteristics. Data having a common characteristic are placed in one class and in this way the entire data get divided into a number of groups or classes. Classification can be one of the following two types, depending upon the nature of the phenomenon involved:

1) Classification according to Attributes

As stated above, data are classified on the basis of common characteristics which can either be descriptive (such as literacy, sex, honesty, etc.) or numerical (such as weight, height, income, etc.). Descriptive characteristics refer to qualitative phenomenon which cannot be measured quantitatively; only their presence or absence in an individual item can be noticed. Data obtained this way on the basis of certain attributes are known as statistics of attributes

and their classification is said to be classification according to attributes. Such classification can be simple classification or manifold classification. In simple classification we consider only one attribute and divide the universe into two classes—one class consisting of items possessing the given attribute and the other class consisting of items which do not possess the given attribute. But in manifold classification we consider two or more attributes simultaneously, and divide that data into a number of classes (total number of classes of final order is given by 2n, where n = number of attributes considered).* Whenever data are classified according to attributes, the researcher must see that the attributes are defined in such a manner that there is least possibility of any doubt/ambiguity concerning the said attributes.

2) Classification according to Class-Intervals

Unlike descriptive characteristics, the numerical characteristics refer to quantitative phenomenon which can be measured through some statistical units. Data relating to income, production, age, weight, etc. come under this category. Such data are known as statistics of variables and are classified on the basis of class intervals. For instance, persons whose incomes, say, are within Rs 201 to Rs 400 can form one group, those whose incomes are within Rs 401 to Rs 600 can form another group and so on. In this way the entire data may be divided into a number of groups or classes or what are usually called, 'class-intervals.' Each group of class-interval, thus, has an upper limit as well as a lower limit which are known as class limits. The difference between the two class limits is known as class magnitude. We may have classes with equal class magnitudes or with unequal class magnitudes. The number of items which fall in a given class is known as the frequency of the given class. All the classes or groups, with their respective frequencies taken together and put in the form of a table, are described as group frequency distribution or simply frequency distribution. Classification according to class intervals usually involves the following three main problems:

i) How may classes should be there? What should be their magnitudes?

There can be no specific answer with regard to the number of classes. The decision about this calls for skill and experience of the researcher. However, the objective should be to display the data in such a way as to make it meaningful for the analyst. Typically, we may have 5 to 15 classes. With regard to the second part of the question, we can say that, to the extent possible, class-intervals should be of equal magnitudes, but in some cases unequal magnitudes may result in better classification. Hence the researcher's objective judgement plays an important part in this connection. Multiples of 2, 5 and 10 are generally preferred while determining class magnitudes. Some statisticians adopt the following formula, suggested by H.A. Sturges, determining the size of class interval:

N) where

$i = R/(1 + 3.3 \log$

i = size of class interval;

R = Range (i.e., difference between the values of the largest item and smallest item among the given items);

N = Number of items to be grouped.

It should also be kept in mind that in case one or two or very few items have very high or very low values, one may use what are known as open-ended intervals in the overall frequency distribution. Such intervals may be expressed like under Rs 500 or Rs 10001 and over. Such intervals are generally not desirable, but often cannot be avoided. The researcher must always remain conscious of this fact while deciding the issue of the total number of class intervals in which the data are to be classified.

ii) How to Choose Class Limits?

While choosing class limits, the researcher must take into consideration the criterion that the mid-point (generally worked out first by taking the sum of the upper limit and lower limit of a class and then divide this sum by 2) of a class-interval and the actual average of items of that class interval should remain as close to each other as possible. Consistent with this, the

class limits should be located at multiples of 2, 5, 10, 20, 100 and such other figures. Class limits may generally be stated in any of the following forms:

Exclusive type class intervals: They are usually stated as follows: 10–20

20–30

30–40

40–50

The above intervals should be read as under: 10 and under 20

20 and under 30

30 and under 40

40 and under 50

Thus, under the exclusive type class intervals, the items whose values are equal to the upper limit of a class are grouped in the next higher class. For example, an item whose value is exactly 30 would be put in 30–40 class interval and not in 20–30 class interval. In simple words, we can say that under exclusive type class intervals, the upper limit of a class interval is excluded and items with values less than the upper limit (but not less than the lower limit) are put in the given class interval.

Inclusive type class intervals: They are usually stated as follows: 11–20

21–30

31–40

41–50

In inclusive type class intervals the upper limit of a class interval is also included in the concerning class interval. Thus, an item whose value is 20 will be put in 11–20 class interval. The stated upper limit of the class interval 11–20 is 20 but the real limit is 20.99999 and as such 11–20 class interval really means 11 and under 21.

When the phenomenon under consideration happens to be a discrete one (i.e., can be measured and stated only in integers), then we should adopt inclusive type classification.

But when the phenomenon happens to be a continuous one capable of being measured in fractions as well, we can use exclusive type class intervals.

iii) How to determine the Frequency of Each Class?

This can be done either by tally sheets or by mechanical aids. Under the technique of tally sheet, the class-groups are written on a sheet of paper (commonly known as the tally sheet) and for each item a stroke (usually a small vertical line) is marked against the class group in which it falls. The general practice is that after every four small vertical lines in a class group, the fifth line for the item falling in the same group, is indicated as horizontal line through the said four lines and the resulting flower (IIII) represents five items. All this facilitates the counting of items in each one of the class groups.

Alternatively, class frequencies can be determined, specially in case of large inquires and surveys, by mechanical aids i.e., with the help of machines viz., sorting machines that are available for the purpose. Some machines are hand operated, whereas other work with electricity. There are machines which can sort out cards at a speed of something like 25000 cards per hour. This method is fast but expensive.

TABULATION

When a mass of data has been assembled, it becomes necessary for the researcher to arrange the same in some kind of concise (brief / short) and logical order. This is known as tabulation. Thus, tabulation is the process of summarizing raw data and displaying the same in compact form. In a broader sense, tabulation is an orderly arrangement of data in column and rows

Need for Tabulation

1. It conserves (save) space and reduce explanatory and descriptive statement to a minimum
2. It facilitates the process of comparison

3. It facilitates the summation (abstract) of items and the detection of errors and omissions
4. It provides a basis for various statistical computations (calculation)

Principles of Tabulation

1. Every table should have a clear, concise (short) and adequate title so as to make the table intelligible without reference to the text and this title should always be placed just above the body of the table
2. Every table should be given a distinct number to facilitate easy reference
3. The column and the row headings of the table should be clear and brief
4. The units of measurements under each heading or sub-heading must always be indicated (i.e.) in Rs.
5. Explanatory footnotes, if any, concerning the table should be placed directly beneath (under) the table, along with the reference symbols used in the table
6. Source or sources from where the data in the table have been obtained must be indicated juts below the table
7. Usually the columns are separated from one another by lines which make the table more readable and attractive. Lines are always drawn at the top and bottom of the table and below the captions
8. There should be thick lines to separate the data under one class from the data under another class and the lines separating the sub-divisions of the classes should be comparatively thin lines
9. The columns may be numbered to facilitate reference
10. Those columns whose data are to be compared should be kept side by side. Similarly, percentages and / or averages must also be kept close to the data
11. It is generally considered better to approximate (rough / estimated) figures before tabulation as the same would reduce unnecessary details in the table itself
12. In order to emphasize the relative significance of certain categories, different kinds of type, spacing and indentations (marks) may be used

13. It is important that all column figures be properly aligned. Decimal points and (+) or (-) signs should be in perfect alignment
14. Abbreviations should be avoided to the extent possible and ditto marks should not be used in the table
15. Miscellaneous and exceptional items, if any, should be usually placed in the last row of the table
16. Table should be made as logical, clear, accurate and simple as possible. If the data happen to be very large, they should not be crowded in a single table for that would make the table unwieldy and inconvenient
17. Total of rows should normally be placed in the extreme right column and that of column should be placed at the bottom
18. The arrangement of the categories in a table may be chronological, geographical, alphabetical or according to magnitude to facilitate comparison. Above all, the table must suit the needs and requirements of an investigation

INTERPRETATION

After collecting and analyzing the data, the researcher has to accomplish the task of drawing inferences followed by report writing. This has to be done very carefully, otherwise misleading conclusions may be drawn and the whole purpose of doing research may get vitiated. It is only through interpretation that the researcher can expose relations and processes that underlie his findings. In case of hypotheses testing studies, if hypotheses are tested and upheld several times, the researcher may arrive at generalizations. But in case the researcher had no hypothesis to start with, he would try to explain his findings on the basis of some theory. This may at times result in new questions, leading to further researches. All this analytical information and consequential inference(s) may well be communicated, preferably through research report, to the consumers of research results who may be either an individual or a group of individuals or some public/private organisation.

Meaning of Interpretation

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Interpretation refers to the task of drawing inferences from the collected facts after an analytical and/or experimental study. In fact, it is a search for broader meaning of research findings. The task of interpretation has two major aspects viz., (i) the effort to establish continuity in research through linking the results of a given study with those of another and (ii) the establishment of some explanatory concepts. "In one sense, interpretation is concerned with relationships within the collected data, partially overlapping analysis. Interpretation also extends beyond the data of the study to include the results of other research, theory and hypotheses."1 Thus, interpretation is the device through which the factors that seem to explain what has been observed by researcher in the course of the study can be better understood and it also provides a theoretical conception which can serve as a guide for further researches.

Need for Interpretation

Interpretation is essential for the simple reason that the usefulness and utility of research findings lie in proper interpretation. It is being considered a basic component of research process because of the following reasons:

1. It is through interpretation that the researcher can well understand the abstract principle that works beneath his findings. Through this he can link up his findings with those of other studies, having the same abstract principle, and thereby can predict about the concrete world of events. Fresh inquiries can test these predictions later on. This way the continuity in research can be maintained.
2. Interpretation leads to the establishment of explanatory concepts that can serve as a guide for future research studies; it opens new avenues of intellectual adventure and stimulates the quest for more knowledge.
3. Researcher can better appreciate only through interpretation why his findings are what they are and can make others to understand the real significance of his research findings.
4. The interpretation of the findings of exploratory research study often results into hypotheses for experimental research and as such interpretation is involved in the

transition from exploratory to experimental research. Since an exploratory study does not have a hypothesis to start with, the findings of such a study have to be interpreted on a post-factum basis in which case the interpretation is technically described as 'post factum' interpretation.

TECHNIQUES OF INTERPRETATION

Interpretation is not an easy job and it requires a great skill on the part of the investigator. The investigator gets the required expertise to apply the techniques. The techniques of interpretation are given below:

1) Relationship between Variables

The basic object of every analytical research is to find out the relationship between any two variables. There may be three types of relationship

- Symmetrical Relationship
- Reciprocal Relationship
- Asymmetrical Relationship

The interpretation of data can be made with the help of these relationships

2) Percentages

Percentages are used in making comparison between two or more series of data.

They are also used to describe the relationships.

3) Averages

There are three forms of averages such as arithmetic mean, median, mode. Though there are other measures of central tendency, the above three measures are commonly used. Instead of using long statistical tables, the use of average makes the interpretation very simple.

4) Dispersion

Dispersion refers to the amount or the magnitude of the spread. Measures of

dispersion include range, inter quartile range, average deviation and standard deviation. These measures help to interpret the data more scientifically

PRECAUTIONS IN INTERPRETATION

1. At the outset, researcher must invariably satisfy himself that (a) the data are appropriate, trustworthy and adequate for drawing inferences; (b) the data reflect good homogeneity; and that (c) proper analysis has been done through statistical methods
2. The researcher must remain cautious about the errors that can possibly arise in the process of interpreting results. Errors can arise due to false generalization and/or due to wrong interpretation of statistical measures, such as the application of findings beyond the range of observations, identification of correlation with causation and the like. Another major pitfall is the tendency to affirm that definite relationships exist on the basis of confirmation of particular hypotheses. In fact, the positive test results accepting the hypothesis must be interpreted as "being in accord" with the hypothesis, rather than as "confirming the validity of the hypothesis". The researcher must remain vigilant about all such things so that false generalization may not take place. He should be well equipped with and must know the correct use of statistical measures for drawing inferences concerning his study.
3. He must always keep in view that the task of interpretation is very much intertwined with analysis and cannot be distinctly separated. As such he must take the task of interpretation as a special aspect of analysis and accordingly must take all those precautions that one usually observes while going through the process of analysis viz., precautions concerning the reliability of data, computational checks, validation and comparison of results.
4. He must never lose sight of the fact that his task is not only to make sensitive observations of relevant occurrences, but also to identify and disengage the factors that are initially hidden to the eye. This will enable him to do his job of interpretation on proper lines. Broad generalisation should be avoided as most research is not amenable to it because the coverage may be restricted to a particular time, a particular area and particular conditions. Such restrictions, if any, must invariably be specified and the results must be framed within their limits.

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The researcher must remember that "ideally in the course of a research study, there should be constant interaction between initial hypothesis, empirical observation and theoretical conceptions. It is exactly in this area of interaction between theoretical orientation and empirical observation that opportunities for originality and creativity lie." He must pay special attention to this aspect while engaged in the task of interpretation.

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POSSIBLE QUESTIONS

PART-B (2 Marks)

1. Define Scaling.
2. What is Nominal Scale?
3. What do you understand by Ordinal Scaling?
4. What is Interval Scale?
5. Describe on Ratio Scaling.
6. What do you meant by Processing of Data?
7. Explain on Field and Central Editing.
8. What is Coding?
9. Briefly explain on Classification.
10. What do you mean by Tabulation?
11. What do you mean by Interpretation?
12. Briefly explain on Technical and Popular Report.

PART C (6 MARKS)

1. What do you mean by Editing? Explain its types.
2. Differentiate between Technical Report and Popular Report.
3. Describe the precautions that the researcher should take while interpreting his findings.
4. Explain on various measurement of Scales.
5. Explain the significance of a research report and narrate the various steps involved in writing such a report.
6. Elucidate on important scaling techniques.
7. Describe the layout of a research report, covering all relevant points.
8. Elucidate in detail on various types of reports.
9. Define Hypothesis. Explain detail on formulation and procedure for testing hypothesis.

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10. Genetic theory states that children having one parent of blood type A and the other of blood type B will always be of one of three types, A, AB, B and that the proportion of three types will on an average be as 1 : 2 : 1. A report states that out of 300 children having one A parent and B parent, 30 per cent were found to be types A, 45 per cent per cent type AB and remainder type B. Test the hypothesis by □2 test. (Table Value: 3.841)
11. Explain in detail on the layout of research report.
12. Explain the principles involved in tabulation.

* * * * *

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Multiple Choice Questions - Each Question Carries ONE Mark

S.No.	Questions	Option 1	Option 2	Option 3	Option 4	Answer
1	First step of an investigation is_____.	collection of data.	presentation of data.	analysis of data.	explanation of data.	collection of data.
2	A complete enumeration of all items in the 'population' is known as a____inquiry	Census	Sample	Probability	Non-Probability	Census
3	All items in any field of inquiry constitute a ____	Universe	Sampling	Area Sampling	Probability Sampling	Universe
4	____is the only institution which can adopt census method of data collection	Private	Public	Government	Educational	Government
5	In India population census is carried out ____	Once in a decade	Once in Five Years	Once in Fifteeen Years	Yearly Once	Once in a decade
6	Research methods refer to the behavior and_____used in selecting and construction research techniques.	Instruments.	Data collection.	Methodology.	Observation.	Instruments.
7	___begins after a research design chalked out	Analysis	Interpretation	Report Writing	Data Collection	Data Collection
8	Individual data is another wise called as_____.	Raw data.	Discrete data.	Continuous data.	Primary data.	Raw data.
9	Classification is the process of arranging data in_____.	Columns.	Rows.	Columns and rows.	Ascending order.	Columns and rows.

10	__data are those which are collected afresh and for the first time	Secondary	Primary	Teritarial	Regional	Primary
11	Data that have been compiled by some agency other than the user is known as____data	Teritarial	Regional	Secondary	Primary	Secondary
12	__data is also the first hand data collected by the researcher for the immediate purpose of the study	Primary	Teritarial	Regional	Secondary	Primary
13	Which one of the following is not a sources of secondary data?	Personal contact.	Records.	Journal.	News paper.	Personal contact.
14	Setting quotas for hard-to-reach respondents is one way to minimize _____bias.	Respondent	Interviewer	Instrument	Non-response	Non-response
15	__method of collecting data involves presentation of oral-verbal stimuli and reply in terms of oral-verbal responses	Observation	Interview	Questionnaire	Secondary data	Interview
16	For carrying out descriptive study____method of data collection is more suitable	Focused	Structured	Unstructured	Clinical	Structured
17	___interviews are characterized by a flexibility of approach to questioning	Focused	Structured	Unstructured	Clinical	Unstructured
18	___interviews are used generally in the development of hypotheses	Structured	Non-directive	Clinical	Focused	Focused
19	___interview is concerned with broad underlying feelings or motivations of an individual	Structured	Clinical	Focused	Non-directive	Clinical

20	In_____interview, the interviewer's function is simply to encourage the respondent to talk about the given topic with a bare minimum of direct questioning	Structured	Clinical	Focused	Non-directive	Non-directive
21	_____method is the most commonly used method specially in studies relating to behavioural sciences	Observation	Questionnaire	Interview	Secondary data	Observation
22	When a population is infinite, the appropriate method is _____.	Census method.	Sample method.	Both the census and sample method.	Neither census nor sample method.	Sample method.
23	Which of the following example does not constitute an infinite population?	Population consisting of odd numbers.	Population of weights of newly born babies.	Population of heights of 15 year old children.	Population of head and tails in tossing a coin successfully.	Population of heights of 15 year old children.
24	Method of complete enumeration is applicable for_____.	Knowing the production.	Knowing the quantum of export and	Knowing the population.	All of above.	All of above.
25	___observation is characterised by a careful definition of the units to be observed	Structured	Unstructured	Participant	Uncontrolled	Structured
26	If the observer observes by making himself a member of the group, the observation is called as __observation	Structured	Participant	Clinical	Focused	Participant
27	When the observer observes as a detached emissary, the observation of this type is often termed as __observation	Participant	Structured	Clinical	Non-Participant	Non-Participant

28	If the observation takes place in the natural setting, it may be termed as __observation	Focused	Structured	Non-Participant	Uncontrolled	Uncontrolled
29	When observation takes place according to definite pre-arranged plans, involving experimental procedure, the same is then termed ___observation	Controlled	Uncontrolled	Focused	Clinical	Controlled
30	___is mailed to respondents who are expected to read and understand the questions and write down the reply in the space meant	Secondary data	Interview Schedule	Observation	Questionnaire	Questionnaire
31	___questionnaires are those questionnaires in which there are definite, concrete and pre-determined questions	Structured	Open ended	Closed ended	Unstructured	Structured
32	__type of questionnaire is used in Marketing research	Structured non disguised	Strucured disguised	Non-structured and disguised	Non-structured non-disguised	Structured non disguised
33	_____Questionnaire is used to find, peoples' attitude	Strucured disguised	Non-structured and disguised	Non-structured non-disguised	Structured non disguised	Strucured disguised
34	Projective techniques are examples of___	Non-structured non-disguised	Strucured disguised	Non-structured and disguised	Structured non disguised	Non-structured and disguised
35	____explain the aims and objects of the investigation and also remove the difficulties which any respondent may feel in understanding the implications of a particular question	Agent	Surveyor	Investigator	Enumerator	Enumerator
36	___method is a very popular form of qualitative analysis and involves a careful and complete observation of a social unit	Case Study	Primary	Secondary	Enquiry	Case Study

37	__data are those which have already been passed through the statistical process	Secondary	Primary	Teritarial	Regional	Secondary
38	___interviews do not follow a system of pre-determined questions and standardised techniques of recording information	Unstructured	Directive	Non-directive	Structured	Unstructured
39	In interview, interviewer follows a rigid procedure laid down, asking questions in a form and order prescribed.	Focused	Structured	Unstructured	Clinical	Structured
40	___method is independent of respondents' willingness to respond and as such is relatively less demanding of active cooperation on the part of respondents	Interview	Questionnaire	Observation	Secondary data	Observation
41	____method is a technique by which individual factor whether it be an institution or just an episode in the life of an individual or a group is analysed	Case Study	Primary	Secondary	Enquiry	Case Study
42	__method may be in the form of direct personal investigation or it may be indirect oral investigation	Questionnaire	Secondary data	Observation	Interview	Interview
43	_____interview happens to be the central technique of collecting information in case of exploratory or formulative research studies	Directive	Structured	Focused	Unstructured	Unstructured

44	__has been defined as a "procedure for the assignment of numbers to a property of objects	Scaling	Measurement	Numbering	Calculation	Scaling
45	__scale is simply a system of assigning number symbols to events in order to label them	Nominal	Ordinal	Interval	Ratio	Nominal
46	In___a series of statements from which a respondent select one as best reflecting his evaluation	Graphic Rating Scale	Itemized Rating Scale	Attitude Scales	Likert's Summated Scale	Itemized Rating Scale
47	__are constructed with sets of rating scales designed to measures one or more aspects of an individual's or group's attitude towards some objects	Graphic Rating Scale	Itemized Rating Scale	Attitude Scales	Likert's Summated Scale	Attitude Scales
48	__consists of 15 to 20 statements which form a continuum of attitudes towards a subject ranging from the most favorable to the least favorable	Thurstone's Equal Appearing Interval Scale	Bogardus's Scale of Social Distance	Guttman's Cumulative Scale	Likert's Summated Scale	Thurstone's Equal Appearing Interval Scale
49	__consist of a series of statements to which a respondent expresses his agreement or disagreement	Thurstone's Equal Appearing Interval Scale	Bogardus's Scale of Social Distance	Guttman's Cumulative Scale	Likert's Summated Scale	Guttman's Cumulative Scale
50	__scales provide convenient ways of keeping track of people, objects and events	Ordinal	Interval	Ratio	Nominal	Nominal
51	____test can be applied, while using nominal scaling	Chisquare	Mean	Median	Mode	Chisquare
52	The lowest level of the ordered scale that is commonly used is the __scale	Ordinal	Interval	Ratio	Nominal	Ordinal

53	Rank orders represent scales and are frequently used in research relating to qualitative phenomena	Interval	Ratio	Nominal	Ordinal	Ordinal
54	__scales can have an arbitrary zero, but it is not possible to determine for them what may be called an absolute zero or the unique origin	Interval	Ratio	Nominal	Ordinal	Interval
55	__scales have an absolute or true zero of measurement	Interval	Ratio	Nominal	Ordinal	Ratio
56	__describes the procedures of assigning numbers to various degrees of opinion, attitude and other concepts	Scaling	Measurement	Numbering	Calculation	Scaling
57	Assignment of numbers just for identification is an example of ___ scaling	Ordinal	Interval	Ratio	Nominal	Nominal
58	__scale represents the actual amounts of variables	Interval	Ratio	Nominal	Ordinal	Ratio
59	In scale, the rater makes judgment about some characteristic of a subject and places him directly on some point on the scale	Rating	Itemized	Attitude	Likerts	Rating
60	_____is a bundle of meanings or characteristics associated with certain events, objects.	Concept	Construct	Variables	Moderating variables	Concept

UNIT - IV

Univariate and Bivariate Analysis of Data: Descriptive vs Inferential Analysis, Descriptive Analysis of Univariate data- Analysis of Nominal scale data with only one possible response, Analysis of Nominal scale data with multiple category responses, Analysis of Ordinal Scaled Questions, Measures of Central Tendency, Measures of Dispersion; Descriptive Analysis of Bivariate data. Testing of Hypotheses: Concepts in Testing of Hypothesis – Steps in testing of hypothesis, Test Statistic for testing hypothesis about population mean; Tests concerning Means- the case of single population; Tests for Difference between two population means; Tests concerning population proportion- the case of single population; Tests for difference between two population proportions. Chi-square Analysis: Chi square test for the Goodness of Fit; Chi square test for the independence of variables; Chi square test for the equality of more than two population proportions. Analysis of Variance: Completely randomized design in a one-way ANOVA; Randomized block design in two way ANOVA; Factorial design. Multivariate Analysis : Factor Analysis, Discriminate analysis, Cluster analysis.

ELEMENTS/TYPES OF ANALYSIS

As stated earlier, by analysis we mean the computation of certain indices or measures along with searching for patterns of relationship that exist among the data groups. Analysis, particularly in case of survey or experimental data, involves estimating the values of unknown parameters of the population and testing of hypotheses for drawing inferences. Analysis may, therefore, be categorised as descriptive analysis and inferential analysis (Inferential analysis is often known as statistical analysis). “

Descriptive analysis is largely the study of distributions of one variable. This study provides us with profiles of companies, work groups, persons and other subjects on any of a multiple of characteristics such as size. Composition, efficiency, preferences, etc.” 2 . this sort of analysis may be in respect of one variable (described as unidimensional analysis), or in respect of two

variables (described as **bivariate analysis)** or in respect of more than two variables (described as multivariate analysis). In this context we work out various measures that show the size and shape of a distribution(s) along with the study of measuring relationships between two or more variables.We may as well talk of correlation analysis and causal analysis.

Correlation analysis

Studies the joint variation of two or more variables for determining the amount of correlation between two or more variables.

Causal analysis is concerned with the study of how one or more variables affect changes in another variable. It is thus a study of functional relationships existing between two or more variables. This analysis can be termed as regression analysis. Causal analysis is considered relatively more important in experimental researches, whereas in most social and business researches our interest lies in understanding and controlling relationships between variables then with determining causes per se and as such we consider correlation analysis as relatively more important. In modern times, with the availability of computer facilities, there has been a rapid development of multivariate analysis which may be defined as "all statistical methods which simultaneously analyse more than two variables on a sample of observations".

The important statistical measures

* that are used to summarise the survey/research data are:

(1) measures of central tendency or statistical averages; (2) measures of dispersion; (3) measures of asymmetry (skewness); (4) measures of relationship; and (5) other measures.

Amongst the measures of central tendency, the three most important ones are the arithmetic average or mean, median and mode. Geometric mean and harmonic mean are also sometimes used. From among the measures of dispersion, variance, and its square root—the standard deviation are the most often used measures. Other measures such as mean deviation, range, etc. are also used. For comparison purpose, we use mostly the coefficient of standard deviation or the coefficient of variation. In respect of the measures of skewness and kurtosis, we mostly use the first measure of skewness based on mean and mode or on mean and median.

Other measures of skewness, based on quartiles or on the methods of moments, are also used sometimes. Kurtosis is also used to measure the peakedness of the curve of the frequency distribution. Amongst the measures of relationship, Karl Pearson's coefficient of correlation is the frequently used measure in case of statistics of variables, whereas Yule's coefficient of association is used in case of statistics of attributes. Multiple correlation coefficient, partial correlation coefficient, regression analysis, etc., are other important measures often used by a researcher. Index numbers, analysis of time series, coefficient of contingency, etc., are other measures that may as well be used by a researcher, depending upon the nature of the problem under study. We give below a brief outline of some important measures (our of the above listed measures) often used in the context of research studies.

MEASURES OF CENTRAL TENDENCY

Raw data are difficult to comprehend. Classification facilitates, many a time, quick and easy understanding of diversified nature of data. A single representative value serves the purpose in a better manner.

Quantitative data in a mass exhibit certain general characteristics. They show a tendency to concentrate at certain values, usually somewhere in the centre of the distribution. Measures of this tendency are called measures of central tendency or averages. This tendency toward centralization, though not universal, has established the expression "measure of central tendency" to describe an average. The terms is imbedded in statistical language, but it is not always pertinent.

An average is a value which is typical or representative of a set of data.

A measure of central tendency gives a single representative value for a set of usually unequal values. The single value is the point of location around which the individual

values of the set cluster. The measures of central tendency are hence known as 'measures of location'. They are popularly called averages.

ARITHMETIC MEAN

Arithmetic mean is the total of the values of the items divided by their number.

Direct Method

Sum 1: The expenditure of 10 families in Rupees are given below.

Family	A	B	C	D	E	F	G	H	I	J
Exp.	30	70	10	75	500	8	42	250	40	36

Calculate the Arithmetic Mean.

Family	**Expenditure (Rs.)**
A	30
B	70
C	10
D	75
E	500
F	8
G	42
H	250
I	40
J	36
Total	**∑X= 1061**

AM = A + (∑fd/n)

= 150 + (192 / 12)

= 150 + 16

= Rs. 166

Short Cut Method

Sum 2: The expenditure of 10 families in Rupees are given below

Family	A	B	C	D	E	F	G	H	I	J
Exp.	30	70	10	75	500	8	42	250	40	36

Solution

Family	**Expenditure (Rs.) X**	**d=X-A; A = 100**
A	30	-70
B	70	-30
C	10	-90
D	75	-25
E	500	400
F	8	-92
G	42	-58
H	250	150
I	40	-60
J	36	-64
Total		**□d=61**

N = 12 and □d = 192

AM = A + (□d/N)
= 100 + (61/10)
= 100 + 6.10
= Rs. 106.10

Sum 3: The monthly income of 12 families in a town is given below:

S.No.	1	2	3	4	5	6	7	8	9	10	11	12
Income	280	180	96	98	104	85	80	94	100	75	600	200

Calculate the arithmetic mean by taking 150 as the assumed mean.

Solution

S.No.	Income (Rs.) X	d=X-A; A=150
1	280	130
2	180	30
3	96	-54
4	98	-52
5	104	-46
6	85	-65
7	80	-70
8	94	-56
9	100	-50
10	75	-75
11	600	450
12	200	50
Total	**-**	**192**

N = 12 and □d = 192

AM = A + (□d/N)

= 150 + (192 / 12)

= 150 + 16

= Rs. 166

Step Deviation Method

Sum 4: Find the arithmetic mean by step deviation method.

Marks	20	30	40	50	50	60	70	80	90	90

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Solution

Marks X	d=X-A/C A= 50; C=10
20	-3
30	-2
40	-1
50	0
50	0
60	1
70	2
80	3
90	4
90	4
Total	**□d=8**

N = 10 ; □d = 8

AM = A + (C□d/N)

= 50 + (10 X 8) / 10

= 50 + 8

= 58

Arithmetic Mean for Discrete Series

Sum 5: Calculate the mean number of persons per house. Given

No. of Persons per house	2	3	4	5	6	Total
No. of Houses	10	25	30	25	10	100

Solution:

No. of Persons per house X	No. of Houses f	fx
2	10	20
3	25	75
4	30	120
5	25	125
6	10	60
Total	**N=100**	**□fx=400**

Arithmetic Mean for Discrete Series – Short Cut Method

Sum 6: Calculate the arithmetic mean.

Marks	40	50	54	60	68	80	Total
No, of Students	10	18	20	39	15	8	110

Solution

Let A = 60

Marks (X)	No. of Students (f)	d=X-A; A=60	fd
40	10	-20	-200
50	18	-10	-180
54	20	-6	-120
60	39	0	0
68	15	8	120
80	8	20	160
Total	**N=110**	**--**	**□fd=-220**

AM = A + (□fd/N)

= 60 + (-220 / 110)

= 60 – 2

= 58

Arithmetic Mean for Discrete Series – Step Deviation Method

Sum 7: Calculate the arithmetic mean from the following discrete series.

Daily Wages (Rs.)	75	100	120	150	200	Total
No. of Labourers	5	12	20	14	9	60

Solution

Daily Wage (Rs.) X	**No. of Labourers (f)**	**d=X-A/C; A=120 C=5**	**fd**
75	5	-9	-45
100	12	-4	-48
120	20	0	0
150	14	6	84
200	9	16	144
Total	**N=60**	**--**	**□fd=135**

AM = A + (C□fd/N)

= 120 + (5 X 135) / 60

= 120 + 11.25
= Rs. 131.25

Continuous Series – Exclusive Class Intervals Sum

8: Calculate Arithmetic mean for the following:

Marks	20-30	30-40	40-50	50-60	60-70	70-80
No. of Students	5	8	12	15	6	4

Solution

Marks	**No. of Students (f)**	**Mid value (m)**	**fm**
20-30	5	25	125
30-40	8	35	280
40-50	12	45	540
50-60	15	55	825
60-70	6	65	390
70-80	4	75	300
Total	**N=50**	**--**	**□fm=2460**

AM = A + □fm/N
= 2460 / 50
= 49.20

Sum 9: From the following data, compute arithmetic mean by short cut method

Marks Obtained	0-10	10-20	20-30	30-40	40-50	50-60
No. of Students	5	10	25	30	20	10

Solution

Marks Obtained	No.of Students (f)	Mid value (m)	d=m-A A=25	fd
00-10	5	5	-20	-100
10-20	10	15	-10	-100
20-30	25	25	0	0
30-40	30	35	10	300
40-50	20	45	20	400
50-60	10	55	30	300
Total	**N=100**	**--**	**--**	**□fd=800**

AM = A + □fd/N

= 25 + (800/100)

= 25 + 8

= 33

Continuous Series –Inclusive Class Intervals

Sum 10: The annual profits of 90 companies are given below. Find the arithmetic mean.

Annual Profit (Rs.)	0-19	20-39	40-59	60-79	80-99
No. of Companies	5	17	32	24	12

Solution

Annual Profit (Rs.)	No. of Companies (f)	Mid value (m)	fm
00-19	5	9.5	47.50
20-39	17	29.5	501.50
40-59	32	49.5	1584.00
60-79	24	69.5	1668.00
80-99	12	89.5	1074.00
Total	**N=90**	**--**	**□fm=4875.00**

AM = □fm/N

= 4875 / 90

= Rs. 54.17

Continuous Series –Inclusive Class Intervals – Step Deviation Method

Sum 11: The annual profits of 90 companies are given below. Find the arithmetic mean.

Annual Profit (Rs.)	0-19	20-39	40-59	60-79	80-99
No. of Companies	5	17	32	24	12

Solution

Annual Profit	**No. of Companies (f)**	**Mid value (m)**	**d=m-A/C A=49.5; C=20**	**fd**
00-19	5	9.5	-2	-10
20-39	17	29.5	-1	-17
40-59	32	49.5	0	0
60-79	24	69.5	1	24
80-99	12	89.5	2	24
Total	**N=90**	**--**	**--**	**∑fd=21**

AM = A + (C∑fd/N)

= 49.5 + (20 X 21)/90

= 49.5 + 4.67

= Rs. 54.17

MEDIAN

Median is the value of the middle most items when all the items are in the order of magnitude.

Arithmetic mean is calculated on the basis of magnitudes or values of all the items. But median is concerned with the position or place of the items in a series. 'Which is the middle most item' is the question.

Median divides the series into two equal parts. Half of the items will be equal to or less than the median; half of the items will be equal or more than the median.

Sum1: Find median for the following

6	9	21	5	7	-2	0	32	9

Solution

Values in Ascending Order

-2, 0, 5, 6, 7, 9, 9, 21, 32

Position of Median is = N+1/2 = 9+1/2 = 5

Median = 7 (It is the value at 5^{th} Position)

Sum2: Find Median for the following data

57	58	61	42	38	65	72	66

Solution

Values in ascending order: 38, 42, 57, 58, 61, 65, 66, 72

Position of Median is = N+1/2

= 8+1/2

= 4.5, a fraction

Value at (N/2 = 8/2) = 4^{th} Position = 58

Value at (N/2+1 = 4+1) = 5^{th} Position = 61

Median = Value at 4^{th} Position + Value at 5^{th} Position /

= 58 + 61 / 2

= 59.5

Discrete Series

Sum 3: Consider the following data and compute Median.

Value (X)	0	1	2	3	Total
Frequency (f)	1	2	5	3	11

Solution

Value (x)	**Frequency (f)**	**Cumulative Frequency (cf)**
0	1	1
1	2	3
2	5	8
3	3	11
Total	**11**	

The position of median is N+1/2 = 11+1/2 = 6. 6 lies between the cumulative frequencies 3 and 8. Hence, the value at 6^{th} position is the value corresponding to the cumulative frequency 8 in the table. It is 2. Hence, Median = 2.

When N+1/2 is a fraction, the two middle most items are to be identified in a similar manner and the mean of those two items is to be found.

Sum 4: The marks (out of a maximum of 10) scored by the students of a class are given below. Find the Median mark.

Mark	3	4	5	6	7	8	9	10	Total
No. of Students	1	5	6	7	10	15	10	5	59

Solution

Mark (x)	**No. of Students (f)**	**Cumulative Frequency (cf)**
3	1	1
4	5	6
5	6	12
6	7	19
7	10	29
8	15	44
9	10	54
10	5	59
Total	**59**	

N+1/2 = 59+1/2=30. When all the 59 items are in ascending order, which is in 30th position? It is included in cf=44. Median =8

Sum 5: Find the median from the following data.

Wages (Rs.)	50	75	100	150	250	Total
No. of Labourers	8	14	10	5	3	40

Solution

Wage Rs. (X)	**No. of Labourers (f)**	**Cumulative Frequency (cf)**
50	8	8
75	14	22
100	10	32
150	5	37
250	3	40
Total	**40**	

Median = N+1/2

= 40+1/2

= 20.5

Looking corresponding to cf=22, Wage (x) at 20th position= 75.

Wage (x) at 21st position 75.

Median = Wage at 20th Position + Wage at 21st Position / 2

= 75+75/2

= Rs. 75

Sum 6: Find the Median

No. of Cars sold in a Day	10	15	17	18	21	Total
No. of Days	4	16	12	5	3	40

Solution:

No. of Cars sold in a Day (x)	**No. of Days (f)**	**Cumulative Frequency (cf)**
10	4	4
15	16	20
17	12	32
18	5	37
21	3	40
Total	**40**	

N+1/2 = 40+1/2

= 20.5

X at 20th position = 15

X at 21st position = 17

Median = X at 20th Position + X at 21st Position /

= 15+17/2

= 16

Median – Continuous Series

Sum 7: Calculate the median height

Height (cms.)	145-150	150-155	155-160	160-165	165-170	170-175
No. of Students	2	5	10	8	4	1

Solution

Height (cms.)	No. of Students (f)	Cumulative Frequency (cf)
145-150	2	2
150-155	5	7
155-160	10	17
160-165	8	25
165-170	4	29
170-175	1	30
Total	**N=30**	

L = 155; f = 10; i = 160-155=5; cf = 7

M = L + (i (N2-cf)/f)

= 155 + (5 (15-7))/10

= 155 + (5X8)/10

= 155 + 4

= 159 Cms.

Sum 8: Calculate the median from the following data:

Marks	10-25	25-40	40-55	55-70	70-85	85-100
Frequency	6	20	44	26	3	1

Solution

Marks	**Frequency (f)**	**Cumulative Frequency (cf)**
10-25	6	6
25-40	20	26
40-55	44	70
55-70	26	96
70-85	3	99
85-100	1	100

N/2 = 100/2 = 50

Median class interval: 40-55

L = 40; f = 44; cf = 26; i = 55 – 40 = 15

M = L + (i (N2-cf)/f)

= 40 + (15 (50-26))/44

= 40 + (15 X 24) / 44

= 40 + 8.18

= 48.18 (or) 48

Sum 9: Calculate the median for the following:

Value	0-9	10-19	20-29	30-39	40-49	50-59	60-69

Frequency	328	720	640	598	524	378	244

Solution

Value	**Frequency (f)**	**True Class Intervals**	**Cumulative Frequency (cf)**
00-09	328	-0.5-9.5	328
10-19	720	9.5-19.5	1048
20-29	664	19.5-29.5	1712
30-39	598	29.5-39.5	2310
40-49	524	39.5-49.5	2834
50-59	378	49.5-59.5	3212
60-69	244	59.5-69.5	3456
Total	**N=3456**		

Second order limit – First upper limit = 10 – 9
= 1

Half of the difference = ½ = 0.5

0.5 has been added to each upper limit to and 0.5 has been subtracted from each lower limit to get the boundaries of the true class intervals. It is the required form for the calculation of median.

N/2 = 3456/2 = 1728. Hence, the median class interval is 29.5 – 39.5

L = 29.5; f = 598; i = 39.5-29.5=10 ; cf = 1712

M = L + (i (N_2-cf)/f)

= 29.5 + (10 (1728-1712))/598

= 29.5 + (10 X 16) / 598

= 29.5 + 0.27

= 29.77

Sum 10: Convert the following "Less than cumulative frequency" distribution into an ordinary "Frequency distribution" and then calculate the median age.

Age (Less than)	10	20	30	40	50	60	70	80
No. of Persons	4	16	40	76	96	112	120	125

Solution

Age (Less than)	**Number of Persons**	**Age**	**No. of Persons (f)**	**Cumulative Frequency (cf)**
10	4	00-10	4	4
20	16	10-20	12	16
30	40	20-30	24	40
40	76	30-40	36	76
50	96	40-50	20	96
60	112	50-60	16	112
70	120	60-70	8	120
80	125	70-80	8	125
Total	**.**	**-**	**N=125**	

N/2 = 125/2 = 62.5; Median class interval: 30-40

L = 30; f = 36; i = 40-30=10; cf=40

M = L + (i (N_2-cf)/f)

= 30 + (10 (62.5-40))/36

= 30 + 6.25

= 36.25

MODE

Mode is the value which has the greatest frequency density. Z or M_O denotes Mode.

According to Croxton and Cowden, "The mode of a distribution is the value at the point around which the items tend to be most heavily concentrated. It may be regarded as the most typical of a series of values". Mode is called the most typical or fashionable value of a distribution.

In individual observations and discrete series, the mode is most often available by inspection. The value which has the greatest frequency is mode. Such values have the greatest frequency density also. The difference between the greatest frequency and the next lower frequency may be nominal in a few cases. Mode is then determined on the basis of the greatest frequency density. That is, on the basis of its frequency and the neighbouring frequencies of each value. It is found out by forming a grouping table and analysis table of frequencies.

In the words of Murray R Spiegel, "The mode of a set of numbers is that value which occurs with the greatest frequency, i.e. it is the most common value. The mode may not exist, and even if it does exist it may not be unique". There is no mode when all the observations occur equal number of times. If one value occurs distinctly more times than

any other value, that value is the mode. The set which has only one mode is said to be unimodal. Sets with two modes are said to be bimodal. Sets which have more than two modes are said to be multimodal. In a few situations due to fluctuations of sampling it becomes a difficult task to identify a single value with greatest frequency in a sample even though the population is undoubtedly unimodal.

Sum 1: Determine the mode on the following:

1. 320, 395, 342, 444, 551, 395, 425, 417, 395, 401, 390, 400
2. 3, 6, 7, 5, 8, 4, 9
3. 25, 32, 24, 27, 32, 27, 25, 32, 24, 27, 25, 24
4. 0, 2, 5, 6, 9, 5, 6, 14, 6, 15, 5, 6, 5

Solution

Mode = 395	Because its frequency, 3, is higher than others. The frequency of others is 1 each. (This is an example for unimodal distribution)
No Mode	Because all the values have equal frequency (1). (This is an example for a distribution which has no mode)
No Mode	Because all the values occur equal number of times (3 times each). (This is an example for a distribution which has no mode)

Modes 5& 6	Because they occur equal number of times and they occur greater number of times than other values. (This is an example for bimodal distribution. Grouping table of frequencies also shows that 5 and 6 have greatest and equal frequency densities. Mode is said to be ill defined in this case. Hence, the answers are not given)

Discrete Series

Sum 2: Determine the Mode:

Size of Dress	18	20	22	24
No. of Sets Produced	55	120	108	45

Solution: Mode

= 20

Sum 3: Find the Modal Size

Size of Shoes	3	4	5	6	7	8	9
No. of Pairs Sold	10	25	32	38	61	47	34

Solution

Mode = 7

Sum 4: Calculate the mode from the following:

Size	10	11	12	13	14	15	16	17	18
Frequency	10	12	15	19	20	8	4	3	2

Solution

Greatest frequency is 20. Mode need not be 14 because the difference between the greatest frequency 20 and the next lower frequency 19 is very small. Further, 19 has the support of the neighbouring frequency 15 while 20 has the support of 8 only.Grouping table and analysis table are formed as explained earlier.

Grouping Table

Size (x)	Frequency (f) (1)	(2)	(3)	(4)	(5)	(6)
10	10					
		22				
11	12			37		
			27			
12	15				**46**	
		34				
13	19					**54**
			39			
14	**20**			**47**		
		28				
15	8				32	
			12			
16	4					15
		7				
17	3			9		
18	2					

Analysis Table

Size X	1	2	3	4	5	6	Total
10							-

11					1		1
12		1			1	1	3
13		1	1	1	1	1	5
14	1		1	1		1	4
15				1			1
16							-
17							-
18							-

Mode = 13

Continuous Series

Sum 5: Calculate the Mode.

Daily Wage in Rs.	50-60	60-70	70-80	80-90	90-100
No. of Labourers	40	62	75	100	65

Solution

L=80	The lower boundary of the modal class interval
f_1=100	The frequency of the modal class
f_0=75	The frequency of the class preceding the modal class and
f_2=65	The frequency of the class succeeding the modal class and
i=90-80=10	The size of the modal class interval

$Z = L + (iD_1/ (D_1+D_2))$

$= 80 + (10 X 25/ (25 + 35))$

= 80 + (250/60)

= 80 + 4.17

= 84.17

Sum 6: Find out the mode for the following data using grouping and analysis table.

CI	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
Frequency	9	12	15	16	17	15	10	13

Solution

Grouping Table

Size (x)	**Frequency (f) (1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
0-5	9					
		21				
5-10	12			36		
			27			
10-15	15				**43**	
		31				
15-20	16					**48**
			33			
20-25	**17**			**48**		
		32				
25-30	15				42	
			25			
30-35	10					38
		23				
35-40	13					

Analysis Table

Size X	1	2	3	4	5	6	Total
00-05							-
05-10					1		1
10-15					1	1	2
15-20			1	1	1	1	4
20-25	1	1	1	1		1	5
25-30		1		1			2
30-35							-
35-40							-

Modal Class Interval = 20 – 25

L = 20; i = 25-20=5; D_1 = 17-16=1; D_2 = 17-15=12

Z = L + (iD_1/ (D_1+D_2))

= 20 + (5X1/(1+2))

= 20 + (5/3)

= 20 + 1.67

= 21.67

MEASURES OF DISPERSION

In a series, all the items are not equal. There is difference or variation among the values. The degree of variation is evaluated by various measures of dispersion.

Averages are central values. They enable comparison of two or more sets of data. They are not sufficient to depict the true nature of the sets. For example, consider the following marks of two students

Student I	Student II
68	85
75	90
65	80
67	25
70	65

Both have got a total of 345 and an average of 69 each. The fact is that the second student has failed in one paper. When the averages alone are considered, the two student are equal.

Less variation is a desirable characteristic. First student has less variation. That is, he is almost equally good in all the subjects. To quote Simpson and Kafka, "An average does not tell the full story. It is hardly fully representative of a mass, unless we know the manner in which the individual items scatter around it. A further description of the series is necessary if we are to guage how representative the average is".

STANDARD DEVIATION

Standard deviation is the root mean square deviation of the values from their arithmetic mean.

SD is the abbreviation and □□(read, sigma) is the symbol. Mean square deviation of the values from their AM is Variance and is denoted by □^{2}. SD is the positive square root of variance. Karl Pearson introduced the concept of standard deviation in 1893. SD is also called root mean square deviation. It is a mathematical deficiency of mean deviation to ignore negative sign. Standard deviation possesses most of the desirable properties of a good measure of dispersion. The corresponding relative measure is Coefficient of Variation.

It is very popular and so extremely used as raise a doubt whether there is any other relative measure of dispersion.

Coefficient of Variation = Standard Deviation / Arithmetic Mean X 100

Sum 1: Find SD for the following: 77, 73, 75, 70, 72, 76, 75, 72, 74, 76

Solution

X	**$X=X-\bar{X}$**	**X^2**
77	3	9
73	-1	1
75	1	1
70	-4	16
72	-2	4
76	2	4
75	1	1
72	-2	4
74	0	0
76	2	4
□X=740	□□(X-X)=0	□X^2=44

Arithmetic Mean, $\bar{X}$ = ∑X/N

= 740/10

= 74

Standard Deviation, □ = $\sqrt{\Sigma X^2/N}$

= $\sqrt{44/10}$

= $\sigma = \sqrt{\frac{\Sigma fd'^2}{N} - \left(\frac{\Sigma fd'}{N}\right)^2}$ $\sqrt{4.4}$

= 2.10 = $\sqrt{20143/10 - (385/10)^2}$

Sum 2: 10 Students of B.Com. class of a College have obtained the following marks in Statistics out of 100 marks. Calculate the standard deviation.

S.No.	1	2	3	4	5	6	7	8	9	10
Marks	5	10	20	25	40	42	45	48	70	80

Solution

S.No.	**Marks X**	**$_X$2**
1	5	25
2	10	100
3	20	400
4	25	625
5	40	1600
6	42	1764
7	45	2025
8	48	2304

9	70	4900
10	80	6400
Total	**$\Sigma X=385$**	**$\Sigma X^2=20143$**

$$= \sqrt{20143 - (38.5)^2}$$
$$= \sqrt{20143 - 148225}$$
$$= \sqrt{532.05}$$
$$= 23.07$$

Deviations taken from Assumed Mean

Sum 3: For the data below, calculate standard deviation 40, 50, 60, 70, 80, 90, 100

Solution

X	**X=X-A; A=70**	**d^2**
40	-30	900
50	-20	400
60	-10	100
70	0	0
80	10	100
90	20	400
100	30	900
Total	**$\Sigma d=0$**	**$\Sigma d^2=2800$**

$$\sigma = \sqrt{\frac{\Sigma fd'^2}{N} - \left(\frac{\Sigma fd'}{N}\right)^2}$$

$$= \sqrt{2800/7 - (0/7)^2}$$
$$= \sqrt{400 - 0^2}$$

$= \sqrt{400}$

= 20

Step Deviation Method

Sum 4: Given below are the marks obtained by 5 B.Com. Students

Roll No.	101	102	103	104	105
Marks	10	30	20	25	15

Calculate Standard Deviation

Solution

Roll No.	**Marks (X)**	**d=X-A/C: A=20; C=5**	**d^2**
101	10	-2	4
102	30	2	4
103	20	0	0
104	25	1	1
105	15	-1	1
Total		**□d=0**	**□d^2=10**

$$\sigma = \sqrt{\frac{\Sigma fd'^2}{N} - \left(\frac{\Sigma fd'}{N}\right)^2} \times C$$

$= \sqrt{10/5 - (0/5)^2}$ X 5

$= \sqrt{2 - 0^2}$ X 5

$= \sqrt{2}$ X 5

= 1.4142 X 5

= 7.07

Discrete Series – Deviation taken from Actual Mean

Sum 5: Calculate the Standard Deviation of the following series.

X	6	9	12	15	18
f	7	12	13	10	8

Solution

X	**f**	**fX**	**$x=X-\bar{X}$**	**X^2**	**fx^2**
6	7	42	-6	36	252
9	12	108	-3	9	108
12	13	156	0	0	0
15	10	150	3	9	90
18	8	144	6	36	288
Total	**N=50**	**$\sum fx=600$**	**-**	**-**	**$\sum fx^2=738$**

Arithmetic Mean = $\sum fx/N$
= 600 / 50
= 12.00

Standard Deviation, σ = $\sqrt{fX^2/N}$
$=\sqrt{738/50}$
$=\sqrt{14.76}$
= 3.84

Discrete Series – Direct Method

Sum 6: Calculate the Standard Deviation

No. of Goals Scored in a Match	0	1	2	3	4	5
No. of Matches	1	2	4	3	0	2

Solution:

X	**f**	**fX**	**fx^2**
0	1	0	0
1	2	2	2
2	4	8	16
3	3	9	27
4	0	0	0
5	2	10	50
Total	**N=12**	**$\Sigma fx=29$**	**$\Sigma fx^2=95$**

$$\sigma = \sqrt{\frac{\Sigma fx'^2}{N} - \left(\frac{\Sigma fx'}{N}\right)^2} \times C$$

$$= \sqrt{95/12 - (29/12)^2}$$

$$= \sqrt{7.9167 - (2.4167)^2}$$

$$= \sqrt{7.9167 - 5.8404}$$

$= \sqrt{2.0763}$

$= 1.44$

Discrete Series – Deviations taken from Assumed Mean Sum

7: Calculate Standard Deviation from the following data

X	6	9	12	15	18
f	7	12	19	10	2

X	**f**	**d=X-A; A=12**	**fd**	**fd^2**
6	7	-6	-42	252
9	12	-3	-36	108
12	19	0	0	0
15	10	3	30	90
18	2	6	12	72
Total	**N=50**	**-**	**$\sum$fd=-36**	**$\sum fd^2$=522**

$$\sigma = \sqrt{\frac{\Sigma fd'^2}{N} - \left(\frac{\Sigma fd'}{N}\right)^2}$$

$= \sqrt{522/50 - (-36/50)^2}$

$= \sqrt{10.44 - (0.72)^2}$

$= \sqrt{10.4400 - 0.5184}$

$= \sqrt{9.9216}$

$= 3.15$

Discrete Series – Deviations taken from Assumed Mean

Sum 8: The weekly salaries of a group of employees are given in the following table. Find the mean and standard deviation of the salaries.

Salary (Rs.)	75	80	85	90	95	100
No. of Persons	3	7	18	12	6	4

Solution:

Salary (Rs.)	**No. of Persons (f)**	**d=X-A/C A=85; C=5**	**fd**	**fd^2**
75	3	-2	-6	12
80	7	-1	-7	7
85	18	0	0	0
90	12	1	12	12
95	6	2	12	24
100	4	3	12	36
Total	**N=50**	**-**	**□fd=23**	**□fd^2=91**

Arithmetic Mean = A + (C□fd/N)

= 85 + (5X23/50)

= 85 + 2.3

= Rs.87.30

Continuous Series – Deviation taken from Actual Mean

Sum 9: Find the Standard Deviation.

Class Interval	0-10	10-20	20-30	30-40	40-50	Total
Frequency	2	5	9	3	1	20

Solution

Class Interval	Frequency (f)	Mid Value (m)	fm	m-X X=23	$(m-X)^2$	$f(m-X)^2$
0-10	2	5	10	-18	324	648
10-20	5	15	75	-8	64	320
20-30	9	25	225	2	4	36
30-40	3	35	10	12	144	432
40-50	1	45	45	22	484	484
Total	N=20		□fm=460	-	-	□f(m-X)^2=192

Arithmetic Mean = □fm/N

= 460/20

= 23

SD □ = $\sqrt{\Sigma f(m-\bar{X})^2/N}$

= $\sqrt{1920/20}$

= $\sqrt{96}$

= 9.80

Continuous Series – Direct Method

Sum 10: The following data were obtained while observing the life span of a few neon lights of a company. Calculate SD.

Life Span (Yrs.)	4-6	6-8	8-10	10-12	12-14	Total
No. of Neon Lights	10	17	32	21	20	100

Solution

Life Span (Yrs.)	No. of Neon Lights (f)	Mid Value (m)	fm	fm^2
4-6	10	5	50	250
6-8	17	7	119	833
8-10	32	9	288	2592
10-12	21	11	231	2541
12-14	20	13	260	3380
Total	N=100		Σfm=948	Σfm^2=9596

$$\sigma = \sqrt{\frac{\Sigma fd'^2}{N} - \left(\frac{\Sigma fd'}{N}\right)^2}$$

$$= \sqrt{9596/100 - (948/100)^2}$$

$$= \sqrt{95.96 - (9.48)^2}$$

$$= \sqrt{95.9600 - 89.8704}$$

$$= 2.47$$

Continuous Series – Deviation taken from Assumed Mean

Sum 11: Calculate the standard deviation of the following series.

No. of Students in 00 (Below)	2	6	10	14	18	22	26
No. of Colleges	0	7	19	42	61	72	80

Solution

No. of Students in 00 (Below)	No. of Colleges	No. of Students in 00	No. of Colleges f	Mid value (m)	d=m-A A=12	fd	fd^2
2	0	2-6	7	4	-8	-56	448
6	7	6-10	12	8	-4	-48	192
10	19	10-14	23	12	0	0	0
14	42	14-18	19	16	4	76	304
18	61	18-22	11	20	8	88	704
22	72	22-26	8	24	12	96	1152
26	80						
Total	**-**	**-**	**N=80**	**-**	**-**	**□fd=156**	**□fd^2=2800**

$$\sigma = \sqrt{\frac{\Sigma fd'^2}{N} - \left(\frac{\Sigma fd'}{N}\right)^2}$$

$$= \sqrt{2800/80 - (156/80)^2}$$

$$= \sqrt{35 - (1.95)^2}$$

$$= \sqrt{35.0000\ 3.8025}$$

$$= 5.59$$

Continuous Series – Step Deviation Method

Sum 12: Calcuate the standard deviation of the following frequency distribution.

Annual Profit (Rs.)	20-40	40-60	60-80	80-100	100-120	120-140	140-160
No. of Banks	10	14	25	48	33	24	16

Solution

Annual Profit (Rs.)	No. of Banks	Mid value (m)	d=m-A A=90; C=20	fd	fd^2
20-40	10	30	-3	-30	90
40-60	14	50	-2	-28	56
60-80	25	70	-1	-25	25
80-100	48	90	0	0	0
100-120	33	110	1	33	33
120-140	24	130	2	48	96
140-160	16	150	3	48	144
Total	**N=170**	**-**	**-**	**$\sum fd=46$**	**$\sum fd^2=444$**

$$\sigma = \sqrt{\frac{\sum fd'^2}{N} - \left(\frac{\sum fd'}{N}\right)^2} \times C$$

$$= \sqrt{444/170 - (46/170)^2} \text{ X } 20$$

$$= \sqrt{2.6118 - (0.2706)^2} \text{ X } 20$$

$$= \sqrt{2.6118 - 0.0732} \text{ X } 20$$

$$= \sqrt{}$$

=1.5933X 20

=Rs. 31.87

HYPOTHESIS

Hypothesis is usually considered as the principal instrument in research. Its main function is to suggest new experiments and observations. In fact, many experiments are carried out with the deliberate object of testing hypotheses. Decision-makers often face situations wherein they are interested in testing hypotheses on the basis of available information and then take decisions on the basis of such testing. In social science, where direct knowledge of population parameter(s) is rare, hypothesis testing is the often used strategy for deciding

whether a sample data offer such support for a hypothesis that generalisation can be made. Thus hypothesis testing enables us to make probability statements about population parameter(s). The hypothesis may not be proved absolutely, but in practice it is accepted if it has withstood a critical testing. Before we explain how hypotheses are tested through different tests meant for the purpose, it will be appropriate to explain clearly the meaning of a hypothesis and the related concepts for better understanding of the hypothesis testing techniques.

What is Hypothesis?

Ordinarily, when one talks about hypothesis, one simply means a mere assumption or some supposition to be proved or disproved. But for a researcher hypothesis is a formal question that he intends to resolve. Thus a hypothesis may be defined as a proposition or a set of proposition set forth as an explanation for the occurrence of some specified group of phenomena either asserted merely as a provisional conjecture to guide some investigation or accepted as highly probable in the light of established facts. Quite often a research hypothesis is a predictive statement, capable of being tested by scientific methods, that relates an independent variable to some dependent variable. For example, consider statements like the following ones:

"Students who receive counselling will show a greater increase in creativity than students not receiving counselling" Or "the automobile A is performing as well as automobile B."

These are hypotheses capable of being objectively verified and tested. Thus, we may conclude that a hypothesis states what we are looking for and it is a proposition which can be put to a test to determine its validity.

CHARACTERISTICS OF HYPOTHESIS

1. Hypothesis should be clear and precise. If the hypothesis is not clear and precise, the inferences drawn on its basis cannot be taken as reliable.
2. Hypothesis should be capable of being tested. In a swamp of untestable hypotheses, many a time the research programmes have bogged down. Some prior study may be done by researcher in order to make hypothesis a testable one. A hypothesis "is testable if other deductions can be made from it which, in turn, can be confirmed or disproved by observation."
3. Hypothesis should state relationship between variables, if it happens to be a relational hypothesis.
4. Hypothesis should be limited in scope and must be specific. A researcher must remember that narrower hypotheses are generally more testable and he should develop such hypotheses.
5. Hypothesis should be stated as far as possible in most simple terms so that the same is easily understandable by all concerned. But one must remember that simplicity of hypothesis has nothing to do with its significance.
6. Hypothesis should be consistent with most known facts i.e., it must be consistent with a substantial body of established facts. In other words, it should be one which judges accept as being the most likely.
7. Hypothesis should be amenable to testing within a reasonable time. One should not use even an excellent hypothesis, if the same cannot be tested in reasonable time for one cannot spend a life-time collecting data to test it.
8. Hypothesis must explain the facts that gave rise to the need for explanation. This means that by using the hypothesis plus other known and accepted generalizations, one should be able to deduce the original problem condition. Thus hypothesis must actually explain what it claims to explain; it should have empirical reference.

FORMULATION OF HYPOTHESIS

1. A hypothesis may originate in different ways. A cultural environment may give rise to it. In India, for example, religion and custom dominate the way of life. This has had it reaction on economic values and individual initiative in various walks of life.

   Such a situation could give rise to any number of hypothesis; sociological, cultural, political and economic
2. A second source of hypothesis is folk wisdom or current popular beliefs and practices suggesting both the problems and the hypothesis
3. Analogies are often a spring of valuable hypothesis. Students of sociology in the course of their studies would have come across analogies wherein a society is compared to a biological organism, the natural law to the social law, thermo- dynamics to social dynamics etc.,
4. The history of science provides an eloquent testimony to the fact that personal and idiosyncratic experiences of the scientist contributes a great deal to the type and form of questions he may ask as also to the kinds of tentative answers to these questions that he can provide
5. Hypotheses may also rest on the findings of other studies. The researcher on the basis of the findings of other studies may hypothesise that similar relationship between specified variables will hold good in the present study, too. This is a very common way of researchers who design their study with a view to replicating another study conducted in a different concrete context
6. Another source of hypothesis formulation in cases which are expectations to accepted theory
7. Personal experience and individual reaction may give rise to hypotheses
8. A hypotheses may turn from a body of theory which, by way of logical deduction, may lead to the production that if certain conditions are present, certain results will follow. Theory is indeed an extremely fertile seed-bed of hypotheses.

PROCEDURE FOR HYPOTHESIS TESTING

To test a hypothesis means to tell (on the basis of the data the researcher has collected) whether or not the hypothesis seems to be valid. In hypothesis testing the main question is: whether to accept the null hypothesis or not to accept the null hypothesis? Procedure for hypothesis testing refers to all those steps that we undertake for making a choice between the two actions i.e., rejection and acceptance of a null hypothesis. The various steps involved in hypothesis testing are stated below:

1) Making a Formal Statement

The step consists in making a formal statement of the null hypothesis (H0) and also of the alternative Hypothesis (Ha). This means that hypothesis should be clearly stated, considering the nature of the research problem. For instance, Mr. Mohan of the Civil Engineering Department wants to test the load bearing capacity of an old bridge which must be more than 10 tons, in that case he can state his hypotheses as under:

Null Hypothesis H_0 : □□=10 tons Alternative Hypothesis H_a: □□> 10 tons

Take another example. The average score in an aptitude test administered at the national level is 80. To evaluate a state's education system, the average score of 100 of the state's students selected on random basis was 75. The state wants to know if there is a significant difference between the local scores and the national scores. In such a situation the hypotheses may be stated as under:

Null Hypothesis H_0 : □□= 80 Alternative Hypothesis H_a: □□□□80

The formulation of hypotheses is an important step which must be accomplished with due care in accordance with the object and nature of the problem under consideration. It also indicates whether we should use a one-tailed test or a two-tailed test. If Ha is of the type greater than (or of the type lesser than), we use a one-tailed test, but when Ha is of the type "whether greater or smaller" then we use a two-tailed test.

2) Selecting a Significance Level

The hypotheses are tested on a pre-determined level of significance and as such the same should be specified. Generally, in practice, either 5% level or 1% level is adopted for the purpose. The factors that affect the level of significance are: (a) the magnitude of the difference between sample means; (b) the size of the samples; (c) the variability of measurements within samples; and (d) whether the hypothesis is directional or non-directional (A directional hypothesis is one which predicts the direction of the difference between, say, means). In brief, the level of significance must be adequate in the context of the purpose and nature of enquiry.

3) Deciding the Distribution to Use

After deciding the level of significance, the next step in hypothesis testing is to determine the appropriate sampling distribution. The choice generally remains between normal distribution and the t-distribution. The rules for selecting the correct distribution are similar to those which we have stated earlier in the context of estimation.

4) Selecting a Random Sample and Computing an Appropriate Value

Another step is to select a random sample(s) and compute an appropriate value from the sample data concerning the test statistic utilizing the relevant distribution. In other words, draw a sample to furnish empirical data.

5) Calculation of the Probability

One has then to calculate the probability that the sample result would diverge as widely as it has from expectations, if the null hypothesis were in fact true.

6) Comparing the Probability

Yet another step consists in comparing the probability thus calculated with the specified value for α□, the significance level. If the calculated probability is equal to or smaller than the α value in case of one-tailed test (and α □/2 in case of two-tailed test), then reject the null hypothesis (i.e., accept the alternative hypothesis), but if the calculated probability is greater, then accept the null hypothesis. In case we reject H0, we run a risk of (at most the level of significance) committing an error of Type I, but if we accept H0, then we run some risk (the size of which cannot be specified as long as the H0 happens to be vague rather than specific) of committing an error of Type II.

CHI-SQUARE

The chi-square test is an important test amongst the several tests of significance developed by statisticians. Chi-square, symbolically written as χ^2 (Pronounced as Ki-square), is a statistical measure used in the context of sampling analysis for comparing a variance to a theoretical variance. As a non-parametric test, it "can be used to determine if categorical data shows dependency or the two classifications are independent. It can also be used to make comparisons between theoretical populations and actual data when categories are used." Thus, the chi-square test is applicable in large number of problems. The test is, in fact, a technique through the use of which it is possible for all researchers
to (i) test the goodness of fit; (ii) test the significance of association between two attributes, and (iii) test the homogeneity or the significance of population variance.

Chi-square is an important non-parametric test and as such no rigid assumptions are necessary in respect of the type of population. We require only the degrees of freedom (implicitly of course the size of the sample) for using this test. As a non- parametric test, chi-square can be used (i) as a test of goodness of fit and (ii) as a test of independence.

As a test of goodness of fit, χ^2 test enables us to see how well does the assumed

theoretical distribution (such as Binomial distribution, Poisson distribution or Normal distribution) fit to the observed data. When some theoretical distribution is fitted to the given data, we are always interested in knowing as to how well this distribution fits with the observed data. The chi-square test can give answer to this. If the calculated value of χ^2 is less than the table value at a certain level of significance, the fit is considered to be a good one which means that the divergence between the observed and expected frequencies is attributable to fluctuations of sampling. But if the calculated value of χ^2 is greater than its table value, the fit is not considered to be a good one.

As a test of independence, χ^2 test enables us to explain whether or not two attributes are associated. For instance, we may be interested in knowing whether a new medicine is effective in controlling fever or not, χ^2 test will helps us in deciding this issue. In such a situation, we proceed with the null hypothesis that the two attributes (viz., new medicine and control of fever) are independent which means that new medicine is not effective in controlling fever. On this basis we first calculate the expected frequencies and then work out the value of χ^2. If the calculated value of χ^2 is less than the table value at a certain level of significance for given degrees of freedom, we conclude that null hypothesis stands which means that the two attributes are independent or not associated (i.e., the new medicine is not effective in controlling the fever). But if the calculated value of χ^2 is greater than its table value, our inference then would be that null hypothesis does not hold good which means the two attributes are associated and the association is not because of some chance factor but it exists in reality (i.e., the new medicine is effective in controlling the fever and as such may be prescribed). It may, however, be

stated here that χ^2 is not a measure of the degree of relationship or the form of relationship between two attributes, but is simply a technique of judging the significance of such association or relationship between two attributes.

In order that we may apply the chi-square test either as a test of goodness of fit or as a test to judge the significance of association between attributes, it is necessary that the observed as well as theoretical or expected frequencies must be grouped in the same way and the theoretical distribution must be adjusted to give the same total frequency as we find in case of observed distribution. χ^2 is then calculated as follows:

$$\chi^2 = \Sigma \frac{\left(O_{ij} - E_{ij}\right)^2}{E_{ij}}$$

If two distributions (observed and theoretical) are exactly alike, □2 = 0; but generally due to 2 sampling errors, □2 is not equal to zero and as such we must know the sampling distribution of □2 □so that we may find the probability of an observed □2 being given by a random sample from the hypothetical universe. Instead of working out the probabilities, we can use ready table which gives probabilities for given values of □2. Whether or not a calculated value of □2 is significant can be ascertained by looking at the tabulated values of □2 for given degrees of freedom at a certain level of significance. If the calculated value of □2 is equal to or exceeds the table value, the difference between the observed and expected frequencies is taken as significant, but if the table value is more than the calculated value of □2, then the difference is considered as insignificant i.e., considered to have arisen as a result of chance and as such can be ignored.

As already stated, degrees of freedom play an important part in using the chi- square distribution and the test based on it, one must correctly determine the degrees of freedom. If

there are 10 frequency classes and there is one independent constraint, then there are (10 – 1) = 9 degrees of freedom. Thus, if 'n' is the number of groups and one constraint is placed by making the totals of observed and expected frequencies equal, the

d.f. would be equal to (n – 1). In the case of a contingency table (i.e., a table with 2 columns and 2 rows or a table with two columns and more than two rows or a table with two rows but more than two columns or a table with more than two rows and more than two columns), the d.f. is worked out as follows: d.f. = (c – 1) (r – 1), where 'c' means the number of columns and 'r' means the number of rows.

CONDITIONS FOR THE APPLICATION OF χ^2 TEST

1. Observations recorded and used are collected on a random basis.
2. All the items in the sample must be independent.
3. No group should contain very few items, say less than 10. In case where the frequencies are less than 10, regrouping is done by combining the frequencies of adjoining groups so that the new frequencies become greater than 10. Some statisticians take this number as 5, but 10 is regarded as better by most of the statisticians.
4. The overall number of items must also be reasonably large. It should normally be at least 50, howsoever small the number of groups may be.
5. The constraints must be linear. Constraints which involve linear equations in the cell frequencies of a contingency table (i.e., equations containing no squares or higher powers of the frequencies) are known are know as linear constraints.

Sum 1: A die is thrown 132 times with following results:

Number turned up	1	2	3	4	5	6
Frequency	16	20	25	14	29	28

Is the die unbiased?

Solution

Let us take the hypothesis that the die is unbiased. If that is so, the probability of obtaining any one of the six numbers is 1/6 and as such the expected frequency of any one number coming upward is 132 ×1/6 = 22. Now we can write the observed frequencies along with expected frequencies and work out the value of χ^2 as follows:

Turned UP	Observed Frequency	Expected Frequency	(Oi – Ei)	(Oi – Ei)	(Oi – Ei) /Ei
1	16	22	–6	36	36/22
2	20	22	–2	4	4/22
3	25	22	3	9	9/22
4	14	22	–8	64	64/22
5	29	22	7	49	49/22
6	28	22	6	36	36/22

$\chi^2 = (O-E)^2/E = 9$

Hence, the calculated $\chi^2 = 9$ DF = (n-1) (6-1)=5

The table value of χ^2 for 5 degrees of freedom at 5 per cent level of significance is 11.071. Comparing calculated and table values of χ^2, we find that calculated value is less than the table value and as such could have arisen due to fluctuations of sampling. The result, thus, supports the hypothesis and it can be concluded that the die is unbiased.

Sum 2: Find the value of χ^2 for the following information:

Class	***A***	***B***	***C***	***D***	***E***
Observed frequency	8	29	44	15	4
Theoretical (or expected) frequency	7	24	38	24	7

Solution : Since some of the frequencies less than 10, we shall first re-group the given data as follows and then will work out the value of χ^2

Class	**Observed Frequency**	**Expected Frequency**	**O-E**	**$(O-E)^2/E$**
A and *B*	(8 + 29) = 37	(7 + 24) = 31	6	36/31
C	44	38	6	36/38
D and *E*	(15 + 4) = 19	(24 + 7) = 31	–12	144/31

$(O-E)^2/E = 6.76$ (Approximate)

Sum 3: Genetic theory states that children having one parent of blood type A and the other of blood type B will always be of one of three types, A, AB, B and that the proportion of three types will on an average be as 1 : 2 : 1. A report states that out of 300
children having one A parent and B parent, 30 per cent were found to be types A, 45 per cent per cent type AB and remainder type B. Test the hypothesis by χ^2 test.

Solution: The observed frequencies of type A, AB and B is given in the question are 90, 135 and 75 respectively.

The expected frequencies of type A, AB and B (as per the genetic theory) should have been 75, 150 and 75 respectively.

We now calculate the value of χ^2 as follows:

Type	Observed Frequency	Expected Frequency	O-E	$(O-E)^2$	$(O-E)^2/E$
A	90	75	15	225	225/75 = 3
AB	135	150	–15	225	225/150 = 1.5
B	75	75	0	0	0/75 = 0

$(O-E)^2/E = 3 + 1.5 = 4.5$

Table value of χ^2 for 2 d.f. at 5 per cent level of significance is 5.991.

The calculated value of χ^2 is 4.5 which is less than the table value and hence can be ascribed to have taken place because of chance. This supports the theoretical hypothesis of the genetic theory that on an average type A, AB and B stand in the proportion of 1 : 2 : 1.

Sum 4: The table given below shows the data obtained during outbreak of smallpox:

Particulars	Attacked	Not attacked	Total
Vaccinated	31	469	500
Not vaccinated	185	1315	1500
Total	**216**	**1784**	**2000**

Test the effectiveness of vaccination in preventing the attack from smallpox. Test your

result with the help of χ^2 at 5 per cent level of significance.

Solution: Let us take the hypothesis that vaccination is not effective in preventing the attack from smallpox i.e., vaccination and attack are independent.

Group	Observed Frequenc	Expected Frequency	O-E	$(O-E)^2$	$(O-E)^2/E$
AB	31	54	–23	529	529/54 = 9.796
Ab	469	446	+23	529	529/44 = 1.186
aB	158	162	+23	529	529/162 = 3.265
ab	1315	1338	–23	529	529/1338 = 0.395

$(O-E)^2/E = 14.462$

Degrees of freedom in this case = $(r - 1)(c - 1) = (2 - 1)(2 - 1) = 1$.

The table value of χ^2 for 1 degree of freedom at 5 per cent level of significance is 3.841. The calculated value of χ^2 is much higher than this table value and hence the result of the experiment does not support the hypothesis. We can, thus, conclude that vaccination is effective in preventing the attack from smallpox.

Sum 5: Two research workers classified some people in income groups on the basis of sampling studies. Their results are as follows:

Investigators	Income groups			Total
	Poor	Middle	Rich	
A	160	30	10	200
B	140	120	40	300
Total	**300**	**150**	**50**	**500**

Show that the sampling technique of at least one research worker is defective.

Solution

Let us take the hypothesis that the sampling techniques adopted by research workers are similar

(i.e., there is no difference between the techniques adopted by research workers). This being so, the expectation of A investigator classifying the people in

OF	EF	(O-E)	$(O-E)^2/E$
160	120	40	1600/120 = 13.33
30	60	–30	900/60 = 15.00
10	20	–10	100/20 = 5.00
140	180	–40	1600/180 = 8.88
120	90	30	900/90 = 10.00
40	30	10	100/30 = 3.33

$(O-E)^2/E = 55.54$

Degrees of freedom = $(c - 1)(r - 1)$ $= (3 - 1)(2 - 1) = 2$.

The table value of χ^2 for two degrees of freedom at 5 per cent level of significance is 5.991. The calculated value of χ^2 is much higher than this table value which means that the calculated value cannot be said to have arisen just because of chance. It is significant. Hence, the hypothesis does not hold good. This means that the sampling techniques adopted by two investigators differ and are not similar. Naturally, then the technique of one must be superior than that of the other.

Sum 6: In an anti a malarial campaign in a certain area, quinine was administered to 812 persons out of a total population of 3248. The number of fever cases is shown below:

Treatment	**Fever**	**No Fever**	**Total**
Quinine	20	792	812
No Quinine	220	2216	2436
Total	**240**	**3008**	**3248**

Discuss the usefulness of Quinine in checking malaria.

Solution

Let us take the hypothesis that quinine is not effective in checking malaria.

Observed Frequency	**Expected Frequency**	**$(O-E)^2$**	**$(O-E)^2/E$**
20	60	1600	26.667
220	180	1600	8.889
792	752	1600	2.128
2216	2256	1600	0.709
			$(\sum((O-E)^2/E)=38.393$

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

= 38.393

v= (r-1)(c-1) = (2-1) (2-1)=1 v=1, χ^2 0.05 = 3.84

The calculated value of χ^2 is greater than the table value. The hypothesis is rejected. Hence, quinine is useful in checking malaria.

Sum 7: Based on information on 1000 randomly selected fields about the tenancy status of the cultivation of these fields and use of fertilizers, collected in an agro-economic survey, the following classification was noted:

Treatment	**Owned**	**Rented**	**Total**
Using Fertilizer	416	184	600
Not using Fertilizer	64	336	400
Total	**480**	**520**	**1000**

Would you conclude that owner cultivators are more inclined towards the use of fertilizer at 5% level? Carry out chi-square test as per testing procedure.

Solution

Let us take the hypothesis that ownership of fields and the use of fertilizers are independent attributes.

Observed Frequency	**Expected Frequency**	**$(O-E)^2$**	**$(O-E)^2/E$**
416	288	16384	56.889
64	192	16384	85.333
184	312	16384	52.513
336	208	16384	78.769
			$(\sum((O-E)^2/E)=273.504$

$$\chi^2 = \Sigma \frac{\left(O_{ij} - E_{ij}\right)^2}{E_{ij}}$$

= 273.504

v= (r-1)(c-1) = (2-1) (2-1)=1 v=1, χ^2 0.05 = 3.84

The calculated value of χ^2 is much more than the table value. The hypothesis is rejected. Hence, it can be concluded that owner's cultivators are more inclined towards the use of fertilizers.

Sum 8: In an experiment on immunization of cattle from tuberculosis, the following results were obtained.

Particulars	**Affected**	**Not Affected**
Inoculated	12	26
Not Inoculated	16	6

Calculate χ^2 and discuss the effect of vaccine in controlling suspectability to

tuberculosis. (5% value of χ^2 for one degree of freedom =3.84)

Solution:

Let us take the hypothesis that the vaccine is not effective in controlling susceptibility to tuberculosis.

Observed Frequency	**Expected Frequency**	**$(O-E)^2$**	**$(O-E)^2/E$**
12.5	17.7	27.04	1.528
15.5	10.3	27.04	2.625
25.5	20.3	27.04	1.332
6.5	11.7	27.04	2.311
			$(\sum((O-E)^2/E)=7.796$

$$\chi^2 = \Sigma \frac{\left(O_{ij} - E_{ij}\right)^2}{E_{ij}}$$

= 7.796

v= (r-1)(c-1) = (2-1) (2-1)=1 v=1, $\chi^2_{0.05} = 3.84$

Since the calculated value of χ^2 is greater than the table value, the hypothesis is not true. We, therefore, conclude that vaccine is effective in controlling susceptibility to tuberculosis.

Sum 9: From the data given below about the treatment of 250 patients suffering from a disease, state whether the new treatment is superior to the conventional treatment.

Treatment	**Favourable**	**Unfavourable**	**Total**
New	140	30	170
Conventional	60	20	80

Total	**200**	**50**	**250**

Solution

Observed Frequency	**Expected Frequency**	**$(O-E)^2$**	**$(O-E)^2/E$**
140	136	16	0.118
60	64	16	0.250
30	34	16	0.471
20	16	16	1.000
			$(\sum((O-E)^2/E)=1.839$

$$\chi^2 = \Sigma \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

= 1.839

v= (r-1)(c-1) = (2-1) (2-1)=1 v=1, χ^2 0.05 = 3.84

The calculated value of χ^2 is less than the table value. The hypothesis is accepted.
Hence, there is no significant difference between the new and conventional treatment.

Sum 10: 1000 students at College level are graded according to IQ and their economic conditions. Use Chi-square test to find out whether there is any association between economic conditions and the level of IQ.

Economic Condition	**Intelligent Quotient**			**Total**
	High	**Medium**	**Low**	
Rich	160	300	140	600

Poor	140	100	160	400
Total	**300**	**400**	**300**	**1000**

Solution

Let us take the hypothesis that there is no association between economic conditions and the level of IQ. On the basis of this hypothesis the expected frequencies corresponding to (a) and (b) are:

Observed Frequency	**Expected Frequency**	**$(O-E)^2$**	**$(O-E)^2/E$**
160	180	400	2.222
140	120	400	3.333
300	240	3600	15.000
100	160	3600	22.500
140	180	1600	8.889
160	120	1600	13.333
			$(\Sigma((O-E)^2/E)=65.277$

$$\chi^2 = \Sigma \frac{\left(O_{ij} - E_{ij}\right)^2}{E_{ij}}$$

= 65.277

v= (r-1)(c-1) = (2-1) (3-1)=2 v=2, χ^2 0.05 = 5.99

The calculated value of χ^2 is much greater than the table value. The hypothesis is rejected. Hence, there is association between economic condition and the level of IQ.

ANALYSIS OF VARIANCE (ANOVA)

Analysis of variance (abbreviated as ANOVA) is an extremely useful technique concerning researches in the fields of economics, biology, education, psychology, sociology,

and business/industry and in researches of several other disciplines. This technique is used when multiple sample cases are involved. As stated earlier, the significance of the difference between the means of two samples can be judged through either z-test or the t-test, but the difficulty arises when we happen to examine the significance of the difference amongst more than two sample means at the same time. The ANOVA technique enables us to perform this simultaneous test and as such is considered to be an important tool of analysis in the hands of a researcher. Using this technique, one can draw inferences about whether the samples have been drawn from populations having the same mean.

The ANOVA technique is important in the context of all those situations where we want to compare more than two populations such as in comparing the yield of crop from several varieties of seeds, the gasoline mileage of four automobiles, the smoking habits of five groups of university students and so on. In such circumstances one generally does not want to consider all possible combinations of two populations at a time for that would require a great number of tests before we would be able to arrive at a decision. This would also consume lot of time and money, and even then certain relationships may be left unidentified (particularly the interaction effects). Therefore, one quite often utilizes the ANOVA technique and through it investigates the differences among the means of all the populations simultaneously.

Professor R.A. Fisher was the first man to use the term 'Variance'* and, in fact, it was he who developed a very elaborate theory concerning ANOVA, explaining its usefulness in practical field. Later on Professor Snedecor and many others contributed to the development of this technique. ANOVA is essentially a procedure for testing the difference among different groups of data for homogeneity. "The essence of ANOVA is that the total amount of variation in a set of data is broken down into two types, that amount which can be attributed to chance and that amount which can be attributed to specified causes."1 There may be variation between samples and also within sample items. ANOVA consists in splitting the

variance for analytical purposes. Hence, it is a method of analyzing the variance to which a response is subject into its various components corresponding to various sources of variation. Through this technique one can explain whether various varieties of seeds or fertilizers or soils differ significantly so that a policy decision could be taken accordingly, concerning a particular variety in the context of agriculture researches. Similarly, the differences in various types of feed prepared for a particular class of animal or various types of drugs manufactured for curing a specific disease may be studied and judged to be significant or not through the application of ANOVA technique. Likewise, a manager of a big concern can analyze the performance of various salesmen of his concern in order to know whether their performances differ significantly.

Thus, through ANOVA technique one can, in general, investigate any number of factors which are hypothesized or said to influence the dependent variable. One may as well investigate the differences amongst various categories within each of these factors which may have a large number of possible values. If we take only one factor and investigate the differences amongst its various categories having numerous possible values, we are said to use one-way ANOVA and in case we investigate two factors at the same time, then we use two-way ANOVA. In a two or more way ANOVA, the interaction (i.e., inter-relation between two independent variables/factors), if any, between two independent variables affecting a dependent variable can as well be studied for better decisions.

BASIC PRINCIPLES OF ANOVA

The basic principle of ANOVA is to test for differences among the means of the populations by examining the amount of variation within each of these samples, relative to the amount of variation between the samples. In terms of variation within the given population, it is assumed that the values of (X_{ij}) differ from the mean of this population only because of random effects i.e., there are influences on (X_{ij}) which are unexplainable, whereas in

examining differences between populations we assume that the difference between the mean of the jth population and the grand mean is attributable to what is called a 'specific factor' or what is technically described as treatment effect. Thus while using ANOVA, we assume that each of the samples is drawn from a normal population and that each of these populations has the same variance. We also assume that all factors other than the one or more being tested are effectively controlled. This, in other words, means that we assume the absence of many factors that might affect our conclusions concerning the factor(s) to be studied.

In short, we have to make two estimates of population variance viz., one based on between samples variance and the other based on within samples variance. Then the said two estimates of population variance are compared with F-test, wherein we work out.

$$F = \frac{\text{Estimate of population variance based on between sample variance}}{\text{Estimate of population variance based on within sample variance}}$$

Sum 1: Set up an analysis of variance table for the following per acre production data for three varieties of wheat, each grown on 4 plots and state if the variety differences are significant.

Plot of land	Per acre production data Variety of wheat		
	A	**B**	**C**
1	6	5	5
2	7	5	4
3	3	3	3
4	8	7	4

Solution: We can solve the problem by the direct method or by short-cut method, but in each case we shall get the same result. We try below both the methods.

Solution through direct method: First we calculate the mean of each of these samples:

Average of X1 = 6+7+3+8 / 4 = 6

Average of X2 = 5+5+3+7 / 4 = 5

Average of X3 = 5+4+3+4 / 4 = 4

Mean of the sample means or $\overline{\overline{X}} = \frac{\overline{X}_1 + \overline{X}_2 + \overline{X}_3}{k}$

= 6 + 5 + 3 /3

= 5

Now we work out SS between and SS within Samples

$$SS \text{ between} = n_1\left(\overline{X}_1 - \overline{\overline{X}}\right)^2 + n_2\left(\overline{X}_2 - \overline{\overline{X}}\right)^2 + n_3\left(\overline{X}_3 - \overline{\overline{X}}\right)^2$$

$= 4(6-5)^2 + 4(5-5)^2 + 4(4-5)^2 5$

= 4 + 0 + 4

= 8

$$SS \text{ within} = \Sigma\left(X_{1i} - \overline{X}_1\right)^2 + \Sigma\left(X_{2i} - \overline{X}_2\right)^2 + \Sigma\left(X_{3i} - \overline{X}_3\right)^2, \qquad i = 1, 2, 3, 4$$

$= \{(6-6)^2 + (7-6)^2 + (3-6)^2 + (8-6)^2\} +$

$\{(5-5)^2 + (5-5)^2 + (3-5)^2 + (7-5)^2\} +$

$\{(5-4)^2 + (4-4)^2 + (3-4)^2 + (4-4)^2\}$

$\{0 + 1 + 9 + 4\} + \{0 + 0 + 4 + 4\} + \{1 + 0 + 1 + 0\}$

14 + 8 + 2

24

$$SS \text{ for total variance } = \sum\left(X_{ij} - \overline{\overline{X}}\right)^2 \qquad i = 1, 2, 3\ldots$$

$$j = 1, 2, 3\ldots$$

$= (6 – 5)^2 + (7 – 5)^2 + (3 – 5)^2 + (8 – 5)^2$

$+ (5 – 5)^2 + (5 – 5)^2 + (3 – 5)^2$

$+ (7 – 5)^2 + (5 – 5)^2 + (4 – 5)^2$

$+ (3 – 5)^2 + (4 – 5)^2$

$= 1 + 4 + 4 + 9 + 0 + 0 + 4 + 4 + 0 + 1 + 4 + 1$

$= 32$

Source of Variation	**SS**	**d.f.**	**MS**	**F-ratio**	**% F-limit(from the F-table)**
Between sample	8	(3 – 1) = 2	8/2 = 4.00	4.00/2.67	$F(2, 9) = 4.26$
Within sample	24	(12 – 3) = 9	24/9= 2.67		
Total	32	(12 – 1) = 11			

The above table shows that the calculated value of F is 1.5 which is less than the table value of 4.26 at 5% level with d.f. being v1 = 2 and v2= 9 and hence could have arisen due to chance. This analysis supports the null-hypothesis of no difference is sample means. We may, therefore, conclude that the difference in wheat output due to varieties is insignificant and is just a matter of chance.

MULTIVARIATE ANALYSIS

All statistical techniques which simultaneously analyse more than two variables on a sample of observations can be categorized as multivariate techniques. We may as well use the term 'multivariate analysis' which is a collection of methods for analyzing data in which a number of observations are available for each object. In the analysis of many problems, it is helpful to have a number of scores for each object. For instance, in the field of intelligence testing if we start with the theory that general intelligence is reflected in a variety of specific performance measures, then to study intelligence in the context of this theory one must administer many tests of mental skills, such as vocabulary, speed of recall, mental arithmetic, verbal analogies and so on. The score on each test is one variable, Xi, and there are several, k, of such scores for each object, represented as X1,X2...Xk. Most of the research studies involve more than two variables in which situation analysis is desired of the association between one (at times many) criterion variable and several independent variables, or we may be required to study the association between variables having no dependency relationships. All such analyses are termed as multivariate analyses or multivariate techniques. In brief, techniques that take account of the various relationships among variables are termed multivariate analyses or multivariate techniques.

CLASSIFICATION OF MULTIVARIATE TECHNIQUES

Today, there exist a great variety of multivariate techniques which can be conveniently classified into two broad categories viz., dependence methods and interdependence methods. This sort of classification depends upon the question: Are some of the involved variables dependent upon others? If the answer is 'yes', we have dependence methods; but in case the answer is 'no', we have interdependence methods. Two more questions are relevant for understanding the nature of multivariate techniques. Firstly, in case some variables are dependent, the question is how many variables are dependent? The other question is, whether the data are metric or non-metric? This means whetherthe data are quantitative, collected on interval or ratio scale, or whether the data are qualitative, collected on nominal or ordinal scale. The technique to be used for a given

situation depends upon the answers to all these very questions. Jadish N. Sheth in his article on "The multivariate revolution in marketing research" has given the flow chart that clearly exhibits the nature of some importantmultivariate techniques as shown in Fig. 13.1.

Thus, we have two types of multivariate techniques: one type for data containing both dependent and independent variables, and the other type for data containing several variables without dependency relationship. In the former category are included techniques like multiple regression analysis, multiple discriminant analysis, multivariate analysis of variance and canonical analysis, whereas in the latter category we put techniques like factor analysis, cluster analysis, multidimensional scaling or MDS (both metric and non-metric) and the latent structure analysis.

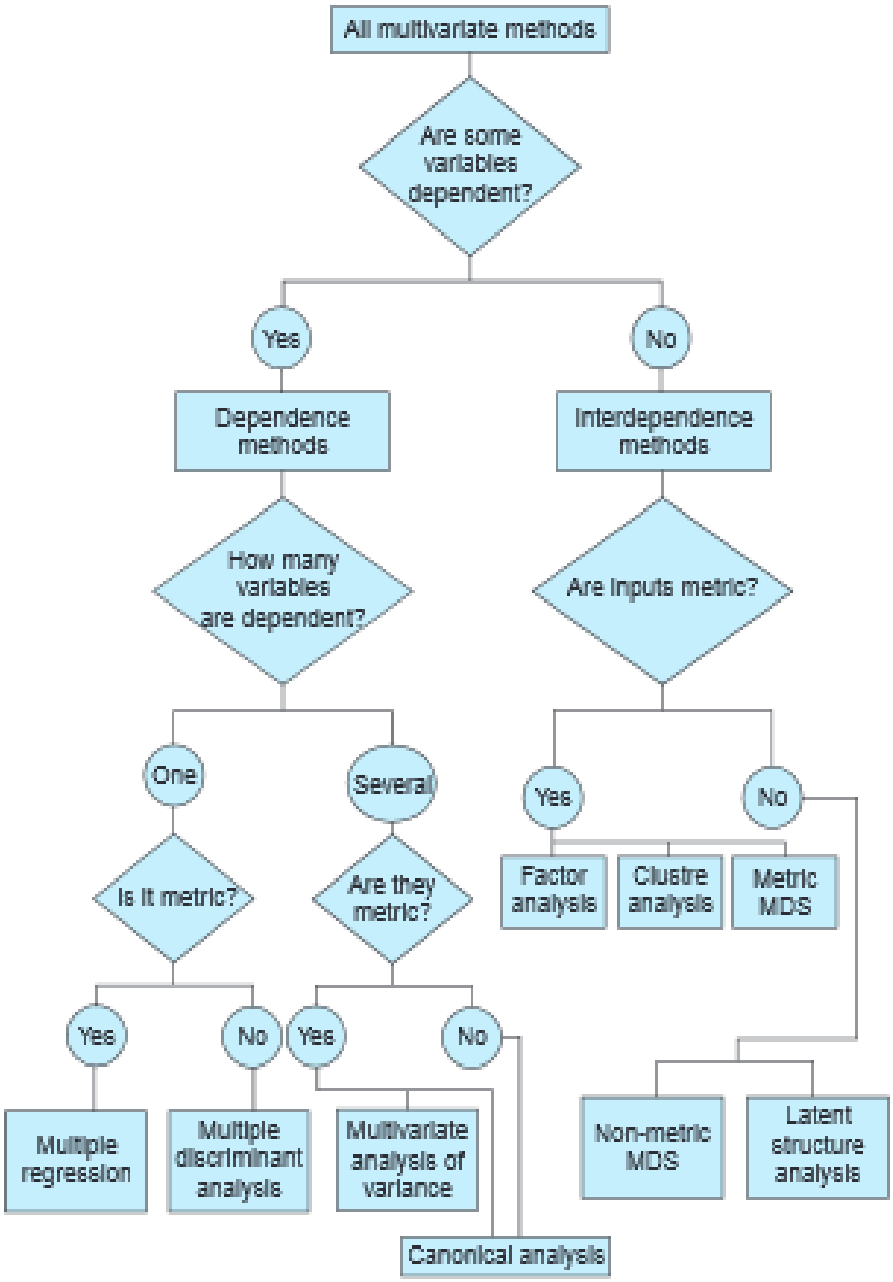

Fig. 13.1

[3]*Journal of Marketing, American Marketing Association*, Vol. 35, No. 1 (Jan. 1971), pp. 13–19.

VARIABLES IN MULTIVARIATE ANALYSIS

Before we describe the various multivariate techniques, it seems appropriate to have a clear idea about the term, 'variables' used in the context of multivariate analysis. Many variables used in multivariate analysis can be classified into different categories from several points of view. Importantones are as under:

(i) Explanatory variable and criterion variable:

If Xmay be considered to be the cause of Y,t hen X is described as explanatory variable (also termed as causal or independent variable) and Yis described as criterion variable (also termed as resultant or dependent variable). In some cases both explanatory variable and criterion variable may consist of a set of many variables in which case set (X1, X2, X3, ..., Xp) may be called a set of explanatory variables and the set (Y1, Y2, Y3, ..., Yq) may be called a set of criterion variables if the variation of the former may be supposed to cause the variation of the latter as a whole. In economics, the explanatory variables are called external or exogenous variables and the criterion variables are called endogenous variables. Some people use the term external criterion for explanatory variable and the term internal criterion for criterion variable.

(ii) Observable variables and latent variables:

Explanatory variables described above are supposed to be observable directly in some situations, and if this is so, the same are termed as observable variables. However, there are some unobservable variables which may influence the criterion variables.

We call such unobservable variables as latent variables.

(iii) Discrete variable and continuous variable:

Discrete variable is that variable which when measured may take only the integer value whereas continuous variable is one which, when measured, can assume any real value (even in decimal points).

(iv) Dummy variable (or Pseudo variable):

This term is being used in a technical sense and is useful in algebraic manipulations in context of multivariate analysis. We call Xi(i= 1, ..., m) a dummy variable, if only one of Xi is 1 and the others are all zero.

IMPORTANT MULTIVARIATE TECHNIQUES

A brief description of the various multivariate techniques named above (with special emphasis on factor analysis) is as under:

(i) Multiple regression*:

In multiple regression we form a linear composite of explanatory variables in such way that it has maximum correlation with a criterion variable. This technique is appropriate when the researcher has a single, metric criterion variable. Which is supposed to be a function of other explanatory variables. The main objective in using this technique is to predict the variability the dependent variable based on its covariance with all the independent variables. One can predict the level of the dependent phenomenon through multiple regression analysis model, given the levels of independent variables. Given a dependent variable, the linear-multiple regression problem is to estimate constants B1, B2, ..Bk and A such that the expression

Y= B1X1+ B2X2+ ... + BkXk+ A are Provides a good estimate of an individual's

Y score based on his X scores.

In practice, Y and the several

X variables are converted to standard scores;

zy, zl, z2, ... zk; eachzhas a mean of 0 and standard deviation of 1. Then the problem is to estimate constants, βI , such that

$$z'_y = \beta_1 z_1 + \beta_2 z_2 + \ldots + \beta_k z_k$$

where z' y stands for the predicted value of the standardized

Y score, z y. The expression on the right side of the above equation is the linear combination of explanatory variables. The constant

A is eliminated in the process of converting X's to z's. The least-squares-method is used, to estimate the beta weights in such a way that the sum of the squared prediction errors is kept as small as possible i.e., the expression ∑−′zzyydi2 is minimized. The predictive adequacy of a set of beta weights is indicated by the size of the correlation coefficient r zy z y· ′between the predicted ′z y scores and the actual zy scores. This special correlation coefficient from Karl Pearson is termed the multiple correlation coefficient (R). The squared multiple correlation, R2, represents the proportion of criterion (zy) variance accounted for by the explanatory variables, i.e., the proportion of total variance that is 'Common Variance'. Sometimes the researcher may use step-wise regression techniques to have a better idea of the independent contribution of each explanatory variable. Under these techniques, the investigator adds the independent contribution of each explanatory variable into the prediction equation one by one, computing betas and R2 at each step. Formal computerized techniques are available for the purpose and the same can be used in the context of a particular problem being studied by the researcher.

ii)Multiple discriminant analysis:

Through discriminant analysis technique, researcher may classify individuals or objects into one of two or more mutually exclusive and exhaustive groups on the basis of a set of independent variables. Discriminant analysis requires interval independent variables and a nominal dependent variable. For example, suppose that brand preference (say brand x or y) is the dependent variable of interest and its relationship to an individual's income, age, education, etc. is being investigated, then we should use the technique of discriminant analysis. Regression analysis in such a situation is not suitable because the dependent variable is, not intervally scaled. Thus discriminant analysis is considered an appropriate technique when the single dependent variable happens to be non-metric and is to be classified into two or more groups, depending upon its relationship with several independent variables which all happen to be metric. The objective in discriminant analysis happens to be to predict an object's likelihood of belonging to a particular

group based on several independent variables. In case we classify the dependent variable in more than two groups, then we use the name multiple discriminant analysis; but in case only two groups are to be formed, we simply use the term discriminant analysis.

(iii) Multivariate analysis of variance:

Multivariate analysis of variance is an extension of bivariate analysis of variance in which the ratio of among-groups variance to within-groups variance is calculated on a set of variables instead of a single variable. This technique is considered appropriate when several metric dependent variables are involved in a research study along with many non-metric explanatory variables. (But if the study has only one metric dependent variable and several non-metric explanatory variables, then we use the ANOVA technique as explained earlier in the book.) In other words, multivariate analysis of variance is specially applied whenever the researcher wants to test hypotheses concerning multivariate differences in group responses to experimental manipulations. For instance, the market researcher may be interested in using one test market and one control market to examine the effect of an advertising campaign on sales as well as awareness, knowledge and attitudes. In that case he should use the technique of multivariate analysis of variance for meeting his objective.

(iv) Canonical correlation analysis:

This technique was first developed by Hotelling wherein an effort is made to simultaneously predict a set of criterion variables from their joint co-variance with a set of explanatory variables. Both metric and non-metric data can be used in the context of this multivariate technique. The procedure followed is to obtain a set of weights for the dependent and independent variables in such a way that linear composite of the criterion variables has a maximum correlation with the linear composite of the explanatory variables.

v) Factor analysis:

Factor analysis is by far the most often used multivariate technique of research studies, specially pertaining to social and behavioural sciences. It is a technique applicable when there is a

systematic interdependence among a set of observed or manifest variables and the researcher is interested in finding out something more fundamental or latent which creates this commonality. For instance, we might have data, say, about an individual's income, education, occupation and dwelling area and want to infer from these some factor (such as social class) which summarises the commonality

of all the said four variables. The technique used for such purpose is generally described as factor analysis. Factor analysis, thus, seeks to resolve a large set of measured variables in terms of relatively few categories, known as factors. This technique allows the researcher to group variables into factors (based on correlation between variables) and the factors so derived may be treated as new variables (often termed as latent variables) and their value derived by summing the values of the original variables which have been grouped into the factor. The meaning and name of such new variable is subjectively determined by the researcher. Since the factors happen to be linear combinations

of data, the coordinates of each observation or variable is measured to obtain what are called factor loadings. Such factor loadings represent the correlation between the particular variable and the factor, and are usually place in a matrix of correlations between the variable and the factors.

MPORTANT METHODS OF FACTOR ANALYSIS

There are several methods of factor analysis, but they do not necessarily give same results. As such

factor analysis is not a single unique method but a set of techniques. Important methods of factor analysis are:

(i) the centroid method;

(ii)the principal components method;

(ii)the maximum likelihood method.

Before we describe these different methods of factor analysis, it seems appropriate that some basic terms relating to factor analysis be well understood.

(i) **Factor:**A factor is an underlying dimension that account for several observed variables. There can be one or more factors, depending upon the nature of the study and the number of variables involved in it.

(ii) **Factor-loadings:**Factor-loadings are those values which explain how closely the variables are related to each one of the factors discovered. They are also known as factor-variable correlations.

In fact, factor-loadings work as key to understanding what the factors mean. It is the absolute size (rather than the signs, plus or minus) of the loadings that is important in the interpretation of a factor.

(iii) **Communality (h2):**Communality, symbolized as h2, shows how much of each variable is accounted for by the underlying factor taken together. A high value of communality means that not much of the variable is left over after whatever the factors represent is taken into consideration.

(iv) **Eigen value** (or latent root) : When we take the sum of squared values of factor loadings relating to a factor, then such sum is referred to as Eigen Value or latent root. Eigen value indicates the relative importance of each factor in accounting for the particular set of variables being analysed.

(v) **Total sum of squares**: When eigen values of all factors are totalled, the resulting value is termed as the total sum of squares. This value, when divided by the number of variables (involved in a study), results in an index that shows how the particular solution accounts for what all the variables taken together represent. If the variables are all very different from each other, this index will be low. If fall into one or more highly redundant groups, and if the extracted factors account for all the groups, the index will then approach unity.

(vi) **Rotation:** Rotation, in the context of factor analysis, is something like staining a microscope slide. Just as different stains on it reveal different structures in the tissue, different rotations reveal different structures in the data. Though different rotations give results that appear to be entirely different, but from a statistical point of view, all results are taken as equal, none

superior or inferior to others. However, from the standpoint of making sense of the results of factor analysis, one must select the right rotation. If the factors are independent orthogonal rotation is done and if the factors are correlated, an oblique rotation is made. Communality for each variables will remain undisturbed regardless of rotation but the eigen values will change as result of rotation.

(vii) **Factor scores:** Factor score represents the degree to which each respondent gets high scores on the group of items that load high on each factor. Factor scores can help explain what the factors mean. With such scores, several other multivariate analyses can be performed.

(vi)Cluster Analysis:

Cluster analysis consists of methods of classifying variables into clusters. Technically, a cluster consists of variables that correlate highly with one another and have comparatively low correlations with variables in other clusters. The basic objective of cluster analysis is to determine how many mutually and exhaustive groups or clusters, based on the similarities of profiles among entities, really exist in the population and then to state the composition of such groups. Various groups to be determined in cluster analysis are not predefined as happens to be the case in discriminant analysis.

Steps: In general, cluster analysis contains the following steps to be performed:

(i) First of all, if some variables have a negative sum of correlations in the correlation matrix, one must reflect variables so as to obtain a maximum sum of positive correlations for the matrix as a whole.

(ii)The second step consists in finding out the highest correlation in the correlation matrix and the two variables involved (i.e., having the highest correlation in the matrix) form the nucleus of the first cluster.

(iii)Then one looks for those variables that correlate highly with the said two variables and includes them in the cluster. This is how the first cluster is formed.

(iv) To obtain the nucleus of the second cluster, we find two variables that correlate highly but have low correlations with members of the first cluster. Variables that correlate highly with

the said two variables are then found. Such variables along the said two variables thus constitute the second cluster.

(v) One proceeds on similar lines to search for a third cluster and so on.

From the above description we find that clustering methods in general are judgemental and are devoid of statistical inferences. For problems concerning large number of variables, various cut-and-try methods have been proposed for locating clusters. McQuitty has specially developed a number of rather elaborate computational routines* for that purpose. In spite of the above stated limitation, cluster analysis has been found useful in context of market research studies. Through the use of this technique we can make segments of market of a product on the basis of several characteristics of the customers such as personality, socio-economic considerations, psychological factors, purchasing habits and like ones.

CLASS: I MBA
COURSE NAME: RESEARCH METHODOLOGY FOR MANAGEMENT
COURSE CODE: 18MBAP206 **BATCH: 2018-2020**

UNIT: IV

POSSIBLE QUESTIONS

PART-B (2 Marks)

1. What is Hypothesis?
2. Explain on null and alternative hypothesis
3. What do you mean by Significance level?
4. What is the purpose of applying 't' Test?
5. Briefly narrate about Analysis of Variance.
6. Explain on Business Forecasting.
7. What do you mean by Business Barometer?
8. What is Extrapolation?
9. Explicate on Exponential Smoothing.
10. What is the purpose of applying Chi-square test?

CLASS: I MBA
COURSE NAME: RESEARCH METHODOLOGY FOR MANAGEMENT
COURSE CODE: 18MBAP206 **BATCH: 2018-2020**

UNIT: IV

PART C (6 MARKS)

1. Define Hypothesis. Explain in detail on formulation and procedure for testing hypothesis.

2. Explain in detail on various method of business forecasting.

3. The contingency table below summarizes the results obtained in a study conducted by a research organization, with respect to the performance of four competing brands of tooth paste among the users.

	Brand A	Brand B	Brand C	Brand D	**Total**
No Cavities	9	13	17	11	50
One to five Cavities	63	70	85	82	300
More than five Cavities	28	37	48	37	150
Total	**100**	**120**	**150**	**130**	**500**

Test the hypothesis that incidence of cavities is independent of the brand of the toothpaste used (The table value of □2 for 6 d.f. are 12.59)

4. Two types of drugs were used on 5 and 7 patients for reducing their weight.
   Drug A was imported and drug B indigenous. The decrease in the weight after using the drugs for six months was as follows:

Drug A	10	12	13	11	14		
Drug B	8	9	12	14	15	10	9

   Is there a significant difference in the efficacy of the two drugs? If not, which drug should you buy (For □=10, $t_{0.05}$=2.228)

5. The manufacturer of a certain make of electric bulbs claims that his bulbs have a mean

life of 25 months with a standard deviation of 5 months. A random sample of 6 such bulbs gave the following values

Life of Months	24	26	30	20	20	18

Can you regard the producer's claim to be valid at 1% level of significance? (Given that the table values of the appropriate test statistics at the said level are 4.032, 3.707 and 3.499 for 5, 6 and 7 degrees of freedom respectively)

6. A random sample of size 16 has 53 as mean. The sum of the squares of the deviation taken from mean is 135. Can this sample be regarded as taken from the population having 56 as mean? Obtain 95% and 99% confidence limits of the mean of the population. (For v=15, t0.05=2.13 for v=15, t0.01=2.95)

7. In a test given to two groups of students, the marks obtained are as follows:

I Group	18	20	36	50	49	36	34	49	41
II Group	29	28	26	35	30	44	46		

Examine the significance of difference between the arithmetic mean of the marks secured by the students of the above two groups. (The value of t at 5% level of significance for v=14 is 2.14)

8. Two random samples were drawn from two normal populations and their values are :

A	66	67	75	76	82	84	88	90	92		
B	64	66	74	78	82	85	87	92	93	95	97

Test whether the two populations have the same variance at the 5% level of significance. (F=3.36) at 5% level of significance level v1=10 and v2=8.

9. A die is thrown 132 times with following results:

Number turned up	1	2	3	4	5	6
Frequency	16	20	25	14	29	28

Is the die unbiased?

10. Genetic theory states that children having one parent of blood type A and the other of blood type B will always be of one of three types, A, AB, B and that the proportion of three types will on an average be as 1 : 2 : 1. A report states that out of 300 children having one A parent and B parent, 30 per cent were found to be types A, 45 per cent per cent type AB and remainder type B. Test the hypothesis by □2 test.

11. Set up an analysis of variance table for the following per acre production data for three varieties of wheat, each grown on 4 plots and state if the variety differences are significant.

12.

Plot of land		**Per acre production data Variety of wheat**	
	A	**B**	**C**
1	6	5	5
2	7	5	4
3	3	3	3
4	8	7	4

* * * * *

Karpagam Academy of Higher Education
Department of Management
Research Methodology for Management - 18MBAP206
Unit IV
Multiple Choice Questions - Each Question Carries ONE Mark

S.No.	Questions	Option 1	Option 2	Option 3	Option 4	Answer
1	___is usually considered as the principal instrument in research	Hypothesis	Report	Table of Contents	List of Charts	Hypothesis
2	Hypothesis should state relationship between , if it happens to be a relational hypothesis	Variables	Data	Report	Objectives	Variables
3	A____hypothesis is one which predicts the direction of the difference between two items	Directional	Vertical	Horizontal	alternative	Directional
4	Level of significance measures___percentage	Data	Error	Inaccuracy	Fault	Error
5	__denotes the chances of occurrence	Chance	Likelihood	Odds	Probability	Probability
6	If the calculated probability is equal to or smaller than the α value in case of one-tailed test then reject the ___hypothesis	Valid	Applicable	Null	Legtimate	Null
7	If a researcher think that the method *A* is superior or the method *B* is inferior, we are then stating what is termed as ___	Null Hypothesis	Alternative Hypothesis	Substitute Hypothesis	Option Hypothesis	Alternative Hypothesis
8	__hypothesis is the one which one wishes to disprove	Alternative	Null	Convinving	Authoratative	Null
9	___level is the maximum value of the probability of rejecting H_0	Implication	Connotation	Significance	Substance	Significance
10	We may reject H_0 when H_0 is true, then it is known as ___	Type II Error	Type I Error	Type III Error	Type IV Error	Type I Error
11	We may accept H_0 when in fact H_0 is not true, then the error is known as ____	Type II Error	Type I Error	Type III Error	Type IV Error	Type II Error
12	't' test is employed when the sample size is less than ____	30	40	50	60	30
13	__test should be employed, when the sample size is less than 30	T	ANOVA	Chisquare	Correlation	T
14	Student test is also known as ____	t' Test	Vertical			t' Test
15	The variable_____ranges from minus infinity to plus infinity	ANOVA	Chisquare	t' distribution	Regression	t' distribution

16	Like the standard normal distribution, the t-distribution is _____and has a mean zero	Symmetrical	Irregular	Asymmetrical	Uneven	Symmetrical
17	When the sample size is greater than , it is known as large sample	30	40	50	60	30
18	When estimates of future conditions are made on a systematic basis, the process is referred to as _____	Conjecture	Guessing	Esimation	Forecasting	Forecasting
19	__relies on the relative consultancy in the pattern of past movements in some time series	Business Barometer	Extrapolation	Opinion Polling	Survey Method	Extrapolation
20	__is an indicator of the present economic situations and sometimes it is used to designate an indicator of future conditions	Business Barometer	Extrapolation	Opinion Polling	Survey Method	Business Barometer
21	__assumes that growth will be by a constant absolute amount each year	Semi log Trend	Arithmetic Trend	Modified Exponential Trend	Logistic Curve	Arithmetic Trend
22	____assumes a constant percentage increase in each year	Semi log Trend	Arithmetic Trend	Modified Exponential	Logistic Curve	Semi log Trend
23	__curve assumes that each increment of growth will be a constant per cent less than 100 of the previous one	Semi log Trend	Arithmetic Trend	Modified Exponential Trend	Logistic Curve	Modified Exponential Trend
24	__curve has both an upper asymptote and a lower asymptote	Semi log Trend	Arithmetic Trend	Modified Exponential Trend	Logistic Curve	Logistic Curve
25	To find the combined influence of select independent variable over dependent variable____analysis is used	Correlation	Multiple Regression	Factor Analysis	Structural Equation Model	Multiple Regression
26	The term____refers to the application of mathematical economic theory and statistical procedures to economic data in order to verify economic theorems and to establish quantitative results in economics	Regression Analysis	Econometric Models	Time Series Analysis	Casual Models	Econometric Models
27	____is the survey of opinion of experts	Opinion Polling	Casual Models	Exponential Smoothing	Time Series	Opinion Polling
28	____expresses mathematically the relevant causal relationships, and may include pipeline considerations and market survey information	Opinion Polling	Casual Models	Exponential Smoothing	Time Series	Casual Models
29	____main function is to suggest new experiments and observations	Report	Table of Contents	List of Charts	Hypothesis	Hypothesis

30	____is nothing but an assumption	Report	Table of Contents	Hypothesis	List of Charts	Hypothesis
31	___testing enables us to make probability statements about population parameter	Concept	Hypothesis	Number	Data	Hypothesis
32	If we are to compare method *A* with method *B* about its superiority and if we proceed on the assumption that both methods are equally good, then this assumption is termed as the ___	Null Hypothesis	Alternative Hypothesis	Substitute Hypothesis	Option Hypothesis	Null Hypothesis
33	_____hypothesis is usually the one which one wishes to prove	Alternative	Null	Convinving	Authoratative	Alternative
34	___hypothesis represents the hypothesis we are trying to reject	Alternative	Null	Convinving	Authoratative	Null
35	___hypothesis is also known as statistical hypothesis	Alternative	Null	Convinving	Authoratative	Null
36	___error means rejection of hypothesis which should have been accepted	Type I	Type II	Type III	Type IV	Type I
37	__error means accepting the hypothesis which should have been rejected	Type I	Type II	Type III	Type IV	Type II
38	___error is denoted by α (alpha) known as a error	Type I	Type II	Type III	Type IV	Type I
39	__error is denoted by β (beta) known as b error	Type I	Type II	Type III	Type IV	Type II
40	The probability of____error is usually determined in advance and is understood as the level of significance of testing the hypothesis	Type I	Type II	Type III	Type IV	Type I
41	____aims at reducing the areas of uncertainty that surround management decision making with respect to costs, profit etc.,	Conjecture	Guessing	Esimation	Forecasting	Forecasting
42	___is a special kind of weighted average and is found extremely useful in short-term forecasting of inventories and sales.	Exponential Smoothing	Business Barometers	Extrapolation	Regression Analysis	Exponential Smoothing
43	___is very widely used as a tool of forecasting for the existing and new products	Survey Method	Extrapolation	Business Barometers	Time Series Analysis	Survey Method
44	___is to find out whether the two independent estimates of population variance differ significantly	F Test	Analysis of Variance	Chisquare	Correlation	F Test
45	___is to find out whether the two samples may be regarded as drawn from the normal populations having the same variance	Analysis of Variance	Chisquare	Correlation	F Test	F Test

46	To find mean difference among more than two groups____test is employed	Analysis of Variance	Chisquare	Correlation	F Test	Analysis of Variance
47	To find mean difference between two groups____is employed	't' Test	F Test	Chisquare	Analysis of Variance	't' Test
48	To find whether there exists any association between variables____test is employed	't' Test	F Test	Chisquare	Analysis of Variance	Chisquare
49	____is a statistical technique specially designed to test whether the means of more than two quantitative populations are equal	Analysis of Variance	Chisquare	Correlation	F Test	Analysis of Variance
50	Chi-square is an example of_____test	Parametric	Non-Parametric	Psychometric	Frequency	Non-Parametric
51	't' test is an example of_____test	Parametric	Non-Parametric	Psychometric	Frequency	Parametric
52	To find difference between observed frequency and expected frequency is known as ___	't' Test	F Test	Chisquare	Analysis of Variance	Chisquare
53	What will be the degrees of freedom, if the Chi-square table has 3 rows and 3 columns ____	2	3	4	5	4
54	What will be the degrees of freedom, if the Chi-square table has 4 rows and 3 columns ____	3	4	5	6	6
55	What will be the degrees of freedom, if the Chi-square table has 3 rows and 2 columns ____	1	2	3	4	2
56	____are statements of expected future conditions, definitive statements of what will accurately happen are potentially impossible	Conjecture	Guessing	Esimation	Forecast	Forecast
57	When the calculated Chi-square value is less than the table value, the hypothesis is ____	Accepted	Rejected	Discarded	Cast off	Accepted
58	When the calculated Chi-square value is greater than the table value, the hypothesis is ____	Accepted	Rejected	Discarded	Cast off	Rejected
59	When the calculated 't' value is greater than the table value, the hypothesis is ____	Accepted	Discarded	Cast off	Rejected	Rejected
60	When the calculated 't' value is less than the table value, the hypothesis is ____	Discarded	Cast off	Accepted	Rejected	Accepted

CLASS: I MBA
COURSE NAME: RESEARCH METHODOLOGY FOR MANAGEMENT
COURSE CODE: 18MBAP206 **BATCH: 2018-2020**

UNIT: V

RESEARCH REPORT WRITING

UNIT V

Research Report Writing: Types of research reports – Brief reports and Detailed reports; Report writing: Structure of the research report- Preliminary section, Main report, Interpretations of Results and Suggested Recommendations; Report writing: Formulation rules for writing the report: Guidelines for presenting tabular data, Guidelines for visual Representations. Ethics in Research: Meaning of Research Ethics; Clients Ethical code; Researchers Ethical code; Ethical Codes related to respondents; Responsibility of ethics in research

REPORT WRITING

Research report is considered a major component of the research study for the research task remains incomplete till the report has been presented and/or written. As a matter of fact even the most brilliant hypothesis, highly well designed and conducted research study, and the most striking generalizations and findings are of little value unless they are effectively communicated to others. The purpose of research is not well served unless the findings are made known to others. Research results must invariably enter the general store of knowledge. All this explains the significance of writing research report. There are people who do not consider writing of report as an integral part of the research process. But the general opinion is in favour of treating the presentation of research results or the writing of report as part and parcel of the research project. Writing of report is the last step in a research study and requires a set of skills somewhat different from those called for in respect of the earlier stages of research. This task should be accomplished by the researcher with utmost care; he may seek the assistance and guidance of experts for the purpose.

TYPES OF REPORTS

1. Research reports vary greatly in length and type. In each individual case, both the length and

the form are largely dictated (determined / ordered) by the problems at hand

2. For instance, business firms prefer reports in the letter form, just one or two pages in length.
3. Banks, Insurance organizations and financial institutions are generally fond of (having a liking for) the short balance-sheet type of tabulation for their annual reports to their customers and shareholders
4. Mathematicians prefer to write the results of their investigations in the form of algebraic (numerical) notations (Symbols + / -)
5. Chemists (Scientist trained in Chemistry) report their results in symbols and formulae (method)
6. Students of literature usually write long reports presenting the critical analysis of some writer or period or the like with a liberal use of quotations from the works of the author under discussion
7. In the field of education and psychology, the favorite form in the report on the results of experimentation accompanied by the detailed statistical tabulations
8. Clinical psychologists and social pathologists (diagnosis of disease) frequently find it necessary to make use of the case-history (all the relevant information previous gatherer) form
9. News items in the daily papers are also forms of report writing. They represent firsthand on-the-scene accounts of the events described or compilation (collection) of interviews with persons who were on the scene (area). In such report the first paragraph usually contains the important information in detail and the succeeding paragraphs contain material which is progressively less and less important
10. Book – reviews which analyze the content of the book and report on the author's intentions, his success or failure in achieving his aims, his language, his style, scholarship (learning / research / study), bias or his point of view, such reviews also happen to be a kind of short report
11. The reports prepared by governmental bureaus (agency) special commissions, and similar other organizations are generally very comprehensive (full / complete) reports on the issues involved. Such reports are usually considered as important research products
12. Similarly, Ph.D.theses and dissertation are also a form of report-writing, usually completed

by students in academic institutions

13. The above narration throws light on the fact that the results of a research investigation can be presented in a number of ways viz., a technical report, popular report,
14. Which method of presentation to be used in a particular study depends on the circumstances under which the study arose (take place) and the nature of the results
15. A technical report is used whenever a full written report of the study is required whether for record-keeping or for public dissimilation
16. A popular report is used if the research results have policy implications.

A) TECHNICAL REPORT

In technical report the main emphasis is on (i) the methods employed (ii) assumptions made in the course of the study (iii) the detailed presentation of the findings including their limitations and supporting data

1) Summary of Results

A brief review of the main findings just in two or three pages

2) Nature of the Study

Description of the general objectives of study, formulation of the problem in operational terms, the working hypothesis, the type of analysis and data required

3) Methods Employed

Specific methods used in the study and their limitations. For instance, in sampling studies we should give details of sample design viz. sample size, sample selection etc.,

4) Data

Discussion of data collected, their sources, characteristics and limitations. If secondary data are used, their suitability of the problem at hand be fully assessed.

5) Analysis of Data and Presentation of Findings

The analysis of data and presentation of the findings of the study with supporting data in the

form of tables and charts be fully narrated (explained). This, in fact, happens to be the main body of the report usually extending over several chapters

6) Conclusions

A detailed summary of the findings and the policy implications drawn from the results be explained

7) Bibliography

Bibliography of various sources consulted be prepared and attached

8) Technical Appendices

Appendices be given for all technical matters relating to questionnaire, mathematical derivations, elaboration on particular technique of analysis and the like ones

9) Index

Index must be prepared and be given invariably in the report at the end. Even in technical report, simple presentation and ready availability of the findings remain an important consideration and as such the liberal use of charts and diagrams is considered desirable

B) POPULAR REPORT

The popular report is one which emphasis on simplicity and attractiveness. The simplification should be sought (required) through clear writing, minimization of technical, particularly mathematical, details and liberal use of charts and diagrams. Attractive layout along with large print, many subheadings, even an occasional cartoon now and then is another characteristic feature of the popular report

1) Findings and their Implications

Emphasis (importance) in the report is given on the findings of most practical interest and on the implication of these findings

2) Recommendation for Action

Recommendations for action on the basis of the findings of the study is made in this section of the report

3) Objectives of the Study

A general review of how the problem arise is presented along with the specific objectives of the project under study

4) Methods Employed

A brief and non-technical description of the methods and techniques used, including a short review of the data on which the study is based, is given in this part of the report

5) Results

This section constitutes the main body of the report wherein the results of the study are presented in clear and non-technical terms with the liberal use of all sorts of illustrations such as charts, diagrams and the like ones

6) Technical Appendices

More detailed information on methods used, forms etc, is presented in the form of appendices. But the appendices are often not detailed if the report is entirely meant for general public

LAYOUT OF THE RESEARCH REPORT

Anybody, who is reading the research report, must necessarily be conveyed enough about the study so that he can place it in its general scientific context (background), judge the adequacy of its methods and thus form an opinion of how seriously the findings are to be taken. For this purpose there is the need for proper layout of the report. The layout of the report means as to what the research report should contain. A comprehensive (complete) layout of the research

RESEARCH REPORT WRITING

report should comprise (a) Preliminary Pages (b) The Main Text and
(c) The end matter

1) Preliminary Pages

In its preliminary pages the report should carry a title and date, followed by acknowledgements in the form of 'preface' or 'foreword'. Then there should be a table of contents followed by list of tables and illustrations so that the decision-maker or anybody interested in reading the report can easily locate the required information in the report

2) Main Text

The main text provides the complete outline of the research report along with all details. Title of the research study is repeated at the top of the first page of the main text and then follows the other details on pages numbered consecutively, beginning with the second page. Each main section of the report should begin on a new page. The main text of the report should have the following sections:

i) Introduction

The purpose of introduction is to introduce the research project to the readers. It should contain a clear statement of the objectives of research i.e. enough background should be give to make clear to the reader why the problem was considered worth investigating. A brief summary of other relevant research may also be stated so that the present study can be seen in that context. The hypotheses of the study, if any, and the definitions of the major concepts employed in the study should be explicitly stated in the introduction of the report

The methodology adopted in conducting the study must be fully explained. The scientific reader would like to know in detail about thing: How was the study carried out? What was its basic design? If the study was an experimental one, then what were the experimental manipulations? If the data were collected by means of questionnaires or interviews, then exactly what questions were asked? If measurements were based on observation, then what

instructions were given to the observers? Regarding the sample used in the study the reader should told: Who were the subject (Respondents)? How many were there? How were they selected? All these questions are crucial for estimating the probable limits of generalizability of the findings. The statistical analysis adopted must also be clearly stated. In addition to all this, the scope of the study should be stated the boundary lines be demarcated. The various limitations, under which the research project was completed, must also be narrated

ii) Statement of Findings and Recommendations

After introduction, the research report must contain a statement of findings and recommendations in non-technical language so that it can be easily understood by all concerned. If the findings happen to be extensive, at this point they should be put in the summarized form

iii) Results

A detailed presentation of the findings of the study, with supporting data in the form of tables and charts together with a validation of results, is the next step in writing the main text of the report. This generally comprises the main body of the report, extending over several chapters. The result section of the report should contain statistical summaries and reductions of the data rather than the raw data. All the results should be presented in logical sequence and splitted into readily identifiable sections. All relevant results must find a place in the report. But how one is to decide about what is relevant is the basic question. Quite often guidance comes primarily from the research problem and from the hypotheses, if any, with which the study was concerned. But ultimately the researcher must rely on his own judgement in deciding the outline of his report. "Nevertheless", it is still necessary that he states clearly the problem with which he was concerned, the procedure by which he worked on the problem, the conclusions at which he arrived, and the bases for his conclusions

i) Implications of the Results

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Toward the end of the main text, the researcher should again put down the results of his research clearly and precisely. He should, state the implications that flow from the results of the study, for the general reader is interested in the implications for understanding the human behaviour.

a. A statement of the inferences drawn from the present study which may be expected to apply in similar circumstances
b. The conditions of the present study which may limit the extent of legitimate (lawful / rightful) generalizations of the inferences drawn from the study
c. The relevant questions that still remain unanswered or new questions raised by the study along with suggestions for the kind of research that would provide answers for them

It is considered a good practice to finish the report with a short conclusion which summarizes and recapitulates (sum up) the main points of the study. The conclusion drawn from the study should be clearly related to the hypotheses that were stated in the introductory section. At the same time, a forecast of the probable future of the subject and an indication of the kind of research which needs to be done in that particular filed is useful and desirable

ii) Summary

It has become customary (Usual) to conclude the research report with a very brief summary (abstract / synopsis), resting in brief the research problem, the methodology, the major findings and the major conclusions drawn from the research results.

3) End Matter

At the end of the report, appendices should be enlisted (join up) in respect of all technical data such as questionnaires, sample information, mathematical derivation and the like ones. Bibliography of sources consulted should also be given. Index should invariably be given at the end of the report. The value of index lies in the fact that it works as a guide to the reader for the contents in the report

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RESEARCH REPORT WRITING

STEPS IN WRITING REPORTS

Research reports are the product of slow, painstaking (careful / meticulous), accurate inductive (logical / reasonable) work

1) Logical Analysis of the Subject Matter

It is the first step which is primarily concerned with the development of a subject. There are two ways in which to develop a subject – (a) logically and (b) Chronologically (arranging data as per time of occurrence). The logical development is made on the basis of mental connections and associations between the one thing and another by means of analysis. Logical treatment often consists in developing the material from the simple possible to the most complex structures. Chronological development is based on a connection or sequence in time or occurrence. The directions for doing or making something usually follow the chronological order

2) Preparation of the Final Outline

It is the next step in writing the research report. Outlines (hints) are the framework upon which long written works are constructed. They are in aid (help) to the logical organization of the material and a reminder of the points to be stressed in the report.

3) Preparation of the Rough Draft

This follows the logical analysis of the subject and the preparation of the final outline. Such a step is of utmost importance for the researcher now sits to write down what he has done in the context of his research study. He will write down the procedure adopted by him in collecting the material for his study along with various limitations faced by him, the technique of analysis for adopted by him, the broad findings and generalizations and the various suggestions he wants to offer regarding the problem concerned

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1) Rewriting and Polishing of the Rough Draft

This step happens to be most difficult part of all formal writing. Usually this step requires more time than the writing of the rough report. The careful revision makes the difference between a mediocre (ordinary) and a good piece of writing. While rewriting and polishing, one should check the report for weaknesses in logical development or presentation. The researcher should also 'see whether or not the material, as it is presented, has unity and cohesion (organization); does the report stand upright and firm and exhibit a definite pattern, like a marble arch? Or does it resemble an old wall of moldering cement and loose bricks. In addition, the researcher should give due attention to the fact that in his rough draft he has been consistent (reliably / steady) or not. He should check the mechanics of writing – grammar, spelling and usage

2) Preparation of the Final Bibliography

Next in order comes the task of the preparation of the final bibliography. The bibliography, which is generally appended (add on) to the research report, is a list of books in some way pertinent to the research which has been done. It should contain all those works which the researcher has consulted. The bibliography should be arranged alphabetically and may be divided into two parts; the first part may contain the names of books and pamphlets, and the second part may contain the name of magazines and newspaper articles. Generally, this pattern of bibliography is considered convenient and satisfactory from the point of view of reader, thought it is not the only way of presenting bibliography

3) Writing the Final Draft

This consists the last step. The final draft should be written in a concise (brief) and objective style and in simple language, avoiding vague expressions such as "it seems". While writing the final draft, the researcher must avoid abstract (theoretical) terminology and technical jargon. Illustrations and examples based on common experiences must be incorporated in the final draft as

RESEARCH REPORT WRITING

they happen to most effective in communicating the research findings to others. A research report should not be dull (boring), but must enthuse (motivate) people and maintain interest and must show originality. It must be remembered that every report should be an attempt to solve some intellectual problem and must contribute to the solution of a problem and must add to the knowledge of both the researcher and the reader

CONTENTS OF REPORTS

1. The format is divided into three broad categories namely (1) Preliminary Section (2) Main body of the text (3) Reference Section
2. The preliminary section will vary according to the type of research one has undertaken. The headings below this section are meant as a guide and one may decide to omit some of them or to amalgamate when this seems appropriate
3. The main body of the report is divided into five sub-sections, namely introduction, review of the literature, design of the study, presentation and analysis of data, summary and conclusions. Introduction is the starting point. In introduction the researcher should say why he / she undertook the research – what the problem is and why it is important. Depending on the particular piece of research, the review of the literature is introduced. This division will show what is known already and how our research will fill a gap in knowledge or replicate earlier work.
4. The description of the design of our research will depend on the particular project the researcher has undertaken. The section presentation and analysis of data will interpret the results of the research. Tables, figures will substantiate the analysis. The summary division will organize the results and point out the implications of the findings for policy or for other researchers and show what further research needs to be done.
5. The last category namely the references section should include bibliography, appendices and index in a proper form.

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RESEARCH REPORT WRITING

INTERPRETATION

After collecting and analyzing the data, the researcher has to accomplish the task of drawing inferences followed by report writing. This has to be done very carefully, otherwise misleading conclusions may be drawn and the whole purpose of doing research may get vitiated. It is only through interpretation that the researcher can expose relations and processes that underlie his findings. In case of hypotheses testing studies, if hypotheses are tested and upheld several times, the researcher may arrive at generalizations. But in case the researcher had no hypothesis to start with, he would try to explain his findings on the basis of some theory. This may at times result in new questions, leading to further researches. All this analytical information and consequential inference(s) may well be communicated, preferably through research report, to the consumers of research results who may be either an individual or a group of individuals or some public/private organisation.

Meaning of Interpretation

Interpretation refers to the task of drawing inferences from the collected facts after an analytical and/or experimental study. In fact, it is a search for broader meaning of research findings. The task of interpretation has two major aspects viz., (i) the effort to establish continuity in research through linking the results of a given study with those of another and (ii) the establishment of some explanatory concepts. "In one sense, interpretation is concerned with relationships within the collected data, partially overlapping analysis. Interpretation also extends beyond the data of the study to include the results of other research, theory and hypotheses."1 Thus, interpretation is the device through which the factors that seem to explain what has been observed by researcher in the course of the study can be better understood and it also provides a theoretical conception which can serve as a guide for further researches.

Need for Interpretation

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Interpretation is essential for the simple reason that the usefulness and utility of research findings lie in proper interpretation. It is being considered a basic component of research process because of the following reasons:

1. It is through interpretation that the researcher can well understand the abstract principle that works beneath his findings. Through this he can link up his findings with those of other studies, having the same abstract principle, and thereby can predict about the concrete world of events. Fresh inquiries can test these predictions later on. This way the continuity in research can be maintained.
2. Interpretation leads to the establishment of explanatory concepts that can serve as a guide for future research studies; it opens new avenues of intellectual adventure and stimulates the quest for more knowledge.
3. Researcher can better appreciate only through interpretation why his findings are what they are and can make others to understand the real significance of his research findings.
4. The interpretation of the findings of exploratory research study often results into hypotheses for experimental research and as such interpretation is involved in the transition from exploratory to experimental research. Since an exploratory study does not have a hypothesis to start with, the findings of such a study have to be interpreted on a post-factum basis in which case the interpretation is technically described as 'post factum' interpretation.

TECHNIQUES OF INTERPRETATION

Interpretation is not an easy job and it requires a great skill on the part of the investigator. The investigator gets the required expertise to apply the techniques. The techniques of interpretation are given below:

1) Relationship between Variables

The basic object of every analytical research is to find out the relationship between any

two variables. There may be three types of relationship

- Symmetrical Relationship
- Reciprocal Relationship
- Asymmetrical Relationship

The interpretation of data can be made with the help of these relationships

2) Percentages

Percentages are used in making comparison between two or more series of data.

They are also used to describe the relationships.

3) Averages

There are three forms of averages such as arithmetic mean, median, mode. Though there are other measures of central tendency, the above three measures are commonly used. Instead of using long statistical tables, the use of average makes the interpretation very simple.

4) Dispersion

Dispersion refers to the amount or the magnitude of the spread. Measures of dispersion include range, inter quartile range, average deviation and standard deviation. These measures help to interpret the data more scientifically

PRECAUTIONS IN INTERPRETATION

1. At the outset, researcher must invariably satisfy himself that (a) the data are appropriate, trustworthy and adequate for drawing inferences; (b) the data reflect good homogeneity; and that (c) proper analysis has been done through statistical methods
2. The researcher must remain cautious about the errors that can possibly arise in the process of interpreting results. Errors can arise due to false generalization and/or due to wrong interpretation of statistical measures, such as the application of findings beyond the range of observations, identification of correlation with causation and the like. Another major pitfall is

the tendency to affirm that definite relationships exist on the basis of confirmation of particular hypotheses. In fact, the positive test results accepting the hypothesis must be interpreted as "being in accord" with the hypothesis, rather than as "confirming the validity of the hypothesis". The researcher must remain vigilant about all such things so that false generalization may not take place. He should be well equipped with and must know the correct use of statistical measures for drawing inferences concerning his study.

3. He must always keep in view that the task of interpretation is very much intertwined with analysis and cannot be distinctly separated. As such he must take the task of interpretation as a special aspect of analysis and accordingly must take all those precautions that one usually observes while going through the process of analysis viz., precautions concerning the reliability of data, computational checks, validation and comparison of results.
4. He must never lose sight of the fact that his task is not only to make sensitive observations of relevant occurrences, but also to identify and disengage the factors that are initially hidden to the eye. This will enable him to do his job of interpretation on proper lines. Broad generalisation should be avoided as most research is not amenable to it because the coverage may be restricted to a particular time, a particular area and particular conditions. Such restrictions, if any, must invariably be specified and the results must be framed within their limits.

The researcher must remember that "ideally in the course of a research study, there should be constant interaction between initial hypothesis, empirical observation and theoretical conceptions. It is exactly in this area of interaction between theoretical orientation and empirical observation that opportunities for originality and creativity lie." He must pay special attention to this aspect while engaged in the task of interpretation.

TABULATION

When a mass of data has been assembled, it becomes necessary for the researcher to arrange the same in some kind of concise (brief / short) and logical order. This is known as tabulation. Thus, tabulation is the process of summarizing raw data and displaying the same in

compact form. In a broader sense, tabulation is an orderly arrangement of data in column and rows

Need for Tabulation

1. It conserves (save) space and reduce explanatory and descriptive statement to a minimum
2. It facilitates the process of comparison
3. It facilitates the summation (abstract) of items and the detection of errors and omissions
4. It provides a basis for various statistical computations (calculation)

Principles of Tabulation

1. Every table should have a clear, concise (short) and adequate title so as to make the table intelligible without reference to the text and this title should always be placed just above the body of the table
2. Every table should be given a distinct number to facilitate easy reference
3. The column and the row headings of the table should be clear and brief
4. The units of measurements under each heading or sub-heading must always be indicated (i.e.) in Rs.
5. Explanatory footnotes, if any, concerning the table should be placed directly beneath (under) the table, along with the reference symbols used in the table
6. Source or sources from where the data in the table have been obtained must be indicated juts below the table
7. Usually the columns are separated from one another by lines which make the table more readable and attractive. Lines are always drawn at the top and bottom of the table and below the captions
8. There should be thick lines to separate the data under one class from the data under another class and the lines separating the sub-divisions of the classes should be comparatively thin lines

9. The columns may be numbered to facilitate reference
10. Those columns whose data are to be compared should be kept side by side. Similarly, percentages and / or averages must also be kept close to the data
11. It is generally considered better to approximate (rough / estimated) figures before tabulation as the same would reduce unnecessary details in the table itself
12. In order to emphasize the relative significance of certain categories, different kinds of type, spacing and indentations (marks) may be used
13. It is important that all column figures be properly aligned. Decimal points and (+) or (-) signs should be in perfect alignment
14. Abbreviations should be avoided to the extent possible and ditto marks should not be used in the table
15. Miscellaneous and exceptional items, if any, should be usually placed in the last row of the table
16. Table should be made as logical, clear, accurate and simple as possible. If the data happen to be very large, they should not be crowded in a single table for that would make the table unwieldy and inconvenient
17. Total of rows should normally be placed in the extreme right column and that of column should be placed at the bottom
18. The arrangement of the categories in a table may be chronological, geographical, alphabetical or according to magnitude to facilitate comparison. Above all, the table must suit the needs and requirements of an investigation

RESEARCH ETHICS

Research, however novel its discoveries, is only of any value if it is carried out honestly. We cannot trust the results of a research project if we suspect that the researchers have not acted with integrity. Although it might be easy enough to take short cuts or even to cheat, it really is not worth it. Not only will your research be discredited when you are found out, but you will suffer severe penalties and humiliation.It is a simple matter to follow the clear guidelines in citation that will prevent you being accused

of passing off other people's work as your own – called plagiarism. In fact, to refer to or quote other peo- ple's work is seen as a virtue, and demonstrates that you have read widely about your subject and are knowledgeable about the most important people and their ideas.

Working with human participants in your research always raises **ethical** issues about how you treat them. People should be treated with respect, which has many implications for how exactly how you deal with them before, during and after the research. Educational and professional organizations who oversee research projects have strict ethical guidelines that must be followed. However, the issues can become quite complicated, with no clear-cut solutions. It is therefore important that you consult with others, especially advisers appointed for that purpose.

Even if you are not using human participants in your research, there is still the question of honesty in the way you collect, analyse and interpret data. By explaining exactly how you arrived at your con-clusions you can avoid accusations of cover-ups or false reasoning.

There are two aspects of ethical issues in research:

1 The individual values of the researcher relating to honesty and frankness and personal integrity.

2 The researcher's treatment of other people involved in the research, relating to informed consent, confidentiality, anonymity and courtesy.

3 Although the principles underpinning ethical practice are fairly straightforward and easy to understand, their application can be quite difficult in certain situations. Not all decisions can be clear-cut in the realm of human relations.

ORGANIZATIONS AND ETHICS COMMITTEES

All organizations that are involved in research involving human par- ticipants have set up a code of practice for their researchers. To see typical examples of these types of guidelines, you can refer to the web page produced by the British Educational Research

RESEARCH REPORT WRITING

Association (www.bera.ac.uk/guidelines.htms) or the British Sociological Asso- ciation statement of ethical practice (www.britsoc.co.uk/index). Uni- versities will have their own codes of practice.

The role of ethics committees is to oversee the research carried out in their organizations in relation to ethical issues. It is they who formulate the research ethics code of conduct and monitor its appli- cation in the research carried out by members of their organizations. Applying for ethics approval inevitably involves filling in forms.

HONESTY IN YOUR WORK

Honesty is essential, not only to enable straightforward, above-board communication, but to engender a level of trust and credibility in the outcomes of the research. This applies to all researchers, no matter what subject they are investigating. Although honesty must be maintained in all aspects of the research work, it is worth focusing here on several of the most important issues.

INTELLECTUAL OWNERSHIP AND PLAGIARISM

Unless otherwise stated, what you write will be regarded as your own work; the ideas will be considered your own unless you say to the contrary. The worst offence against honesty in this respect is called **plagiarism**: directly copying someone else's work into your report, thesis etc. and letting it be assumed that it is your own. Using the thoughts, ideas and works of others without acknowledging their source, even if you paraphrased into your own words, is unethical. Equally serious is claiming sole authorship of work which is in fact the result of collaboration or amanuensis ('ghosting').

ACKNOWLEDGEMENT AND CITATION

Obviously, in no field of research can you rely entirely on your own ideas, concepts and theories. You can avoid accusations of plagiarism by acknowledging the sources of these features and their origina- tors within your own text. This is called **citation**. Although there are several well established citation methods, they all consist of brief annotations or

numbers placed within the text that identify the cited material, and a list of references at the end of the text that give the full publication details of the source material. These methods of ref- erence cater for direct quotations or ideas etc. from the work of oth- ers gathered from a wide variety of sources (such as books, journals, conferences, talks, interviews, TV programmes etc.), and should be meticulously used. You should also indicate the assistance of others and any collaboration with others, usually in the form of a written acknowledgement at the beginning or end of the report.

RESPONSIBILITY AND ACCOUNTABILITY OF THE RESEARCHER

Apart from correct attribution, honesty is essential in the substance of what you write. You do have responsibilities to fellow research- ers, respondents, the public and the academic community. Accurate descriptions are required of what you have done, how you have done it, the information you obtained, the techniques you used, the analysis you carried out, and the results of experiments – a myriad of details concerning every part of your work.

DATA AND INTERPRETATIONS

Although it is difficult, and some maintain that it is impossible, to be free from bias, distorting your data or results knowingly is a serious lapse of honesty. Scientific objectivity should be maintained as much as possible. If you can see any reason for a possibility of bias in any aspect of the research, it should be acknowledged and explained. If the study involves personal judgements and assessments, the basis for these should be given. Silently rejecting or ignoring evidence which happens to be contrary to one's beliefs, or being too selective in the data used and in presenting the results of the analysis consti- tutes a breach of integrity.

The sources of financial support for the research activities should be mentioned, and pressure and sponsorship from sources which might influence the impartiality of the research outcomes should be avoided.

UNIT: V

RESEARCH REPORT WRITING

WHERE DO YOU STAND?

The theoretical perspective, or epistemology, of the researcher should be made clear at the outset of the research so that the 'ground rules' or assumptions that underpin the research can be understood by the readers, and in some instances, the subjects of the research. One of the principal functions of doing background research is to explore just this aspect, and to come to decisions on theory that will form the basis of your research approach. The theoretical approach will influ- ence the type of data collection and analysis used. These methods are not ethically neutral so they will raise ethical issues.

SITUATIONS THAT RAISE ETHICAL ISSUES

Social research, and other forms of research which study people and their relationships to each other and to the world, need to be par- ticularly sensitive about issues of ethical behaviour. As this kind of research often impinges on the sensibilities and rights of other people, researchers must be aware of necessary ethical standards which should be observed to avoid any harm which might be caused by carrying out or publishing the results of the research project.

RESEARCH AIMS

Although research aimed merely at gaining greater knowledge and understanding of a phenomenon has little or no ethical consequences – the expansion of scientific knowledge is generally regarded as a good thing – applied research is more easily subjected to ethical investigation. Will the results of the research benefit society, or at least not harm it? Will there be losers as well as gainers? The research aims and their consequences must be clearly stated. Normally you will have to argue that the aims of your research are in accordance with the ethi- cal standards prescribed by your university or organization.

USE OF LANGUAGE

How you use language has an important influence when doing and writing up research. You should aim be as neutral as possible in the way you use terminology involving

people – who and what they are, and what they do. Guard against being patronizing or disparaging, and avoid bias, stereotyping, discrimination, prejudice, intolerance and discrimination. You will notice that acceptable terminology changes with time, so be aware that terms used in some older literature are not suitable for use now. You need to be constantly aware of the real meaning of terms, and their use within the particular context.

PRESENTATION

This relates to how you present yourself in the role of the researcher which might influence the attitude and expectations of the people you involve in your project. Student-researchers should present themselves as just that, and give the correct impression that they are doing the research as an academic exercise which does not have the institutional or political backing to cause immediate action. Practitioner researchers, such as teachers, nurses or social workers, have a professional status that lends more authority and possibly power to instigate change. Do not raise false expectations.

The research situation can also be influential. Stopping people in the street and asking a few standardized questions will not raise any expectations about actions, but if you spend a lot of time with a, per- haps lonely, old person delving into her personal history, the more intimate situation might give rise to a more personal relationship that could go beyond the simple research context. Even more expectations can be raised if you are working in a context of deprivation or inequality – will the subjects begin to expect you to do something to improve their situation?

DEALING WITH PARTICIPANTS

You should treat participants with due ethical consideration, in the way you choose them, deal with them personally and how you use the information they provide. In many cases, participants choose freely whether to take part in a survey by simply responding to the form or not. However, friends or relatives may feel that they have an obligation to help you despite reservations they may have and could result in a restriction of their freedom to refuse. Pressure might be exerted on participants if they are left too little time for due

consideration which might also result in them regretting taking part. Obviously, you should avoid dishonest means of persuasion, such as posing as an official, making unrealistic and untrue promises, being unduly persistent, and targeting people in vulnerable situations. This could occur almost inadvertently if you are not alert to people's situations and reactions.

Participants will decide whether to take part according to the information they receive about the research. The form that this information takes will depend on the type of person, the nature of the research process and the context. It should be clear and easily understood so they can make a fair assessment of the project in order to give an **informed consent**. Particular attention is needed when getting consent from vulnerable people such as children, the elderly or ill, foreign language speakers and those who are illiterate.

When working within organizations, managers or other people with overall responsibilities may need to be consulted, with the result that several layers of consent will be required. Make it clear and get agreement at all levels about what issues are to be discussed, how the investigation will be conducted, how confidentiality will be maintained. Be aware that there may be conflicts of interest between the management and employees so there must be some obvious form of protection for those making criticisms of the organization or systems of work or conditions.

Although verbal explanations may be sufficient in informal situations, a written résumé on a flyer could be useful. Questionnaires should always provide the necessary written information as an introduction. Participants must have the right to terminate their participation at any time.

CARRYING OUT THE RESEARCH

POTENTIAL HARM AND GAIN

The principle behind ethical research is to cause no harm and, if possible, to produce some gain for the participants in the project and the wider field. Therefore the researcher

RESEARCH REPORT WRITING

should assess the potential of the chosen research methods and their outcomes for causing harm or gain. This involves recognizing what the risks might be and choosing methods that minimize these risks, and avoiding making any revelations that could in any way be harmful to the reputation, dignity or privacy of the subjects.

RECORDING DATA

There is a danger of simplifying transcripts when writing up data from interviews and open questions. When you clean up and organize the data, you can start to impose your own interpretation, ignoring vocal inflections, repetitions, asides, and subtleties of humour, thereby loosing some the meanings. Further distortion can be introduced by being governed by one's own particular assumptions.

PARTICIPANT INVOLVEMENT

Questions about rapport are raised if your research entails close com- munication between you, the researcher, and the participants. Will those involved understand the motivation for your actions and do these conform to your own practice? You should not take familiarity

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so far as to deceive in order to extract information that the participant might later regret giving. Neither should you raise unrealistic expectations in order to ingratiate yourself.

SENSITIVE MATERIAL

Information can be thrown up that is of a sensitive nature which, if revealed, could do damage to the participants or to other people. Every case will have to be judged individually, but if this information is relevant to the research, it must be presented in such a way that individuals are not damaged by assuring confidentiality and anonymity. In cases of, for example, unfairness, victimization or bullying, it is unwise to get personally involved, but it may be possible to give advice to the participant about who to contact for help, such as a school tutor, trade union or ombudsman.

HONESTY, DECEPTION AND COVERT METHODS

Honesty is a basic tenet of ethically sound research so any type of deception and use of covert methods should be ruled out. Although you might argue that certain information of benefit to society can only be gained by these methods due to obstruction by people or organizations that are not willing to risk being scrutiniszed, how can you be sure of the benign consequences of the actions? The risks involved make the use of deception and covert methods extremely questionable, and in some cases even dangerous.

STORING AND TRANSMITTING DATA

The Data Protection Act 1998 in the UK and equivalent regulations elsewhere cover the conditions regarding collections of personal data in whatever form and at whatever scale. They spell out the rights of the subjects and responsibilities of the compilers and holders of the data. The data that you have collected may well contain confidential details about people and/or organizations. It is therefore important to devise a storage system that is safe and only accessible to you. If you need to transmit data, take measures that the method of transmission is secure and not open to unauthorized access.

UNIT: V

RESEARCH REPORT WRITING

CHECKING DATA AND DRAFTS

It is appropriate to pass the drafts of your research report on to colleagues or supervisors for comment, but only with the proviso that the content is kept confidential, particularly as it is not ready for publication and dissemination at this stage. The intellectual independence of the findings of the report could be undermined if you allow sponsors to make comments on a draft and they demand changes to be made to conclusions that are contrary to their interests. It is not practical to let respondents read and edit large amounts of primary data.

DISSEMINATION

Dissemination of your results in the form of conference or journal papers, a website or other types of publication inevitably involves reducing the length of the material, and perhaps changing the style of the writing. You must therefore be careful that the publication remains true to the original and avoid oversimplification, bias towards particular results or even sensationalization.

DISPOSING OF RECORDS

A suitable time and method should be decided for disposing of the records at the end of the research project. Ideally, the matter will have been agreed with the participants as a part of their informed consent, so the decision will have been made much earlier. The basic policy is to ensure that all the data is anonymous and non-attributable. This can be done by removing all labels and titles that could lead to identification. Better still, data should be disposed of in such a way as to be completely indecipherable. This might entail shredding documents, formatting discs and erasing tapes.

CLASS: I MBA
COURSE NAME: RESEARCH METHODOLOGY FOR MANAGEMENT
COURSE CODE: 18MBAP206 **BATCH: 2018-2020**

UNIT: V

RESEARCH REPORT WRITING

POSSIBLE QUESTIONS

PART-B (2 Marks

1. Define Scaling.
2. What is Nominal Scale?
3. What do you understand by Ordinal Scaling?
4. What is Interval Scale?
5. Describe on Ratio Scaling.
6. What do you meant by Processing of Data?
7. Explain on Field and Central Editing.
8. What is Coding?
9. Briefly explain on Classification.
10. What do you mean by Tabulation?
11. What do you mean by Interpretation?
12. Briefly explain on Technical and Popular Report.

PART C (6 MARKS)

1. What do you mean by Editing? Explain its types.
2. Differentiate between Technical Report and Popular Report.
3. Describe the precautions that the researcher should take while interpreting his findings.
4. Explain on various measurement of Scales.
5. Explain the significance of a research report and narrate the various steps involved in writing such a report.
6. Elucidate on important scaling techniques.
7. Describe the layout of a research report, covering all relevant points.
8. Elucidate in detail on various types of reports.
9. Define Hypothesis. Explain detail on formulation and procedure for testing hypothesis.

UNIT: V

RESEARCH REPORT WRITING

10. Genetic theory states that children having one parent of blood type A and the other of blood type B will always be of one of three types, A, AB, B and that the proportion of three types will on an average be as 1 : 2 : 1. A report states that out of 300 children having one A parent and B parent, 30 per cent were found to be types A, 45 per cent per cent type AB and remainder type B. Test the hypothesis by □2 test. (Table Value: 3.841)
11. Explain in detail on the layout of research report.
12. Explain the principles involved in tabulation.

Karpagam Academy of Higher Education

Department of Management

Research Methodology for Management - 18MBAP206

Unit V

Multiple Choice Questions - Each Question Carries ONE Mark

S.No.	Questions	Option 1	Option 2	Option 3	Option 4	Answer
1	__is considered a major component of the research study for the research task remains incomplete till the report has been presented and/or written	Data Collection	Research Report	Hypothesis	Objectives	Research Report
2	Writing of____is the last step in a research study	Summary	Report	Conclusion	Suggestion	Report
3	__development is made on the basis of mental connections and associations between the one thing and another by means of analysis	Illogical	Irrational	Unscientific	Logical	Logical
4	__development is based on a connection or sequence in time or occurrence	Chronological	Logical	Irrational	Unscientific	Chronological
5	___are the framework upon which long written works are constructed	of the Subject Matter	Preparation of the Final Outline	Preparation of the Rough Draft	Polishing of the Rough Draft	Preparation of the Final Outline
6	The books, journals referred by the researcher are mentioned under ___	Bibliography	Webliography	Citation	Quotation	Bibliography
7	References collected from website are mentioned under ___	Bibliography	Webliography	Citation	Quotation	Webliography
8	___prefer reports in the letter form, just one or two pages in length	Business firms	Banks	Mathematicians	Chemists	Business firms
9	___prefer to write the results of their investigations in the form of algebraic notations	Mathematicians	Chemists	Students of Literature	Education	Mathematicians
10	____report their results in symbols and formulae	Mathematicians	Chemists	Literature	Education	Chemists

11	__which analyze the content of the book and report on the author's intentions	News Items	Book Reviews	Internet	Debates	Book Reviews
12	___reports are generally very comprehensive	Business firms	Banks	Government	Financial Institutions	Government
13	In____report all informations are presented in exhaustive form	Popular	Technical	General	Common	Technical
14	In___report informations are presented by liberal use of graph, charts, diagrams etc.,	Popular	Technical	General	Common	Popular
15	In where detailed summary of the findings and the policy implications drawn from the results be explained	Methods Employed	Data	Analysis of Data	Conclusion	Conclusion
16	A brief review of the main findings is presented in ___	Nature of Study	Methods Employed	Summary	Analysis	Summary
17	In___where various sources consulted be prepared and attached	Bibliography	Webliography	Citation	Quotation	Bibliography
18	___be given for all technical matters relating to questionnaire, mathematical derivations, elaboration on particular technique of analysis and the like ones	Bibliography	Webliography	Citation	Appendices	Appendices
19	__must be prepared and be given invariably in the report at the end	Bibliography	Webliography	Index	Appendices	Index
20	Presenting author names in an alphabetical order is known as ____	Bibliography	Webliography	Indexing	Appendices	Indexing
21	Interview schedule used for data collection is affixed in the report under the heading____	Appendices	Bibliography	Webliography	Indexing	Appendices
22	Presentation of findings of the study through oral verbal stimulus is known as ___	Oral Presentation	Written Presentation	Printed	Typed	Oral Presentation
23	___aid to the logical organization of the material and a reminder of the points to be stressed in the report	Logical Analysis of the Subject Matter	Preparation of the Final Outline	Preparation of the Rough Draft	Rewriting and Polishing of the Rough Draft	Preparation of the Final Outline
24	__follows the logical analysis of the subject and the preparation of the final outline	of the Subject Matter	Preparation of the Final Outline	Preparation of the Rough Draft	Polishing of the Rough Draft	Preparation of the Rough Draft

25	Diagrams are for_____	the use of exports.	better quantitative picture.	better mental appeal	the use of imports	better quantitative picture.
26	A grouped distribution is can be represented by_____.	Frequency polygon.	Histogram.	Frequency curve.	Ogives.	Histogram.
27	Subdivided bar diagram can be prepared on percentage basis_____.	always.	never.	sometimes.	at a particular time.	at a particular time.
28	The hierarchy of subheadings in the research report are_____.	Centred, underlined.	Centred, not underlined.	Left, underlined	Both a and b.	Both a and b.
29	Hyphen is a_____.	Small horizontal line.	Large horizontal line.	Dotted line.	Splitted line.	Small horizontal line.
30	Print paper for the research report should be only on_____paper.	Mat .	Low quality glossy .	High quality glossy .	Filter .	High quality glossy .
31	The shortlist of working bibliography is _____.	Pertinent.	Selected .	Annotated.	Permanent.	Pertinent.
32	In references if the author is a woman it is usual to spell her_____.	Name	First name	Sur name	Name with initial	First name
33	_____are suitable for research reading:	We should force our self to read fast	We should make a few stops or eye fixations in each line as possible	We should practice to keep on reading forward	All the above	All the above
34	A bibliography is an_____list of all source material to which reference has been made	Numbers	Alphabets	Notations	Bullets	Alphabets
35	____is to be included in imprint:	publication.	Publishers.	Date of publication.	All the above.	All the above.
36	_____are essential information required for all references:	Author's surname and initials.	The imprint.	Call number of the book or journal.	All the above.	All the above.
37	Many journals require the use of "&" in the place of "and" in order to save:	Time.	Space.	Easy to understand.	To introduce symbols.	Space.
38	The_____should be placed at the end of the text:	Conclusion.	Reference.	Summary.	methods.	Reference.
39	_____is required for web articles:	Name of the authors.	Year and title of the article.	Journal, Volume of the title.	All the above.	All the above.

40	A full length research article generally consists of:	A title.	Keywords and abstract.	Name of the author and address.	All the above.	All the above.
41	Which of the following types of graphs is commonly used in business?	scatter diagrams	multiple line graphs	bar , pie and area charts	all of the above	all of the above
42	To show the periodic fluctuation in values of stock exchange indexes and share prices, one would use a(n)	high-low-close-chart.	pie chart.	vertical bar chart.	horizontal bar chart.	high-low-close-chart.
43	Graph which shows changes over a specific time period is called	meridian graph	pie graph	line graph	bar graph	line graph
44	Considering line graph, x-axis represents	false energy units	infrared energy units	subject of measurement	time period	time period
45	Considering line graph, y-axis represents	time period in years	subject of measurement	time period in days	time period in minutes	subject of measurement
46	When data are observed over a period of time the type of classification is known as_____	chronological classification	Geographical classification	Quantitative classification	Qualitative classification	chronological classification
47	In_____classification data are classified on the basis of some attributes or quality such as sex, colour, literacy , religion etc	Quantitative classification	chronological classification	Qualitative classification	Geographical classification	Qualitative classification
48	Classification of data according to some characteristics that can be measured, such as height, weight, income, sales are_____	Geographical classification	chronological classification	Quantitative classification	Qualitative classification	Quantitative classification
49	A_____is a systematice arrangement of statistical data in columns and rows	Graph	Diagram	Table	chart	Table
50	Brief explanatory statement applying to all or a major part of the material in the table, and is placed below the point centered and enclosed in brackets	Headnote	Footnote	Stub	caption	Headnote
51	Two or more set of interrelated data are represented in _____	Sub-divided bar diagrams	Simple bar diagrams	Multiple bar diagrams	Deviation bar diagrams	Multiple bar diagrams

52	_____bars are particularly useful in statistical work which requires the portrayal of relative changes in data	Percentages bars	Sub-divided bar diagrams	Simple bar diagrams	Multiple bar diagrams	Percentages bars
53	_____are used to give quantitative information on a geographical basis to represent spatial distribution	Cartograms	Pictograms	Pie diagrams	Three-dimensional diagrams	Cartograms
54	A_____is a set of vertical bars whose areas are proportional to the frequencies distributed	Histogram	Frequency polygan	Simple bar diagrams	Pie diagrams	Histogram
55	Many research in our country face the difficulty of adequate____.	Timely secretarial assistance.	Information gathering.	Data collection.	Working.	Timely secretarial assistance.
56	_____classification is the universe classified.	manifold	qualitative.	qualitative.	spatial.	manifold
57	The core ingredients of a dissertation are _____	Introduction; Data collection; Data analysis; Conclusions and recommendations.	Executive summary; Literature review; Data gathered; Conclusions; Bibliography.	Research plan; Research data; Analysis; References.	Introduction; Literature review; Research methods; Results; Discussion; Conclusion.	Introduction; Literature review; Research methods; Results; Discussion; Conclusion.
58	Every research proposal, regardless of length should include two basic sections. They are:	Research question and research methodology	Research proposal and bibliography	Research method and schedule	Research question and bibliography	Research question and research methodology
59	Whether classification is done first or tabulation?	Classification follows tabulation.	Classification precedes tabulation.	Both are done simultaneously.	No criterion.	Classification precedes tabulation.
60	Class interval is measured as_____.	The sum of the upper and lower limit.	Half the sum of upper and lower limit.	Half the difference between upper and lower limit.	The difference between upper and lower limit.	The difference between upper and lower limit.

Reg. No.....

[12MBAP206]

KARPAGAM UNIVERSITY

(Under Section 3 of UGC Act 1956)
COIMBATORE – 641 021
(For the candidates admitted from 2012 onwards)

MBA DEGREE EXAMINATION, APRIL 2013

Second Semester

MASTER OF BUSINESS ADMINISTRATION

RESEARCH METHODS FOR MANAGEMENT

Time: 3 hours Maximum : 100 marks

PART A (15 X 2= 30 Marks)
Answer ALL the Questions

1. Define Research.
2. Mention the types of research.
3. Bring out the objectives of research?
4. List the various types of scale?
5. What are the errors in measurement?
6. How will you formulate research hypothesis?
7. What do you mean by deliberate sampling?
8. Mention the different types of questions?
9. Define random sampling.
10. List the tools used to test one samples.
11. What is parametric test?
12. What do you mean by Null Hypothesis?
13. Why review of literature is necessary for a research?
14. Give any two differences between Practical Reports and General Reports.
15. Mention the uses of Chi – Square test.

PART B (5 x 14 = 70 Marks)
Answer ALL the Questions

16. a. Mention the different types of research and explain them in detail.

Or

b. Enumerate the steps to be followed in Research Process?

17. a. Explain the scale construction techniques with examples.

Or

b. Describe the steps involved while doing Research Design.

18. a. Explain the different types of data sources.

Or

b. How will you design the questionnaire? - Explain it.

19. a. Explain the different types of Reports with examples.

Or

b. A population is divided into 3 strata N1= 10,000, N2= 4,000 & N3= 6,000 respectively SD are $\sigma 1=30$, $\sigma 2= 36$, $\sigma 3=10$. How sample size n=168 to be allotted in 3 strata if optimum allocation the using disproportionate sample design?

20. **Case Study (Compulsory)**

Keep your city Clean: Environmental Concerns

Over the last decade, recycling of household waste has become an extremely important behavior across the nations. However, in Asian countries this fluctuates from one country to the other. China is the leader amongst waste management while India, an equally large country, still has a long way to go. Though these are essentially policy driven or community driven initiatives, there are a number of attitudinal and motivational barriers to recycling, acting at an individual level.

Punitha, a business studies graduate with a keen interest in environmental issues, read about this in a special report in the newspaper. She recognized a potential business opportunity. It seemed obvious to her that there was scope for a potentially profitable business related to some aspect of household recycling. All she had to do was work out some way of alleviating the inconvenience people associated with recycling.

Punitha decided that a door-to-door recycling service may be a profitable way to get people to recycle. She believed that households would be willing to pay a small fee to have their waste collected on a weekly basis, from outside their home. Punitha discussed this idea with a few friends, who were very receptive reinforcing Punitha's views that this was indeed a good business opportunity. However, before she developed a detailed business plan, she decided it was a necessary to confirm her thoughts and suspicions regarding the consumer's view about the recycling. In particular, she needed to check that her ideas, about convenience and recycling, were on the right track. To do this, she decided to conduct some research into attitude towards household recycling.

Questions:

i. What is the kind or research design you would advocate here?
ii. Identify your variables and the population under study.
iii. Can you suggest any alternative design? Why? / Why not?
