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Prescribed for M. Com. Part-I

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Preface

The subject Research Methodology is instrumental to orient post-graduate students with research design, research process and its significance in a particular discipline. We can educate and sensitize students to take up their steps in research to contribute to the society at large.

This book is written for the purpose of students on distance mode. It is contemplated here that the students will read the book, they will make exercise and come to the contact sessions with their queries which can be solved in it. This book is for their basic preparation for their study however they can make supplementary and extensive learning by using reference books.

This book aims at providing for a conceptual kit on research methodology to orient the students with basic ideas about types, methods, design, process, data analysis and report writing etc. It was challenge before authors to cover span of research methodology within four units. However, we have contributed to our level best.

This book is divided into four chapters of 'Research Methodology' for M. Com. Part-I (Semester-I). four units are on the topic of 'Introduction to Research', 'Research Design', 'Data Collection and Processing' and 'Analysis and Interpretation of Data'. The first unit covers meaning and objectives of research, research in commerce and management, types of research, review of literature, research process, methods of research: case study and survey method. The Second unit presents meaning and components of research design, exploratory research design, descriptive research design, diagnostic research design and experimental research design; meaning and types of hypothesis, process of formulating hypothesis; sample designsampling techniques, random and non-random sampling methods. The third unit comprises meaning of data, types of data, quantitative and qualitative data, primary and secondary sources, methods of primary data collection, questionnaire method, interview method, observation method, focus group interview method, types of questions in questionnaire, sources of secondary data, classification, tabulation and graphical presentation. The fourth unit describes about analysis and interpretation of data using various descriptive statistical tools (measure of central tendency, measures of dispersion, correlation and regression) hypothesis testing by suitable methods (Parametric and non-parametric tests), Chi-square test, One Sample 't' test and independent sample 't' test, layout of research project, steps involved in report writing, requisites of good research report.

Along with the theoretical components, illustration is given in every unit to understand and learn every concept clearly. At every regular interval, objective type questions are given to check the progress of the student. At the end of each unit, exercise is available which will be useful to students to make preparation according to the syllabus stipulated.

We are grateful to Hon. Vice-Chancellor Prof. (Dr.) D. T. Shirke and Hon. Pro-Vice-Chancellor Prof. (Dr.) P. S. Patil, Prof. (Dr.) D. K. More, Director, Centre for Distance Education and the Registrar for their support and cooperation. We are thankful to all university staff for timely support for this book.



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M. Com. Part-I

SIM I OF RESEARCH METHODOLOGY

(Syllabus in Accordance with NEP - 2020)



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Each Unit begins with the section objectives -

Objectives are directive and indicative of :

- 1. what has been presented in the unit and
- 2. what is expected from you
- 3. what you are expected to know pertaining to the specific unit, once you have completed working on the unit.

The self check exercises with possible answers will help you understand the unit in the right perspective. Go through the possible answers only after you write your answers. These exercises are not to be submitted to us for evaluation. They have been provided to you as study tools to keep you in the right track as you study the unit.

Dear Students

The SIM is simply a supporting material for the study of this paper. It is also advised to see the new syllabus 2023-24 and study the reference books & other related material for the detailed study of the paper.



Basics of Research

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1.0 Objectives:

After studying this unit you should be able:

- 1. To understand the meaning and objectives of research
- 2. To be familiar with the research in Commerce and Management
- 3. To classify the research into different types
- 4. To understand the review of literature and research process
- 5. To understand the methods of research: case study method and survey method.

1.1 Introduction:

The development of whole world is due to research in various fields of life. Human being is benefited by the research undertaken in various subjects. The human urge for new areas of knowledge has developed a sense for search and research in him. Every society or economy has serious social, economic and political problems. These problems need systematic, intelligent and practical solution. The business organizations have managerial problems which also require solutions. **The innovation is solution for many problems and it comes from the research**. However, what is the research that we have to understand.

1.2 Presentation of Subject Matter

In this unit, we are going to see the meaning and objectives of research; the research in Commerce and Management; types of research; review of literature; research process; and the methods of research. This unit also includes the meaning, advantages and disadvantages of case study method and survey method.

1.2.1 Meaning of Research

As per dialect, research refers to a search for new knowledge. However it is systematic enquiry of a research topic. It is critical investigation of a phenomenon with specific objectives. We can understand the meaning of research with the help of definitions given by some thinkers. The characteristics of research clear us the meaning of research. Research brings improvement in practical life. Redman and Morey has defined research briefly as 'systematized effort to gain new knowledge.'

P. V. Young defined the research as 'social research is the systematic method of discovering the new facts or verifying the old facts, their sequences, interrelationship, causal explanations and the natural laws which govern them.'

D. Slesinger and M. Stephenson say 'social research is manipulation of things, concepts or symbols for the purpose of generalizing to extend correct and verifying knowledge, whether that knowledge aids in the construction of a theory or in the practice of an art.'

Another definition of research is given by F. A. Ogg who says that 'research may or may not come to success; it may or may not add anything to what is already known. It is sufficient that its objectives be new knowledge or at least a new mode or orientation of knowledge.'

Clifford Moody has given whole process of research in his definition, he says 'It comprises defining and redefining problems; formulating hypotheses or suggested solutions; collecting, organizing and evaluating data; making deductions and making conclusions; and at last carefully testing the conclusions to determine whether they fit the formulated hypothesis.'

According to Webster's International Dictionary, the research has been defined as 'a careful and critical enquiry or examination in seeking facts or principles, diligent investigation in order to ascertain something.'

Francis Rummel says 'Research is a careful inquiry or examination to discover new information or relationships and to expand and to verify existing knowledge.'

John W. Best says 'Research may be defined as the systematic and objective analysis and recording of controlled observations that may lead to the developments of generalizations, principles, or theories, resulting in prediction and possibly ultimate control of events.'

Kerlinger defines research as 'a systematic, controlled empirical and critical investigation of hypothetical propositions about the presumed relations among natural phenomena.'

1.2.1.2 Characteristics of Research:

- (1) Research is a systematic, objective and logical process.
- (2) Research is a systematic and critical investigation.
- (3) Research is a serious and rigorous process of analyzing data with specific purpose.
- (4) Research is a controlled activity.
- (5) Research is a valid experience and provides verifiable evidences.
- (6) Research should be relevant.

1.2.2 Objectives of Research

The main objective of a research is to find out a truth which has not been yet discovered. The specific objectives are as follows:

- **1.** *Creating knowledge:* Research is a process of gaining new knowledge. It is conducted to develop a new theory or to test an existing theory or to extend the existing knowledge. Research always contributes to the knowledge.
- 2. *Describing characteristics:* Research is also conducted to describe accurately the characteristics of a particular individual, situation or a group.
- 3. *Diagnosis of problem:* Research can be conducted to determine the frequency with which something occurs or with which it is associated with something else.
- 4. *Testing relationship:* Research is also conducted to test a hypothesis of causal relationship between variables.
- 5. *Welfare objective:* Research should have social objective for broader view of welfare of the society. It is always expected that research should be useful to the society at large. After solving any problem

Check your progress-1:

(A) Fill in the blanks:

- (a) is systematized effort to gain new knowledge.
- (b) Research is a and critical investigation.
- (c) Research is a experience and provides verifiable evidences.

- (B) State whether the following statement is true or false
 - (a) Creating knowledge is one of the objectives of research.
 - (b) Describing characteristics is not the objective of any research.

1.2.3 Research in Commerce and Management

Research is backbone for all areas of business hence it is nothing but lifeline of business studies. The development of various disciplines of commerce and management is dependent on research. The research in commerce and management is constantly done for effective and actionable decision-making. Most of the decisions require additional information or information evaluation, which is addressed by business research. There are different areas of business research which include:

- 1. Research in Human Resource Management and Organizational Behaviour
- 2. Research in Marketing Management
- 3. Research in Financial Management and Accounting
- 4. Research in Operations and Production Management and Supply Chain Management
- 5. Research in Entrepreneurship and business models etc.

1.2.3.1 Human Resource Management:

Fundamental research in human resource management and organizational behaviour can be applied by business organizations in their policies and programmes. It may cover topics like (a) performance management, leadership analysis, organizational climate and work environment studies, talent and aptitude analysis and management, (b) employee recruitment and selection, (c) organizational planning and development, (d) incentive and benefit studies, job analysis and performance appraisal, employee benefits and reward analysis etc., (e) training and development gap analysis, impact and effectiveness of training.

1.2.3.2 Marketing Management:

Research in marketing management includes broader industry specific studies. Some market research agencies conduct such research and they are sold to business organizations to assist their business decisions. Research in marketing consists of: (a) market potential analysis, market segment analysis and demand estimation, (b) market structure analysis, (c) consumer and business trend analysis, (d) buying behaviour and customer satisfaction etc. Some organizations prefer to conduct the research by their own product development department or R and D department. Such department carries out research related to all 4Ps of marketing such as (i) product research, (ii) pricing research, (iii) promotional research and (iv) place research. Research in customer relation management, customer satisfaction and customer loyalty etc. is now significant research carried out in the scenario of increased competition.

1.2.3.3 Finance and Accounting:

Research in finance and accounting is vast area of business studies and significant in decision-making. It includes: (a) capital market research, market micro structure, corporate finance, (b) analysis of financial derivatives, (c) market-based accounting research, (d) earning management, (e) risk management, (f) auditing and accountability, (g) integrated financial reporting, (h) financial econometrics, (i) merchant banking and insurance, (j) economic value added, and (k) micro-finance, financial inclusion and financial literacy etc.

1.2.3.4 Operations and Production Management:

Research in operations and production management is highly focused and problem-specific. Such research areas consists of operation planning, demand forecasting and analysis, process planning, project management, maintenance management, logistics and supply chain management, inventory management, quality assurance, quality control, total quality management and quality certification analysis etc.

1.2.3.5 Cross-functional and Multi-disciplinary Research:

Business research is not only confined to functional areas of management, however, cross-sectional and multi-disciplinary approach is always useful for businesses with considering changes in business environment. It requires research areas such as corporate social responsibility, corporate governance and ethics, technical support system, enterprise resource planning, knowledge management, data mining and warehousing and artificial intelligence and so on. Business environment is also integrated subject which carries out research on ecological and environmental analysis, legal analysis, human rights and discrimination studies etc. In this way, we can understand research in commerce and management in diverse areas with various purposes.

Check your progress-2:

(A) State whether the following statement is true or false

- (a) There is no any space for research in Commerce and Management.
- (b) Most of the decisions require additional information or information evaluation, which is addressed by business research.
- (c) Market potential analysis is made in the research of human resource management.
- (d) Market micro-structure is studied in finance research.
- (e) Process planning is the topic of operations management.

1.2.4 Types of Research:

There are different type of research which may be pure research, basic research, applied research, descriptive research, analytical research, quantitative research and qualitative research etc.

1.2.4.1 Pure or Basic Research:

Pure research is also called as basic research or fundamental research. Such research is undertaken for the sake of knowledge without any intention to apply it in practice. Out of intellectual curiosity such research is carried out. It may aim to either discover a new theory or refinement of an existing theory. Fundamental research may include (a) the research deals with natural phenomenon and (b) the research related to human behavior make generalization.

Pure research makes scientific contribution to the development of the theoretical knowledge for e.g. Elton Mayo's Hawthorne Study's contribution to Behavioural Science. The contribution of pure research may be seen in major four areas (i) contributing new facts, (ii) putting theory to test, (iii) conceptual clarification and (iv) interesting previously existing theories.

The examples of pure research we can find as Einstein's theory of relativity, Joan Robinson's Imperfect Competition, Chamberlains Monopolistic competition, Milton Friedman made new interpretations of the monetary phenomenon which questioned some of assumptions of Keynesian theory etc. Basic research contributes either by discovery of new theory or development in the existing theory.

1.2.4.2 Applied Research:

Applied research is the research which is to find out a solution for practical problem which is being faced by society or business etc. The main aim of applied research is to discover a solution for some practical problems. Following are the examples of applied research:

- a) The research which find out conclusions for social or business problem
- b) The research which identify social, economic or political trends which affects an institution
- c) Marketing research
- d) Evaluation research

Applied research provides solutions to practical problems, help to identify critical factors in practical problem and develop alternative solutions. It is problemoriented and action-oriented. As far as business research is concerned, the research in marketing carried out for developing a new market is treated as applied research.

1.2.4.3 Descriptive Research:

It is nothing but surveys and fact-finding enquiries. It aims at description of the state of affairs. In this type of research in social science, researcher has no control over the variable. Census of India which is done after every 10 years is famous example of descriptive research which describes characteristics of Indian population. Other examples of descriptive study include Economic Survey of India, World Bank Reports, Pre-election Surveys etc.

1.2.4.4 Analytical Research:

Analytical research is the research when the researcher uses facts and information already available and makes critical evaluation of the material. It focuses on analyzing data in depth and examining relationships with different perspectives in as many variables as possible. It is useful for measuring variables, comparing groups and examining association between factors. There is wide scope for conducting analytical research by using data collected by World Bank, International Monetary Fund, Government departments, Reserve Bank of India, NABARD, NSE, BSE, Central Statistical Organization and Centre for monitoring Indian Economy (CMIE) etc.

1.2.4.5 Quantitative Research:

Quantitative research is based on quantitative measurements. The phenomenon which can be expressed in terms of quantities to them quantitative research is applicable.

1.2.4.6 Qualitative Research:

Qualitative research is concerned with qualitative phenomenon. When we are interesting to investigate

1.2.4.7 Historical Research:

Historical research is a study of past records and information sources with a view to reconstructing

Check your progress-3:

(A) State whether the following statement is true or false

- (a) Pure research is also called as basic research or fundamental research.
- (b) Evaluation research is categorized under applied research.
- (c) Descriptive research aims at description of the state of affairs.

(B) Choose most appropriate alternative:

- (1) Following are the examples of applied research:
 - (a) The research which find out conclusions for social or business problem
 - (b) The research which identify social, economic or political trends which affects an institution
 - (c) Marketing research
 - (d) Theory developing research
- (2) The contribution of pure research may be seen in major four areas (i) contributing new facts, (ii) putting theory to test, (iii) applied research, (iv) conceptual clarification and (v) interesting previously existing theories.
 - (a) (i), (ii), (iii) & (iv)
 - (b) (i), (ii), (iv) & (v)
 - (c) (i), (ii), (iii) & (v)

(d) (ii), (iii), (iv) & (v)

1.2.5 Review of Literature:

Review of literature is not mere reading of different resources. It is systematic process of reviewing scholarly written sources like books and research papers/articles published in journals etc. in the context of a particular research problem. With different purposes it is done which may include (a) to gain subject insight, (b) to be familiar with concepts relating to research problem, (c) to identify potential relationship between the variables, (d) to formulate hypothesis, (e) to identify methodology appropriate to research problem, (f) to check utility of data sources used by other researchers and (g) to learn how others have written their reports.

After formulating of the problem, researcher has to conduct an extensive review of literature related to the problem under study. This covers review of books, journals, conference proceedings, government reports, published and unpublished studies and theses etc. Most important part of review of literature is the review of earlier studies on the similar topic or dimensions of research problem. We can understand there are two-folds of review of literature i.e. (i) review concepts and theories and (ii) review of previous research findings.

Review of literature is required to carried out at different stages of research with different purposes:

- At the beginning of research, to identify and select research problem, the researcher has to review source materials, encyclopedia, reference books, bibliography of doctoral dissertations, databases, theses in selected disciplines. At this stage, review of literature is done for gaining preliminary orientation about research topic, gaining ideas of recent trends in the field of knowledge, knowing work already done and finding out research gap to avoid duplication.
- 2. When the research problem is formulated, the review of literature is made for becoming familiar with appropriate research methodology, tools and techniques relevant to the study. Hence, it is necessary to review previous studies in the field, journals published and unpublished theses etc.
- 3. At the stage of operationalizing concepts, the researcher should review previous studies in the field, journals published and unpublished theses etc. It is needed to clarify the concepts and for knowing measurement techniques.

- 4. When the research proposal is prepared, review of literature include review of sources like illustrated books on research methodology and published and unpublished theses. It is required at this stage to develop alternative research designs and for formulating hypothesis and defining sample design etc.
- 5. At the stage of constructing data collection instrument, the researcher has to review the sources like illustrated books on research methodology and published and unpublished theses and especially specimens of instruments and scales appended to theses etc. Such review is don for gaining thorough knowledge of tools and measurement techniques.
- 6. At the time of writing theoretical chapters in the research report, the researcher should review journals, reference books and reports on the subject matter etc. The purpose of review at this stage is to notes and complete bibliography.
- 7. When findings and conclusions are written at that time also review is useful to strengthen them or justifying them with references of previous studies and also justifying differences in the findings by specific reference.

By this discussion we can understand that the review of literature is not isolated part of research report however every part of research report is ornamented by glimpses of review of literature and their references either for comparison or justification.

1.2.6 Research Process:

The research process consists of series of various actions, which are necessary to effective research work. The stages in research process are listed as, selecting research problems and stating of hypothesis, formulating of research design, collecting, analyzing and interpreting of data.

Research process is a cyclic and interlinked with different stages. It is series of actions or steps necessary to carry out research effectively. This research process consists of steps such as (a) defining the research problem, (b) review of literature, (c) developing the hypothesis, (d) formulating the research design, (e) determining sample design, (f) data collection, (g) data analysis, (h) testing of hypothesis, (i) interpretation and (j) preparing research report.

1.2.6.1 Defining research problem:

The first step of research process is defining research problem. The researcher has to identify and select the research problem. This stage answers about 'why' and 'what' research is to be conducted. When sales are dipping in a specific market, the marketer want to know why the sales are dipping in that market. Hence, the researcher should come from broader to narrow approach. Firstly, we can fix which is broader area, then identify topic and our research problem under this topic. When the researcher decides about research problem, he/she has some investigative questions on which you decide the objectives of a particular research and we can write the statement of the research problem.

The problem has to be defined properly before research problem is taken for study. The issue for inquiry or investigation should be identified and specified in detail. Consequently it needs to define scope of the problem, justification of the problem and feasibility of the problem.

1.2.6.2 Review of literature:

Review of literature is done with specific purpose of getting basic idea and conceptual clarity about research problem, identifying theoretical gap and methodological gap. The repetition of the same research problem is not expected. The review of literature assists him in this respect. It is also useful in formulating hypothesis.

1.2.6.3 Developing hypothesis:

Hypothesis is tentative assumption which may probable answer to the research question. It is a working assumption for a specific research. It should be a logical statement. 'By formulating a series of reasonable guesses of cause and effect, we are able to understand and explore the events in our surrounding environment (Leedy and ormrod, 2001). For proper evaluation, the researcher needs to define specifics in operational terms. A hypothesis is a 'supposition made as a starting point for further investigation from known facts' (Pearsall & Trumble, 1996). It has aim of generating new knowledge. It should be novel and contain a testable prediction. Hypothesis may be formulated on the basis of earlier theories or review of literature or pilot studies. (The detailed discussion on hypothesis is made in chapter 2.7 page 52-68)

1.2.6.4 Formulating the research design:

Research design is formulated while the research problem and objectives are defined. It is nothing but blueprint of the research proposed. It will clear all future things about research project i.e. when, how, why, where and who will do things about research. It will clear the methods, tools and techniques to be adopted, the methods of data collection, methods of data presentation and methods of data analysis and interpretation. Research design also explain the structure of the research project and the material to be used for it. On the basis of orientation of the research, the researcher has number of techniques for testing the stated objectives. Such orientation may be exploratory, descriptive or causal and so on. After defining research problem, review of literature and developing hypothesis, the research design is formulated for the proper planning and execution of the research.

1.2.6.5 Determining sample design:

Sample design of the research project clears population and sample of the study. It also explains the adequacy of sample size, sampling method adopted and its justification, basis of selecting sample. The researcher has to make sample most representative of population. To avoid a probability of error in prediction, the selected sample should be free from bias. The degree of precision/error should be measurable and small enough to be deducted from the results. The selection of probability or non-probability sampling depends on the nature of research, degree of accuracy required and the time and financial resources available for the research.

1.2.6.6 Data collection:

Data collection is a crucial stage of research process. It is based on research design. Before going into the field, scales of measurement is important issue addressed. Before execution of data collection instrument we have check measurement options. There is wide variety of data collection instruments available to any researcher. They may be broadly classified as secondary sources and primary sources of data. The data collection instruments include interviews, focus group discussions, telephonic interview, mail survey, questionnaire or schedule etc. To achieve objectives of a particular research, the researcher collect the data either quantitative or qualitative. This stage requires systematic collection of data with considering careful and rigorous quality checks to ensure the reliability and validity of the data collected.

1.2.6.7 Data analysis:

Firstly the data collected should be refined and processed for evaluating the information in order to answer the research question(s) and test the hypothesis. The data editing is also required to minimize errors and improve accuracy. Data analysis depends upon the type of data i.e. quantitative or qualitative. Quantitative analysis or statistical analysis is divided into two parts i.e. descriptive statistics and inferential statistics. Qualitative data collected should be classified into broad categories to be able to arrive at any inference and conclusion. In the present age, software like MS Excel, SPSS or R etc. are used for data analysis.

1.2.6.8 Testing of hypothesis:

Testing of hypothesis is also a part of data analysis. It is one of the important stages of research process. The researcher well understands his research objective, because the type of test that will be used has to go in meeting the research objectives. Test of hypothesis is an inference and a decision-making process in which we use sample information to test whether a population parameter is less than, equal to or greater than a specified value.

Testing of hypothesis is made according to univariate (population) analysis, bivariate (population) analysis and multivariate (population) analysis. Test of hypothesis may be test of association or test of differences. Parametric or nonparametric test are alternatively applied for normal distribution and non-normal distribution respectively.

1.2.6.9 Interpretation:

In simple words, an interpretation is the process of making the things simple and clear. This stage involves interpretation and generalization. Researcher evaluates and enhances data quality and assess potential for bias. Tools and techniques are applied to give shape to the collected data. The expert-opinions can be tools for qualitative research and the statistical methods can be tools for quantitative research. Interpretation is making things simple and clear. It is the skill of researcher to link the results with the research objectives, stating clearly the implications of the findings and it is done with objective and rational approaches.

1.2.6.10 Preparing research report:

Preparing research report is the final stage of research process. The report is nothing but documenting whole research in a single report or communicating the research in a particular form. It is the report regarding whole research from problem formulation to the interpretation. The report communicates the reader all aspects of research i.e. problem formulation, objectives, conceptual framework, review of literature, scope and limitations of the research, research methodology, data analysis and interpretation, findings, conclusions and suggestions etc. It appends enclosures like specimen questionnaire and documents like financial statements etc. At the end, the bibliography is also appended.

Check your progress-4:

(A) Fill in the blanks:

- (a) is systematic process of reviewing scholarly written sources like books and research papers/articles published in journals etc. in the context of a particular research problem.
- (b) We can understand there are two-folds of i.e. review concepts and theories and review of previous research findings.
- (c) The consists of series of various actions, which are necessary to effective research work.
- (B) Choose the most appropriate alternative:
 - (1) Following is not the step of the research process.....
 - (a) defining the research problem,
 - (b) selling books
 - (c) review of literature
 - (d) developing the hypothesis
 - (2) is the last step of the research process.
 - (a) data analysis
 - (b) testing of hypothesis
 - (c) interpretation

(d) preparing research report.

1.2.7 Methods of Research

Research methods refer to the methods of researchers use in performing research operations. There are methods of research such as case study method, survey method, historical method and experimental method etc.

1.2.8 Case Study Method:

The case study method is one of the most popular methods of research. Here, a case is a unit of study and case study is the study of a unit. As far as history of case study method is concerned, **Fredric Le Play (1806-1882)** firstly used this method in studying family budgets. After that, Herbert Spencer used this method in his ethnographic studies.

The case study method is a tool of social investigation which was intitially developed in U. S. A. Actual introduction of case study as a method of sociological field research was made by Thomas and Zeneniecki and their case studies known as the 'Polish Peasant' by using personal diaries, letters, autobiographies and the files of social agencies n the search for concrete and specific details about personal conduct and group behaviour.

Clifford R. Shaw made an intensive study of a series of such cases and subjected them to a careful analysis and comparison to unique and of common difference. It is extensively used in psychology, education, sociology, economics, political science, commerce and management and so on.

1.2.8.1 Meaning of Case Study Method:

A case study is an in-depth comprehensive study of a person, a social group, an episode, a process, a situation, a programme, a community, an institution or any other social unit.

- 1) Burges termed the case study method as "the social microscope".
- 2) According to P. V. Young, "case study is a method of exposing and analyzing the life of a social unit". (P. V. Young, Scientific Social Survey and Research, p.229). She also explained that "A comprehensive study of a social unit- be that unit a person, a group, a social institution, a district or a community- is called a case study".

- 3) Shivpao Young says that "case study method may be defined as a small inclusive and intensive study of an individual in which investigator brings to bear his skills and methods".
- 4) According to **H-Odum**, "case study 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 analyzed in its relationship to any other is the group".
- 5) **Goode and Hatt** say that "It is a way of organizing social data so as to present the unitary character of the social object being studied".
- 6) According to Sart a Queen, case study is the examination of a single situation, person, group or institution as complex wholes in order to identify types and process".

Case study is the method which aims at studying deeply and thoroughly different aspects of a social unit. Case study method is a careful and complete observation of a social unit. This unit may be a person, a family, an institution, a cultural group or even the entire community. All characteristics of such case are studied under this method with comprehensive approach. In nutshell, we can say that case study is a careful and complete observation of a social unit, be that unit a person, a family or an institution, a cultural group or even the entire community.

Case study method is a form of qualitative analysis wherein careful and complete observation of an individual or a situation or an institution is done. In this method, efforts are made to study such and every aspect of the concerning unit in minute detail. With its limitation, generalization may not be possible, however, inferences can be drawn.

1.2.8.2 Characteristics of Case Study Method:

- (a) Case study method is a single unit analysis.
- (b) It is an intensive study of a social unit.
- (c) Case study method is integrated study of all facets of a single unit.
- (d) Case study method makes qualitative analysis of characteristics of a unit under study.
- (e) The interrelationship can be studied by case study method.
- (f) The behavioural pattern of unit can be studied by using case study method.

- (g) It helps to generalize social science.
- (h) It is flexible to adopt any data collection methods.
- (i) With using case study method, the mutual interrelationship can be studied.

1.2.8.3 Process of Case Study:

The case study has a specific process to accomplish the objective of finding characteristics of a unit under study. Such process of case study is divided into following steps:

- (a) Identifying specific problem
- (b) Collection of data
- (c) Analyzing problem
- (d) Applying remedies
- (e) Evaluating and Conclusion
- (f) Taking follow-up
- (a) *Identifying specific problem:* In the first step of case study method, specific research problem is identified. The basic issues are defined. It selects and formulate research problem in this step.
- (b) Collecting data: The collection of data is the second step of case study method. It also collects data regarding a particular case. Such data can be collected from documents such as correspondence, diaries and personal and historical documents etc. The researcher can also collect the data by taking in-depth interview.
- (c) *Analyzing problem:* The research problem is divided into rational easily understood divisions. Such divisions can be examined separately. Analyzing research problem is a process of comparing data collected according to objectives set and identifying deviation, if any, and to influence it.
- (d) *Applying remedies:* After defining and analyzing the problem, the suitable remedies are suggested to solve the problem. It plays important role in case study method.
- (e) *Evaluating and Conclusion:* The case study method is used in education, law, human resource management, organizational behaviour, marketing and so on.

Different solutions should be suggested to the problem concerned. After evaluating data collected regarding a particular unit, the researcher should come out with conclusion.

(f) *Taking follow-up:* After identifying solution and applying it to a particular problem, the researcher should take follow-up for determining effectiveness of remedial actions.

1.2.8.3 Merits of Case Study Method

The case study method has some merits or advantages to the researcher and the society.

- (1) *Intensive study:* With the help of case study method, it is possible to study intensively all aspects of a unit under study. It aims at studying everything about few units. The study is done in comprehensive manner under this method.
- (2) *Flexible data collection:* The researcher has freedom to approach the problem from any angle he so desire. There is no need of sampling in this method. The researcher can use more than one data collection method such as depth interview, questionnaire, documents, individual letters and study reports etc.
- (3) *Useful for formulating hypothesis:* The case study method helps to formulate hypothesis. Goode and Hatt say 'the depth of insight afforded by case study will yield fruitful hypothesis for later, full scale study'.
- (4) *Less expensive:* As compared to laboratory experiment, field experiment and sample surveys, the case study method is less expensive.
- (5) *Comparative study:* If two sets of cases are picked up, the independent case studies can be done. After such case studies, the comparative study will be possible.
- (6) *Real and enlightened record:* This method helps us to collect real and enlightened record of personal experiences. It is useful in using sociological material as a real record of personal experience.
- (7) *In-depth study:* In case of survey it is not possible to go into detail for each and every unit. However, case study method provides an opportunity to make indepth study of social unit.

- (8) *Suitable for diagnostic study:* The case study method is most suitable for diagnostic research and to develop strategy to solve the same problem.
- (9) *Useful for change study:* The case study method is useful for understanding the social change. The immediate reading of change is possible by this method.

1.2.8.4 Demerits of Case Study Method:

- (1) *Lack of objectivity:* The case study method involves the relationship between a researcher and the unit under study, which develops personal feeling and emotions affects. Due to these effects, the objectivity is lost. Hence, there is danger of subjectivity.
- (2) *Comparison not possible:* In social research, values, attitudes, behaviour, reactions, circumstances etc. of human being are different from each other. So it is very difficult to find out to identical cases. Hence, it is not possible to compare two cases.
- (3) *Time and money consuming:* The case study method is intensive study which study the all aspects and also its past, present and future. It requires more time, more money and more man-power as it requires to study the natural history of social unit minutely.

1.2.9 Survey Method:

If we look into the history of survey, it is found that in 300 B.C., Herodotus talked of survey of population of Egypt and as such this method in crude form was known to the people. In 11th Century, William, the Conqueror's work 'Dooms Day Book' also has traces of social investigation of problems with the help of surveys. It became scientific in the writings of John Howard who conducted a survey of prison houses of England and Wales. Le play, a French Social Reformer, undertook research on the conditions of workers, after industrialization. Earnest Engles, a German Economist made research on budget of families. He came to conclusion that the pattern of desire of the people differed on the basis of their income.

Sorokin, the first American scholar, he was inspired by the work of Le Play. Others who follow the same include Zimmerman and Trampton, Llyod Warner, Ralph Linton etc. Charles Booth studied poverty of London and used survey method and written book 'Life and Labour of People of London'. He introduced statistics in social survey.

B. S. Rowntree studied economic conditions of the people on large scale. He made survey of 16,362 families in New York. Survey conducted twice in 1899 and in 1936. He came to the conclusion that economic condition of 10% of the population had improved.

Arthur Bowley picked up middle size towns in England. He wrote book 'Livelihood and Poverty'. He made survey twice, used sampling techniques and introduced comparative method in his study.

1.2.9.1 Meaning of Survey Method

Survey is the research method which is overlooking the phenomenon. It is common method of diagonising and solving social problem. It is useful for method of social investigation which is confined to particular area. Under this method, data may be collected through observation, mailing questionnaire or interviewing. This is the method of gathering data from respondents thought to be representative of some population.

According to Festinger and Kat, "Many research problems require systematic collection of data from population through the use of personal interviews or other data gathering devices. These studies are usually called surveys, especially when they are concerned with large and widely diverse groups of people."

Mark Abram says, "A social survey is a process by which quantitative facts are collected about the social aspects of a community composition and activities."

Bogardus E. S. has defined survey as "A social survey is the collection of data concerning the living and working conditions, broadly speaking the people in a given community."

According to E. W. Burgess, "A social survey is the scientific study of conditions and needs of a commodity for the purpose of presenting a constructive programme of social advance."

As per S. M. Harison's perception, "A social survey is a process by which quantitative facts are collected about the social aspects of a community's composition and activities."

P. V. Young has defined social surveys in comprehensive manner as follows:

"Social surveys are concerned with

- a. The formulation of a constructive programme of social reform
- b. Amelioration of current or immediate conditions of a social pathological nature, which have definite geographical limits and definite social implicaptions and significance
- c. These conditions can be measured and compared with situations which can be accepted as model."

On the basis of overview of all above definitions of social survey, we can summarize the following characteristics of survey as given below:

- (a) Social Survey are continued in Modern Times
- (b) Characteristics of Modern Social Surveys
- (c) Large Scale Social Surveys
- (d) Regular Social Surveys
- (e) Inter-disciplinary Nature
- (f) No Collection of Unnecessary Data
- (g) Employment of Trained Field Workers

1.2.9.2 Process of Survey:

The process of survey can be divided into different stages such as selecting problem, defining objective, definitions, operationalization of concepts and constructs, sampling, designing instrument and pre-testing, field work and data collection, processing of data and tabulation, analysis of data and reporting.

- (1) Selecting problem: The first stage of survey is selecting problem. The problem should be defined in such a way that it must be clear and precise. It should be socially useful.
- (2) Defining objective: The aim of the study should be clearly defined in the line of research problem already formulated.
- (3) Definitions: The scope of the study should delimited and concepts should be clearly defined so as to measure them properly afterwards.



- (4) Operationalization of concepts and constructs: For the purpose of analysis, variables should be properly measured. Hence, concepts and constructs should be operationalized for measuring idexes and scales.
- (5) Sampling: Census survey is not possible all the times. The researcher can select sample which is representative units of population.
- (6) Designing instrument and pre-testing: Tools for data collection should be designed properly in the light of objectives of the study. Schedule can be drafted and it can be administered in pilot survey and it can be pre-tested with reliability and validity of scales for the constructs.
- (7) Field work and data collection: After pre-testing, the data can be collected from the respondents. While collecting data, situation, mindset of respondent, attitude should be taken into account. Psychological factors always affects on data collection in survey method. The researcher should try to collect realistic data with objectivity.
- (8) Processing of data and tabulation: The data collected are processed which include data cleaning, data editing, data transcription etc. After that data are tabulated with the specific purpose of analysis as simple frequency table, one-way table or two-way table, cross-table etc.
- (9) Analysis of data: After processing of data, quantitative analysis is carried out in two parts: descriptive statistics and inferential statistics. As per the research design, data are analyzed with specific perspective.
- (10) Reporting: The research report may be prepared in the detailed form or it can be published in the form of research paper/ article.

1.2.9.3 Types of Survey:

Social surveys can be of different kinds. Survey can be very limited or very comprehensive in nature. It can be conducted by the government or private agencies. Briefly we can see the types of surveys as follows:

(1) Census or Sample Survey: Each and every unit of population is investigated in census survey. In limited geographical scope, an individual researcher can adopt sample survey. Otherwise, census survey may be time-consuming, costly and required more efforts. Sample survey is limited to representative units of population. It is a method of research which implicit that findings on the basis of

data analysis of sample is attributable to whole population. Findings are put forth about whole population on the basis of analyzing sample. It is possible only when population is homogeneous.

- (2) **Regular or Ad hoc Survey:** When survey is conducted after regular interval, it is called regular survey. Regular surveys include surveys by RBI, Economic Surveys of India, Census Survey made by the Registrar General of India etc. When survey is conducted to find out some information required for a particular purpose, it is called ad hoc survey. In this case, purpose of the survey is over as soon as the object is achieved. The information required on regular nature, the regular survey is suitable; however, ad hoc survey is suitable to collect data related to certain specific subject matter.
- (3) *Direct or Indirect Survey:* Direct survey interprets facts quantitatively. Indirect survey concludes results out of the available data.
- (4) General or Specific Surveys: Entire community is studied in a general way, in case of general survey. Without any hypothesis, when general information of any population is purpose of the survey, it is called general survey. General surveys include Economic Survey of India, Survey of Banking etc. When survey is conducted with specific aspect of the community, it is called specific survey. It includes unemployment survey, health survey, survey of children for identifying malnutrition etc.
- (5) *Social or Economic Survey:* When social aspects are covered by the survey it is called social survey. Social surveys may be based on demographic characteristics of a group of people, social environment of people, people's opinion and attitudes and people's behaivour and activities etc. Economic aspects are involved in economic surveys. Economic surveys may include the aspects like economic condition of people, working of economic units and operations of an economic system etc.
- (6) Official and Non-official Survey: Government can conduct official surveys for policy prescription and intervention or welfare purposes. When surveys are done without any help from government, which are done by individuals or organizations. Such surveys are called non-official surveys.

- (7) *Personal or Postal Survey:* When the surveyor personally collect the information from respondents, it s personal survey. If surveyor gets information through post, it is postal survey.
- (8) Primary or Secondary Survey: When surveyor himself starts work on particular subject and personal collects data, it is primary survey. When surveyor does not collect data on his own, instead he depends on the work which is already done by somebody else, it is called secondary survey.

1.2.9.4 Merits of Survey Method

There are some advantages of survey method which are as follows:

- (1) *Versatility:* Survey method is the only practical way to collect various types of information such as personal characteristics, socio-economic data, attitude, opinion, experiences and expectations etc.
- (2) *Thorough study:* Survey method enables to study the problem thoroughly and deeply in all aspects. By this method, causes of the problems also can be studied. Remedies can be used to find solution to the problem.
- (3) *Generalization:* Survey method provides drawing generalization about even large population on the basis of sample studied.
- (4) *Useful or policy prescription:* Survey method is very useful for administrators and policymakers. Many states have taken legislative measure as a result of findings of social surveys.
- (5) *Flexibility in method of collection:* This method is flexible to use of various methods of collecting data.
- (6) Finding out unknown facts: Social surveys are able to find out unknown facts. In every society, there are certain hidden problems which do not come to light and hence not known to society. A survey reveals these facts and once these are focused new theories are expounded.
- (7) *Verifying theories:* Survey is useful instrument for verifying theories.

1.2.9.5 Demerits of Survey Method

Social surveys are really time consuming and also costly. So those should be conducted with care and conscious. Survey method has certain limitations/ demerits.

- (1) *Time consuming:* Survey method is very time consuming. Sufficient time is required to spend to complete survey.
- (2) *Feasibility of data:* Survey method primarily collects data from primary sources such as individuals, households or institutions. Its feasibility depends upon willingness and cooperation of the respondents.
- (3) *Costly:* Survey method has limitation of human and economic resources. Heavy funds are needed for getting every survey conducted. Manpower is another problem of survey. It is required in the form of trained investigators, field workers etc. Administrative and field staff is required for survey method hence it is costly method.
- (4) *Sampling Error:* When sample survey method is adopted, it is subject to sampling error. It is subject to sampling error. Its findings must be interpreted with considering the probable implications of these errors.
- (5) *Response Errors:* Survey method depends on verbal responses. At the time, the respondent can give untrue or misleading answers. It is not possible all the times to identify them. Hence, survey method is subject to response error. There is no mechanism to verify the data.
- (6) *Not deep study:* It is blamed that survey touches only the surface of the research field and does not make deeper study.
- (7) *Unsuitable for past problem:* Survey method can be used only for current problem. Problems in the past cannot be explored by this method.

1.2.10 Historical Method:

When the researcher wants to investigate events and phenomenon in the past, the historical method is adopted on the basis of historical documents and evidences.

A. N. Whitehead, a logician once said that "each emerging is perceived as containing within itself all its past and seeds of its future".

Historical study is a study of past records and other information sources with a view to reconstructing the origin and development of an institution or a movement or a system and discovering the trends in the past. Historical method is described as "the induction of principles through research into the past and social forces which have shaped the present".



1.2.11 Experimental Method:

If researcher wants to assess the effect of independent variable on dependent variable by artificially controlling the effect of rest of the variables.

For e.g.- Crop yield per hectare is dependent variable and the factors such as soil fertility, irrigation, quality of seed and cultural practices which influences the yield are independent variables.

Check your progress-5:

(A) Fill in the blanks:

- (a) Fredric Le Play (1806-1882) firstly used this method in studying......
- (b) Burges termed the case study method as
- (c) According to P. V. Young, is a method of exposing and analyzing the life of a social unit.
- (d) Each and every unit of population is investigated in
- (e) The information required on regular nature, the survey is suitable
- (B) State whether the following statement is true or false
 - (a) When survey is conducted after regular interval, it is called regular survey.
 - (b) Government does not conduct official surveys for policy prescription and intervention or welfare purposes.
 - (c) Case study method makes qualitative analysis of characteristics of a unit under study.

1.3 Summary:

Human being is benefited by the research undertaken in various subjects. This unit covered the meaning and objectives of research; the research in Commerce and Management; types of research; review of literature; research process; and the methods of research. This unit also includes the meaning, advantages and disadvantages of case study method and survey method. The objectives of research are creating knowledge, describing characteristics, diagnosis of problem, testing relationship and welfare objective. The research in commerce and management is constantly done for effective and actionable decision-making. There are different
areas of business research which include human resource management and organizational behaviour, marketing management, financial management and accounting, operations and production management and supply chain management and entrepreneurship and business models etc. There are different type of research which may be pure research, basic research, applied research, descriptive research, analytical research, quantitative research and qualitative research etc.

Review of literature is systematic process of reviewing scholarly written sources like books and research papers/articles published in journals etc. in the context of a particular research problem. With different purposes it is done which may include (a) to gain subject insight, (b) to be familiar with concepts relating to research problem, (c) to identify potential relationship between the variables, (d) to formulate hypothesis, (e) to identify methodology appropriate to research problem, (f) to check utility of data sources used by other researchers and (g) to learn how others have written their reports. The research process consists of steps such as (a) defining the research problem, (b) review of literature, (c) developing the hypothesis, (d) formulating the research design, (e) determining sample design, (f) data collection, (g) data analysis, (h) testing of hypothesis, (i) interpretation and (j) preparing research report.

There are methods of research such as case study method, survey method, historical method and experimental method etc. A case study is an in-depth comprehensive study of a person, a social group, an episode, a process, a situation, a programme, a community, an institution or any other social unit. Survey is the research method which is overlooking the phenomenon. It is common method of diagnosing and solving social problem. It is useful for method of social investigation which is confined to particular area. Under this method, data may be collected through observation, mailing questionnaire or interviewing. This is the method of gathering data from respondents thought to be representative of some population. Historical study is a study of past records and other information sources with a view to reconstructing the origin and development of an institution or a movement or a system and discovering the trends in the past. If researcher wants to assess the effect of independent variable on dependent variable by artificially controlling the effect of rest of the variables, it is experimental research.

1.4 Terms to Remember:

- 1. **Research:** Research is the systematic method of discovering the new facts or verifying the old facts, their sequences, inter-relationship, causal explanations and the natural laws which govern them.'
- 2. Pure or Basic Research: Pure research is also called as basic research or fundamental research. Fundamental research may include (a) the research deals with natural phenomenon and (b) the research related to human behavior make generalization.
- **3. Applied Research:** Applied research is the research which is to find out a solution for practical problem which is being faced by society or business etc.
- 4. **Descriptive Research:** Descriptive research is nothing but surveys and fact-finding enquiries which aims at description of the state of affairs.
- 5. Analytical Research: Analytical research is the research when the researcher uses facts and information already available and makes critical evaluation of the material.
- 6. **Review of Literature:** Review of literature is a systematic process of reviewing scholarly written sources like books and research papers/articles published in journals etc. in the context of a particular research problem.
- 7. Case Study Method: A case study is an in-depth comprehensive study of a person, a social group, an episode, a process, a situation, a programme, a community, an institution or any other social unit. Case study is the method which aims at studying deeply and thoroughly different aspects of a social unit. Case study method is a careful and complete observation of a social unit.
- 8. Survey Method: Survey is the research method which is overlooking the phenomenon. It is common method of diagnosing and solving social problem. It is useful for method of social investigation which is confined to particular area. Under this method, data may be collected through observation, mailing questionnaire or interviewing.
- **9. Historical Method:** Historical study is a study of past records and other information sources with a view to reconstructing the origin and development of an institution or a movement or a system and discovering the trends in the past.

10. Experimental Method: If researcher wants to assess the effect of independent variable on dependent variable by artificially controlling the effect of rest of the variables, it is an experimental research.

1.5 Answers to Check your progress

Answers to Check your progress:

Check your progress-1:

- (A) (a) Research, (b) systematic and (c) valid
- (B) (a) True and (b) False

Check your progress-2:

(A) Answer: (a) False, (b) True, (c) False, (d) True and (e) True.

Check your progress-3:

- (A) Answers- (a) True, (b) True and (c) True
- (B) Answers- (1)- (d) and (2)- (b)

Check your progress-4:

- (A) Answer- (a) Review of literature, (b) review of literature and (c) research process
- (B) Answer- (1) (b) and (2) (d)

Check your progress-5:

- (A) Answer- (a) family budgets, (b) "the social microscope", (c) case study, (d) census survey and (e) regular
- (B) (a) True, (b) False and (c) True

1.6 Exercise:

- 1. What is research? Describe the objectives of research.
- 2. Explain the types of research.
- 3. Explain the review of literature, in detail.
- 4. What is case study method? Describe its merits and demerits.
- 5. What is survey method? Describe its merits and demerits.



- 6. Write short notes:
 - (a) Pure research
 - (b) Historical research method
 - (c) Research process
 - (d) Experimental research method
 - (e) Descriptive research

1.7 Reference for further study:

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Research Design

2.1 Objective

After studying this Unit you will be able to:

- 1. Understand designing research protocol for research problem, the concept and types of hypothesis.
- 2. Prepare research design.
- 3. Explain types of research designs, types of hypothesis and types of sampling.
- 4. Understand the sampling design and types of sampling methods.
- 5. Find relationship between research question, hypothesis and objectives.
- 6. Explain the process of formulation of hypotheses and do it in actual practice.

2.2 Introduction

Previous chapter narrates the basic concepts of research. We have studied the definition of research and various objectives behind research. Research is purely a science hence; it flows through scientific process from formulation of research problem, finding the possible solution to the problem under study and designing the implementation of the solution to achieve objectives. In commerce and management, dealing with various business problems, we adopt different research techniques and research methods. Survey method and case study method are popularly used, which has been discussed in sufficient length in the previous chapter. Manager and entrepreneur is a decision maker and for taking decisions he needs data. Since the management decisions are rational decisions and not impulse, the decisions have to take on the basis of data. The data would be available with the organization and if the data is not available then it needs to be collected. At this instance of collecting needed data, the research plays role.

This chapter is a step ahead to previous chapter and discusses research designs to be adopted to resolve problems before management by collection and analysis of relevant data.

2.3 Presentation of Subject Matter.

Section – 1

Research design is a blue print, a comprehensive and detailed document which facilitates research in systematic and scientific manner. The document is a detailed plan which answers every question arouses regarding research problem under study. Unlike while building a home one has a detailed plan on a paper (often called as blue print) and the home is build accordingly likewise the research design is a document carries every details of conduct of research which drives towards a plausible, applicable solution of a problem under study. The outcome of research always helps managers in decision making with substantial evidences of facts. See in our day to day life the activities we undertake we have planning. For a day away from home to picnic or trekking we have planning on a piece of paper, here we are taking of research which is expected to resolve a problem or help in decision making to undertake few future strategies. The document research design is also termed as research protocol.

Let's understand the definition of research design.

2.3.1 Definition of Research Design:

Various authors have defined the concept research design, few definitions are mentioned below.

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 (Kothari & Garg, 2015)

"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". – (Selitiz, 1965)

"A Research Design is a master plan specifying the methods and procedures for collecting and analysis the needed information." (Zikmund, 2008)

"The planned sequence of the entire process involved in conducting a research study." Prof. Miller

"The design results from controlling general scientific model into varied research procedure." (Young, 1939)

"A research design provides the framework to be used as a guide in collecting and analyzing data."

"A research design is a logical and systematic planning and it helps directing a piece of research." (Nargundkar, 2008)

From the above definitions we learn that

a. It is a systematic plan

- b. It directs the entire research activity towards a specific point.
- c. It provides a framework to researcher to act within
- d. It specifies methods and procedures to conduct research
- e. It laid down condition of collection and analysis of data.

In short, research design is systematic plan to find out the answer for a research question under study. The research design mainly has six components as depicted in the following figure.

Figure 1: Components of research design.

Invariably research design is expected to answer following WH questions.

What : What is the research problem under study?. What hypothesis put to test ? and what are objectives of the study? .

Why : Why the study has been undertaken? What is the importance of study? In what way and to whom the studey is going to be benefited?

Which: Which data and findings to be consider for building suggestions/prescriptions and building models to solve the research problem.

Whom: Sampling design. Whom to approach to get the variabels, to get the data? The experts and the samples.

When: When to conduct the study? Period of conduct of study.

How: Statistical Design. Operational Design. Observational Design. How to implement the research design? this talks about implementation plan, opertional plan. How to investigate? How to collect the data? How to analyse the data?

Source: (Composed by author)

While undertaking any research project students have to have above questions in the mind to answer. The thought process should revolve around these questions. This habit of thinking often around the questions would help to come out with quality research and quality project.

The question 'what?' answers the major issue that what researcher/student wants to do. The research problem is a set of questions to be answers. The answers to the question we do not know and need to find out with conducting research. The question 'what?' also set the hypothesis to test and laid down objectives of the study. Researcher gets the specific point to attain from answering this question 'what?'

Now why to conduct this research? or why to undertake this research? The answer to this question narrates importance of research. And whom the research is going to be benefited? It means the number of stakeholders going to be benefited because of this research. And in what way the stakeholders are going to be benefited? The answer to why details the importance of research.

Which data and findings to be considered for building suggestions or prescriptions is answered by question which? Researcher collects the data on which the analysis of data is done. Analysis leads to some findings and findings leads to suggestions. The decision of appropriate scales, decision on acute variables to measure what we want to measure is important. Appropriateness of selection of variables and measurement scales only would help appropriate analysis and drawing findings.

Research design also narrates the period a study to be undertaken in detail. The studies in social sciences have time value. The social sciencing may leads to different opinions as per the change in time. For instance the workers may have a certain opinion at the time economy going well towards their emoluments and facilities receive by employer. The same workers may have different opinion on the same issue when the economy is in recession. The research work in financial management, stock market prices of shares, economics which are always time related. So the decision of when the research is to be undertaken or at what time frame the research has undertaken carries apex importance.

The next question while preparing research design to ask is how to conduct the research. This question gathers the procedural stages of research design.

Every research design especially in social sciences has four important aspects as,

- 1. Sampling design
- 2. Observational design
- 3. Statistical design and
- 4. Operational design

Sampling design talks about the population, sampling unit, and overall sampling frame. Whom researcher is going to approach and ask for the information, data or opinion? How many individuals or organizations to approach are also decided in sampling design i.e. number of samples to be approached. The detailed discussion of sampling is done in the last section of this chapter only.

Observational design specifies conditions to observe, what to observe and note down. The observational design is more relevant to qualitative studies. But even in quantitative studies few qualitative observations plays role. For example, while studying labour welfare facilities in a factory it if often needs not to ask about availability of pure drinking water facilities, fire extinguisher, sufficient light arrangements and ventilation and the like. These aspects merely can be observed by researcher and utilized for data analysis. There are many aspects in quantitative research as well which instead asking needs to be observed and utilized during data analysis. A few research reports carry general observations or general findings. The general observations and findings are mentioned are the outcome of observational design.

Statistical design decides on processing and analytical tools of be applied on collected data. Various statistical tools are available viz. measures of central tendency, measures of dispersion, correction, regression and so. The very purpose of teaching these statistical tools to students is to make use of the same for better analysis of data and drawing meaning out of the analysis. The analysis, which is to be used for decision making. It is expected that students should practice using this in the project report and make project enriched. At the time of research design researcher decides on data collection and select the tools to be used for data analysis.

Operational design explains how the entire research design is to be executed. It is detailing of steps and procedure to execute the field work, data collection, data feeding and data analysis within a given resources especially time and money.

So, by this time you might have come to know how important these WH questions are.

2.3.2 Types of research designs:

There exist two basic research designs one is fundamental research also known as ideal or basic research and second is applied research also known as practical research.

Fundamental research meant to bring afloat the new facts which has not yet discovered by any one. The detailing of these facts and further probing into its relations with variables is basic task of fundamental research. Fundamental research is a continuous process since there are many unexplored things in the nature and even many unexplored facts about human behavior as such. So till the existence of universe the fundamental research is warranted. We have very eminent research institute dealing fundamental research, which is pride of India that is Tata Institute of Fundamental Research, Mumbai. (TIFR) are basically into basic science, technology and computers. Whereas applied research addresses real life problem. The

knowledge contributed by fundamental research is bringing in use to resolve real life problems.

Besides these two basic research designs we have following four research design to study.



Source: (figure composed by Authors)

Research designs mentioned above has a logical sequence.

To suffice newly evolved want, to answer newly evolved questions and to find out solutions to newly evolved problems, exploration is warranted.

The outcome of exploratory research is particularly in social sciences is the categories and variables which influenced human behavior in different capacities. The different capacities mean, human as a social animal and human as a customer. These Variables out of exploration are enough to describe population using descriptive research and establishment of relationships is done using diagnostic research design. The outcomes of diagnostic research are tested over a period of time in different circumstances. This is to generalize outcomes to the population. This is

done using experimental research design. Successful experimentation is then generalized to population as a solution to problem defined in exploratory research design. A cycle of proposing solution to a problem hence, begins at exploration and end up with experimentation.

1. Exploratory Research Design

Very meaning of exploration reveals to bring a float altogether new thing.

Exploratory research design is used to find the solution for new problems. Definitions of exploratory research designs are,

Exploratory Research Design refers to, "Formulating a problem for more precise investigation or of developing the working hypothesis from an operational point of view." – (Kothari & Garg, 2015)

Exploratory Research Design refers to, "Conducted as a preliminary step to clarify and define the nature of a problem."- (G., 2013; Zikmund, 2008)

"A Flexible design which must provide opportunity for considering different aspects of the problems." –B.D.Kulkarni, D. (1996)

"It is systematic scientific and at times the only when through which a social scientists can check whether an idea, that sounds promising to him, has much appeal in reality or not." –Hasouneh, A. B. (2003)

Exploratory research manifest with something new in the domain knowledge. The exploration facilitates further thinking in different perspective. It may also facilitate the discussions and debates which are well explained and tested using descriptive research design.

Exploratory research design is very flexible because, it is very difficult to predict the time exploration would require and also difficult to limit the resources it requires. No one can guarantee of results out of exploratory research. We have heard Edison tried numerous to illuminate electrical bulb and he quote, "I have not **failed**. I've just found 10,000 ways that won't work." Research scholar registered for degree does not deal with exploratory research since it is not sure when the research will complete? whether it will complete or not?

For example we have to develop a model depicting green buying behavior. That is a model depicts behavior of consumers towards purchasing the environment friendly products/green products or we can say the products produced without hearting the environment. Now a day we are talking about sustainable businesses. And the sustainable businesses include care for an environment. Like organic vegetables, fruits etc. Now for the development of such models research need to find out the input variables, process variables i.e. buyers thinking process and output variables. Since every individual has their own thinking process and the behavior to reflect towards such products. Hence the study needs to probe into the psychological variables to construct the model. Since the model building involve psychological variables which are by nature very complex to understand. The mere development of theoretical model does not suffice purpose but the step ahead the model needs to put to test as well for its implementation. The successful testing of model gives inputs to the businesses dealing in green product.

Such studies which are not much addressed by researcher needs exploration and these are need to be addressed using exploratory research design.

2. Descriptive Research Design

Outcomes of exploratory research design are the inputs to the descriptive research design which facilitates to check the scenario of variables manifested from exploratory study within the existing population.

Descriptive research design answers the question, what it is about. And it does not probe into the reasons behind the population scenario towards defined variables.

Definitions of descriptive research design are,

Descriptive Research Design refers to, "Which are concerned with describing the characteristics of a particular individual or of a group."- *Garg*, *C. R. (2014)*

"The Descriptive research designs enable researcher to describe or present pictures of a phenomenon or phenomena under investigation." –Hasouneh, A. B. (2003)

"The true beginning of scientific activity consists...describing phenomena and (Only) then in proceeding to group, clarify and correlate them..." –Bhandarkar, W. &. (1992).

Features of descriptive research design are,

- Descriptive research design meant to explain the population features with respect to phenomena under study. What it is?
- · It has resource constraints especially time and money
- The design is rigid and does not allow many changes
- It brings in use descriptive statistical tools.

For example a study of investment pattern of people. Now this study studies merely the investment made by samples under study drawn from a specific defined population in different investment avenues. The study further may narrate the association of demographic profile with the investment made, such as, inclination of male and female samples towards investment. Or the inclination of different socio economic class towards investment in different avenues and the like. This study only describes the population under study about the investment pattern. The study does not necessarily explain the reasons behind the same.

3. Diagnostic Research Design

Variables well defined in descriptive research design are taken to find out its interrelations, dependability with gamut of variables and the like. The design used to seek some sort of solution to the problem observed and under study. It purposefully establishes the relationships between variables to find out the extent of different variables are contributing to the existing problem and the like.

Definitions of research designs are,

Diagnostic Research Design refers to, "Determining the frequency with which something occurs or its association with something else." –*Garg*, C. R. (2014)

Diagnostic Research Design refers to, "Discovering what is happening, why is it happening and what can be done about." – *M.Ranganatham, D. O. (2005)*

"It is the most typical and simple problem solving strategy of the helper faced with problems and crises on the job." –B.D.Kulkarni, (1996)

"It may be concerned with discovering and testing whether certain variables are associated." –Bhandarkar, W. &. (1992)

"Diagnostic Research Design refers to scientific differentiation among various conditions or phenomena for the purpose of accurately classifying these conditions."

- Hasouneh, A. B. (2003)

Above definitions concludes that diagnostic research design is used for problem solving using different inferential statistical tools.

Now for example continuing with the case we have seen above about study of investment pattern. If researcher studies the determinants of investment pattern then it requires diagnostic research design. Here researcher is finding the variables which are influencing the decisions behind investment and the investment in a specific investment avenue. The outcome of diagnostic research design could be a model for example regression model and the like. For a defined population under study we can state that the defined variables determine the investment in shares, mutual funds, bank FD etc. which ultimately help decision maker to decide upon the segment to target and focus advertising efforts.

4. Experimental Research Design

Experimentations are a base in physical sciences like chemistry, physics, botany and the like. In social sciences especially experimentations are now widely used to find out behavior of human being. In management human beings are considered as a customer, consumer, employees, middlemen and the like. Studying behaviour of such human being under different circumstances is of use in decision making. Hence, management practitioners and researchers are using experimental research design.

For example, if a marketer shows a model of particular product which helps in the safeguard of your house and property in house like gold, silver and cash in your home. Looking towards the model which cost Rs. 2000/- and not more if marketer ask you being a sample, that after launching this product would you buy this? Almost 90% of samples would reply Yes!! they would buy it. When the product actually get launched in the market the sales does not turn out to 90% of targeted segment. Now the question is why it is so? It is because the circumstances marketer ask about possible purchase was different that the circumstances of actual purchase.

Say if I ask your opinion on a transaction happened with you, that on a retail counter you bought a product and paid the amount. Say a product priced Rs. 160/you gave Rs. 200/- in return you get Rs. 50/- instead of Rs. 40/- what would you do? The general answer I will receive is rather almost all would reply that I will bring to the notice this fact and return Rs. 50/- for Rs. 40/- right? If it actually happens with you, what would be the scenario? The scenario would be different. Isn't it? So the point here is there is likely to be difference in opinion and actual act. What is more reliable for researcher to know is actual act. And measurement of actual act is at the core of experimental research.

Experimental research design necessarily follows a hypothesis and seeks relationship between two or more variables.

"More than a hundred ways of conducting such experiments and each these may be termed as a experimental design." -Donald Cambell & Julian Stanley

"Experimental research is designed to assess the effects of a particular variables on a phenomenon by keeping the other variables constant or controlled." – M.Ranganatham, D. O. (2005)

"In Experimental Design the researcher can often exert a great deal of control over extraneous variables and thus ensure that the stimuli in the experimental conditions are similar." – Hasouneh, A. B. (2003)

"Experimental method means those methods wherein researcher tests hypothesis of casual relationship between variables." B.D.Kulkarni, D. (1996)

Experimental research design follows three basic principles

One is principle of randomization – it refers to selection of samples strictly on random basis to avoid possible biases.

Second is principle of replication – this means that experimentation should be repeated more times. This may bring afloat extraneous variables which has impact on results in experimentation.

Third principal is principal of local control- this refers to allow the indulgence of extraneous variables to play role in experimentation. This would allow researcher to know about extraneous variables which cause variability in measurement. Extraneous variables then are studies for its inclusion in experimentation to minimize experimental error.

The best example of experimental research design is Hawthorne experiment which details the illumination effect on the productivity of employee. In experimentation a single variable or set of variables play role of which the impact is measure. Necessarily in experimentation there likely to be two groups one is control group and second is experimental group. Say to test the effect of newly develop tablet which increases iron/calcium content in the body. One group of people can be given these tablets for a week and the changes into the iron/calcium content in the body are measures. This can be measured and analyzed in two ways. One is take the count before experiment i.e. giving the tablets and compare it with the post tablet consumption count. Second way it takes the count of iron/calcium of samples in control group and compare the count it with the people in experimental group who have consumed the tablet for a defined period.

In social sciences also we can have such experimentations. The English aptitude of entire class can be measured first. Then for half of the class a special coaching can be provided in an effort to increase the English aptitude. The students can be selected using random sampling technique to avoid biasness. After completion of coaching of a defined period. Again the English aptitude for the entire class can be measures. The scores of students attending the coaching and the students who were not the part of such coaching can be compared. This testing will tell the impact of English coaching efforts. If significant difference found then it can be said that the coaching has leads to improve the aptitude of participants in the coaching class.

2.3.3 Features of Good Design

- 1. Reliability of data –good research design has more reliability of data collected. Reliability refers to correctness of opinions collected from samples.
- 2. Experimental error –repetitive execution of research design in different context if gives same results or similar results then it is considered to have less experimental error and treated to be a good research design.
- 3. Information yields researchers requires more data and information to test hypothesis and suffice objectives effectively. The design which yields more data and information with shallow instrument termed to be a good research design.
- 4. Flexibility it means the design should be able to consider many different aspects of a problem under study.
- 5. Economical –research design which consumes less resources especially money and time and provides maximum utility is considered to be economical research design.

Besides above mentioned points of features of good research design. Every practical research has sampling design, statistical design, observational design and operational design as their important components.

Invariably post graduate students at M.Com. MBA, PGDM program needs to undergo summer implant training. The research design mostly bring in use is descriptive research design and in rare cases diagnostic research design bring in use. Since the summer project has to be completed within some 50 to 60 days it is difficult to handle exploratory or experimental research design. The research protocol template given below is suitable to descriptive and diagnostic research design provides general guidelines and layout of points to be covered in research design document. These points constitute the research design as well the same points constitute the chapter titled, 'Research Methodology' in the project report. Few of the points are exceptions at the M.Com. and MBA level viz. hypothesis and pilot testing. If any student is setting hypotheses to test and also conducting pilot testing then it is more appreciating work.

After finalizing the organization to work in for summer in-plant training, student has to decide on the research problem to be taken for study in consultation with project guide allotted to you and industry expert. In line with research problem follow the points given in the template below, student has to prepare a research proposal/project proposal. After finalization of research proposal/research protocol only the study has to be initiated.

How to Write a Research Protocol?

Research protocol is a document which describes scientific planning to conduct research. It is a blue print of research that directs researcher at every stage of research voyage. It talks about, what is the problem chosen for research? Where from the problem arises i.e. Source of research problem with support of a review, how the research problem is to be addressed i.e. methodology.

Contents of Research Protocol

Cover page: Contains title of the research, investigator's name and other details, affiliation, details of supervisor and the like.

Title to the Study:

It is short but inclusive, conveys the gist of research under study using technical

details mentioned in the scope of the study. It should give overall idea of research problem under study.

1. Introduction:

Explain in detail the background and context of research issues under consideration.

2. Social or Management Problem:

Here discuss the research problem in detail with the support of literature review. The crux of literature review should be supported in the discussion. On the basis of context and review of literature list down number of questions which are unanswered and still to be addressed to using research for scientific output. The outputs that can be generalize to the population. The entire discussion should pave the way towards finding research gap.

3. Statement of Research Problem:

From amongst the series of questions rose above in social or management problem **grouping on questions on the basis of similarity.** Prioritize these groups of questions. On the backdrop of resources available select an appropriate group of questions for research. Write the justification of selection and depict its importance. The detailing ends with title of research and justification of its suitability.

4. Hypothesis of the Study:

Hypothesis is **answer to the research question(s)** taken for study. Answer to the select category of research question(s) stated above in statement of research problem that are put to test.

5. Objectives of the Study:

These objectives are derived from hypothesis. Statements direct towards collection of data.

6. Scope of the Study:

Need to specify what geography to cover and taken for sampling? (Geographical scope) Which concepts the study revolves around? Are any new concepts under study? (Conceptual scope) Which analytical tools to be used for data analysis and testing of hypothesis? (Analytical scope) What period is to be considered for data collection (Historical/periodic scope) especially applicable to secondary source data?

Specific gender focused by research (Biological scope). Scope determines the context of application of research outcome.

7. Importance of the Study:

Specify for whom? and to what extent the study is important to society, industry, organization (s), government and stakeholders. What are the possible outcomes of the study?

8. Research Methodology:

8.1. Research Design: Need to specify the research design adopted either, an Exploratory, descriptive, diagnostic or experimental.

8.2. Data Required: a list of data points require to test hypothesis and to suffice objectives is to be specified in details.

8.3. Data Sources: From a data list mentioned above few data points are to be gathered using secondary data sources and few are to be collected using primary data sources. Mention bifurcated list of data points to be sourced under heading primary data source and secondary data source clearly.

8.4. Instrument: Detailed description of data collection instrument used (questionnaire or schedule or observation sheet). Mention nature of schedule i.e. structured/unstructured, codified/non codified, closed ended/open ended. If instrument is structured then what are the structures and their titles. Which questions/variables every structure carries and how it is to be measured. Which scales are used dichotomous, interval scales (Five point likert type scale, seven point scale), ratio scales or mix of it? Open ended, close ended or mix of it.

8.5. Sampling: A justified description of nature of universe and population, probability/non probability method used for selection of samples, size of samples, sampling unit(s), statistical technique used for calculation of sample size, justification for the **representativeness and adequacy of samples**.

8.6. Data Analysis: Details of scheme of data analysis. Statistical tools to be used for data analysis. The descriptive statistical tools, inferential tools and statistics used for hypothesis testing. Any special tools used for model building viz. regression analysis, discriminant analysis, structural equation modeling and the like. Planning on scheme of data presentation. into consideration by researcher.

8.7. Concepts Used: Detailing of concepts around which the research revolves. The new defined concepts or the concepts defined by researcher that formulates base for study. Or the concepts taken.

8.8. Pilot Testing: Planning of pilot testing or testings in case of series of pilots. Samples to be handled, reliability and validity analysis. Hypothesis testing. Statistical tools to be applied to pilot testing.

9. Organization of Research Report:

Narration on the articulation of report after completion with the help of different chapters. The description of chapter contents to be given.

Description of Annexure:

Bibliography/References: APA, MLA, Harward style.

Annexure: Planning of list to be enclosed in the support to main report.

Time Table: Detailed plan of action coupled with time frame. It is to be prepared in table format and carries four columns viz. serial number as first column, second column is period, third column is description of planned work corresponding to period and fourth column is remark/corrections/follow-up.

The documents ends with, Signature with name of research scholar and Signature with name of research supervisor. It also carries the place and date where the document is signed.

Since the research protocol is a planning it is to be written in future tense and after execution of same, the actual detailed implementation is to be written in present tense as initial chapter of research report which is generally titled as, 'Research Methodology' or Introduction to the Study'.

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2.4 Check your progress - 1

Objective Type Questions

-				
1.	1. The document research design is also termed as			
	a) Research Protocol	b) Hypothesis		
	c) Sampling	d) None of the above		
2.	A Research design is			
	a) It is a systematic plan			
	b) It specifies methods and procedures to conduct research			
	c) It laid down condition of collection and analysis of data.			
	d) All the above			
3.	3. The question when in research design sought the answer for.			
	a) Statistical design	b) Period of conduct of study		
	c) Sampling design	d) None of the above		
4.	Statistical design decides on the			
	a) Implementation of research design			
	b) Processing and Analysis of data			
	c) Conditions of observe			
	d) All the above			
5.	The logical sequence of research designs are			
	a) Experimental – Diagnostic – Descriptive – Exploratory			
	b) Exploratory – Descriptive – Diagnostic – Experimental			
	c) Descriptive – Diagnostic – Experimental – Exploratory			
	d) Diagnostic – Descriptive – Exploratory – Experimental.			
6.	One of the important principles of experimental research design is.			
	a) Principal of observation			
	b) Principal of sampling			

- c) Principal of randomization
- d) None of the above

2.5 True of False

- 1. Research design specifies methods and procedures to conduct research
- 2. Research only talks about sampling and hypothesis
- 3. Research design is a blue print, a comprehensive and detailed document which facilitates research in systematic and scientific manner.
- 4. The question whom ? in research design sort out sampling design issues.
- 5. Descriptive research design is very flexible.
- 6. Experimental research design necessarily follows a hypothesis

2.6 Fill in the Blanks:

- 1. Outcomes of exploratory research design are the inputs to the -----research design.
- 2. Principal of randomization refers to selection of samples strictly on basis to avoid possible biases.
- 3. is a master plan specifying the methods and procedures for collecting and analysis the needed information.
- 4. talks about the population, sampling unit, and overall sampling frame.
- 5. decides on processing and analytical tools of be applied on collected data.
- 6. Fundamental research also known as research

Section -2

Hypothesis: Meaning and Types of Hypothesis, process of formulating hypothesis.

2.7 Meaning of Hypothesis:

Hypothesis is a central and focal point of any research; it is a supposition about desired results of research issues or research phenomenon under study. The research study, especially academic research centered on the hypothesis. Research begins with a problem or a question in the mind of researcher. The question arouses may be from the literature or from the observation of researcher. The answer given to the question using experience and knowledge is a statement of hypothesis. But all such answers cannot be termed as hypothesis. The answers which are trivial or but obvious are not hypothesis.

Say for eg. To a teacher if one asks where male students are intelligent or female students? Then the obvious answer to this question is female students are more intelligent than male students. Since, over a period of time it has been experienced and witnessed. And for this no research is required hence, the answer to this question is trivial statement and cannot be termed as hypothesis since it is not going to be contributed anything new into the existing theory. If a further question asked continuing with previous question that, if female are more intelligent then why male students are getting placed in the campus over female students? Now here there could be various answers to this question. One answer could be male students possess more employability skills compare to female students. Now this statement could be termed as hypothesis since, we do not have conclusive evidence to it. The evidences need to be gathered and put to test.

Hypothesis is a skeptical assumption about desire results. The answer given to a question by a person or research is correct from their perspectives. And also the person or researcher feels like that after testing their answer should hold true.

2.7.1 Definition of Hypothesis:

Various authors have defined the term hypothesis. Few of these definitions are presented here.

Hypothesis as a possible explanation of the phenomenon under observation ...

Prof. C.T.Curien.....

"A hypothesis is a conjectural statement, of the relation between two or more variables." Kerlinger

"The guesses he (researcher) makes are the hypothesis which either solve the problem or guide him for further investigation." –Werkmeister

"Hypothesis as a testable statement of a potential relationship between two and more variable." – Mc Guigan.

Term hypothesis as a "Proposition, condition or principle which is assumed, perhaps without belief, in order to draw out it's logically consequences and by this method to test its accord with facts which are known or may be determined." - Webster's new international Dictionary of English language.

"Hypothesis is an explanation held after careful canvass of known facts, in full knowledge of other explanations that have been offered and with a mind open to change of view, if the facts disclosed by the inquiry warrant a different explanation." -- Chaddock

Above definitions of hypothesis reveals that hypothesis is

- 1. A possible answer to a question.
- 2. Establishes imaginary relationship between two or more variables which needs to be tested.
- 3. A guess may be correct, if not then it will guide further to researcher.

In short hypothesis is affirmatory statement which is an answer to a research question of which the validity needs to be tested using scientific research.

2.7.2 Characteristics of Hypothesis:

In the process of stating the hypothesis students should see that the following aspects of hypothesis are taken care of.

- Conceptual clarity
- Specificity
- Testability
- Availability of techniques
- Theoretical relevance

• Consistency –Two or more propositions logically derived from the same theory must not be mutually contradictory.

eg. There is no significant difference in the skills possesses before perusing MBA and skills possess after MBA course.

See in this example there is conceptual clarity since the example talks about skills preferably managerial skills, the hypothesis is specific since it talks about skills possess before MBA and skills possess after MBA course. The hypothesis can be tested since we have a very good statistical tool i.e. paired sample't' test. The technique of testing is available, we can manually test is or even using a few available statistical software we can test it. The hypothesis has theoretical relevance since now a day's much has been talked about skills i.e. employability skills and so on. In the same fashion every hypothesis needs to be evaluated on the basis of characteristics of hypothesis.



2.7.3 Types of Hypothesis:

Source: (figure compiled by Authors)

In the parlance of research invariably there are two types of hypotheses discussed one is null hypothesis and another is alternative hypothesis.

The beauty of types of hypotheses is, the name suggest the nature of hypothesis. lets study these types of hypotheses.

Null Hypothesis: the null hypothesis is statement which describes the normal and natural position of any variable(s). It is a statement toned opposite to alternative hypothesis. For example if a government report says that the male farm worker in India receives wages of Rs. 300 per day and female farm worker receives wages of Rs. 250 per day then the null hypothesis is

 μ = Rs. 300 (for male farm worker)

 μ = Rs. 250 (for female farm worker)

Now to check the claim of government regarding the wages received by male and female worker researcher need to collect the data of wages from workers in defined area and compare it with the claim of government using some relevant statistical tool. The results so received from the calculations would decide where the claim of government is correct or otherwise.

Alternative Hypothesis: Alternative hypothesis is statement proposed by researcher. It is a statement which is an answer for a research question. This statement is necessarily affirmative statement. Researcher expect that the testing of hypothesis result in rejection of null hypothesis and acceptance of alternative hypothesis. It means the educated guess as answer for research question is correct. Continuing with example given above of farm worker wages, the alternative hypothesis is

 $\mu \neq Rs. 300$ (For male farm worker)

if, $\mu \neq \text{Rs.300}$ then it could be that $\mu > \text{Rs.300}$ or $\mu < \text{Rs. 300}$ and $\mu \neq \text{Rs. 250}$ (for Female workers) if, $\mu \neq \text{Rs. 250}$ then it could be that, $\mu > \text{Rs. 250}$ or $\mu < \text{Rs. 250}$ Now if the null hypothesis is rejected it means the alternative hypothesis is accepted. This time is to decide which of the alternative hypothesis is accepted. Since, we have three possibilities of alternatives.

Descriptive Hypothesis: The statement which describes the behavior of population under study is termed as descriptive hypothesis. eg. The electronic gadgets along with internet connectivity changed the lifestyle of rural people. Or say the savings and investment pattern of rural people differs compared to their urban counterparts. In the said examples we are only going to find out how the scenario of population is under study. We are not going to find out the reason behind it. It means we are finding the answer for a question what it is? And not why it is?

Relational Hypothesis: the relational hypothesis narrates the possible relationship between two variables and or phenomenon.

eg. More the number of management cases attempted and discussed more the possibility of quality placement.

The relational hypotheses have two sub types one is directional and another is non directional. In directional hypothesis if one variable goes up then another might go up or go down i.e. there might be positive or negative relationship between two variables.

eg. More the income more would be the savings and hence investment. This is directional hypothesis. Where the relationships have been attempted to established or check between income, savings and investment.

Now the statement girls are more intelligent than boys is a non directional statement. Since, we are talking about gender and also the intelligence. It is important in this case to decide on measurement of intelligence. How we are going to measure the intelligence, which also needs to be defined in the research design.

Correlation Hypothesis: Correlation means the relationship between two or more variables. In correlation hypothesis the words positive, negative or no correlation has been used. The claim is clearly mentioned. eg. There is positive correlation between price of commodity and supply. When price of commodity goes up supply also goes up. There is inverse relationship between price and demand. When price of commodity goes up demand falls down. The directional hypothesis and correlation hypothesis are sounding same. There is difference in the use of hypothesis sentence

construction. Since, in correlation we always use the words positive correlation, negative correlation and no correlation which is explicitly not used in directional relationship. Since this is the way the terms are defined.

Explanatory Hypothesis:

Explanatory hypotheses is one wherein the claims are made that one variable caused other to occur eg. Elderly investors prefer to invest in safer investment avenues as compare to younger investors prefer risky avenues.

Statistical Hypothesis:

One of the simplest forms of hypothesis formulation which uses population parameter to state the hypothesis in the form of numbers only. The population parameters eg. Mean, mode, median, variance, proportion etc.

eg. A company claims that there electric bulb has 3000 hours of life. Then in this case the null hypothesis is

H0: $\mu = 3000$ and alternative hypotheses are

H1: $\mu \neq 3000$

 $\mu \geq 3000$

 $\mu \leq 3000$

2.8 Process of Formulation and testing of Hypothesis:

- 1. Research issue:
- 2. Statement of research problem:
- 3. Hypothesis:
- 4. Research Protocol:
- 5. Data collection:
- 6. Select the relevant test:
- 7. Decide on level of significant, degrees of freedom and one tail or two tailed test:
- 8. Calculate the test statistics:
- 9. Decision on the basis of test statistics:

Above depicted the process of hypothesis formulation from step one to step 4 and from step 5 to step 9 are depicting hypothesis testing.

Let's study first four steps of formulating the hypothesis.

- 1. **Research issue**: Research issue is a research problem unearthing situation/event/happening which needs a solution and for which possible solutions are exist. Amongst many problems we select one problem for study. The problem leads many questions to answer. We prepare a list of questions then attempt to group the questions carrying similar tone. After grouping of these questions we prioritize these groups on the basis of attention it needed.
- 2. Statement of Research Problem: Second step of formulation of hypothesis is, select appropriate set of category of research questions or a prioritized research question from earlier step i.e. step one. While selecting question for statement of problem the evidences against questions should be located. The set of questions we select for research should be relevant and interesting. The research problem should be manageable and should have something new to find out. The set of questions we select to find out the answers with the help of systematic research helps us to decide the title of research study. The title encompasses the analytical, geographical, biological, contextual frame of the study. The title is thought short explain the central problem under study.
- 3. Hypothesis: Third step is stating the hypothesis. As discussed earlier in this chapter hypothesis is an affirmatory answer to the questions raised in step two.
- 4. Research Protocol: Then to test the hypothesis we need to develop a research protocol. The term research design and research protocol are used synonyms many a times. But research protocol is a document which is written much more in details. The steps involved in the research are narrated much in details which provide answers and guideline to every question a researcher have in his mind regarding research problem under study. This is discussed earlier. The detailed document needs to prepare which guides research student in the voyage of research.

These are the four important stages of formulation of hypothesis. Then onwards rest stages help to test the hypothesis in which development of data collection schedule appropriately including variables which are going to help the testing of hypotheses needs careful consideration. Data is collected, compiled and processed. When hypothesis is formulated it needs to be testing using appropriate statistical tools. Steps 5 to 9 details the same. The suitable data needs to be collected and entered into worksheet for further process.

Rests of the stages are elaborative discussed with the help of five step method of hypothesis testing proposed by Neave (1976)



Source: (Figure complied by Authors)

Step 1: Formulate the Practical Problem in Terms of Hypothesis:

The initial stage of hypothesis testing is formulation of hypothesis. The statement needs to be decided to put on test. The null hypothesis is put to test which is basically a standard or control with which the evidence pointing to the alternative hypothesis can be compared.

Step 2: Calculate Statistics:

The statistical calculation is undertaken in this stage. The data for testing a hypothesis has already been collected. Looking towards the scale of measurement used and number of variables to put to test needs to be considered while selecting the test statistics. The appropriate statistical tool is to be selected for example Chi-square test, 't' test and the like. While selecting the test besides scale of measurement and

number of variables processed the conditions to use the respective tests also needs to be considered.

Step 3: Choose a critical region:

Next step after selection of appropriate tool to test the hypothesis is selection of critical region to test the hypothesis. Where it is going to be tested at two tails or right tail or left tailed test. The figure below helps to understand the concept of critical region.

- Right sided, so that we reject H₀ if the test statistics is greater than or equal to some (right) critical value.,
- Left sided, so that we reject H_0 if the test statistics is less than or equal to some (left) critical value
- Both-sided so that we reject H_0 if the test statistics is either greater than or equal to right critical value or less than or equal to left critical value.



Source of figure:

https://www.google.com/search?q=right+tailed+test+left+tailed+test+two+tailed +test&source=lnms&tbm=isch&sa=X&ved=2ahUKEwiJq6rvj7DqAhWOyzgG HdF2C04Q_AUoAXoECAwQAw&biw=1366&bih=635#imgrc=GMz1W1aEWg jgGM, 03.07.2020, 8.52am. The statement of hypothesis itself directs the selection of critical region to test the hypothesis where it is going to be tested at right tail or left tail or two tailed.

The examples given in following table would help to clarity the issue of selection of critical region for testing of hypothesis.

Test	Particulars	Example	$H_0 \& H_1$
Left Tailed Test (One Tailed test)	H ₁ : parameter < value Notice the inequality points to the left.	The wages of female farm labor is less than Rs. 250/- per day.	H ₀ : $\mu = 250$ H ₁ : $\mu < 250$
Right Tailed Test (One Tailed test)	H ₁ : parameter > value Notice the inequality points to the right.	Female students studying in M.Com score more than first class.	H ₀ : $\mu = 60$ H _a : $\mu > 60$
Two Tailed Test	H_1 : parameter not equal value Another way to write not equal is < or > Notice the inequality points to both sides.	The average of a vehicle claimed by company is 20 kilometers per liter.	H ₀ : $\mu = 20$ H ₁ : $\mu \neq 20$

From above table it is very easy to understand that the words less than, more than directs the tail where hypothesis need to be tested. In the third case just plain statement has been proposed and does not make any use of words more than or less then.

Step 4: Decide the Size of Critical Region:

After deciding the tail where hypothesis is tested the next step is to decide on critical region.

The decision on deciding critical region is based on the amount of risk the research problem carries it means the degree of importance of the research problem under study. Say for example a life saving drug is under test then naturally it needs to be tested at 1% level of significance i.e. 99% level of confidence. This reveals that after successful testing if the drug is introduced in market that there is probability that out of 100 the 99 patients will have positive impact of the drug.

The levels of significance are set generally as 1%, 5% and 10%.

The confidence with which a null hypothesis is accepted or rejected depends upon the significance level u

- A significance level of 5% means that the risk of making a wrong decision is 5%.
- The researcher is likely to be wrong in accepting a false hypothesis or rejecting
- A true hypothesis in 5 out of 100 occasions.
- A significance level of 1% provides 99% confidence
- A significance level of 10% provides 90% confidence

Following figures details the two tailed test and one tailed test with its statistical critical value with which we need to compare the calculated test value for decision making to either accept or reject the null hypothesis.

Two tailed test.



One Tailed Test



The critical values of different significance level of one tailed and two tailed tests are summarized in following table.

Critical Value		Level of Significance α	
	1%	5%	10%
Two tailed test	Z = 2.58	Z = 1.96	Z = 1.645
Right tailed test	Z = 2.33	Z = 1.645	Z = 1.28
Left tailed test	Z = - 2.33	Z = - 1.645	Z = -1.28

Step 5: Conclusion: Comparison of Statistics with Significance Level:

After working out aforementioned steps now we have with us two values one is standardized critical value and another is calculated value. Applying test on the data we have calculated a values it is termed as calculated value and this value need to be computed with standardized critical value which already derived for us and generally at the end of any book on statistics these values are given. We have to make comparison of these two values to arrive at decision. The decision whether to reject the null hypothesis or otherwise is to be taken and mention clearly.

Here we need to remember one important thing that while testing the hypothesis we always test null hypothesis and also propose the description of null hypothesis testing first.

Tools used to test the hypothesis.

The quest is to select the appropriate statistical tool to test the hypothesis. Every statistical tool used to test the hypothesis has its own pre conditions regarding the data. The pre conditions are measurement scale used to collect the data, number of variables involved in hypothesis testing, normality of the data and the like. Before selection of tool for testing the pre-requisite needs to be taken care of.

Generally for the beginners it is two important dimensions needs to be taken into consideration while selecting the hypothesis testing tool. One dimension is the scale of measurement of data. The data can be measured using either of the four scales. One is nominal scale, second is ordinal scale, third is interval scale and fourth is ratio scale. Second dimension needs to be taken into consideration is how many variables are involved in testing of hypothesis. Either one variable or two variables or three variables. It is called as univariate analysis, bi-variate analysis and multivariate analysis. Now these two dimensions help to decide the appropriate statistical tool to be selected to test the hypothesis.

Following table is exemplary to explain the tools.
Testing of Hypothesis

Number of Variables	Measurement Scale Used							
processed	Univariate	Bi-Variate	Multivariate					
Nominal	Chi-Square Test K-S Test	Chi-Square Test	Chi-Square					
Ordinal	Count and %	Rank Correlation	Rank Correlation					
Interval	One Sample 't' Test	Independent sample 't' Test Paired 't' Test Regression	ANOVA Regression					
Ratio	One Sample 't' test	Independent sample 't' Test Paired 't' Test Regression	ANOVA Regression					

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Source: (compiled by Authors)

The table shows that if one variable is in process of which the data is collected using nominal scale then chi-square test is useful. Likewise if the data is measured using ratio scale and number of variables is more than two then Anova can be used. If in this case researcher wants to establish the relationship then Karl Pearson correlation coefficient followed by regression can be used.

We have very good't' test family extensively used for hypothesis testing. If the data is collected using interval and or ratio scale in any case of univariate or bivariate data appropriate test from't' test family can bring in use.

The relevant discussion of hypothesis testing is done in chapter number 4.

2.9 Check your progress - 2.

Objective Type Questions. Choose the appropriate alternative

1. The major characteristics of hypothesis is

- a. Conceptual clarity
- b. Specificity
- c. Testability
- d. All the above
- 2. The hypothesis narrates the possible relationship between two variables is termed as ...
 - a. Descriptive hypothesis
 - b. Explanatory hypothesis
 - c. Relational hypothesis
 - d. None of the above
- 3. The hypothesis stated using population parameters viz. mean, median etc. is termed as
 - a. Descriptive hypothesis
 - b. Statistical Hypothesis.
 - c. Explanatory hypothesis
 - d. Relational hypothesis
- 4. The statement of hypothesis can be tested at
 - a. Right tail
 - b. Left tail
 - c. Two tails
 - d. All the above
- 5. The critical value at 1% level of significance two tailed test is
 - a. 1.96
 - b. 2.58
 - c. -1.64
 - d. None of the above
- 6. The critical value at 5% level of significance one tailed test is

- a. 2.33
- b. 1.64
- c. 1.28
- d. None of the above

2.10 State whether the following statements are True or False.

- 1. Hypothesis is a central and focal point of any research.
- 2. Hypothesis is a skeptical assumption about desire results.
- 3. Hypothesis is a possible answer to a question.
- 4. Two or more propositions logically derived from the same theory must be mutually contradictory.
- 5. Null and alternative hypothesis are the same statements.

2.11 Fill in the Blanks.

- 1. as a possible explanation of the phenomenon under observation.
- 2. The statement of alternative hypothesis is to the null hypothesis.
- 3. Alternative hypothesis is statement proposed by
- 4. If the null hypothesis is rejected it means the hypothesis is accepted
- 5. In descriptive hypothesis the statement of hypothesis describes the behavior of

Section – 3

2.12 Sampling

Research in social sciences has a biggest quest on sampling. The major characteristic of sampling is of its representativeness of population. In physical science like chemistry, medical, physics, biology, botany and the like only one pigment, piece of material, drop of blood is enough as a sample since it represents the entire population. The principal of homogeneity plays role. Hence, testing one piece out of whole or testing one drop of blood out of entire body suffice the purpose and the results received then are applicable to the whole lot. The experimentation done on a sample gives same results on experimentation on whole lot. The subject of social science is human beings and by nature human being is heterogeneous in thoughts, attitude, behavior and personality. Hence, one person cannot represent the entire population. Even in our family the thoughts and attitudes towards one issue are different. To be more specific the thoughts and attitudes of twins does not found same at most instances. This poses challenge before research scholar of social sciences to decide on sampling frame on the magnitude of its representativeness. The majority of the results of research are based on the very reason of representativeness of sampling. In social science research we often take sampling study and the results such found from study are generalize to the population. The way sampling behaves we say the population behaves like the same. Hence, selecting the most appropriate sampling which truly represents the population is a quest. The results are entirely depending on the method adopted for selection of samples.

Various definitions of sampling are put forth by scholars few to mention here are:

2.12.1 Definition of Sampling:

The term sample should be reserved for a set of unit or portion of an aggregate and material which has been selected in the belief that it will be representative of the whole aggregates.

- Frank Yates

"A Sample may be defined as a part of population which selected and examined for estimating the quality of the population." – Sharma A. (2006)

"A Sample is a collection of observations representing only a portion of the population." Lapin L. L. (1973).

"A sample as the name implies is smaller representative of a larger whole." - William J.George and Paul K. Hatt

"A statistical method is a miniature picture or cross section of the entire group or aggregate from which the sample" (Young, 1939)

Understanding sampling requires understanding few related concepts as

1. Universe: Universe is the maximum possible source of information. Say for example researcher wish to assess opinions on changes in the university examination system from the heads of the higher educational institute i.e. principals of HEI affiliated to Shivaji University, Kolhapur. Now the question is

what is the universe of study? Universe of study is number of colleges affiliated to Shivaji University, Kolhapur i.e. 293. So the universe is 293 principals.

2. Population: Population consists of whole set of data or information from the entire universe which is considered to be the whole source of information. The example we are studying in this case not all the colleges have appointed Principals then in this case the number of available Principals is the population. See that is the difference between universe and population.

The population is of two types one is finite population and second is infinite population. Finite population where in one can count the size of information source. If the information source is students, workers, housewife's etc. then one can count these information sources and even prepare a list of the sources. Whereas infinite population refer to information sources which cannot be counted. For example how many consumers in Kolhapur, Sangli and Satara like to consume beverages or Pizza. Virtually the entire data sources are finite only but sometimes counting a few data sources is difficult hence they are treated as infinite. We can count how many consumers in these three districts consume beverages then it is not impossible but difficult since we needs to apply different kind of methodology and would also consume much resources. The type of population i.e. finite and infinite determines the type of sampling method to select the samples.

3. Sampling frame: Sampling frame is a defined part of a population. This is a final list of sources of information finalized by researcher from which a few samples are going to pick up for study. For example out of 293 colleges only 193 colleges found to have principal appointed then the population for the study is 193. Then looking towards the issue/problem under study we finalized the list of principles to be considered for study, say principal having a particular experience, principal as per gender, principles working in single faculty college or multi faculty colleges and so on. The final list of principles would be prepared and then from the list applying appropriate statistical technique the number of samples get finalized.



Source: (Figure developed by Authors)

One very important characteristics of sample students have to remember is, samples must be representative of population. This is very difficult in case of social sciences. Hence one person's opinion cannot be considered as the opinion of population. Likewise one student's response towards quality of teaching in a particular college cannot be considered as the opinion of entire class.

Statistically capital letter 'N' is denoted to know the population and small letter 'n' is denoted to know sample.

2.12.3 Types of Sampling:

Following diagram narrates the different types of sampling.

Entire types of sampling are classified into two groups one is random sampling also called as probability sampling and another is non random sampling also called as non probability sampling.



Source: (figure composed by authors)

Random Sampling: (Probability Sampling):

Random sampling is one where every sample in the population has equal opportunity or chance to participate as a sample in the study.

Say in a class of 60 students, teacher wish to take feedback on the understanding of a topic delivered. Applying random sampling every student has equal chance to be selected as sample to provide feedback on. If teacher asks to specific students pointing out or students seating at first bench then it is not termed as random sampling. Since here few specific students only have pointed out and others have not given an opportunity to be a part of feedback. The random sampling generally has less sampling errors as compared to non random sampling.

Simple Random Sampling: This sampling method to select the sample in which out of the total population researcher select the number of samples by providing equal opportunity to every sample. The simple method to select such samples is lottery method. Say you have to select 10 people from a group of 30. Just make 30 chits

naming individual in every chit, put those chits in a box, mix it well and blindly take 10 chits out of the box. Make a list of those 10 names they are your samples. In case of large size of population using Ms-Excel also the random numbers are generated and out of list of population the computer generated sample numbers is to be termed as samples for the study.

Stratified Random Sampling: when the population is large and moreover heterogeneous in that case for getting good and representative results. The population is groups on the basis of some variables to make it homogeneous. The number of homogeneous groups is called as stratum. From every stratum using simple random sampling mentioned above the samples are selected and taken for study are termed as stratified ransom sampling. There are two methods into stratified random sampling. One is proportionate stratified sampling and disproportionate sampling. In proportionate stratified sampling is selected in the ratio of population of group. And in disproportionate sampling the samples are taken without considering the size of stratum.

For example few studies need to understand the opinions on the basis of gender differences. In such case when we classify the samples in two groups of gender i.e. male samples and female samples and then we take appropriate size of samples using random sampling method then this is stratified random sampling since the samples are classified into two stratums i.e. male and female. Likewise few studies demand stratification of companies on the basis of their constitution i.e. public limited companies, private limited companies, partnership firms, proprietary firms, cooperative firms and the like.

Systematic Sampling: the first unit is drawn at random from the selected class interval and the remaining units are systematically and purposively drawn. eg. The size of the population (N) is 500, and the size of the sample (n) is 50; then the proportion of the sample would be (N/n=10) 1:10. The first unit may be chosen at random from the first interval i.e. 1-10. Suppose the first unit drawn is 5, then the second would then be 5+10=15(5+K), where K stands for N/n; the third sample would be 5+K+K i.e. 5+2K=25.

For example to study the satisfaction of workers towards welfare facilities provided by large scale company. A list of all workers arranged in a alphabetic order is to be taken. Following the above formula the samples are to be selected for study. In drawing systematic sampling the updated data of population is needed.

Sequential Sampling: the process of selecting a small number of samples from a large population. Sequential sampling is generally used in industrial tests. Statistical quality control of finished products. In a pharmaceutical company, small samples are drawn from each batch in a sequential manner to test the quality in which case sequential sampling is useful.

For example a pharmaceutical company or a company producing milk products like paneer, ice crème or a company manufacturing hair oil, edible oil will have a policy to pick up every 100th product or every 1000th product from a production line for testing to decide whether the product is in line with defined parameters of quality. The 100th or 1000th product will be tested in laboratory for its defined quality parameters.

Multi Stage sampling: the selection of sample is made in different stages. The selection is made in different stages so called multi stage sampling. This method is used when the universe is very large area.

eg. Study the migrated labour in sugar industry of Maharashtra.

- i. Prepare list of district where sugar factories are in existing. And select randomly few districts for study.
- ii. Prepare list of sugar factories from the selected district. And select randomly few sugar factories for study.
- iii. Prepare list of all migrated labour from selected sugar factors. Suppose the list of labour is 1000.
- iv. Select randomly number of labour to be studies. eg. 10% or 20% etc.

Another example is when one wish to take a election poll multistage sampling is used. To know the opinion of citizens of nation towards an economic policy, educational policy and the like then multistage sampling is used.

Non Random Sampling: (Non Probability Sampling)

It is exactly opposite to random sampling, where every sample in the population does not get equal opportunity to be selected as a sample.

This is deliberate effort to select the sample for study.

Quota Sampling: This sampling is parallel to stratified sampling. In quota sampling for better representation of population the entire population is divided into various groups i.e. stratum and from every stratum the number of samples to be taken are decided. The stratums are done on the basis of some kind of similarities like gender, income group, age group, occupation and the like. The samples from such sub groups are selected to find a general opinion of the entire group. For example there is quite a possibility the different gender and people from different socio economic class may have different preferences towards investment and also have different objectives behind investment. In such case quota sampling is preferred.

Convenience Sampling: The name itself suggests that the sampling is drawn at the convenience of researcher is termed as convenience sampling. This method of sampling preferably used during pilot testing. For example researcher takes samples from their nearby vicinity so to avoid travelling. Or researcher would include those people as samples that are easily get ready to cooperate to give feedback to data collection instrument. Your own friend circle or for a teacher their own students are better example of convenience sampling.

On the Spot Sampling: sometimes some persons opt for their own inclusion or noninclusion in the sample units. In this case, researcher may select such samples on the spot. Reporters usually use this method of sampling. At the place of event happened reporter interview the people who are available at the place and seen the event happened. Many a times the sample already listed for inclusion but due to non availability the sample needs replacement. At this stage also on the spot sampling technique is used. Many a times we see the journalist while taking the opinions of people about a particular happening they use on the spot sampling. The people who are available to comment on and also ready to participate in the discussion are taken and interviewed.

Purposive Sampling: the name itself suggests the nature of purposive sampling. The samples are purposefully selected and taken for study. Say for example researcher wish to study the effect of a particular cosmetic on the fairness of skin. In such case samples using the specific cosmetic need to be identified and taken for study. This act of identifying a specific sample using a defined cosmetic is purposeful act.

Snow Ball Sampling: Snow ball is used when the population is scattered and niche in nature. It is difficult for a research student to exactly identify the samples from the population. In such cases one sample is identified and from the same sample the references for next samples are taken. Say for example researcher with to study the quality deployment function of racing bikes then finding racing bikes users is difficult hence, in this case anyhow from the population one racing bike user is identified and from him information of such racking bike owner/users will be taken. From the next sample racing bike user the additional information on racking bike users will be taken. This method is termed as snow ball sampling.

2.12.4 Features of Good Sampling:

- 1. Representative Character: Sample must be representative of population. Since in social sciences most of the time people are the samples and the very characteristics of population is, it is heterogeneous. From this heterogeneous population selecting samples that would represent the population is difficult task.
- 2. Small sampling error: Sample design must be such which results in a small sampling error.
- 3. Adequate number of samples: entire study is governed by the representative units. Since the opinions are very subjective in social sciences it is necessary that their number should be adequate. We often use the statistical formulae to calculate the sample size.
- 4. Economic Viability: Sample design must be viable in the context of funds available for the research study.

2.13 Sample Size Calculation:

There is range of formulas to calculate the sample size. But for our discussion we are going to limit only two formulas.

As we have discussed above that the population is of two types one is finite and another is infinite population.

We have simple two formulas below one is used when the population is finite and another is used for infinite population.

$$n=\frac{N}{1+N*(e)^2}$$

Where,

n= sample size N = Size of population e= sampling error for example,

Principal of college wish to take feedback from students regarding different facilities provided in the college. Facilities like sports, library, computer laboratory, language laboratory and the like college students strength is 3200 students. The question is how many students to be taken as a sample?

By using above formula and assuming 5% sampling error the sample size is calculated as below.

 $n = 3200/1 + 3200 (0.05)^2$

n=355.5 the calculated sampling size needs to be rounded off since we cannot have half student to interview hence the final sample size is 356.

Following formula is used to calculate sample size where population is infinite means the exact information resources are difficult to calculate.

For example

You want to know the additional likely flavors preferred by consumers of potato chips. In this case the consumers to be considered who consumes potato chips often. We cannot estimate the size of number of consumers in a defined geography. In such cases following formula is to be used.

Sample Size Formula

$$n = \left(\frac{zs}{E}\right)^2$$

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Where,

n= sample size

Z= the desired level of significance (confidence level)

S= standard deviation

e= tolerable sampling error

The assumed tolerable sampling error is 5% and the standard deviation is 0.66.

at 5% level of error the value of 'Z' should be taken at 95% confidence level i.e.

1.96.

So plugging the above figures in given formula yields,

n=((1.96*0.66)/0.05))2

n=669.36

rounded off to 670

So the adequate sample size calculated using stated formula is 670.

	Sample size										
Population size	Continuous o (margin of ei	data rror=.03)	Categorical data (margin of error=.05)								
	alpha=.10 <u>t</u> =1.65	alpha=.05 <u>t</u> =1.96	alpha=.01 \underline{t} =2.58	$\underline{p}=.50$ $\underline{t}=1.65$	<u>p</u> =.50 <u>t</u> =1.96	<u>p</u> =.50 <u>t</u> =2.58					
100	46	55	68	74	80	87					
200	59	75	102	116	132	154					
300	65	85	123	143	169	207					
400	69	92	137	162	196	250					
500	72	96	147	176	218	286					
600	73	100	155	187	235	316					
700	75	102	161	196	249	341					
800	76	104	166	203	260	363					
900	76	105	170	209	270	382					
1,000	77	106	173	213	278	399					
1,500	79	110	183	230	306	461					
2,000	83	112	189	239	323	499					
4,000	83	119	198	254	351	570					
6,000	83	119	209	259	362	598					
8,000	83	119	209	262	367	613					
10,000	83	119	209	264	370	623					

 Table 1: Table for Determining Minimum Returned Sample Size for a Given

 Population Size for Continuous and Categorical Data

NOTE: The margins of error used in the table were .03 for continuous data and .05 for categorical data. Researchers may use this table if the margin of error shown is appropriate for their study; however, the appropriate sample size must be calculated if these error rates are not appropriate. Table developed by Bartlett, Kotrlik, & Higgins.

Source: (https://www.slideshare.net/sumitmonk/samle-size, 1.9.2020, 6.00pm)

2.14 Check your progress - 3

Objective Type Questions

- 1. The type of random sampling includes
 - a. Simple random sampling
 - b. Stratified random sampling
 - c. Systematic sampling
 - d. All the above
- 2. The type of non random sampling includes
 - a. Quota sampling
 - b. Convenience sampling
 - c. On the spot sampling
 - d. All the above
- 3. Random sampling is also called as
 - a. Non probability sampling
 - b. Probability sampling
 - c. Both probability and non probability sampling
 - d. None of the above
- 4. In the formula of sample size calculation the term 'e' refers to
 - a. Exact figure
 - b. Extract from population
 - c. Sampling error
 - d. Estimated figure
- 5. The feature of good sampling includes
 - a. Economic viability
 - b. Adequate number of samples

- c. Representative of population
- d. All the above

2.15 True of False

- 1. Sample is a miniature picture of the entire group
- 2. Universe is the maximum possible source of information
- 3. Universe and population and same concepts.
- 4. The population is denoted by small letter n and sample is denoted by capital letter N
- 5. Random sampling is one where every sample in the population has equal opportunity or chance to participate as a sample in the study.

2.16 Fill in the Blanks

- 1. Sampling frame is a defined part of a.....
- 2. Samples must be of population.
- 3. Statistically small letter '....' is denoted to know sample.
- 4. Non random sampling also called as sampling.
- 5. In the formula of sample size calculation 's' explains

2.17. Solve the following examples

- 1. A pharmaceutical distributor having supplying medicines to 326 retail counters in a city wish to know the satisfaction of retailers towards the services provided by a distributor. Calculate the sample size for 1% level of significance, 5% and 10% level of significance.
- 2. Researcher wanted to know the satisfaction towards government functioning during a calendar year/financial year or in the pandemic situation like Covid-19 and the like. Calculate the sample size to be approached.

2.18 Summary :

Finding the answers to the research questions are pivotal. Research design is a systematic way to find the answers to the research problem. The research design has four major sub designs within it, sampling design, statistical design, operational design and observational design. Research design is a systematic plan and

comprehensive document which answers the basic questions what is the research problem under study, why the study has to be undertaken, which data needs to be considered (the variables and categories), from whom the data is to be collected (sampling), when the data is to be collected and how to analyze the data and interpret it. There are four major designs of research i.e. exploratory research design, descriptive research design, diagnostic research design and experimental research design. Every research design has its own features. The important concept in research design is hypothesis. Since the entire research is revolves around this concept. We undertake research to test the hypothesis. Hypothesis is a end point of research. Hypothesis is skeptical assumption about the results of research. When researcher has a question or questions in mind then the question or questions are answered by researcher with almost care using the experience and knowledge acquired. The answer is tentative not confirm whether it is right or wrong and hence put to test. So the statement of answer which put to test is hypothesis. There are major two types of hypotheses one is null hypothesis and another is alternative hypothesis. Researcher tests the null hypothesis. The science has evolved towards every stage of research. Hypothesis testing as well a scientific process which involves five steps, first is formulate the practical problem in terms of hypothesis then calculate statistics, choose a critical region, decide the size of critical region and last is draw the conclusion. One of the important aspects of research design is sampling. Since in social science we get the data from people and hence sampling carries importance. Sampling is cross section of population. It is a smaller representation of larger population. Since always it is not possible to attain the entire population under study. We take a small portion of population and study and then the results we get out of it we generalize it to the population. We say that population behaves like this since we got it known from the samples. Since the generalization of results are based on the results of population the right selection of sample carries utmost importance. Sample must be representative one of population and that is the quest. Selection of sample can be done by two methods one is probability sampling method and another is non probability sampling method. Probability sampling means every sample has equal opportunity to be selected as sample and non probability method is quite reverse to it. The science has developed and formulae are available to calculate the sample size.

2.19 Terms to Remember -

- a. Research Design: is a document that detailed plan which answers every question arouses regarding research problem under study.
- b. Components of research design: what (problem under study, hypothesis and objectives of study), Why (importance of study), which (data, findings and suggestions), whom (sampling design, variables detailing), when (period of study) and how (statistical design, operational design, observational design).
- c. Types of research designs: Four types of research design, exploratory research design, descriptive research design, diagnostic research design and experimental research design.
- d. Three basic principles of experimental research design: Three principles, one is principle of randomization, principle of replication and principle of local control.
- e. Features of good research design: reliability of data, experimental error, information yields, flexibility and economical.
- f. Hypothesis: Hypothesis is a central and focal point of any research; it is a supposition about desired results of research issues or research phenomenon under study. Hypothesis is a possible explanation of the phenomenon under observation.
- g. Types of hypothesis: Null hypothesis, alternative hypothesis, descriptive hypothesis, relational hypothesis, correlation hypothesis, explanatory hypothesis and statistical hypothesis.
- h. Five steps for testing hypothesis: First is formulate the practical problem in terms of hypothesis, calculate statistics, choose a critical region, decide the size of critical region and the last is comparison of statistics with significance level.
- i. Sampling: sampling as a part of population which selected and examine for estimating the quality of the population.
- j. Random sampling: Random sampling is one where every sample in the population has equal opportunity or chance to participate as a sample in the study.

- k. Non random sampling: It is exactly opposite to random sampling, where every sample in the population does not get equal opportunity to be selected as a sample.
- 1. Types of random sampling: Simple random sampling, stratified random sampling, systematic sampling, sequential sampling and multi stage sampling.
- m. Types of non random sampling: Quota sampling, convenience sampling, on the spot sampling, purposive sampling and snow ball sampling.

2.20 Answers to check your progress -

Section: 1

Answers to the question	ons					
MCQ type questions 1		a	2	d	3	b
	4	b	5	b	6	с
True of False	1	True	2	False	3	True
	4	True	5	False	6	True
Fill in the blanks		Descriptive	2	Random	3	Research Design
	4	Sampling Design	5	Statistical Design	6	Ideal /Basic

Section: 2

Answers to the question	s:					
MCQ type questions	1	D	2	С	3	В
	4	D	5	В	6	В
True of False	1	True	2	True	3	True
	4	False	5	False	6	
Fill in the blanks	1	Hypothesis	2	Opposite	3	Researcher
	4	Alternative	5	Population	6	



Section: 3

Answers to the question	s:					
MCQ type questions	1	d	2	d	3	b
	4	с	5	d		
True of False	1	True	2	True	3	False
	4	False	5	True		
Fill in the blanks	1	population	2	representative	3	n
	4	non	5	Standard		
		probability		Deviation		
Solve the examples	1	1% = 316	2	670		
		5% = 180				
		10% = 77				

2.21 Exercise:

- a. Define research design and narrate various components of research design.
- b. Elaborate different types of research designs.
- c. Details the contents of research design.
- d. Narrate the basic principals need to be observed in experimental research design.
- e. Which research design according to you is more reliable to get the accurate results Justify your answer.
- f. Define a term hypothesis and briefly narrate the different types of hypothesis.
- g. Hypothesis is backbone of any research project discuss.
- h. Elaborate the process of formulating and testing of hypothesis.
- i. Discuss the five step method of hypothesis testing.
- j. Define sampling and explain the concepts related to sampling.



- k. Brief the different types of sampling
- 1. Explain the sample size calculation.

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Data Collection and Processing

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3.0 Objectives:

After studying this unit you will be able to:

- 1. To explain the meaning and types of data
- 2. To describe the advantages and disadvantages of primary data and secondary data
- 3. To understand different methods of primary data collection such as questionnaire, interview, observation and focus group and their meaning, advantages and disadvantages

3.1 Introduction:

Research process includes one of the important stages of data collection which is dependent on the research problem identified and carried out for accomplishing the research objectives. This unit covers meaning of data, types of data, methods of data collection and data processing and graphical presentation.

3.2 Presentation of Subject Matter:

This is core section of the unit in which we will learn various aspects of data collection data processing and data presentation. It presents the meaning of data, types of data-quantitative and qualitative, sources- primary and secondary, methods of primary data collection-questionnaire method, interview method, observation method, focus group interview method, types of questions in questionnaire, sources of secondary data, classification, tabulation and graphical presentation.

3.2.1 Meaning of Data

'Datum' is singular whereas 'Data' is plural. In the research process, the collection of data is very important stage. If researcher does not carefully decide about various issues related to collection of data, he may create may hurdles himself. If he takes proper precautions while collection of data, the analysis will be easier and comfortable as far as proper selection of statistical techniques are concerned. Sources of data can be classified into two types which are: (i) data collected from primary sources and (ii) data collected from secondary sources. We can say that the data can be treated as bases or raw material for analysis.

3.2.2 Types of Data:

Data can be classified on different basis. Such classification may be quantitative data vs. qualitative data, primary data vs. secondary data and

3.2.2.1 Quantitative and Qualitative data:

- (1) *Quantitative Data:* Quantitative data is statistical and is typically structured in nature. This data type is measured using numbers and values. Quantitative data can be broken into further sub-categories. These categories are called discrete and continuous data.
 - (a) Discrete data is just data that cannot be broken down into smaller parts. This type of data consists of integers (positive and negative numbers, e.g., -100, 10, 100, and so on) and is finite (meaning it reaches a limit).

For e.g.- how many phones were sold last year,

(b) Continuous data is data that can be infinitely broken down into smaller parts or data that continuously fluctuates.

For e.g.- weight, age, time taken to complete the task etc.

(2) **Qualitative Data:** Qualitative data are non-statistical and are typically unstructured or semi-structured. It is categorized on basis of properties, attributes, labels, and other identifiers. Qualitative data identifiers can be subjective, making qualitative data analysis a complex process with numerous possibilities and structures.

In case of a room, colour of walls, ventilation, lighting etc. are qualitative data identifier whereas height, width, length, area, number of doors, number of windows etc. are quantitative data identifiers.

3.2.2.2 Primary and Secondary data:

There are two types of data on the basis of sources of data i.e.- primary data and secondary data.

(1) Primary Data: It is the data which is originally collected for the first time by the investigator himself or his representative for pre-defined specific objective. For e.g. Researcher Mr. X collected data from respondents by using questionnaire, it is primary data for Mr. X's research. The collection of primary data is costlier and time consuming as compared to secondary data.

(2) *Secondary Data:* It is the data which is collected by somebody else and which is used by the researcher. For e.g. Researcher Mr. Y used data which is originally collected by RBI, for Mr. Y's research. The collection of secondary data is relatively less costly than the collection of primary data.

3.2.2.3 Types of Data for Social Sciences Need:

On the basis of need of social sciences, data can be classified into three types: (1) Data regarding human being, (2) Data regarding organization and (3) Data regarding territorial areas.

- (1) Data regarding human being consist of education, age, sex, income, class, religion, marital status, occupation, family type, family size, location of household, life style etc. It also includes behavioural variables like attitude, opinion, awareness, knowledge, practice, intention etc.
- (2) Data regarding organization include data related to organization's origin, ownership, objectives, resources, functions, performance and growth etc.
- (3) Territorial data are geophysical data, resources endowment, population, occupational pattern, infrastructure, structure, degree of development etc. of village, cities, talukas, districts, states and the nation.

3.2.3 Data collection from Primary Sources:

This data are also called as primary data. Primary data are first hand data. Primary sources are original sources from which data are collected by any researcher yet nobody has collected the same data. Primary data can be collected through various methods such as mailing, interviewing, focus group and observation etc.

3.2.3.1 Advantages of Primary Data:

- 1. *Fresh Data:* Through primary sources a fresh data are collected as per the requirement of the study. A researcher can collect this data on the basis of definitions adopted by his own study. It is nothing but the first hand data.
- 2. Accurate Data: While collecting primary data, a researcher can maintain accuracy at appropriate level. He can avoid the circumstances which create errors in data collection of primary data. He can take precautions to collect the accurate data.

- 3. *Reliable and Valid Data:* The reliability and validity can be tested while collecting data or by pilot survey it can be tested. It is possible in case of primary data to collect reliable and valid data.
- 4. *Easy Access:* The primary data are collected direct from respondents and not from any other organization. So it is easy to collect it from them with easy access. In many types of collection of primary data, face to face interaction results into the data required.
- 5. *Collection of suitable Data:* The collection of primary data is nothing but creating a new dataset. So suitable data can be collected while collecting primary data considering objectives of the study.

3.2.3.2 Disadvantages of Primary Data:

- 1. *Costly Data:* More cost is required for collecting primary data. The researcher has to spend money for developing and mailing questionnaire, meeting respondents to take their interview etc.
- 2. *Time Consuming:* Sometime frequent meetings are required if the respondent is busy with his own work. It will take more time which increase the cost. As secondary data are readily available, primary data require more time because it is collected from field.
- 3. *Difficult in Broader Scope*: If the scope of the study is broader, it is highly impossible to collect primary data, in individual capacity of a researcher. For e.g. collecting data from throughout the country.
- **4.** *Personal Limitations:* Primary data is not ready, it is collected from respondents. So the quality of data depends upon skills of researcher or enumerator. It means quality of data is dependent on abilities of person who collects data.
- 5. *Misleading Data:* The reliability of primary data is dependent on answers given by respondents. If they have not given valid answers, the data may be mislead.

Check your progress-1:

- (A) Fill in the blanks:
 - 1. 'Datum' is singular whereas is plural.

- 2. The data type which is measured using numbers and values is called
- 3. is the data which is originally collected for the first time by the investigator himself or his representative for pre-defined specific objective.
- (B) State whether the following statements are 'true' or 'false':
 - 1. The data regarding organization include data related to organization's origin, ownership, objectives, resources, functions, performance and growth etc.
 - 2. The data regarding infrastructure of villages is territorial data.

3.2.4 Mailing Method/ Questionnaire Method:

Questionnaire is an instrument through which the data are collected by mailing it to respondents. It is nothing but a set of questions; the data are collected in the form of answers to such questions. It is prepared exclusively for the specific purpose.

3.2.4.1 Meaning of Questionnaire Method: We can be familiar with the meaning of questionnaire after discussing following definitions:

- 1) G. Lundburg- "Fundamentally, the questionnaire is a set of stimuli to which illiterate people are exposed in order to observe their verbal behaviour under social stimuli."
- 2) Bogardus- "A questionnaire is list of questions sent to a number of persons for them to answer. It secures standardized results that can be tabulated and treated statistically."
- 3) Goode and Hatt- "In general the word questionnaire refers to a device for securing answers to questions by using a form which respondent fills in himself."

It is a set of questions which is sent to respondents and the investigator himself does not go to the informant for collecting information. The respondent returns it after filling answers to the questions. Then this data are used for research project.

3.2.4.2 Types of questionnaire:

Forms of questionnaire may be broadly divided into two parts as structured questionnaire and unstructured questionnaire.

- Structured Questionnaire: In structured questionnaire, questions are set in advance. It includes definite questions. According to P. V. Young, 'Structured questionnaires are those which pose definite, concrete and preordained questions, that is, they are prepared in advance and not constructed on the spot during the questioning period.' The forms of questions may require closed responses or open responses.
- 2) Unstructured Questionnaire: When pre-decided questions cannot serve the purpose of our research, the researcher frame out on the spot questions to get appropriate responses. In this case, questions are not set in advance.
- 3) Open Form Questionnaire: In this form, all open ended questions are asked. Here the respondent has freedom to give his own answer in detail. It provides greater depth of response.
- 4) Close Form Questionnaire: It is closed or restricted form of questionnaire. It provides selection of alternatives or ranking the items or checking an item from the list. The respondent has no freedom to elaborate his answer or stating reasons.
- 5) *Mixed Questionnaire:* It is a combination of close and open forms of questionnaires. It is more useful in social research. Here, characteristics of both forms are available.
- 6) *Opinion Questionnaire:* The opinion, attitude or preference regarding some phenomenon is sought through opinion questionnaire.
- 7) *Pictorial Questionnaire:* In this method, pictures are used to promote interest of respondents in answering questions. For answering the questions, alternative answers are given in the form of pictures and the respondent is required to tick mark any of them. It is more suitable if the respondents are illiterate or less educated.

3.2.4.3 Types of Questions:

There are different types of questions such as closed ended questions and open ended questions.

1) Closed Ended Questions: The answers to be given by respondents are made restricted to the certain alternatives. The respondents are required to select answer from such alternatives. Closed ended questions include dichotomous

questions, multiple choice questions and scaled questions. It has limitation that the respondent cannot explain his views or reasons. Such questions are as follows:

(a) Dichotomous Questions: The questions where maximum two alternatives of answer are given those questions are called dichotomous questions. Example-'Yes' or 'No'.

Dichotomous Question	

Do you have a bank account?

(i) Yes (ii) No

(b) Multiple Choice Questions (MCQs): In such type of questions, multiple alternatives of answer are given and respondent has to select one of them which is the most appropriate alternative. It is a popular type of closed ended question. Following is the example of MCQ.

Multiple Choice Question

'What is status of your business unit?

(i) Micro enterprise (ii) Small enterprise (iii) Medium enterprise (iv) Large scale enterprise

(c) Scaled Questions: When responses are graded on a continuum, they are scaled questions. Likert scale, semantic differential scale and rank-order scale are examples of such scales.

Likert Scale Question							
My manager provides	Strongly	Agree	Neutral	Disagree	Strongly		
constructive criticism	agree				disagree		
Semantic Differential Scale Question							
How do you rate your performance?GoodAverageB							
Rank Order Scale Question							
When you select the product, rank what your priorities are.							
(i) Price							

(11) Quality	
--------------	--

(iii) Availability

2) Open Ended Questions: When options of answers are not given, they are called open ended question. Here the respondent has an opportunity to explain or elaborate answers. Such questions include completely unstructured questions, word association testing question, sentence completion question, story completion question, picture completion question and thematic appreciation test question etc.

3.2.4.4 Advantages of Questionnaire Method:

It is very popular method of primary data collection because it has several advantages.

- (1) *Cost Saving:* Questionnaire is sent to respondents and he replies the questions. So it is less costly than interview method as researcher/investigator has to meet each and every respondent for taking interview which is costly due to travelling cost. In case of questionnaire method, postage is cost which relatively less. Now days, it is sent by email or social media it is like free of cost.
- (2) *Time Saving:* Questionnaire saves time. Simultaneously several persons can be approached. For the same, interview method may take very long time.
- (3) *Anonymity is possible:* It is not required to indicate respondent's name on the questionnaire. They can express their views and opinions frankly without any influence. Anonymity is meaningful in this method.
- (4) *No Pressure:* This method gives less pressure for immediate response and gives more time to think on it and answer the questions. They can complete it with their convenience.
- (5) *Uniformity:* Questionnaire is impersonal technique. Questionnaire has its standardized wording and sequence of questions as well as standardized instructions for recording responses. Hence, uniformity from one measurement situation to another is provided by virtue.
- (6) *Wider Scope:* By using questionnaire, wider geographical areas can be covered.
- (7) *Free from bias:* This method is free from the interviewer's bias as there is no personal contact between the respondents and the investigator.

3.2.4.5 Disadvantages of Questionnaire:

- (1) *Illustrate and less educated:* Questionnaire can be administered with those people who can read and understand the questions. The scope of using this method is very limited when percentage of literacy is very low. Complex questionnaire requiring elaborate written replies can be administered on very small percentage of population.
- (2) *Low response:* As compare to other methods, questionnaire method gets low response. Sometime resulting sample may not be representative.
- (3) *Incomplete responses:* Several questionnaires may have unanswered questions and incomplete responses.
- (4) *Misinterpretation:* Some respondents do not understand questions properly, hence they may misinterpret the questions and give answer with different direction.
- (5) *No clarification:* This method allows little opportunity for respondents to seek clarification of questions and statements made in the questionnaire.
- (6) *Bias:* Misleading or ambiguous questions allow bias to creep in. Bias can come in data due to certain choices in multiple choice questions or due to faulty layout of the questionnaire.

3.2.5 Interview Method:

Interview is one of the methods of collecting data. Under this method, interview schedule is an instrument of collecting data. The investigator takes interview of respondents to seek answers to the questions formulated in interview schedule.

3.2.5.1 Meaning of Interview Method:

In this part, we will learn the meaning of interview method by listening various definitions of interview.

- 1) According to P. V. Young, "Interviewing is not a simple way to conversation between an interrogator and informant. Gestures, glances, facial expressions, pauses often reveal subtle feelings."
- 2) Goode and Hatt have stated that "Interview is fundamentally a process of social interaction."

- 3) As far as interview is concerned, Fred N. Kerlinger said that "The interview is face to face inter-personal situation in which one person, the interviewer asks a person being interviewed, the respondent, questions designed to obtain answers pertinent to research problems."
- 4) According to P. V. Young, "It may be sen as an effective, informal, verbal, nonverbal, conversation, initiated for specific purposes and focused on certain planned content areas."
- 5) About interview, Eckhardt and Ermann stated that "Interviewing is a data collection procedure involving verbal communication between the researcher and respondent either by telephone or in a face to face situation."

Interview is initiated by the investigator. It is a process completed by interviewer and interviewee. It is thus a system in which both the investigators as well as the informants discuss the problem under research. The objective of an interview is to collect information about unknown facts through face to face contacts. It is very important and popular method of collecting data for the purpose of research.

3.2.5.2 Type of Interview:

The interviews may be classified into types of interview as: Structured interview, Unstructured interview, Focused interview, Clinical interview and Depth interview.

- (a) *Structured Interview:* When predetermined questions are put in interview, it is called structured interview or directive interview. We can say it is an interview made with a detailed standardized schedule. The same questions are put before all respondents and in the same order. Each question is asked in the same way in each interview, promoting measurement reliability. It is used for large-scale surveys.
- (b) Unstructured Interview: The unstructured interview is also called uncontrolled, unaided and non-directive interview. In this method, the interviewer does not follow any list of pre-determined questions. Interviewer is also permitted to give his own definition of particular social situation and also importance of events from his view point. The interviewer allows the respondent to talk freely about given topic with a minimum of promoting or guidance. This type of interview is

more useful in case studies rather than in surveys. It is also more useful in gathering information on sensitive topics.

- (c) *Focused Interview:* It takes place only with such persons who have been involved in a particular concrete situation. It is the interview where the investigator attempts to focus the discussion on the actual effects of a given experience to which the respondents are exposed. 'The interview is focused on the subjective experiences of the respondent i.e. his attitudes and emotional responses regarding the situation under study.' (*Merton, R.K. et. al., The Focused Interview, Glencoe: The Free Press, 1956).
- (d) *Clinical Interview:* Broad underlying feelings or motivations are studied in clinical interview. It collects data regarding individual's life experiences rather than the effect of specific experiences. It is similar to the focused interview but with a subtle difference.
- (e) **Depth Interview:** It is an intensive and searching interview aiming at studying the respondents' opinion, emotions or convictions on the basis of an interview guide. Dr. Fay B. Karpf has defined depth interview as the interview which "deliberately aims to elicit unconscious as well as other types of material relating especially to personally dynamics and motivations." Depth interview is a lengthy procedure in which free expression is fully encouraged. This method helps in revealing important aspects of psycho-social situations. The interviewer should handle such situation with great care.
- (f) *Personal Interview:* Interviewer takes interview of a single person, it is called personal interview. It is believed that such a person possesses the required information and that will serve his purpose. According to Bogardus, "attitudes and changes in them may best be secured by the personal interview method." In personal interview, the view expressed are his own and spontaneous and not under group influence.
- (g) *Group Interview:* A group interview is one in which the interviewer does not meet any single individual but the group of persons who are concerned with the subject matter as a whole. The group interview is suitable for gathering routine information. The idea is that since all are involved and concerned obviously all may be met at one sitting so that time is saved.

- (h) *Formal Interview:* Formal interview are known as structured interview. It has form of questions to be put is already determined. The interviewer presents a set of well-defined questions and notes down the answers of informant in accordance with prescribed rules.
- (i) *Informal Interview:* Informal interview are known as unstructured interviews. The interviewer has full freedom to make suitable alternatives in the questions suitable for a particular situation.
- (j) **Qualitative Interview:** Qualitative interviews are such which are not quantifiable and are also very complex. It attempts at finding out attitudes, values and behaviours which are not measurable and vary from individual to individual.
- (k) *Quantitative Interview:* It is interview which is concerned with quantity. In these interviews facts are collected from a large number of persons.

3.2.5.3 Advantages of Interview Method:

- 1) This method achieves high rate response participation. It has both inflow and outflow of ideas.
- 2) It helps in collecting information from the incapable like children or illiterate persons. In interview the interviewer can assist them to understand the question and to answer properly.
- 3) It helps in collecting information from the reluctant.
- 4) It is possible to go deep into the problem. It enables a trained and qualified interviewer to study the research problem much deeper.
- 5) The interviewer can crosscheck whether the information being collected is correct.
- 6) It is flexible as the interviewer can reframe the question if informant cannot understand it.
- 7) Emotions and fears can be appreciated while interviewing the informant and especially when he becomes emotional and excited.
- 8) Viewpoints of respondents are recorded by interviewer himself; therefore, the information collected will be most reliable.

9) Interview method can be used on all types of persons.

3.2.5.4 Disadvantages of Interview Method:

- 1) The interviewer has to meet every respondent, so it is costly method.
- 2) Due to different characteristics of every person, it is problem of validity and reliability measurement, when interview method is adopted.
- 3) The stress on specific aspect is given in research but this stress may be changed while interviewing respondent.
- 4) There is too much reliance on memory in interview method. The interviewer wants to collect data regarding many things so the collection is dependent on memory.
- 5) In interview method, too much reliance is on an individual who is expected to share his views-points, impressions and feelings.
- 6) The interviewer and interviewee have different world of discourse. They have different social philosophies so they may ascribe different values and meaning of social phenomenon.
- 7) The subjective nature of unstructured interview create problem that the data collected cannot be subject to statistical treatment.
- 8) It is difficult to find trained interviewers because everybody cannot take interview unless and until he has the skill of taking interview.
- 9) It is difficulty in persuading the interviewee for providing the information. It is possible only when he is confident.

Check your progress-2:

- (A) Fill in the blanks:
 - 1. questions include dichotomous questions, multiple choice questions and scaled questions.
 - 2.is an intensive and searching interview aiming at studying the respondents' opinion, emotions or convictions on the basis of an interview guide.
(B) State whether the following statements are 'true' or 'false':

- 1. When options of answers are given, they are called open ended question.
- 2. Questionnaire method is less costly than interview method.
- 3. Interview is initiated by the interviewee.

3.2.6 Observation Method:

In fact today, our different acts, social behaviours, attitudes and present day fashions are the result of observation. For study of social problems or business studies, observation method had been and is being used continuously. Under observation method, the data from the field is collected with the help of observation. Observation of social behaviour can produce values if it includes an adequate description of the character of social atmosphere of the larger unit of activity within which the specific social act occurs. It is oldest method of study (data collection).

3.2.6.1 Meaning of Observation:

According to P. V. Young "Observation may be defined as systematic viewing, coupled with consideration of seen phenomena" (Young, P. V., p.161).

Concise Oxford Dictionary has defined observation as "accurate watching, noting of phenomena as they occur in nature with regard to cause and effect and mutual relationship."

Observation is nothing but seeing the things either from a distance or going near to the object of study.

Webb and Webb (1932) have pointed out all social research begins and ends with observation.

(Webb, Sidney and Webb, Beatrice, Methods of Social Study, London: Longmans Green, 1932, p.158)

Observation is divided into three processes: sensation, attention and perception. Sensation is gained and perception. Sensation is gained through the sense organs which depends upon the physical alertness of the observer. Then comes attention on concentration which is largely a matter of will power with adequate training and experience can make it almost a matter of habit. The third process is perception which comprises the interpretation of sensory reports. The perception enables the mind to recognize the facts. Observation becomes scientific, when it (a) serves a formulated research purpose, (b) is planned deliberately, (c) is recorded systematically and (d) is subjected to check and control on validity and reliability (Krisnaswami and Ranganathan, 2011).

(Krishnaswami, O. R. and Ranganathan, M. (2011). Methodology of Research in Social Sciences, Himalaya Publishing House, Mumbai, p.169)

3.2.6.2 Types of Observation:

Observation can be classified into the categories like simple observation, controlled observation, participant observation, non-participant observation, direct observation and indirect observation.

- (1) *Simple or non-controlled observation:* In this method, observation is made in natural course without extra influences, controls or guidance or instructions from external agencies and factors. It is generally not very reliable because observation itself may be biased and coloured by the views of the observer. When the observation is made in the natural surroundings and the activities are performed in their usual course without influence, it is called as simple or uncontrolled or natural observation. The most important advantage of this method is that it becomes impossible to have first-hand knowledge of the group to be studied without extra influences and pressures.
- (2) *Controlled Observation:* It is generally carried out according to definite prearranged plans which might include considerable experimental procedure. Employee behaviour studies are commonly carried out with the help of this method. Controlled observation may be by control over phenomena or control over observer. In this method, researcher can use the devices like detailed observation plan, observation schedule, team observation, use of control groups, use of hypothesis, use of sociometric scales and use of mechanical appliances etc.
- (3) *Participant Observation:* If the observer participates with the activities of this group under study it is known as participant observation. The observer can understand the emotional reactions of the observed the emotional reactions of the observed group, and get a deeper insight of their experiences. The degree

and the period of participation vary with the purpose of study and the practical demands of the situation.

- (4) Non-participant Observation: In which method, observer does not participate in observation, it is called non-participant observation. The observer does not actually participate but watches everything from a distant. Goode and Hatt say "Non-participant observation is, then, usually quasi-participant observation."
- (5) *Direct Observation:* Observation is done personally by the observer, it is direct observation. It is flexible and allows the observer to see and record subtle aspects of events and behaviour. He is also free to shift places, change the focus of the observation, or concentrate on unexpected events.
- (6) *Indirect Observation:* When recording is done by mechanical, photographic or electronic means, it is called indirect observation. It is less flexible than direct observation, but it is less biasing and less erratic in recording accuracy.

3.2.6.3 Advantages of Observation Method:

- (a) *Direct Method:* It is most direct mean of data collection. Due to this method, it makes it possible to study behaviour and interactions. Many aspects of human behaviour can be studied directly of observation method.
- (b) *Simplicity:* It is simple method of data collection. It is not technical and requires relatively less training for making observation.
- (c) *Useful for hypothesis:* The observation method is useful for formulating and testing of hypothesis. The observation method enables researcher to know about the sequences and the cause-effect relationship. On that basis, researcher can formulate and test hypothesis.
- (d) *Accurate and Reliable Data:* This method provides accurate data. The data collected by observation are based on first-hand perception by the eyes. It is not based on retrospection or reflection
- (e) *Eye witness:* Observation provides eye-witness for research conducted. Observation makes it possible to capture the whole event as it occurs.
- (f) *Suitable for proper analysis:* Observation improves the opportunities for analyzing properly the contextual background of behaviour.

3.2.6.4 Disadvantages of Observation Method:

- (a) *Not Suitable:* Observation is not always suitable. All occurrences are open to observations. Occurrences can be observed when the observer has at hand. All occurrences are not lend themselves to study by observational techniques.
- (b) *Only Current Situation:* Observation is not possible for past occurrences and incidents. Observation is possible only for present.
- (c) *Sampling Difficult:* Observation method may have difficulties in obtaining representative sample. Observation is possible with permission. It is not possible in all types of people.
- (d) *Expensive:* For adopting observation method, researcher has to go every places where he wants to observe the occurrences. It will make expensive the collection of data.
- (e) *Lack of proper orientation:* Observation requires great attention and observer should be properly oriented. However, every observer may not be properly oriented for making observation.

3.2.7 Focused Group Interview:

Focused group method was developed by sociologist Robert Merton and his colleagues in 1940s. It is highly versatile and dynamic method of collecting data from representative group of respondents.

3.2.7.1 Meaning of Focus Group:

This method is used for qualitative research. A focus group refers to an interview carried out by a trained researcher whose role is both to ask questions and to observe participants with the group. For this purpose a group of 8 to 10 individuals is made to take their interview.

Tuckman (1965) formulated linear model of group development which is comprehensive. Chrzanowska (2002) has stipulated stages of focus group discussion which are: forming, storming, norming, performing ad mourning. The skilled moderator is required for focus group discussion who conduct whole discussion. He plays key role to supervise the group discussion as far as nature, content and validity of the data are concerned.

3.2.7.2 Advantages of Focus Group Method:

Focus group method has following benefits:

- (1) *Idea generation:* Focus group provides idea generated through discussion. The interaction between members of group helps to refine and rephrase the perspective into a usable solution. Such discussion generates ideas which are useful to solve the problems.
- (2) *Group dynamics:* The moderator initiates the debate. Some members express their opinion. Members' involvement increases. They present reactions and counter-reactions. It brings openness in group discussion.
- (3) *Process advantage:* The focus group discussion provides considerable flexibility in extracting the relevant information. It provides a simultaneous condition and collection of data from many respondents at a single point of time.
- (4) *Reliable and valid data:* According to objectives of the study, the moderator determine the structure of discussion, hence, reliable data is possible. The recording of data does not give opportunity to human bias and error in collecting data.
- (5) *10 Ss advantages:* Zikmund(1997) articulated advantages of focus group discussion which can be called 10 Ss advantages. Synergy, snowballing, serendipity, stimulation, security, spontaneity, specialization, structure, speed and scrutiny are 10 Ss advantages of focus group method (Wilson, 2010). The researcher can observe how a group interact and it examines both the verbal and non-verbal communication.

3.2.7.3 Disadvantages of Focus Group Method:

There are some disadvantages of focus group method

- (1) *Group dynamics as disadvantage:* In group discussion, the members might present not their own but along the lines of the group expression. Instead of own opinion, members try to involve in group conformity.
- (2) *Scientific process:* The group discussion under this method is indicative and it should not be generalized. It is difficult to analyze the data when answers obtained are varied and are in narrative form.

- (3) *Moderator bias:* As success or failure of focus group discussion is dependent on the skill of moderator. It is rare to have unbiased moderator and consequently have unbiased discussion.
- (4) *Limitations:* For conducting focus group discussion, there are some limitations such as inability to acquire a suitable venue, difficulty in attracting suitable participant and lack of experience in organizing.

Check your progress-3:

(A) Fill in the blanks:

- 1. is a set of questions like questionnaire, prepared and administered for collecting data from respondents.

(B) State whether the following statements are 'true' or 'false':

- 1. When the observer participates in observation, it is called non-participant observation.
- 2. When recording is done by mechanical, photographic or electronic means, it is called indirect observation.
- 3. Focus group interview method is used for qualitative research.

3.2.8 Schedule and Questionnaire:

3.2.8.1 Schedule:

A schedule is also a set of questions like questionnaire, prepared and administered for collecting data from respondents. According to Goode and Hatt, "schedule is the name usually applied to a set of questions which are asked and filled in by the investigator in a face to face situation with another person."

Bogardus says that "a schedule is a form of abbreviated questions which interviewer keeps with him and fills out as he proceeds with his enquiry."

A schedule may be of different types like interview schedule, observation schedule, rating schedule, document schedule, institutional survey schedule etc.

3.2.8.2 Difference between Schedule and Questionnaire:

The main aim of schedule and questionnaire is to collect the data from respondents and both are instruments of collecting primary data, however, there is difference between them.

Schedule	Questionnaire								
1) Schedule is used as tool for interviewing.	1) Questionnaire is sent by mail to respondent to be answered.								
2) Schedule is filled in by interviewer (researcher or enumerator) while taking interview.	2) It is filled in by respondent.								
3) Schedule can be used for observation.	3) Questionnaire cannot be used for observation.								
4) It is direct method of data collection.	4) It is indirect method of data collection.								
5) Very short questions are included in the schedule.	5) Lengthy question can be included in questionnaire to get detailed information.								
6) The data collected through schedule	6) The reliability of data collected by								
are more reliable.	questionnaire in doubtful.								
7) A limited area can be covered by schedule method.	7) A wide area can be covered by questionnaire method.								
8) An investigator can collect the information from uneducated people by clarifying question and its purpose.	8) The clarification of questions is not possible in questionnaire method.								
9) When schedule is used for interviewing, interviewer will try to get answer from respondent by clarifying the questions. Hence, respondent will give detail answer.	9) In questionnaire method, researcher is dependent on respondent for collecting data. The respondent can stick-up with his level of answering questions.								
10) The data collected by schedule will be completely representative as clarification or explanation is possible.	10) The data collected by questionnaire may not be completely respresentative.								

3.2.9 Data collection from Secondary Sources:

This data are also called as secondary data. Secondary data are the data which have been collected by somebody else and used by the researcher. Secondary sources may be books, journals, reports etc.

3.2.9.1 Advantages of Secondary Data:

- 1. *Quick and Cheap:* Secondary data are readily available as it is collected by someone else. Once their source of documents and reports are identified, collection of data is just a matter of desk work. The researcher can access data quickly and cheaply.
- 2. *Coverage of Wider Scope:* Without much cost, longer reference period and geographical scope can be covered if secondary data is option for researcher.
- 3. *Generalization Possible:* The database is broadened by secondary data through which generalization is possible scientifically.
- 4. *Supporting Verification:* The secondary data may be used as support to verify the findings based on the primary data.

3.2.9.2 Disadvantages of Secondary Data:

- 1. *Non-suitability:* Our needs may not meet with the available data because there may be difference between the definition adopted by those who have collected the data and meaning expected by us. In such case the available data may be not suitable.
- 2. *Inaccuracy:* The desired accuracy may not be available in secondary data. We have to know how data were collected by them, then it may be possible to assess the accuracy. But it is not possible in many situations.
- **3. Outdated Data:** The secondary data may not be uptodate and become obsolete because of time lag required to publish it. Population census data are published three or four years later after compilation and afterwards no few figures would be available for next ten years.
- 4. *Non-accessible Data:* What type of data the social scientist require, may not be available easily. The accessibility depends primarily on proximity. Sometime the organizations are reluctant to avail the data to the researchers.

5. *Difficult to test Reliability and Validity of Data:* In which situation the data have been collected is not known. So it is difficult to test reliability and validity of secondary data.

3.2.10 Data Processing:

After collecting data, the next step is to arrange data for processing and proper presentation. Before analysis of data, data should be processed properly. The data are processed carefully and systematically for statistical treatment and meaningful interpretation.

The data processing comprises questionnaire checking, editing, coding, classification, tabulation, graphical presentation, data cleaning and data adjusting. The stages of data processing provides us minimizing errors.

- (1) *Questionnaire Checking:* Questionnaires are examined after data collected for checking whether they are acceptable or not. If this work is not simultaneously while collecting data, we have to do it after collection of data. The incomplete questionnaire is not acceptable. The questionnaire answered by inappropriate person is not acceptable. The questionnaire answered in such a way that who could not understand questions.
- (2) *Editing:* Editing is the process of examining the data collected. It is done to detect errors and omissions. Editing is done to assure that the data are accurate, consistent with other facts gathered, uniformly entered, as possible.
- (3) *Coding:* Coding is the process by which data are organized into classes and numerals or other symbols are given to each item according to the class in which it falls. Coding have tow operations: deciding the categories to be used and allocating individual answers to them.
- (4) *Classification:* We can see the next stage of data processing: classification in the next section in detail.

3.2.10.1 Classification: Classification is a process of grouping the statistical data. It is the process of arranging data in groups or classes on the basis of common characteristics. Entire data are divided into groups or classes, by making classification. It can be done either classification according to attributes or classification according to class-intervals.

The four types of classification are given below:

(1) *Qualitative Classification:* It refers to classification of data made according to some attribute or quality such as sex, literacy, religion etc.

For e.g.- The classification of the whole population as per sex, literacy and employment which we can see in the following table.

Table 3.1

Classification of Population of a city according to Sex, Literacy and Employment

Employment		Male		Female					
	Literate	Illiterate	Total	Literate	Illiterate	Total			
Employed	200000	400000	600000	100000	200000	300000			
Unemployed	40000	200000	240000	20000	100000	120000			
	240000	600000	840000	120000	300000	420000			

(2) *Quantitative Classification:* It refers to the classification of data according to some characteristics that can be measured such as height, weight, age etc. As per this classification, data are classification by assigning arbitrary limits call class-intervals.

For e.g.- The marks obtained can be classified in the class-intervals as 0-34, 35-59, 60-74 and 75-100 as per standard of passing.

(3) *Chronological or Temporal Classification:* It refers to classification with respect to time.

For e.g.- The sale of Kolhapur outlet of the company is given quarter-wise:

Table 3.2

Quarter-wise Sale at Kolhapur outlet

Quarter	Sale in Rs.
1 st Quarter 2020-21	10,00,000
2 nd Quarter 2020-21	20,00,000
3 rd Quarter 2020-21	50,00,000
4 th Quarter 2020-21	40,00,000

(4) *Geographical or Spatial Classification:* It refers to classification made with respect to places.

For e.g.- The yield of onion in India state-wise such classification is called spatial classification.

Table	3.3
-------	-----

Name of StateProduction in thousand tonnesMaharashtra5355.39Madhya Pradesh3859.83Karnataka3197.40Gujrat1303.07Rajsthan1292.20

State-wise Production of Onion in India

Rules for classification of data (Tulsian and Zunzunwala, 2018):

- (1) The classes should be unambiguously defined.
- (2) The classes should be exhaustive. It means every observation must get classified into a class.
- (3) As far as possible, the classes should be of equal width.
- (4) The number of classes should neither be too larger nor too small.
- (5) Width of class interval is decided first by fixing the number of class intervals and then dividing the total range into those many classes.

Class width = $\frac{Range}{No.of Classes decided}$

3.2.10.2 Tabulation:

Tabulation is presenting data in tabular form. It is systematic representation of the information collected in the data in rows or colums according to certain characteristics. Tabulation is the process of summarizing raw data and displaying it is compact form for further analysis. It presents the information in concise and attractive manner. It helps to make data easy to read understand. It helps to make a comparison of two or more sets of data gathered on the same characteristics.

Firstly classification is made. Then preparing table is one of the important steps. Tabulation may be done by hand, mechanical or electronic. Table can be divided into different categories such as frequency tables, response tables, contingency tables, univariate tables, bivariate tables, statistical tables and time series tables.

3.2.10.2.1 Elements of Table:

- (1) *Table number:* Every table should be properly numbered by which anybody can identify the specific table when there are large numbers of tables. Table numbers may be consecutive serial numbers. Alternatively chapter-wise numbering is also preferred. For e.g.- For Chapter-1, the table number will be 1.1, 1.2, 1.3 and so on whereas for Chapter-4, the table number will be 4.1, 4.2, 4.3 and so on.
- (2) *Title of table:* Table should have brief, simple and clear title. It should be self-explanatory. It should be given in bold type.
- (3) *Number of Columns and Rows:* Each table should be prepared in just adequate number of columns and rows. Columns and rows should be divided by means of thin or thick rulings.
- (4) *Stubs or row designations:* Heading should be given to each row of the table. It is called stubs. It explains what the figures in row represent. Instead of taking full question from the instrument, brief and clear heading should be given in the form of sub.
- (5) *Captions or Columns headings:* Headings should be given to each column of the table. It explains what the figures in column represent. Instead of taking full question from the instrument, brief and clear heading should be given in the form of caption.
- (6) **Body of the table:** The actual data should be so arranged that any figure may be readily located. Comparable figures should be arranged side by side. Size of the column should be as per requirement. Arrangement of items should be according to the problem. Totals of each columns and rows as well as grand total should be given as far as possible.

- (7) *The unit of measurement:* The unit of measurement should be noted below the title. If different units are there, they may be given along with 'stubs' or 'captions' whichever appropriate.
- (8) *Source:* The source of information should be mentioned below the table.
- (9) *Foot-notes:* These may be given below the table. They may be explanation about the concept used in table or any estimation made, if any.

Specimen of Table

Table Number

Title of the Table

Designation in units

Stub-head	Caption or C	Column head	Total
	Yes	No	
High			
Moderate			
Low			

Foot-note:

Source:

3.2.1.2.2 Type of Table:

Table can be classified as one-way table, two-way table, three-way table and so on.

(1) *Simple table or One-way table:* The table which is prepared for only one quality or characteristic, is called simple table or one-way table. It presents the distribution of cases on only a single dimension or variable.

Table 3.4

Marks-wise Distribution of Students

Marks obtained	Number of Students
00-20	05
20-40	10

40-60	45
60-80	65
80-100	15
Total	140

(2) *Two-way Table:* The table which is prepared on the basis of two qualities or characteristics. It presents the distribution in terms of two variables.

Table 3.5

Marks and Gender-wise Classification of Students

Marks obtained	Number of Students									
	Male	Female	Total							
00-20	03	02	05							
20-40	07	03	10							
40-60	32	13	45							
60-80	35	30	65							
80-100	07	08	15							
Total	84	56	140							

(3) *Three-way Table:* The table which is prepared on the basis of three qualities or characteristics. It is also called as mani-fold table. It presents the distribution in terms of three variables.

Table 3.6

Marks, Stream and Gender-wise Classification of Students

	Number of Students											
Marks		Male	e		Fema	le	Total					
	Arts	Science	Commerce	Arts	Science	Commerce	Arts	Science	Commerce			

00-					
20					
20-					
40					
40-					
60					
60-					
80					
80-					
100					
Total					

Check your progress-4:

(A) Choose the most appropriate alternative:

- 1.is the first stage of data processing.
 - (a) Classification
 - (b) Questionnaire Checking
 - (c) Editing
 - (d) Coding
- 2. is not one of the types of classification.
 - (a) Quantitative Classification
 - (b) Qualitative Classification
 - (c) Geographical Classification
 - (d) Personal Classification
- (B) State whether the following statements are 'true' or 'false':
 - (a) The number of classes should neither be too larger nor too small.

- (b) Tabulation is not the process of summarizing raw data and displaying it is compact form for further analysis.
- (c) Table should have brief, simple and clear title

3.2.10.3 Graphical Presentation:

It is a technique of presenting the data visually in the form of graph. The quickest understanding is availed by graphical presentation. It eliminates the dullness of the numerical data. If data are presented in the form of diagram or graphs, the comparison of data is much easier.

Graphical presentation should be made in the line of research objectives. According to the purpose, graphical tool should be selected. It is very useful to prospective readers who are non-technical and general public. Graphic forms should be simple, clear and accurate. The most commonly used graphic forms are as follows:

- (1) Bar Chart
- (2) Multiple Bar Chart
- (3) Sub-divided Bar Chart
- (4) Histogram
- (5) Ogive Curve
- (6) Pie-chart
- (7) Pictogram
- (8) Frequency Polygon
- (1) *Bar Chart:* Bar chart is a chart that uses either horizontal or vertical bars to show comparisons between categories. The length various bars is in the ratio of the magnitude of the given data. The bar chart is prepared when the data indicate different values of a variable over a period of time or data represent different situations.



Specimen Bar chart

Bar chart indicates data category in a frequency distribution. It shows relative numbers or proportion of multiple categories. It also summarizes a large data set in visual form. With considering its benefit, it is widespread used in business, the media and research as well. Though there are these benefits, however, it requires additional explanation.

(2) *Multiple Bar Chart:* Multiple bar chart is one graph in which two or more bars. It is used to represent district values for more than one item that share the same category. It provides comparison of the values of different variables in a set and comparison of the values of the same variable over a period of time.



Multiple Bar Chart

(3) *Sub-divided Bar Chart:* It is one dimensional diagram in which bar is subdivided. It is used to represent data in which the total magnitude is divided into different components. It helps in identifying and comparing the difference between the components.



Sub-divided Bar Chart

(4) *Histogram:* A histogram is a two dimensional chart. It is a graphical representation that is helpful to organize and display the data in more user-friendly format. It is a series of adjacent vertical rectangles with bases, proportionate to width of the class intervals on x-axis and with area of the rectangles proportionate to the number of frequencies along y-axis of the corresponding class intervals.



Histogram helps in comparing process within specified limits. It summarizes large data and assists in decision-making.

(5) *Ogive Curve:* Ogive is a graph that represents the cumulative frequencies for the classes in a frequency distribution. An ogive is obtained by plotting the cumulative frequency on y-axis against the class boundaries on x-axis.

Ogive helps to determine graphically the number of proportion, observation above or below the given value of variable. It facilitates the comparison of two frequency distributions.



There are two types of ogives (cumulative frequency distribution graphs).

Less than ogive: It is drawn on the basis of cumulative frequencies which are in ascending order. Here, cumulative frequencies are plotted against upper limits from left to right of respective class. It has upward slope because it is an increasing curve.

More than ogive: It is drawn on the basis of cumulative frequencies which are in descending order. Here, cumulative frequencies are plotted against lower limits of respective class. It is downward slope from left to right because it is an decreasing curve.

(6) *Pie-chart:* Pie-chart is also called as circle graph. It makes use of sectors in a circle. The angle of sector is proportional to the frequency of the data. It is a circular diagram in which are is proportionately divided among the various components of a given variable. It is a good way of displaying data when you want to show how something is shared or divided.

Illustration: The following picture shows percentages of types of transport that sample of 500 people uses most often:

Pie-chart: Type of transport



- a) How many people use bus most often?
- b) How many people don't use train most often?
- c) How many people use bicycle or car most often?

Solution:

Certainly, total frequency is N = 500.

a) 20% of 500 people use bus most often.

In other words, the answer is $20\% \times 500 = 0.2 \times 500 = 100$ people.

b) 10% of 500 people use train most often.

Therefore, we have $(100\%-10\%) \times 500 = 0.9 \times 200 = 450$

In conclusion, 450 people don't use train most often.

c) 30% of 500 people use bicycle most often and 40% of them use car most often. Therefore, we have (30% + 40%) x 500 = 70% x 500 = 0.7 x 500 = 350. In conclusion, 350 people use bicycle or car most often. (7) *Pictogram:* Pictogram refers to a chart that uses pictures to represent data. Each picture or symbol may represent one or more units of the data. Pictogram is also called as pictograph.



Pictogram

(8) *Frequency Polygon:* Frequency polygon is a graph that uses lines that connect points plotted for the frequencies at the midpoints of the classes, frequencies are represented by the heights of the points. The main purpose in constructing a polygon is to locate the mode (i.e. the value of the variable having maximum frequency of a series).



Frequency Polygon

Check your progress-5:

- (A) State whether the following statements are 'true' or 'false':
 - (a) The bar chart is prepared when the data indicate different values of a variable over a period of time or data represent different situations.
 - (b) A histogram is a one dimensional chart.

- (c) The main purpose in constructing a polygon is to locate the mode
- (B) Fill I the blanks:
 - 1.is also called as circle graph.
 - 2.is a graph that represents the cumulative frequencies for the classes in a frequency distribution.

3.3 Summary:

The collection of data is very important stage in the research process. Data can be classified as quantitative data vs. qualitative data, primary data vs. secondary data and types of data for social sciences needs. The advantages of primary data are fresh data, accurate data, reliable and valid data, easy access and collection of suitable data. The disadvantages of primary data costly data, time consuming, difficult in broader scope, personal limitations and misleading data.

Questionnaire is an instrument through which the data are collected by mailing it to respondents. It is nothing but a set of questions. There are different types of questionnaires such as structured questionnaire, unstructured questionnaire, open form questionnaire, close form questionnaire, mixed questionnaire, opinion questionnaire and pictorial questionnaire. The different types of questions are used in questionnaire such as closed ended questions, dichotomous question, multiple choice question, scaled questions and open ended questions. The advantages of questionnaire method are such as cost saving, time saving, anonymity is possible, no pressure, uniformity, wider scope and free from bias. The disadvantages of questionnaire are such as illustrate and less educated, low response, incomplete responses, misinterpretation, no clarification and bias.

Interview is one of the methods of collecting data. The objective of an interview is to collect information about unknown facts through face to face contacts. There are various types of interviews such as structured interview, unstructured interview, focused interview, clinical interview, depth interview, personal interview, group interview, formal interview, informal Interview, qualitative interview and qualitative interviews

Under observation method, the data from the field is collected with the help of observation.

Observation is divided into three processes: sensation, attention and perception. Observation can be classified into the categories like simple observation, controlled observation, participant observation, non-participant observation, direct observation and indirect observation. The advantages of observation are such as direct method, simplicity, useful for hypothesis, accurate and reliable data and eye witness and suitable for proper analysis. The disadvantages of observation method are such as not suitable, only current situation, sampling difficult, expensive, and lack of proper orientation.

A focus group refers to an interview carried out by a trained researcher whose role is both to ask questions and to observe participants with the group. Focus group method has advantages such as idea generation, group dynamics, process advantage, reliable and valid data and 10 Ss advantages. This method has some disadvantages also which are group dynamics as disadvantage, scientific process, moderator bias and limitations.

A schedule is also a set of questions like questionnaire, prepared and administered for collecting data from respondents. A schedule may be of different types like interview schedule, observation schedule, rating schedule, document schedule, institutional survey schedule etc. Schedule is filled in by interviewer while taking interview while questionnaire is sent by mail to respondent to be answered.

Secondary data are the data which have been collected by somebody else and used by the researcher. Secondary sources may be books, journals, reports etc. There are advantages of secondary data such as quick and cheap, coverage of wider scope, generalization possible and supporting verification. The disadvantages of secondary data are such as non-suitability, inaccuracy, outdated data, non-accessible data and difficult to test reliability and validity of data.

The data processing comprises questionnaire checking, editing, coding, classification, tabulation, graphical presentation, data cleaning and data adjusting. Classification is a process of grouping the statistical data. The four types of classification are called qualitative classification, quantitative classification, chronological classification and geographical classification.

Tabulation is the process of summarizing raw data and displaying it is compact form for further analysis. Table can be divided into different categories such as frequency tables, response tables, contingency tables, univariate tables, bivariate tables, statistical tables and time series tables. They are also classified as one-way table, two-way table and three-way table. Elements of table include table number, title of table, number of columns and rows, stubs or row designations, captions or columns headings, body of the table, the unit of measurement, source and footnotes.

Graphical Presentation is a technique of presenting the data visually in the form of graph. Types of charts include bar chart, multiple bar chart, sub-divided bar chart, histogram, ogive curve, pie-chart, pictogram and frequency polygon.

3.4 Terms to Remember:

- **1. Primary data:** Primary sources are original sources from which data are collected by any researcher yet nobody has collected the same data.
- 2. Secondary data: It is the data which is collected by somebody else and which is used by the researcher.
- 3. **Questionnaire:** Questionnaire is an instrument through which the data are collected by mailing it to respondents. It is nothing but a set of questions.
- 4. **Schedule:** Schedule is the name usually applied to a set of questions which are asked and filled in by the investigator in a face to face situation with another person.
- 5. **Focus group:** A focus group refers to an interview carried out by a trained researcher whose role is both to ask questions and to observe participants with the group.
- 6. **Classification:** It is the process of arranging data in groups or classes on the basis of common characteristics. Entire data are divided into groups or classes, by making classification.
- 7. **Tabulation:** Tabulation is presenting data in tabular form. It is systematic representation of the information collected in the data in rows or colums according to certain characteristics.

3.5 Answers to check your progress

Check your progress-1:

- (A) 1. Data, 2. Quantitative Data, 3. Primary data
- (B) 1. True, 2. True

Check your progress-2:

- (A) 1. Close ended, 2. Depth interview
- (B) 1. False, 2. True, 3. False

Check your progress-3:

- (A) 1. Schedule, 2. Zikmund
- (B) 1. False, 2. True, 3. True

Check your progress-4:

- (A) 1.- (a) Questionnaire Checking, 2.- (d) Personal Classification
- (B) 1. True, 2. False, 3. True

Check your progress-5:

- (A) 1- True, 2.- False, 3- True
- (B) 1- Pie-chart, 2.- Ogive

3.6 Exercise

- 1. What are different types of data?
- 2. What is primary data? Explain the advantages and disadvantages of primary data.
- 3. What is secondary data? Describe the advantages and disadvantages of secondary data.
- 4. Explain advantages and disadvantages of questionnaire method.
- 5. Describe benefits and limitations of interview method.
- 6. What is focused group interview? What are its advantages and disadvantages?
- 7. Explain different types of graphs?
- 8. Write short answers of the following questions:
 - (a) What are types of questionnaire?
 - (b) What are types of interview?
 - (c) What are types of observation?
 - (d) What are types of classification?
 - (e) Explain the process of tabulation.
 - (f) What are types of tables?

- 9. Write short notes on the following points:
 - (a) Types of questions
 - (b) Schedule and Questionnaire
 - (c) Data processing
 - (d) Elements of table
 - (e) Bar chart
 - (f) Pie chart
 - (g) Histogram

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Analysis and Interpretation of Data

4.0 Objective -

After studying this Unit you will be able to:

- 1. Understand the concept, tools and techniques of analysis and interpretation of data.
- 2. Analyze and interpret data with computing measures of central tendency, measures of dispersion, correlation and regression.
- 3. Explain the methods of hypothesis testing and their application.
- 4. Explain the layout of research project and prepare such layout.
- 5. Find relationship between the nature of data and analytical tool to use.
- 6. Explain concept and types of research report and characteristics of good report.
- 7. Write a research report.

4.1 Introduction

The previous chapter dealt with data, collection of data and processing of collected data. The data collection instrument has been discussed in sufficient length. The chapter also dealt with classification and tabulation of data. Having collected the data using data collection instrument or data collected from secondary sources it is needed to be analyzed. The analysis of data is done using statistical tools and techniques. Present chapter probe detailed into the statistical tools used to analyze the data.

To make it more practical and easy to understand a live survey data has been used. The online questionnaire has been executed to the first year and second year students studying in MBA in the institute affiliated to Shivaji University have been collected using Google form and their responses have been invited. The questionnaire (Google Form) is attached at the end of this chapter (refer annexure number 01). The data of first 20 students of MBA-I and MBA-II have been only taken as sample for analysis in this chapter. The detailed code sheet (refer annexure number 02) along with data sheet (refer annexure number 03) has also been given.

The solved examples in this chapter are based on the data from the data sheet. Also the exercise questions are asked based on the data in the data sheet.

4.2 Analysis of Data:

Analysis of data is an important step in research process. Collected data should be systematically analyzed. Data analysis means searching and showing the relationship between or among the tabulated data. Analysis shows the pattern of correlation between the data.

"Processing of data refers to concentrating, recasting, and dealing with the data so that they are as amenable to analysis as possible, while analysis of data refers to seeing the data in the light of hypothesis of research questions and the prevailing theories and drawing conclusions that are as amenable to theory formation as possible"....by Prof John Gatting.

"Analysis of data involves a number of closely related operations that are performed with the purpose of summarizing the collected data and organizing these in such a manner that they will yield answer to the research questions or suggest hypothesis or questions if no such questions of hypothesis had initiated the study".

....by Wilkinson and Bhabdarkar.

Data analysis means to establish an association or relationship between variables. Analysis has supported by interpretation where positive correlation or negative correlation. The analysis can use statistical parameters for drawing quantifiable inference. In data analysis, high degree or low degree of variables should be measured. The degree may be positive or negative or liner. The researcher can be used mean, median; mode, standard deviation, coefficient of variation, t-test, z-test, etc can be applied for interpretation of data. These statistical parameters are very useful for data processing and drawing inference. In data analysis cross checking the fulfillment of objectives and hypothesis testing is undertaken. Data processing is required for analysis and interpretation of the data. The required data has collected through questionnaire or schedule and observation. The researcher has to check that all questions have filled or not, quality of the respondents, sampling method wise questionnaire, respondent sincerity while filled the questionnaire, impression of the respondents about questionnaire etc.

4.2.1 Interpretation of Data:

The very important in any research especially in social sciences, is an interpretation of the collected and analyzed data. Interpretation is drawing inferences from the data. Interpretation has to be done very carefully; otherwise misleading conclusions may be drawn. Interpretation means establishing relationship among different variables. This is based on observation made by the researcher in his data collection period. Interpretation provides conceptual and suggestive parameters for the selected subject. It helps for drawing number of useful and applicable inferences and findings. Interpretation is the last stage of the research where different inferences, sequential order, findings, and applied suggestions. Any researcher is not only fact finding activity but also relation to the previous findings, cross sectional analysis, fulfillment of objectives and hypotheses etc. Interpretation is required for knowing the research finding, knowing abstract principles behind findings, guidance for future research, establishing relationship among the variables, etc.

Section - I

4.3 Measure of central tendency, measures of dispersion.

Measures of central tendency are a value attempt to describe the central position of the set of data. The most common measures of central tendency are mean, median and mode.

Definitions of Average:

- 1. "Averages are statistical constant which enable us to comprehend in a single effort the significance of the whole." A.L.Bowley
- 2. "An average is a single value selected from a group of values to represent them in some way, a value which is supposed to stand for whole group of which it is a part, as typical of all the values in the group." A.E. Waugh
- 3. "An average is a sometimes called a measure of central tendency because individual values of the variable usually cluster around it. Average are useful, however for certain types of data in which there is little or no central tendency." Crum and smith
- 4. "An average is a single value within the range of the data that is use to represent all of the values in the Series. Since an average is somewhere within the range of

the data, it is sometimes called a measure of central value." Croxton and Cowden

Definition of Arithmetic Mean: "Arithmetic mean is a set of observations is their sum divided by the number of observations."

Suppose if $x_{2}x_{2}x_{3}x_{4}$ the given n observations are, then their arithmetic mean, usually denoted by is given by:



where,

 $\sum x =$ Sum of the values N = Number of values.

Definition of Median:

"The median is that value of the variable, which divides the group in two equal parts, one part comprising all the values greater and the other, all values less than the median."

Formula:

Median = size of (+1) th item

Definition of Mode: "Mode is the value which has the greatest frequency density in its immediate neighborhood." –

Formula:

Mode= the value having maximum frequency.

Above given three measures of central tendencies are most widely used in data analysis.

4.3.1 Measures of Dispersion

Dispersion refers to the spread of the data how one data point is spread from another data point. In the analysis the term dispersion is very important. It might possible that the mean of two series would be same that does not reveals that the two series performs the same. It is the dispersion tell researcher about the performance. If the value of measures of dispersion especially standard deviation is small then it can be stated that the series has less variability and it has more consistency. Definition of Measures of Dispersion:

"Dispersion is the measure of the variation of the items." - A.L.Bowley Dispersion is a measure of the extent to which the individual items vary." -

L.R.Connor "Dispersion or spread of the degree of scatter or variation of the variables about central value." -B.C.Brooks.and W.F.L.Dick.

"The degree to which numerical data tend to spread about and average value is called the variation or dispersion of the data." - Spiegel.

We have few commonly used measures of dispersion. Even in our routine life also we use some of the measures of dispersion especially range is widely used in common transactions.

Let's get into little depth to understand these measures of dispersions.

4.3.2 Range

It is the difference between the minimum and maximum items of the series. It is generally used in quality control.

Absolute Range or Range = $x_{max} - x_{min}$. or Range = L - S, where L is the largest value and S is the smallest value of the term.

Coefficient of Range or Relative Range $= \frac{\text{Absolute Range}}{\text{Sum of the two extremes}} = \frac{L-S}{L+S}$.

4.3.3 Standard Deviation

Standard deviation is the most important and commonly used measure of dispersion. It measures the absolute dispersion or variability of a distribution. A small standard deviation means a high degree of uniformity in the observations as well as homogeneity of the series.

Definition

Standard deviation is the positive square root of the average of squared deviations taken from arithmetic mean.

Standard Deviation:
$$\sigma = \sqrt{\Sigma \frac{(x-\overline{x})^2}{n}}$$

Alternatively,

$$\sigma = \sqrt{\frac{\Sigma d^2}{n} - \left(\frac{\Sigma d}{n}\right)^2},$$

Coefficient of standard deviation is a relative measure of standard deviation.

Coefficient of Standard Deviation = $\frac{\sigma}{\overline{r}}$,

4.3.4 Variance

The variance is the square of standard deviation and is denoted by σ^2 .

We have to understand that calculating every statistics there are formulae available we need to understand the formulae. There different formulae also available to calculate same statistics one has to understand the alternate use of such formulae.

Beyond the use of formulae and mechanical calculations what more important is the very interpretation of figure derived out of statistical calculations.

Now let's understand the aforementioned concepts of measures of central tendency and measures of dispersion with the help of examples based on the data we have collected.

We are taking a data of MBA-I year students age only to calculate measures of central tendency and dispersion.

4.3.5 Case 1:

Calculate the measures of central tendency and measure of dispersion for the age of MBA-I year students.

22	23	20	22	20	25	22	21	21	22	25	21	23	20	22	23	24	21	21	21
C	1																		

Solution:

First we arrange the data in ascending order as follows

20	20	20	21	21	21	21	21	21	22	22	22	22	22	23	23	23	24	25	25

Formula:

We are going to use following formulae to calculate desired measures of central tendency and measures of dispersion.

- 1) $\overline{X} = \sum xi / n = (Sum of all values / Total Number of values)$
- 2) Median = $\{(n/2)$ th term + [(n/2) + 1]th term $\}/2$
- 3) Mode = Most of the value
- 4) Range= Maximum Value Minimum Value = (L-S)
- 5) Coefficient of range =(L-S)/(L+S)
- 7) Standard Deviation (σ) =[$\sqrt{(\sum xi^2/n)} (\sum xi/n)^2$]
- 8) Coefficient of s.d= (σ/\overline{X})
- 9) Variance $=\sigma^2$

Calculations:

- 1) $\overline{X} = \sum xi / n=$ (Sum of all values / Total Number of values) $\overline{X} = 439 / 20$ $\overline{X} = 21.95$
- 2) Median = {(n/2)th term + [(n/2) +1]th term} /2

Median = $\{(20/2)$ th term + [(20/2) + 1]th term $\}/2$

Median = [(10)th term + (11)th term]/2

Median = (22+22)/2

Median =22

- 3) Mode = Most common value = 21
- 4) Range= Maximum Value Minimum Value = (L-S) Range= (25-20) Range = 5
- 5) Coefficient of range =(L-S)/(L+S)Coefficient of range =(25-20)/(25+20)

Coefficient of range =0.1111

Standard Deviation (σ)

Here n=20

Sr.No	Х	X^2
1	22	484
2	23	529
3	20	400
4	22	484
5	20	400
6	25	625
7	22	484
8	21	441
9	21	441
10	22	484
11	25	625
12	21	441
13	23	529
14	20	400
15	22	484
16	23	529
17	24	576
18	21	441
19	21	441
20	21	441
Total	439	9679

Standard Deviation (σ) =[$\sqrt{(\sum xi^2 / n) - (\sum xi/n)^2}$] Standard Deviation (σ) =[$\sqrt{(9679 / 20) - (439/20)^2}$] Standard Deviation (σ) =[$\sqrt{(483.95) - (481.8025)}$] Standard Deviation (σ) =($\sqrt{2.1475}$) Standard Deviation (σ) =1.4654

6) Coefficient of S.d= (σ/\overline{X})

Coefficient of S.d= (1.4654 / 21.95)

Coefficient of S.d= 0.0668

7) Variance $=\sigma^2$

Variance = $(0.0668)^{2}$

Variance = 0.0046

4.4 Check your progress:

Multiple Choice Questions

1. Data analysis means to establish an association or between variables.

- a. Association
- b. Merit
- c. Relationship
- d. None of the above
- 2. Interpretation is drawing from the data.
 - a. Inferences
 - b. Conclusions
 - c. Resulting meaning
 - d. All the above
- 3. Measures of central tendency are a value attempt to describe the of the set of data.
 - a. Central position

- b. Right end position
- c. Left end position
- d. None of the above
- 4. The most common measures of central tendency are
 - a. Mean
 - b. Standard deviation
 - c. Variance
 - d. All the above
- 5. The median is that value of the variable, which divides the group inequal parts.
 - a. Three
 - b. Four
 - c. Two
 - d. All the above
- 6. Mode is the value which has the frequency density in its immediate neighborhood.
 - a. Lowest
 - b. Greatest
 - c. Nearest
 - d. None of the above
- 7. Dispersion refers to the of the data
 - a. Spread
 - b. Center
 - c. Tail
 - d. None of the above
- 8. It is the difference between the minimum and items of the series.
 - a. Maximum
- b. Central
- c. Left tailed
- d. Right tailed
- 9. Standard deviation is the of the average of squared deviations taken from arithmetic mean.
 - a. Negative square root
 - b. Multiplication
 - c. Deviation
 - d. Positive square root
- 10. The variance is the square of
 - a. Standard deviation
 - b. Mean Deviation
 - c. Range
 - d. None of the above

4.5 Case Example 1:

Calculate the measures of central tendency and measure of dispersion for the CET scores of MBA-II year students.

25	35	91	38	51	31	48	60	23	52	79	36	46	45	52	40	55	54	48	41

Section - II

4.6 Correlation and Regression:

Correlation is a statistical tool which studies the relationship between two variables.

Correlation analysis is a statistical procedure by which we can determine the degree of association or relationship between two or more variables.

Coefficient of correlation is a measure of such a tendency, i.e. the degree to which the two variables are interrelated is measured by a coefficient which is called the coefficient of correlation. Definition – The relationship between two variables such that a change in one variable results in a positive or negative change in the other variable and also a greater change in one variable results in corresponding greater or smaller change in the other variable is known as correlation.

'When the relationship is of a quantitative nature, the appropriate statistical tool for discovering and measuring the relationship and expressing it in a brief formula is known as correlation'. – Craxton and Cowden.

The coefficient of correlation between the two variables x, y is generally denoted by r or $r_{\rm XY.}$

Covariance is an, 'absolute measure' and coefficient of correlation is relative measure of association.

The coefficient of correlation between the two variables x and y is generally denoted by r or r $_{xy}$ or p (x,y) or p.

4.6.1 Properties of coefficient of correlation:

- 1. It is a measure of the closeness of a fit in a relative sense.
- 2. Correlation coefficient lies between - and +1 i.e. $-1 \le r \le 1$.
- 3. The correlation is perfect and positive if r=1 and it is perfect and negative if r= -1.
- 4. If r=0 then there is no correlation between the two variables and thus the variables are said to be independent.
- 5. The correlation coefficient is a pure number and is not affected by a change of origin and scale.
- 6. It is a relative measure of association between two or more variables.



Ref:

https://www.google.com/search?q=diagrams+of+correlation+positive+and+negative



+correlation&tbm=isch&ved=2ahUKEwiU6cj3-uzqAhXe3XMBHcoOAmMQ2cCegQIABAA&oq=diagrams+of+correlation+positive+and+negative+correlation&g s_lcp=CgNpbWcQAzoICAAQsQMQgwE6AggAOgUIABCxAzoECAAQQzoHCA AQsQMQQzoECAAQCjoGCAAQBRAeOgYIABAIEB46BggAEAoQGDoECAAQ GFD9fFiSyQFgoswBaAFwAHgAgAGfAogBllKSAQYwLjUwLjiYAQCgAQGqAQ tnd3Mtd2l6LWltZ8ABAQ&sclient=img&ei=EIkeX5ShJ967z7sPyp2ImAY&bih=63 5&biw=1366#imgrc=ikLqb7i9v05m3M, 27.07.2020, 1.29pm.

4.6.2 Karl Pearson's coefficient of correlation

Karl Pearson (1857-1936) gave following formula for measuring the magnitude of linear correlation coefficient between two variables.

$$\rho(X, Y) = \frac{\sum x_i y_i - \frac{(\sum x_i) (\sum y_i)}{n}}{\sqrt{\left\{\sum x_i^2 - \frac{(\sum x_i)^2}{n}\right\} \left\{\sum y_i^2 - \frac{(\sum y_i)^2}{n}\right\}}}$$

4.6.3 Let's study the correlation with an example from our case.

We will attempt two examples of correlation one is

Calculate the Correlation between HSC marks and Graduation marks and second is Calculate the Correlation between graduation marks and CET score.

HSC	Graduation	CET
64.9	69.6	36
53.9	53.77	35
69.5	53	29.8
66.6	55.55	67
64.2	69.24	20.5
59	65	94.45
53	52	40
65.7	61.52	43
64.7	45.67	38.11
82	77	36
61.7	68.94	49
70.3	75.08	51
58.8	67.38	39

69	64	39
60	70	78
54	48	39
50	62	38
70	63	50
63.2	72.28	52.11
68.7	66	51

First we will calculate the Correlation between HSC marks and Graduation marks

For the same using the formula we need to calculate few figures viz. Xi square, Yi square and multiplication of xi and yi. So preparing such table below we will calculate the figures.

		(xi)2	(yi)2	(xiyi)		
		This column is	This column is	This column is the		
USC Marks	Graduation	the square of	the square of	multiplication of		
	Marks	figures given	figures given I	figures in column		
	(yi)	in column	column	1 and column 2 i.e.		
		number one	number two	multiplication of		
		i.e. xi	i.e. yi	xi x yi		
(1)	(2)	(3)	(4)	(5)		
64.9	69.6	4212.01	4844.16	4517.04		
53.9	53.77	2905.21	2891.21	2898.203		
69.5	53	4830.25	2809	3683.5		
66.6	55.55	4435.56	3085.8	3699.63		
64.2	69.24	4121.64	4794.18	4445.208		
59	65	3481	4225	3835		
53	52	2809	2704	2756		
65.7	61.52	4316.49	3784.71	4041.864		
64.7	45.67	4186.09	2085.75	2954.849		
82	77	6724	5929	6314		
61.7	68.94	3806.89	4752.72	4253.598		
70.3	75.08	4942.09	5637.01	5278.124		
58.8	67.38	3457.44	4540.06	3961.944		

69	64	4761	4096	4416
60	70	3600	4900	4200
54	48	2916	2304	2592
50	62	2500	3844	3100
70	63	4900	3969	4410
63.2	72.28	3994.24	5224.4	4568.096
68.7	66	4719.69	4356	4534.2
Total the res	spective colum	ins		
((y _i)=	$(\mathbf{x})^2 = 81618.6$		$(x_i)^2 (y_i)^2 =$
x _i)=1269.2	1259.03		$(y_i)^2 = 80776$	80459.26

Now we got all the figures we want for n=20, here 20 is the sample size or we can say the cases we have processed. Now plug in the figures in the formula to calculate correlation as follows.

$$\rho (X, Y) = \frac{\sum x_i y_i - \frac{(\sum x_i)(\sum y_i)}{n}}{\sqrt{\left\{\sum x_i^2 - \frac{(\sum x_i)^2}{n}\right\} \left\{\sum y_i^2 - \frac{(\sum y_i)^2}{n}\right\}}}$$
$$= \frac{80459.26 - \frac{(1269.2)(1259.03)}{20}}{\sqrt{\left\{81618.6 - \frac{(1269.2)^{3/2}}{20}\right\} \left\{807760.1 - \frac{(1259.03)^{3/2}}{20}\right\}}}$$
$$= \frac{80459.26 - \frac{1597960.88}{20}}{\left\{\sqrt{(81618.26 - 80453.432)} \left\{80776.01 - 79257.82704\right\}}\right\}}$$
$$= \frac{80459.26 - 79898.0438}{\sqrt{\{1075.168\}} \{1518.18296\}}$$
$$= \frac{561.216}{\sqrt{1632301.736}}$$
$$= \frac{561.216}{1277.6156}$$
$$= 0.4392$$

Correlation between HSC marks and Graduation marks is 0.4392

Now using the diagrammatic scale of correlation given above this correlation of 0.4392 is interpreted as low positive correlation.

So there is low positive correlation between HSC marks and Graduation marks.

Let's solve another example, to calculate the correlation between graduation marks and CET score.

Graduation	CET			
marks	marks	(x _i)2	$(y_{i})^{2}$	$(\mathbf{x}_i)(\mathbf{y}_i)$
(x _i)	(y _i)			
69.6	36	4844.16	1296	2505.6
53.77	35	2891.21	1225	1881.95
53	29.8	2809	888.04	1579.4
55.55	67	3085.8	4489	3721.85
69.24	20.5	4794.18	420.25	1419.42
65	94.45	4225	8920.803	6139.25
52	40	2704	1600	2080
61.52	43	3784.71	1849	2645.36
45.67	38.11	2085.75	1452.372	1740.484
77	36	5929	1296	2772
68.94	49	4752.72	2401	3378.06
75.08	51	5637.01	2601	3829.08
67.38	39	4540.06	1521	2627.82
64	39	4096	1521	2496
70	78	4900	6084	5460
48	39	2304	1521	1872
62	38	3844	1444	2356
63	50	3969	2500	3150
72.28	52.11	5224.4	2715.452	3766.511
66	51	4356	2601	3366
			$(y_i)^2 =$	(x _i)(
$(x_i)=1259.03$	(y _i)=925.97	(x_i) 2=80776.01	48345.92	y _i)=58786.78

Correlation between graduation marks and CET score.

$$\rho(X, Y) = \frac{\sum x_i y_i - \frac{(\sum x_i)(\sum y_i)}{n}}{\sqrt{\left\{\sum x_i^2 - \frac{(\sum x_i)^2}{n}\right\} \left\{\sum y_i^2 - \frac{(\sum y_i)^2}{n}\right\}}}$$

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$$= \frac{58786.76 - \frac{(1269.03)(925.97)}{20}}{\sqrt{\left\{80776.01 - \frac{(1259.03)^2}{20}\right\}\left\{48345.92 - \frac{(925.97)^2}{20}\right\}}}$$
$$= \frac{58786.76 - 58291.20043}{\sqrt{(80776.01 - 79257.82704)(48345.92 - 42871.02204)}}$$
$$= \frac{495.57955}{\sqrt{(1518.18296)(5474.89796)}}$$
$$= \frac{495.57955}{\sqrt{8311896.790}}$$
$$= \frac{495.57955}{2883.036036}$$
$$= 0.1718$$

Correlation between Graduation marks and CET marks is 0.1718

Again this correlation is also very low positive correlation. Looking towards this figure the figure nearer to zero but the figure is not exactly zero hence, this figure is termed as very low positive correlation and good as no correlation.

Having studied the correlation now let's study the concept of regression. Generally regression is followed by correlation.

4.7 Regression

Regression is a statistical measure that attempts to determine the strength of the relationship between one dependent variable (Y) and a series of other changing variables (independent variables) (X).

Linear regression: Y = a+bx+e

Where,

Y = Dependent variable

a = constant (population Y intercept)

b = Population slope coefficient

x = independent variable

e = random error

4.7.1 Definition:

Regression analysis is a mathematical measure of the average relationship between two or more variables in terms of the original units of the data - M.M. Blair.

One of the most frequently used techniques in Economics and Business research, to find a relation between two or more variables that are related usually is Regression Analysis. – Taro Yamane.

Regression Analysis attempts to establish the Nature of Relationship between the variables, that is, to study the functional relationship between the variables x and y, and thereby provides a mechanism for predication or forecasting - Ya-Lun - Chou.

Regression Helps.....

- 1. Analyze the relationship between y and x since $y = f(x_1, x_2, x_3, \dots, x_k)$
- 2. How much y changes with changes in each of the x's (x1, x2, x3xn).
- 3. Forecast or predict the value of y based on the values of the X's.

Now let's take a practical example to understand the linear regression analysis.

4.7.2 Case: CET scores are dependent on the HSC and graduation marks.

Here we have used regression analysis where CET score is dependent variable and marks scored at HSC and Graduation are independent variables. Our effort is to check whether the CET score of a candidate is dependent on the HSC and graduation marks or otherwise.

So the formula to calculate regression is,

 $Y=b_0+b_1x_1+b_2x_2$

to get the values of above formula we, first need to calculate,

1)
$$\overline{X}_1 = \frac{\sum X_1}{n}$$

2)
$$\overline{X}_2 = \frac{\Sigma X^2}{n}$$

3)
$$\overline{Y} = \frac{\Sigma Y}{n}$$

$$4) \quad b_0 = \overline{Y} \cdot b_1 \, \overline{X}_1 \cdot b_2 \, \overline{X}_2$$

5)
$$b_1 = \frac{[(\sum X_2)_2 (\sum X_1Y) - (\sum X_1 X_2).(\sum X_2Y)]}{[(\sum X_1)_2 (\sum X_2)_2 - (\sum X_1X_2)_2]}$$

6) $b_2 = \frac{[(\sum X_1)_2 (\sum X_2Y) - (\sum X_1X_2).(\sum X_1Y)]}{[(\sum X_1)_2 (\sum X_2)_2 - (\sum X_1X_2)_2]}$

Observation Table:

From raw data we go following figures of CET score of n=40 candidates

CET	HSC	Graduation
Ŧ	$\overline{X}1$	<u></u> X 2
38	50	62
46	63	71
35	53.85	53.77
36	64.92	69.6
20.5	64.15	69.24
48	63.54	59
45	57	58
40	53	52
38	60	60.13
79	80.5	59
94.45	59	65
55	55	69
40	72	65
41	83	65
36	60.31	73.36
78	60	70
51	68.66	66
43	65.69	61.52
29.8	69.53	53
60	58	71
23	80	69
91	64.45	58
39	58.8	67.38
49	61.67	68.94
52.11	63.23	72.28

50	70	63
52	64.46	65.12
54	54.92	51
51	70.31	75.08
48	60	61.74
25	61	64
35	70.31	59.14
67	66.6	55.55
51	55	62
31	51.38	57.56
52	75.69	61.61
38.11	64.65	45.67
39	54	48
39	69	64
36	82	77

Calculations:

To facilitate the figures for our formula lets prepare a table as below.

Sr.No	Y	X ₁	X2	X ₁ X ₂	X ₁ Y	X ₂ Y	X_1^2	X_2^2
1	38	50	62	3100	1900	2356	2500	3844
2	46	63	71	4473	2898	3266	3969	5041
3	35	53.85	53.77	2895.515	1884.75	1881.95	2899.823	2891.213
4	36	64.92	69.6	4518.432	2337.12	2505.6	4214.606	4844.16
5	20.5	64.15	69.24	4441.746	1315.075	1419.42	4115.223	4794.178
6	48	63.54	59	3748.86	3049.92	2832	4037.332	3481
7	45	57	58	3306	2565	2610	3249	3364
8	40	53	52	2756	2120	2080	2809	2704
9	38	60	60.13	3607.8	2280	2284.94	3600	3615.617
10	79	80.5	59	4749.5	6359.5	4661	6480.25	3481
11	94.45	59	65	3835	5572.55	6139.25	3481	4225
12	55	55	69	3795	3025	3795	3025	4761
13	40	72	65	4680	2880	2600	5184	4225
14	41	83	65	5395	3403	2665	6889	4225
15	36	60.31	73.36	4424.342	2171.16	2640.96	3637.296	5381.69
16	78	60	70	4200	4680	5460	3600	4900
17	51	68.66	66	4531.56	3501.66	3366	4714.196	4356
18	43	65.69	61.52	4041.249	2824.67	2645.36	4315.176	3784.71

19	29.8	69.53	53	3685.09	2071.994	1579.4	4834.421	2809
20	60	58	71	4118	3480	4260	3364	5041
21	23	80	69	5520	1840	1587	6400	4761
22	91	64.45	58	3738.1	5864.95	5278	4153.803	3364
23	39	58.8	67.38	3961.944	2293.2	2627.82	3457.44	4540.064
24	49	61.67	68.94	4251.53	3021.83	3378.06	3803.189	4752.724
25	52.11	63.23	72.28	4570.264	3294.915	3766.511	3998.033	5224.398
26	50	70	63	4410	3500	3150	4900	3969
27	52	64.46	65.12	4197.635	3351.92	3386.24	4155.092	4240.614
28	54	54.92	51	2800.92	2965.68	2754	3016.206	2601
29	51	70.31	75.08	5278.875	3585.81	3829.08	4943.496	5637.006
30	48	60	61.74	3704.4	2880	2963.52	3600	3811.828
31	25	61	64	3904	1525	1600	3721	4096
32	35	70.31	59.14	4158.133	2460.85	2069.9	4943.496	3497.54
33	67	66.6	55.55	3699.63	4462.2	3721.85	4435.56	3085.803
34	51	55	62	3410	2805	3162	3025	3844
35	31	51.38	57.56	2957.433	1592.78	1784.36	2639.904	3313.154
36	52	75.69	61.61	4663.261	3935.88	3203.72	5728.976	3795.792
37	38.11	64.65	45.67	2952.566	2463.812	1740.484	4179.623	2085.749
38	39	54	48	2592	2106	1872	2916	2304
39	39	69	64	4416	2691	2496	4761	4096
40	36	82	77	6314	2952	2772	6724	5929
Total	1875.97	2558.62	2518.69	161802.8	119912.2	118190.4	166420.1	160717.2

Calculations:

1)
$$\overline{X}_1 = \frac{\sum X_1}{n}$$

 $\overline{X}_1 = 2558.62/40$

 $\overline{X}_1 = 63.9655$

2)
$$\overline{X}_2 = \frac{\sum X2}{n}$$

 $\overline{X}_2 = 2518.69/40$

X₂=62.96725

3)
$$\overline{Y} = \frac{\Sigma Y}{n}$$

 $\overline{Y} = \frac{1875.97}{40}$

<u>¥</u>=46.89925

4)
$$b_{1} = \frac{\left[(\sum X2)2 (\sum X1Y) - (\sum X1 X2) (\sum X2Y)\right]}{\left[(\sum X1)2 (\sum X2)2 - (\sum X1X2)2\right]}$$

$$b_{1} = \frac{\left[(160717.2) (119912.2) - (161802.8) (118190.4)\right]}{\left[(166420.1) (160717.2) - (161802.8)2\right]}$$

$$b_{1} = \frac{\left[19271953030 - 19123537653\right]}{\left[26746572496 - 26180146088\right]}$$

$$b_{1} = \frac{148415380}{566426408}$$

$$b_{1} = 0.262020587$$
5)
$$b_{2} = \frac{\left[(\sum X1)2 (\sum X2Y) - (\sum X1X2) (\sum X1Y)\right]}{\left[(\sum X1)2 (\sum X22) - (\sum X1X2)2\right]}$$

$$b_{2} = \left[(166420.1) (118190.4) - (161802.8) (119912.2)\right] / \left[(166420.1) (160717.2) - (161802.8)^{2}\right]$$

$$b_{2} = \left[19669258187 - 19402129714\right] / \left[26746572496 - 26180146088\right]$$

$$b_{2} = (267128473 / 566426408)$$

$$b_{2} = 0.471603$$
6)
$$b_{0} = \overline{Y} - (b_{1} \overline{X}_{1} - b_{2} \overline{X}_{2})$$

$$b_0 = 46.89925 - [(0.262020587)(63.9655)] - [(0.471603)(62.96725)]$$

 $b_0 = 46.89925 - 16.76027786 - 29.695544$

b₀=0.443428141

7)
$$Y = b_0 + b_1 X_1 + b_2 X_2$$

After calculation of above now we can establish the regression as,

 $Y = 0.4434 + (0.2620)X_1 + (0.471603)X_2$

It means dependent variable i.e. CET score = 0.4434 times x1(HSC marks) plus 0.4716 times x2 (Graduation marks).

Now with this we can estimate the figure of dependent variables as well with having known HSC and Graduation marks of candidate

51, 55, 62 Y = 0.4434(55)+ 0.4716 (62) Y = 24.39 + 29.24 Y = 53.62

Actual figure of y is 51 and from our regression statement we got the figure 53.62 we got little deviation, but the estimated figure is close to 51.

4.8 Check your progress:

Multiple Choice Questions:

1. Correlation is a statistical tool which studies thebetween two variables

- a. Relationship
- b. Dependability
- c. Independence
- d. None of the above
- 2. Correlation coefficient lies between plus 1 and
 - a. Plus 1
 - b. Minus 1
 - c. Zero
 - d. None of the above
- 3. If r=0 then there is between the two variables
 - a. Perfect positive correlation
 - b. Perfect negative correlation
 - c. No correlation
 - d. Low positive correlation
- 4. The dependent variable in regression analysis is generally denoted by English letter
 - a. X
 - b. e
 - c. b
 - d. <mark>Y</mark>

- 5. In linear regression Y = a+bx+e the letter e stands for.....
 - a. Dependent variable
 - b. Constant
 - c. Independent variable
 - d. Random error

4.9 Case 1: Calculate the correlation between HSC marks and graduation marks using our collected data from MBA-II year students.

Case2: Calculate the correlation between Graduation marks and CET score using our collected data from MBA-II year students.

Case 3: Calculate the correlation between CET score and HSC marks from MBA-II year students.

HSC	61	70	65	60	55	51	64	58	80	76	81	60	63	57	65	72	55	55	60	83
Graduation	64	59	58	60	62	58	59	71	69	62	59	73	71	58	65	65	69	51	62	65
CET	25	35	91	38	51	31	48	60	23	52	79	36	46	45	52	40	55	54	48	41

Case 4: Work out the regression analysis and find out the dependability of graduation score on HSC score.

Graduation	69.6	53.8	53	55.6	69.2	65	52	61.5	45.7	77	68.9	75.1	67.4	64	70	48	62	63	72.3	66
HSC	64.9	53.9	69.5	66.6	64.2	59	53	65.7	64.7	82	61.7	70.3	58.8	69	60	54	50	70	63.2	68.7

Section - III

4.10 Hypothesis Testing:

In chapter two we have studied in detail the process of formulation of hypothesis; here we are going to study the process of hypothesis testing.

Just to remind that, Neave has proposed five steps of hypothesis testing as follows.

Five Step Method - Neave (1976)



Source: (Compiled by Authors)

The above steps we have learned in details in chapter 2, now we are going to see some practical problems using different statistical tools.

The data annexed has used for testing the hypothesis.

We have put to test five hypotheses as follows,

1. H01: The gender of students studying in MBA and their graduation are independent.

- 2. H02: Parent's current profession and students future plans are independent.
- 3. H03: There is no association between the income of parents and stay of vicinity.
- 4. H04: There is no significant difference between the CET score of MBA-I and MBA-II year students.
- 5. H05: There is no significant difference between the agreement on output of MBA syllabus among MBA-I and MBA-II Year students.

We will take our set hypotheses one by one to test.

4.10.1 Hypothesis: H_{01} : The gender of students studying in MBA and their graduation are independent

Here we have taken gender on nominal scale and graduation also on nominal scale and we want to see whether these two variables are associated to each other or they are independent means not associated to each other. See since both the variables are measured on nominal scale hence we need to use chi-square test to find out association between variables.

Formula to calculate chi-square test is as below.

1)
$$\chi^2_{\text{cal}} = \sum_{i=1}^n \frac{(oi - Ei)2}{Ei}$$

Where-

 $O_i = observed$ Frequencies

 $E_i = Expected Frequencies$

2) $\chi^2_{tab} = (R-1) (C-1), \alpha$ here we are calculating the degrees of freedom with the help of this formula.

Where,

R= Number of rows

C= Number of columns

 α = Level of significance

Observation Table:

Gender of Samples * Graduation Held Cross tabulation.

			Graduation Held						Total
-			B.Com.	B.Sc.	B.A.	B.E.	BBA/	Any	
							BCA	Other	
Gender	Male	Count	8	5	2	1	2	2	20
of		Expected	7.5	6.5	1.0	1.5	2.5	1.0	20.0
Samples		Count							
	Female	Count	7	8	0	2	3	0	20
		Expected	7.5	6.5	1.0	1.5	2.5	1.0	20.0
		Count							
Total		Count	15	13	2	3	5	2	40
		Expected	15.0	13.0	2.0	3.0	5.0	2.0	40.0
		Count							

Sr.No.	Oi	Ei	(Oi-Ei)	$(Oi-Ei)^2$	(Oi – Ei)2/Ei
	(Observed	(Expected			
	frequency)	frequency)			
1	8	7.5	0.5	0.25	0.0333
2	5	6.5	-1.5	2.25	0.3462
3	2	1.0	1	1	1
4	1	1.5	-0.5	0.25	0.1667
5	2	2.5	-0.5	0.25	0.1
6	2	1.0	1	1	1
7	7	7.5	-0.5	0.25	0.0333
8	8	6.5	1.5	0.25	0.3462
9	0	1.0	-1	1	1
10	2	1.5	0.5	0.25	0.1667
11	3	2.5	0.5	0.25	0.1
12	0	1.0	-1	1	1
Total	40				(Oi – Ei)2/Ei
					= 5.2924

From above table we calculate,

$$\chi^{2}_{cal} = \sum_{i=1}^{n} \frac{(oi - Ei)^{2}}{Ei}$$

$$\chi^{2}_{cal} = 5.2924$$
and
$$\chi^{2}_{tab} = (R-1) (C-1), \alpha$$

$$= (2-1) (6-1), 0.05$$

$$= (1) (5), 0.05$$

$$\chi^{2}_{tab} = 11.71$$

Calculated by using chi-square table at 0.05 level of significance

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Result:

 $\chi^2_{cal} = 5.2924 < \chi^2_{tab} = 11.71$

Hence, H0 i.e. null hypothesis is accepted at 5% level of significance and alternative hypothesis is rejected.

Interpretation:

The gender of students studying in MBA and their graduation are independent. It means there is no any association found between gender of students studying in MBA and their graduation.

Note:

If the calculated value of chi-square is less than the table value then null hypothesis is accepted and alternative hypothesis is rejected.

4.10.2 Hypothesis:

H0₂: Parent's current profession and students future plans are independent.

Here also the case is same like above hypothesis. Both the variables have been measured using nominal scale and hence, chi-square test has brought in use.

Observation Table:

Profession of Parents of Samples * Future Plan of Samples Cross tabulation

			Future Plan of Samples			Total
			Business	Self-	Employme	
				Profession	nt	
				al		
Professio		Count	3	0	15	18
n of	Farmer	Expecte	5.0	1 /	117	18.0
Parents of		d Count	5.0	1.7	11.7	10.0
Samples		Count	5	1	1	7
	Business	Expecte	1.0	5	16	7.0
		d Count	1.7	.0	4.0	7.0
	Self-	Count	1	0	0	1
	Professiona	Expecte	03	0.1	0.7	1.0
	1	d Count	0.5	0.1	0.7	1.0

	Employmen t	Count	2	2	10	14
		Expecte d Count	3.9	1.1	9.1	14.0
Total		Count	11	3	26	40
		Expecte d Count	11.0	3.0	26.0	40.0

Calculations:

Sr No	Oi (Observed	Ei (Expected	(Oi-Fi)	$(Oi-Fi)^2$	(Oi – Ei)2/Ei
51.110	value)	value)	(OI LI)		
1	3	5.0	-2	4	0.8
2	0	1.4	1.4	1.96	1.4
3	15	11.7	3.3	10.89	0.9308
4	5	1.9	3.1	9.61	5.0579
5	1	0.5	0.5	0.25	0.5
6	1	4.6	-3.6	12.69	2.8174
7	1	0.3	0.7	0.49	1.6333
8	0	0.1	-0.1	0.01	0.1
9	0	0.7	-0.7	0.49	0.7
10	2	3.9	-1.9	3.61	0.9256
11	2	1.1	0.9	0.81	0.7364
12	10	9.1	0.9	0.81	0.0890
Total	40				(Oi – Ei)2/Ei
					=15.6904

From above table we can calculate,

$$\chi^2_{cal} = (Oi - Ei)2/Ei$$

=15.6904

 $\chi^{2}_{tab} = (R-1) (C-1), \alpha$

= (4-1) (3-1), 0.05
= (3) (2), 0.05
= 6, 0.05

$$\chi^{2}_{tab} = 12.392$$
 Value calculated by using chi-square table at 5%

level of significance

Result:

 $\chi^2_{cal} = 15.6964 > \chi^2_{tab} = 12.392$

Hence H0₂ (Null Hypothesis) is rejected at 5% level of significance.

Interpretation:

Parent's current profession and students future plans are associated.

4.10.3 Hypothesis:

 H_{O4} : There is no significant difference between the CET score of MBA-I and MBA-II year students.

Here we have taken actual scores of students of CET from MBA-I year and MBA-II year students. Now these two groups are different though we have taken a common variable of score i.e. CET score. So to find the statistical difference between these two series of data we are using independent sample't' test to test the hypothesis. The hypothesis we are going to test at 5% level of significance.

Formula:

So formula to calculate independent sample't' test is,

 $t=(\overline{X}i - \overline{X}ii/S.E.)$

Here,

 $\overline{X}i = is$ mean of first series

 \overline{X} ii = is mean of second series

S.E. = Standard error of mean

Now how to calculate the S.E.

S.E. = s * $\sqrt{1/n1} + 1/n2$

Now calculation of $s = \sqrt{n1s_1^2 + n_2s_2^2/n_1 + n_2-2}$ (here the value of s = value of standard deviation)

$$t_{Cal} = \frac{(\bar{X} - \bar{Y})}{S\sqrt{(1/n1) + (1/n2)}}$$

where,

S= standard derivation from the population

In this chapter at the beginning we have studied the calculation of standard deviation by using the formula: $\left[\sqrt{(\sum xi^2/n)} - (\sum xi/n)^2\right]$

Now we are clear about the process and all the required formula are with us.

Let's start for calculations.

First we will prepare a table as below which will facilitate data for further calculations.

		MBA1 ²	$MBA2^2$
MBA1 CET	MBA2 CET	Square of column 1	Square of column 2
Score (x)	Score (y)	$(x^{2)}$	$(y^{2)}$
(1)	(2)	(3)	(4)
36	25	1296	625
35	35	1225	1225
29.8	91	888.04	8281
67	38	4489	1444
20.5	51	420.25	2601
94.45	31	8920.803	961
40	48	1600	2304
43	60	1849	3600
38.11	23	1452.372	529
36	52	1296	2704
49	79	2401	6241
51	36	2601	1296
39	46	1521	2116
39	45	1521	2025
78	52	6084	2704
39	40	1521	1600

38	55	1444	3025
50	54	2500	2916
52.11	48	2715.452	2304
51	41	2601	1681
925.97	950.00	48345.92	50182.00

Now we have basic calculations ready with us.

We need to calculate mean of MBA- I and II CET scores

1.
$$\overline{X} = \frac{\sum xi}{ni} = 925.97/20 = 46.30$$

2. $\overline{Y} = \frac{\sum yi}{n2} = 950.00/20 = 47.50$

Now let's calculate the standard deviation of both the series.

S.D. of MBA-I CET Score = $[\sqrt{(\sum xi^2/n)} - (\sum xi/n)^2] = (\sqrt{(48345.92/20)} - ((925.97/20)^2))$

$$= \sqrt{2417.30-2143.55}$$

 $= \sqrt{273.74}$

= 16.55

S.D. of MBA-II CET Score

 $=(\sqrt{(50182.00/20)}-(950.00/20)^2)$

$$=(\sqrt{2509.1}-2256.25)$$

 $= \sqrt{252.85}$

Now we should calculate standard error for which we need value of s (refer formula above of calculation of s)

$$S = \sqrt{(20*16.55^2) + (20*15.90^2)/20 + 20 - 2}$$

= $\sqrt{5478.05 + 5056.2/38}$
= $\sqrt{277.2}$
= 16.64

Now calculate the figure of standard error

S.E. = s * $\sqrt{1/n1}$ + 1/n2 = 16.64 * s * $\sqrt{1/20}$ +1/20 = 5.2620

Now we have calculated all the values we require to calculate the value of 't'

't' = (Xi - Xii/S.E.) = (46.30-47.50)/5.2620 't' = - 0.228

After calculating the value of t' we need to check the value of table value of t'

We have decided to test the hypothesis at 5% level of significance. So to find out table value we have to use following formulation. The table value has to sort out from the tables given at the end of statistic book.

7. $t_{tab} = t_{(n-1)}, \frac{\alpha}{2}$ (two tailed test)

where,

n= total number of samples

 α = degree of freedom

Calculation of degrees of freedom -(c-1)(r-1) = (2-1)(20-1) = (1)(19) = 19 so degrees of freedom is 19, hence, in the table titled, 'Students *t* Distribution' at the end of any statistic reference book, first column denotes the degrees of freedom in our case the degrees of freedom is 19 so we have to point out 19 figure and we have decided to test the hypothesis at 5% level of significance. Here one point we have to remember this is two tailed test hence the value of alpha (α) in our case 5% is to be divided in 2 so it comes to 0.025. We have to find out figure which intersect 19 degrees of freedom at 0.25 alpha level that figure comes to 2.093 so that table value of 't' is 2.093. This table value we have to compare it with calculated value i.e. - 0.228

So here calculated't' is -0.228 is less than table value of't' 2.093

i.e. -0.228 < 2.093, so our interpretation is accept the null hypothesis and reject the alternative hypothesis.

There is no significant difference between the CET score of MBA-I and MBA-II year students.

4.11 Check your progress:

Multiple choice questions

- 1. Chi-square test is used to find the between variables.
 - a. Association
 - b. Relation
 - c. Dependency
 - d. None of the above
- 2. In the formula of chi-square test the letter E_i denotes
 - a. Observed frequencies
 - b. Expected frequencies
 - c. Column data
 - d. Row data
- 3. In hypothesis testing the term alpha (α) refers to
 - a. Degrees of freedom
 - b. Level of confidence
 - c. Level of significance
 - d. None of the above
- 4. When the value of calculated test statistics is less than table value then null hypothesis is
 - a. Accepted
 - b. Rejected
 - c. No action is taken
 - d. None of the above
- 5. The measurement scale preferred to test the hypothesis using 't' test is
 - a. Nominal scale

- b. Ordinal scale
- c. Interval and ratio scale
- d. None of the above

4.12 Test following two hypotheses. (The data is provided in the annexure number 3)

Case problem 1: Test the hypothesis. HO_3 : There is no association between the income of parents and stay of vicinity i.e. residential location. 5% level of Significance.

Case Problem 2: Test the hypothesis. There is no significant difference between the agreement on output of MBA syllabus among MBA-I and MBA-II Year students. 5% level of significance.

Section - IV

4.13 Report Writing:

This chapter section helps to understand report writing. Meaning and purpose of report, various types to write a report. Most importantly, project report invariably students need to undertake as a part of partial fulfillment of professional course like MBA.

Introduction:

In the entire process of research, report writing is one of inseparable part. It is considered to be the end task of research which is not true. Report is written at completion of entire research work but its planning is done at beginning. In research design the scheme of report writing and its layout is determined.

The very word report conveys its meaning and purpose. Report means reporting it to somebody. In the research parlance report mean, whatever researcher has studied on the basis of research design is to be reported to expected audience viz. Experts, students dealing in research as a part of their curriculum, researchers dealing in the subject in which your research indulge in and the like.

Report writing is science and art. The writing flows through few stages. Different types of reports have specific defined parts which are needed to be understood and follow. Writing is an art as well since report is a written communication of research to others. The communication expected to be very clear and should communicate the same results which researcher mean to be.

Presentation of Subject Matter

4.13.1 Nature:

Research report presents results of formal investigation preferably in a written form. Now-a-days a document carries few pages called report is also presented in electronic form.

Research report carries major three aspects

- 1. Research problem under investigation
- 2. Methodology adopted to address research problem
- 3. Outcomes or results of investigation.

Research report is self explanatory since it is presented to a layperson. Report is written in a manner which is clearly followed by a reader in the absence of researcher.

4.13.2 Various types of reports

Dr. V. P. Michael in his book has classified report on the basis of approach and on the basis of nature of presentation.

On the basis of approach

- 1. *Journalistic report* report by journalist for publication in the media termed as journalistic reports
- 2. *Business report and memorandum* report for business communication from one department head to another, one functional area to another or ever from top to bottom in the organization.
- 3. *Project reports* report on a project undertaken by an individual or a group of individuals relating to any functional area or any segment of a functional area.
- 4. *Dissertation* is a detailed report on the subject of study.
- 5. *Enquiry reports* detailed report prepared by a committee or a commission appointed for specific purpose of conducting a detailed study of any matter of dispute or of a subject requiring greater insight.

6. *Thesis* – a detailed report on the research problem under investigation. This generally used as documents to be submitted for getting higher research degrees from a university or an academic institution.

On the basis of nature of presentation

- 1. *Inductive report* the report, which has a beginning, middle and an end. This report goes from the specifics (facts, figures, and materials of research) to general conclusions, summary, recommendations etc. eg. Academic research reports.
- 2. *Deductive report* the pattern of presentation is from general to the specific i.e. from the more important to the less important. eg. Report writing accepted in the business world.
- 3. *Step by step report* simply present the material step by step. It is a way of presenting events or steps in an operation frequently following one another in point of time. eg. reports on manufacturing operations. Enquiry reports are generally written step by step.
- 4. *Time sequence report* it is like step by step report but gives greater emphasis on the time element.

4.13.3 Layout of project report

A report consists of three broad sections one is introductory section second is body of report and third is supplementary section. Each section envelops different contents.

- *A. Introductory section this contents*
- 1. Title Page: title page contents, title of the research, name of researcher or author, publication, date, name of research institute etc.
- 2. Certificate and declaration: Certificate issued by company where project is undertaken need to be given as a part of procedure. Certificate should be on the company letter head, signed by authorized person, stamped and should have date and outward number. Certificate issued by guide and declaration of researcher also need to be given as a part of procedure.
- 3. Acknowledgement: researcher, author extends gratitude to people and agencies helped directly or indirectly to complete research work.

- Executive Summery Executive summery is crux of research report which is most readable part since, it gives clear idea in brief about research done. Executive summery arouses interest into the mind of reader about reading a complete report.
- 5. Table of contents i.e Index.
- B. Main body –
- 1. Opening section includes definition of the problem, problem area, rationale of the study, objective of the study, methodology of the study, sources of data, hypothesis, scope and limitations of the study etc.
- 2. Section headings classification and tabulation of data, analysis and interpretation, identifying variables and establishing their relationships, detailed investigation etc.
- 3. Concluding section includes mainly findings, conclusions and suggestions.
- C. Final section or supplementary section:
- 1. Appendix supportive material which is not appropriate to provide in the main body but the mention of such material has made in main body need to be appended to quench of curiosity of readers.
- 2. Technical aspects –maps and data collection instruments like, schedule, questionnaire etc.
- 3. Bibliography: list of references used for study undertaken.

Chapterization:

The study revolves around a research or management problem presented in a systematic manner for readers. Presentation of project report with help of chapters is Inductive type of report. Invariably project report housed following five chapters i.e. chapterization also termed as organization of project.

Chapter 1: Introduction to the Study, the chapter also titled as, Research Methodology. The chapter contains research methodology adopted for study.

Chapter 2: Profile of Company (or any organization/ village/ district/ state/ country/ sector/ industry etc.), this chapter contains briefing of company where project is undertaken.

Chapter 3: Theoretical Background (or review of literature), the chapter carries concepts based for research project.

Chapter 4: Data Presentation and Analysis, this chapter presents collected data and presented preferably in tabular form with analysis and interpretation.

Chapter 5: Findings and Suggestions, this is the last chapter based on earlier chapter for its contents.

4.13.4 Writing a Research Report (Contains of chapters):

Chapter 1 Introduction to the Study

This chapter is expected to give technical information about the framework adopted for the project work. It should be written in specific words i.e. in the words of research and generally runs to six to seven pages. This chapter should be expected to be sub divided into the following sub heads. The matter under each of these sub heads should be technically clear and self explanatory.

- a. Research Problem or Management Problem it is a problem observed in society or market and in case of case study type of research it is a problem unearth in a single unit. Research problem or management problem is vague in nature and touches various perspectives and sub functional area of management. This point of research problem may end up with number of questions raised in the mind of students of which answers can be sought scientifically to tackle existing problem.
- b. Statement of research problem from amongst various questions raised above in research problem one prominent question or the question of students interested functional area of management can be taken for study. This is perspective to approach a problem. Since the research problem is very vague in nature cannot be taken as it is for study. It needs to be converted into researchable statement termed as statement of research problem.
- c. Objectives of the study or project here objectives behind undertaking project should be stated. Objective of study is/are statement for which the study has been undertaken. The statement should be small, clear and should carry specific meaning. One objective statement should not inter-link another objective, which may mislead reader. Statement of objective should start with word 'To'. Objective should be co-related with title of project study.

- d. Importance of the project –the reasons why student considers project to be important or significant are to be stated.
- e. Scope of the study –scope or the extent or depth or coverage of study is to be stated here. The information about following aspects is necessary.
 - i. Period covered by study i.e. records used in case of secondary data and period work in case of primary data.
 - ii. Units or departments covered in study.
 - iii. Number of persons contacted, surveyed etc.

Scope of project study should also include geographical scope, conceptual scope, analytical scope (like fulfillment of objectives set for study) and functional scope (like offering meaningful suggestions for improving research problem).

- d. Data details the information about following aspects of data is to be given.
 - i. Type of data whether data is primary or secondary in nature.
 - ii. Sources of data –sources of data i.e. previous records etc. should be stated in specific terms i.e. attendance register, interview of employees etc.
 - iii. Method and extent of selection of source of data whether the census, probability sampling or non probability sampling was adopted or whether any other criteria were applied for selection of source of data is to be given.
 - iv. Technique or instrument of data collection the techniques used i.e. observation, questionnaire, scheduled, interviews, discussions, group discussion etc need to be stated.
 - v. System of presentation and analysis of data the system followed in presentation and analysis of data is to be stated here i.e. tabulation, description etc.
- e. Concept and operational definitions the definitions of the key words of the criterion, formulas considered to be basic importance for study are to be given.
- f. Limitations –difficulties experienced while conducting study are to be stated. Only such difficulties, which are not in form of excuses, are expected to be stated. These difficulties may be of following nature.
 - i. The duration of the study i.e. two months may not be sufficient to give

justice to your work.

- ii. Problem of communication with some labourers due to language barrier.
- iii. Non-availability of certain data. But it must be noted that if the difficulties experienced are of basic nature then they cannot be mentioned as limitation. If student has no data to present, as data was not made available to him, he cannot plead it as a limitation. Student must change project itself in such case.

Chapter 2 Profile of Company

This chapter is expected to give in brief information about the general background operation of the industrial unit in which the project report was undertaken. The expected length of this chapter should be about ten pages. Usually, the information in relation to the following points may be included in this chapter.

- a. Name of the industrial unit.
- b. Location of the unit (address).
- c. Name (s) of the subsidiaries and location details.
- d. Brief history of the unit.
- e. History of promoters.
- f. Present position of the unit. The information about product(s) of the company, services provided, etc. is to be included under this head.
- g. Financial position this should include information in brief about capital structure, assets, sale, turnover, profits etc. preferably of last three years and the researchers comment on the same from financial management point of view. The information regarding the financial position can be gathered from the organization's balance sheet.
- h. Manpower this should include the information about number of departments and number of employees working under each department. The tabular presentation of data is expected.
- i. Important milestones achieved by the unit, e.g. received ISO 9000 certification, development new version of product, commencement of exports etc.
- j. Future plans of company

k. Organizational chart to append at the end of this chapter to give bird eye view of the unit. If the unit doesn't have organizational chart then prepare it.

It is expected that chapter should give overall picture of unit and industry as such.

Chapter 3: Theoretical Background

This chapter is expected to give a theoretical basis of the topic of the project undertaken. Suitable theoretical background should be carefully presented in a precise and specific manner. The matter from any textbook printed work should not be copied out as it is. It should be presented by the students in their own words after careful reading and understanding the contents.

Definitions, quotations and diagrams, figures charts developed by experts may be borrowed from text -books which should be acknowledged through footnotes. The footnotes are given at the bottom of the page. The footnote should be presented in the same fashion, as bibliography and the numbering should be done to the borrowed text and respective footnotes. Care should be taken that the footnote references should appear in bibliography. For maintaining decency and sequence in footnote Microsoft Ms-Word provides insertion function the menu is: references – footnotes –

Insert Footnote. At the end of borrowed text or figure cursor should be placed and given menu command be executed for facilitation of footnote. The chapter should not exceed 20% of the total number of pages of the project report.

Chapter 4: Presentation and Analysis of Data

Collected data is systematically presented in this chapter. The data presented in logical sequence. The data may also include many responses or figures. Collected data is of two types one is quantitative and another is qualitative. Quantitative data is presented with the help of tables and qualitative data can be presented in chapter itself. Qualitative data is presented in descriptive form and used to support the quantitative data.

Quantitative data presented in table in a systematic way. Table has a specific layout.

Table: 4.1. (Title of the table):

Little description related to title as to what exactly has given in following table.

Sr.No.	Particulars/Description	Frequency	Percentage
1	2	3	4
	Total		

Source: (Filed data) Analysis Interpretation

It is also necessary to note that every table must have reference number and title. Similarly, every row and column of a table must have a reference number and a subheading. Title of table should be followed by little description of what exactly has been given in the table. This would help to give general idea to reader on the table contain. Every table carries source which refers origin of data. In case of data collected from samples the source is, 'field data' and in case of secondary data, source should be document, book, website from where data has taken for study.

The tables should be explained in their logical sequence. They must also be numbered in sequence.

Collected data is discussed below the table. Effort has been made to give meaning to figures in table since figures does not speak on its own. It is duty of researcher to give meaning to figures. Analysis also includes finding relationship between two figures to draw meaningful conclusion. Analyzed data is needed to be interpreted. A conclusion needs to draw at the end of comprehensive data discussion.

Chapter 5 Findings and Suggestions

The purpose of this chapter is to summarize previous chapter 4 in a precise manner or draw conclusions on the basis of data analyzed in chapter 4 in a precise manner and suggest measures to improve the situation. This chapter therefore is to be divided into two subsections as show below.

a. Findings-

Findings are factual results or decisions arrived at on the basis of data analyzed or explained in chapter 4. It is therefore clear that this chapter cannot have any conclusions which are not borne out by justified on the basis of data given in chapter 4. The findings must be given in the form of definite precise and specific statements. They should be serially numbered. The order of statements of findings should be according to the sequence of interpretation of data followed in chapter 4.

A further subdivision of findings may be thought of if necessary i.e. General findings and specific findings. General findings are findings based on the overall picture of interpretation or explanation of data. Specific findings are based on a specific part of data interpreted, analyzed, or explained. In such a case, all general findings must be stated first and then specific findings should be stated each, subdivision should have a fresh serial number. Order of stating the findings within this subdivision should be as found in chapter 4.

b. Suggestion -

Suggestions are definite steps or measures recommended for improvement of the situation. They must be based on findings. Therefore, it is clear that in this part no suggestions can be stated which are not borne out by, justified by, or based on the findings. The suggestions should be in the form of definite, precise and specific statements. They should be serially numbered. They should be concrete plan of action and should be capable of implementation. If findings are subdivided into general and specific findings, a similar plan should be followed in giving suggestions. General suggestions pertaining to or on the basis of general conclusions and specific suggestions based on specific findings should be given. These must be separately numbered under each head.

Appendices

It means addition to the original part. Appendices are plural of the word Appendix. This is not a separate chapter. The document charts, questionnaires, tables, schedules etc. which are actually referred to in the body of the project report (this consists of chapters I to VI) are to be included under appendix or appendices. So, appendices may include.

Questionnaires used for collecting information.

Schedules used for collecting information.

Tables formed for presenting the data.

Documents/forms etc., refereed to in body of project report.

Diagram, graphs etc. referred to in body of project report.

Each type of appendix must have a common or classified serial number for facility of quick reference and mention in the body of project report. Every appendix must have a self-explanatory heading. In case of tables etc. all vertical, horizontal columns must also have sub headings and column numbers.

It should be specifically noted that no documents, table, chart etc. which is not refereed to or mentioned specifically should be included in the appendix.

Bibliography:

Bibliography means list of books, journals, published work actually referred to or used in writing of project report. This is not a separate chapter. Bibliography has to be written in a specific manner. It must be in following manner.

The name of author (surname followed by initials), title of the book (is to be underline), year of publication, place of publication, number of the edition, name of the publisher in full (address), pages referred to.

4.13.5 IN SHORT THE FORM OF PROJECT REPORT IS AS GIVEN BELOW

Preface

- a) Title Page
- b) Certificates and declarations
- c) Acknowledgements. Synopsis/ executive summery Index

Chapter	Description	Page Number

Chapter 1: Introduction to Study

- a. Research Problem
- b. Statement of research problem
- c. Objectives of the study

- d. Importance of the project
- e. Scope of the study
- f. Data type, sources, method and/or techniques
- g. Limitations
- h. Chapterization

Chapter 2 : Profile of Company

- a. Name of the unit
- b. Location or address of the unit
- c. Brief history of the unit and present position
- d. Financial position
- e. Manpower

Chapter 3: Theoretical Background

Chapter 4: Data Presentation and Analysis Chapter 5: Findings and Suggestions Appendices

Bibliography

The Arrangements of Chapters is the Discretion of Research Guide.

4.13.6 Writing Executive Summary

Executive summery comes first in report but written at the completion of entire research work. It is crux of study undertaken preferably includes non technical data. Some important technical issues pertaining to core research problem may be accommodated.

Executive summery is a page or two in length. Major parts of summery includes research problem under study, methodology adopted for study, major findings related to objectives and conclusion.

Summery serves as bird eye view of entire research efforts. Academic research reports and preferably business reports carry executive summery. Researcher dealing in academic research does not include summery in report but in case of business report it begins with executive summery.

The general Skelton of executive summery is as below:

Title of study

1. Introduction
- 2. Research problem
- 3. Statement of research problem
- 4. Methodology in one paragraph highlighting important aspects of research methodology viz. objectives of study, sampling, instrument used, data analysis tools used etc.
- 5. Major findings and discussion.

Business reports invariably carries executive summery in report itself but research report does not carry such summery. The summery in form of synopsis is submitted independently be student or researcher in five to ten copies.

4.13.7 Language and Formatting in Research Report

4.13.7.1 Language of report

Generally the report is written only on one side of the paper. But now owing to environmental consciousness printing of report is done on both sides of paper. The need to written ligile since it is to be read by others. Use small sentences for better understanding and also need to use the words commonly knows. Wisecracks might mislead the very meaning of sentence we want to convey.

While writing a report the combination of past tense and present tense needs to be used. While citing the findings of others and describing the conduct of study the past tense needs to be used. Present perfect tense is to be used in presenting findings of the study. We write the report in third gender it means we do not use the words I, You, We while writing the narration. We use the term 'researcher' while writing the detailing and narrations.

Few important cares has to be taken while writing the report as follows.

- 1. Do not use any short forms. All words must be written in long form and in full.
- 2. Contents once written in the report should not be repeated in different places in the report.
- 3. The chapters, sections in the chapters, titles, sub titles must be planned and executed.
- 4. Every chapter should have number and the title of the chapter should be written in capital letters.

- 5. The beginning of sentence should be in capital letter. In between the sentence the unnecessary use of capital letter should be avoided.
- 6. When the sentence is to begin with a number i.e. figure then the write the figure in words.

These few writing instructions should be followed.

4.13.7.2 Page Layout of Report

It is said that the page layout of report should be such that every page should look like as a photo frame. Following are few points to consider while doing layout of a research report.

- 1. Page size: A4 Executive Bond quality of paper is preferred for final project, dissertation and thesis printing. Dumy quality paper is preferred for rest printing than final printing.
- 2. Margins: on the left 1.5 inches, other sides's 1 inches. If the number of pages in the report exceeds 400 then the left margin should increase.

If the report is to be printed at both side of the page then mirror margin is to be kept.

3. Font: Times New Roman , Font Size: for chapter headings: 16 ft

For titles: 14 ft.

For sub titles: 12ft.

For regular text: 12 ft.

Avoid unnecessary marking of bold letters.

- 4. Insert guided headers and footers. Generally header is chapter title and footer is name of institution.
- 5. Insert page numbers preferably printed at the bottom right corner of the page

In case of mirror margin insert page numbers at the bottom center is preferred.

6. Spacing: spacing of regular text should be 1.5. Spacing of table should be 1, spacing of mere list of points should also be 1, spacing between table number and table heading should be 1.



4.14 Check your progress

4.14 Fill in the blanks.

1.	Time sequence report has greater emphasis on	Element.
2.	Academic research reports are of	report type.
3.	Pattern of presentation of type of report to less important.	ort flows from more important

4. Executive summery is a Of research report.

5 is a list of references used for study undertaken.

4.15 Summary:

This chapter is fusion of two important concepts in research one is analysis and interpretation of data and another is report writing.

We have learned from previous three chapters the different dimensions of research designs. Now it is time to analyze and interpret the data when data is collected. The data analysis is done objectively hence the statistical tools to be selected to analyze the data need due consideration. Measures of central tendency viz. mean, mode and median helps to find out the central figure in data series whereas the measured of dispersion viz. range, standard deviation and variance helps to identify variation in the data set. Every measure of central tendency and measure of dispersion has formula to calculate.

Correlation and regression are another interesting statistical tools helps to establish the relationship between variables. Correlation narrates the relationship in figures ranging from -1 to +1 perfect negative correlation to perfect positive correlation. Correlation is followed by regression. Regression analysis determines the relationship between two variables on the basis of dependability or impact of one variable on another. Hence we have a linear regression model i.e. Y = a+bx+e where Y is dependent variable.

Hypothesis is skeptical assumption about desired results of research undertaken. Hypothesis is central cord of any research and the entire research design in revolve around the hypothesis set for study. The major types of hypothesis we have studied in earlier chapters. The set hypothesis needs to be tested. The testing follows five steps one is formulate the hypothesis i.e. practical problem second is calculate the statistics using relevant statistical tool third is choose the critical region then fourth step is decide the size of critical region i.e. 1%, 5% and 10% level of significance and the last compare the test statistics with standard table value to arrive at conclusion towards null hypothesis. Whether the statistics support to accept null hypothesis or reject the null hypothesis. There are various statistical tools available to test the hypothesis. Every tool has its own conditions of applications which needs to be carefully studied and select the appropriate tool for testing the hypothesis.

Report is written at the end of research but its planning is done at the beginning of which mention is made in the research design. Research report is a systematic process of unfolding entire research using different sections or chapters for lucidity. Report writing is science as well as art. Science mean it has a specific way to write the aspects and art mean the way of presentation and language should be clear to make understand researcher's views or facts in understandable manner. Report is written owing to reporting facts to lay persons, which may be read in absence of researcher hence, while writing a report precaution is to be taken that in absence of researcher the facts, figures, explanation mentioned in report should clearly be followed by readers. Research report often comes along with executive summery. Executive summery is a synoptic presentation of entire research carried by researcher. The quality report also comes with quality of language uses as well as quality of layout of report.

4.16 Terms to Remember:

- 1. Analysis of data: Data analysis means searching and showing the relationship between or among the tabulated data. Analysis shows the pattern of correlation between the data.
- 2. Interpretation of Data: Interpretation is drawing inferences from the data.
- 3. Measure of Central Tendency: Measures of central tendency are a value attempt to describe the central position of the set of data.
- 4. Statistical tools of Measures of Central Tendency: mean, median and mode.
- 5. Measures of Dispersion: Dispersion refers to the spread of the data how one data point is spread from another data point.
- 6. Variance: The variance is the square of standard deviation and is denoted by σ^2 .
- 7. Statistical tools to measure dispersion: Range, Coefficient of range, standard

deviation, coefficient of standard deviation, Variance.

- 8. Correlation: Correlation is a statistical tool which studies the relationship between two variables.
- 9. Regression: Regression is a statistical measure that attempts to determine the strength of the relationship between one dependent variable (Y) and a series of other changing variables (independent variables) (X).
- 10. Five steps of hypothesis testing: first is formulate the practical problem in terms of hypothesis, second is calculate statistics, third is choose a critical region fourth is decide the size of critical region and the last is conclusion i.e. compare calculated test statistics with table statistics.
- 11. Chi-square test: $\chi^2_{cal} = \sum_{i=1}^{n} \frac{(oi-Ei)2}{Ei}$
- 12. Degrees of freedom: for one sample it is (n-1) and for two and more samples it is (C-1)*(R-1).
- 13. The formula to calculate independent sample't' is, $t = (\overline{X}i \overline{X}ii/S.E.)$
- 14. The formula to calculate standard error is, S.E. = s * $\sqrt{1/n1} + 1/n2$
- 15. Types of Reports: on the basis of approach journalistic report, business report and memorandum, project report, dissertation, enquiry reports and thesis.
- 16. On the basis of nature of presentation inductive report, deductive report, step by step report, time sequence report.
- 17. Layout of Project Report introductory section includes title page, certificate and declaration, acknowledgement, executive summery and table of contents.
- 18. Main body includes, opening section, section headings and concluding section.
- 19. Final section or supplementary section includes appendix, technical aspects and bibliography.
- Chapterization contains five chapters, introduction to the study, profile of company, theoretical background, data presentation and analysis and last chapter is findings and suggestions.
- 21. Executive summery- crux of entire report.

4.17 Answers to Check your progress:

Section – I

Ans: Multiple Choice Questions

MCQ	1	2	3	4	5	6	7	8	9	10
Ans:	c	d	a	a	c	b	a	a	d	a

Ans. Case Example 1:

Mean	47.5	Median	47	Mode	48 & 52		
Range	68	Coefficient of Range	0.5996	Standard Deviation	15.90	Coefficient of s.d.	0.3347
Variance	3.987						

Section – II

Multiple Choice Questions:

Question number	Answer option
1	a
2	b
3	с
4	d
5	d

Case	Problem	Answer
1	Correlation between HSC and graduation marks	0.130
2	Correlation between graduation marks and CET Score	- 0.246
3	Correlation between CET score and HSC marks	0.028
4	Regression analysis	a = 29.8568
		x1 = 0.5219

Section – III

	1	2	3	4	5
MCQ s	а	b	c	а	c

Solution Case 1:

Hypothesis: H0₃: There is no association between the income of parents and stay of vicinity.

5% level of Significance.

Again the variables income of parents and stay of vicinity have measured on nominal scale and hence, to check the association between these two variables Chi-Square test has been used.

Observation Table

Vicinity of Stay * Annual Family Income of Samples Household Cross tabulation.

			Annual Family Income of Samples				
			Househo	ld			
			Below	5 to 10	10 to 15	15 to	
			5 Lakhs	Lakhs	Lakhs	20	
						Lakhs	
Vicinity	Rural	Count	17	6	1	0	24
of Stay		Expected Count	17.4	4.2	1.2	1.2	24.0
	Urban	Count	12	1	1	2	16
		Expected Count	11.6	2.8	0.8	0.8	16.0
Total		Count	29	7	2	2	40
		Expected Count	29.0	7.0	2.0	2.0	40.0

Calculation:

Sr.N	Oi	Ei	(Oi-Ei)	$(Oi-Ei)^2$	(Oi-Ei) ² /Ei
0.	(Observed	(Expected			
	frequency)	frequency)			
1	17	17.4	-0.4	0.16	0.0092
2	6	4.2	1.8	3.24	0.7714
3	1	1.2	-0.2	0.04	0.0333
4	0	1.2	-1.2	1.44	1.2
5	12	11.6	0.4	0.16	0.0138
6	1	2.8	-1.8	3.24	1.1571
7	1	0.8	0.2	0.04	0.05
8	2	0.8	1.2	1.44	1.8
Total	N=40				(Oi-Ei) ² /Ei=
					5.0348

from above table we can calculated

$$\chi^{2}_{cal} = \sum_{i=1}^{n} \frac{(oi-Ei)2}{Ei}$$

=5.0346
2) $\chi^{2}_{tab} = (R-1) (C-1), \alpha$
= (2-1) (4-1), 0.05
= (1) (3), 0.05
= 3, 0.05
 $\chi^{2}_{tab} = 7.815$

...... Value calculated by using chi-square table at 5%

level of significance

Result: $\chi^2_{cal} = 5.0348 < \chi^2_{tab} = 7.815$

Hence, H_{03} (Null hypothesis) is accepted at 5% level of significance.

Interpretation:

There is no association between the income of parents and stay of vicinity.

Solution Case 2:

H0: There is no significant difference between the agreement on output of MBA syllabus among MBA-I and MBA-II Year students. 5% level of significance.

This hypothesis is same as above where both variables have been measured using ratio scale data which is considered to be very pure data in statistics. Since the MBA-I and MBA-II students are different and we have to check the statistical difference between these two data series, we are applying independent sample't' test.

Solution:

MBA1	MBA2	Square of Column 1	Square of Column 2
(1)	(2)	(3)	(4)
3.29	4	10.82	16.00
4.14	4.29	17.14	18.40
4	4.29	16.00	18.40
4.57	3	20.88	9.00
3.29	4.71	10.82	22.18
3.43	4.43	11.76	19.62
4.57	3.86	20.88	14.90
4	3	16.00	9.00
3.86	3.86	14.90	14.90
3.71	3.71	13.76	13.76
3.71	3.71	13.76	13.76
3.86	3.14	14.90	9.86
3.86	2.57	14.90	6.60
3.43	3.29	11.76	10.82
3	4.57	9.00	20.88
4.71	3.71	22.18	13.76
4.29	3.86	18.40	14.90
3	4.14	9.00	17.14

The data given is presented in column 1 and 2. The squares of data have been worked out in column 3 and 4.

3.71	3.86	13.76	14.90
3.71	4.14	13.76	17.14
Total of a	all columns		
76.14	76.14	294.43	295.96

Calculate means of two series

MBA-I = 76.14/20 = 3.807

MBA-II = 76.14/20 = 3.807 (see here means of both the series are same, if you remember the formula of independent sample't' test then in numerator we have to make subtraction of both means, in this case the subtraction is going to be zero (0) and zero is divided by any value comes to zero hence the value of t' is going to be zero only. Let's calculate.

Calculation of standard deviations

MBA-I =
$$(\sqrt{294.43/20})$$
- $(76.14/20)^2$) = $(\sqrt{14.72}$ -14.49) = 0.48
MBA-II = $(\sqrt{295.96/20})$ - $(76.14/20)^2$) = $(\sqrt{14.80}$ -14.49) = 0.57

Calculation of standard error

Calculation of s

$$S = \sqrt{(20*0.48^2) + (20*0.57^2)/20 + 20 - 2} = \sqrt{(4.61+6.50)/38} = 0.2923$$

Calculation of standard error

 $= 0.2923 * \sqrt{1/20} + 1/20$

= 0.09243

Calculation of t' test

=(3.807-3.807)/0.09243

= 0

Result:

 $t_{cal} = 0 < t_{tab} = 2.093$

Hence H0₅ is accepted at 5% level of significance.

Interpretation:

There is no significant difference between the agreement on output of MBA syllabus among MBA-I and MBA-II year students. 5% level of significance.

Section – IV

Answers to check your progress

- 1. Time
- 2. Inductive
- 3. Deductive
- 4. Crux
- 5. Bibliography

4.18 Exercise:

- 1. What is data analysis and interpretation?
- 2. Define the measures of central tendency with their formula to calculate.
- 3. Define the measures of dispersion with their formula to calculate.
- 4. Narrate the concept of correlation with its types.
- 5. Describe the process of attempting regression problem.
- 6. Narrate five step methods to test the hypothesis.
- 7. Describe the process of using independent sample't' test.
- 8. Define Report. Give the types of report.
- 9. Explain the layout of report.
- 10. What is chapterization? What are the contains of chapters?

4.19 Reference for further study:

- 1. V.P.Michel, Research Methodology in Management, Himalaya Publishing House, Delhi.
- Aczel Amil D and Sounderpandian Jayavel, Complete Business Statistics, . The MacGraw-Hill Companies, 6th edition, 2006, Mumbai.
- 3. Arora P.N., Arora Sumeet, Arora S., Comprehensive Statistical Methods, S.Chand, 2007, New Delhi.

- 4. Sachdeva J.K., Business Research Methodology, Himalaya Publishing House, 2nd revised edition 2011, Mumbai.
- 5. Kothari C.R. & Gaurav Garg, 'Research Methodology Methods and Techniques, New Age International Publishers, 3rd edition, 2014, New Delhi.

4.20 Annexure: 01:

Sr.	Question	Options Facilitated					
1.	Gender	Male / Female					
2.	Class	MBA-I /MBA-II					
3.	Graduation	B.Com. /B.Sc. /B.A. /B.E./ BBA-BCA / A	Any Other				
4.	Vicinity	Rural / Urban					
5.	Parent Profession	Farmer/ Business /Self Professional /Emp	ployment				
6.	Family Income	Below 5 lakhs/ 5 to 10 lakhs/10 to 15 lak	hs/15 to 20				
		lakhs					
7.	Your Future Plan Farmer/ Business/ Self Professional/ Employment						
Regard	ing MBA Syllabus						
Rate the	e statement on five por	int likert scale					
Strong	Strongly Disagree Neither Agree Strongly						
Disag	Disagree Agree nor Agree						
	Disag	gree					
1	2 3	4 5					
	Statement		Rating				
8.	The syllabus structur	e is quite interesting and you like it.					
9.	The syllabus offere	ed is contemporary and meet industry					
	requirements.						
10.	The subjects offered	d are quite relevant syllabus offered is					
	contemporary and m	eet industry requirements.					
11.	Practicals in the syl	labus gives exposure to the real life of					
	business and management.						
12.	The open book exam	nination helps in development of decision					
	making skills.						
13.	The syllabus seems	to be compatible with other universities					
	and autonomous inst	itutes.					

Google form used to collect the data from students.

14.	The	electives	offered	are	quite	relevant	to	the	industry	
	dema	and.								

Annexure 02: Coding of Variables:

Following table narrates the coding of variables used in Ms-Excel sheet for feeding the data.

Note: The difference between above format and following format is of coding. Above format is not coded but yes following format have coding. This coding helps data entry into electronic spreadsheet.

Q.No.	Description	Code	Variables.
1	Gender	1	Male
		2	Female
2	Class	1	MBA-I
		2	MBA-II
3	Graduation	1	B.Com.
		2	B.Sc.
		3	B.A.
		4	B.E.
		5	BBA/BCA
		6	Any Other
4	Vicinity	1	Rural
		2	Urban
	Parent		
5	Profession	1	Farmer
		2	Business
		3	Self Professional
		4	Employment
6	Family Income	1	Below 5 lakhs

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		2	5 to 10 lakhs
		3	10 to 15 lakhs
		4	15 to 20 lakhs
	Your Future		
7	Plan	1	Farmer
		2	Business
		3	Self Professional
		4	Employment
	Regarding		The syllabus structure is quite interesting and you
8	MBA Syllabus	a1	like it.
			The syllabus offered is contemporary and meet
		a2	industry requirements.
			The subjects offered are quite relevant syllabus
			offered is contemporary and meet industry
		a3	requirements.
			Practicals in the syllabus gives exposure to the real
		a4	life of business and management.
			The open book examination helps in development
		a5	of decision making skills.
			The syllabus seems to be compatible with other
		a6	universities and autonomous institutes.
			The electives offered are quite relevant to the
		a7	industry demand.

MBA-I																			
Sr.	Gende r	Clas s	Gradu ation	Ag e	Vicini ty	Parents profess ion	Annua 1 family incom e	HS C	Gradu ation	CET	Your future plan	a1	a2	a3	a4	a5	a6	a7	Summat ed Score
1	1	1	6	22	1	1	1	64.9	69.6	36	4	4	3	3	4	3	3	3	3.29
2	1	1	2	23	1	1	1	53.9	53.77	35	2	4	5	4	4	5	2	5	4.14
3	2	1	1	20	1	1	1	69.5	53	29.8	4	3	5	5	5	3	3	4	4.00
4	1	1	1	22	1	1	1	66.6	55.55	67	4	5	4	5	5	4	5	4	4.57
5	2	1	2	20	1	1	1	64.2	69.24	20.5	4	4	3	3	3	3	3	4	3.29
6	1	1	4	25	2	4	3	59	65	94.4 5	4	3	3	3	4	5	2	4	3.43
7	1	1	2	22	1	1	1	53	52	40	4	4	4	5	5	5	4	5	4.57
8	1	1	1	21	2	3	1	65.7	61.52	43	2	5	5	5	5	1	3	4	4.00
9	1	1	1	21	1	2	3	64.7	45.67	38.1 1	2	2	5	5	5	3	3	4	3.86
10	2	1	1	22	2	4	1	82	77	36	2	5	3	3	4	5	3	3	3.71
11	2	1	5	25	1	4	1	61.7	68.94	49	3	4	4	4	4	3	3	4	3.71
12	1	1	1	21	2	4	1	70.3	75.08	51	4	4	3	4	4	5	4	3	3.86
13	2	1	2	23	1	1	1	58.8	67.38	39	4	3	4	3	4	5	4	4	3.86
14	2	1	1	20	1	1	1	69	64	39	4	4	4	3	4	3	3	3	3.43
15	2	1	2	22	1	4	2	60	70	78	4	3	3	3	4	4	2	2	3.00
16	1	1	1	23	2	2	1	54	48	39	2	5	5	5	5	4	5	4	4.71
17	1	1	6	24	1	1	1	50	62	38	2	4	5	4	5	5	3	4	4.29
18	2	1	1	21	2	1	1	70	63	50	4	4	3	3	2	2	2	5	3.00
19	2	1	2	21	2	4	1	63.2	72.28	52.1 1	4	4	4	4	4	3	3	4	3.71
20	2	1	1	21	2	4	4	68.7	66	51	3	4	4	4	4	3	4	3	3.71

Annexure 03: Data Sheet:

MBA-II																			
Sr.	Gend er	Clas s	Graduat ion	Ag e	Vicini ty	Paren ts Profe ssion	Annua l Famil y Incom e	HS C	Graduat ion	CET	Your Futur e Plan	a1	a2	a3	a4	a5	a6	a7	Sum mate d Score
1	1	2	1	25	2	4	2	61	64	25	2	3	4	4	4	5	4	4	4.00
2	2	2	5	22	2	2	1	70.3	59.14	35	4	5	4	4	5	4	4	4	4.29
3	1	2	1	22	2	4	1	64.5	58	91	4	4	4	4	5	5	4	4	4.29
4	2	2	5	24	1	4	1	60	60.13	38	4	1	2	2	3	4	5	4	3.00
5	2	2	2	22	1	1	1	55	62	51	4	5	4	4	5	5	5	5	4.71
6	1	2	2	23	1	1	1	51.4	57.56	31	4	4	4	4	5	5	5	4	4.43
7	1	2	2	23	1	1	1	63.5	59	48	4	3	4	4	4	4	5	3	3.86
8	2	2	4	23	1	1	1	58	71	60	4	2	2	5	2	3	3	4	3.00
9	1	2	1	22	2	2	4	80	69	23	2	4	4	3	4	5	3	4	3.86
10	2	2	1	23	1	1	2	75.7	61.61	52	4	4	4	3	4	3	4	4	3.71
11	2	2	4	24	2	4	1	80.5	59	79	4	4	4	4	4	3	3	4	3.71
12	2	2	2	22	1	4	2	60.3	73.36	36	4	4	2	2	4	4	4	2	3.14
13	1	2	2	23	2	2	1	63	71	46	2	2	3	4	3	2	2	2	2.57
14	2	2	2	23	2	2	1	57	58	45	3	3	2	4	4	2	4	4	3.29
15	2	2	2	23	2	4	1	64.5	65.12	52	4	4	4	5	5	4	5	5	4.57
16	1	2	3	24	1	2	2	72	65	40	2	4	4	4	3	3	4	4	3.71
17	1	2	3	23	1	4	1	55	69	55	4	4	4	4	4	4	3	4	3.86
18	1	2	5	24	1	1	1	54.9	51	54	4	4	4	4	5	4	4	4	4.14
19	1	2	5	22	1	1	2	60	61.74	48	2	3	4	4	5	4	3	4	3.86
20	2	2	1	22	1	1	2	83	65	41	4	4	4	4	4	4	4	5	4.14