

## I B.SC PSYCHOLOGY

### UNIT-I

#### INTRODUCTION TO RESEARCH

**Meaning-Definition-Objectives-Types of research- Characteristics of research-Steps in Research Process- Criteria of good research- Techniques involved in defining a research problem- Ethical Consideration in Psychological research**

##### Meaning:

- ❖ “Re” is the prefix meaning ‘Again or over again or a new’ and “Search” is the latter meaning ‘to examine closely and carefully’ or ‘to test and try’. Together they form, a careful, systematic, patient study and investigation in some field of knowledge undertaken to establish principles / policies.

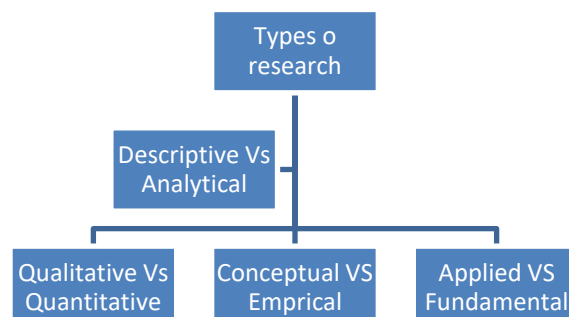
##### Definition:

- ❖ *Research is an art of scientific investigation.*
- ❖ *Research is referred as systematic methods which consist of identifying a problem, formulating hypothesis, collecting data, analyzing the data and reaching certain conclusions.*

##### Objectives of research:

- ⇒ To gain familiarity with our area of interest or subject matter
- ⇒ The purpose of research is to find answers(Solutions) to problems
- ⇒ To find hidden truth
- ⇒ To achieve new ideas in subject matter
- ⇒ To bring out the characteristics of an individual, groups or situations.
- ⇒ To find the frequency of something which occurs often that causes problem.
- ⇒ To test hypothesis of a casual relationship between dependent and independent variable.

#### TYPES OF RESEARCH



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## **I. Descriptive Vs Analytical**

### **Descriptive Research:**

- ❖ Survey or fact finding enquires of different kinds.
- ❖ It describes the actual prevailing state of affairs, existing at present.
- ❖ Also known as ex post facts means existing position of facts / issues.
- ❖ Here the researcher has no control or the researcher has no control over the variables.

*Eg: Frequency of shopping, customer preference etc*

### **Analytical Research:**

- ❖ The researcher has to use facts / information already existing and analyze these data to make a critical evaluation.

*Eg: document study / historical evidence.*

## **II. Applied Vs Fundamental**

### **Pure Research: (Basic or Fundamental Research)**

- ❖ Gathering, knowledge is termed as 'pure' or 'basic' research. Just to gather knowledge in order to understand generalized theories or policies.

*Eg: Research on mathematics.*

- ❖ These types of research add knowledge to the already existing organized body.

### **Applied Research:**

- ❖ To find an immediate solution for a pressing practical problem.
- ❖ This aims at finding solutions to various social and business problems.

*Eg: Social, economical and political trends prevailing in a country.*

## **III. Qualitative Vs Quantitative research:**

### **Quantitative Research:**

- ❖ Relates to aspects that can be quantified and expressed in terms of quantity.
- ❖ Otherwise known as structured Research.
- ❖ In this type of Research, the objectives, design, sample and all the other factors influencing the research is pre determined.

### **Qualitative Research:**

- ❖ This aims in finding the motives and desires of humans.
- Techniques used are

- ✓ Association tests,
- ✓ Sentence completion test
- ✓ Story completion test so on

❖ This is mostly used to know attitudes and opinions of people under behavioral science.

#### IV. Conceptual Vs Empirical:

##### Conceptual research:

- ❖ Research related to some abstract idea or theory
- ❖ Used by philosophers or thinkers for developing new concepts.

##### Empirical research

- ❖ Otherwise known as experimental type of Research.
- ❖ The result obtained by adapting Empirical Research is considered to be most powerful (evidence enclosed)
- ❖ This research looks for sources of data and working hypothesis to find solutions.
- ❖ The experimenter can control the variables.

#### OTHER RESEARCH TYPES:

- a) **One time research:** this is conducted only once
- b) **Longitudinal research:** the research carries for many years. *Eg: behavioral change of a person from age 2 to 12.*
- c) **Field Research:** Observation, questionnaires, personal, Group or telephonic interviews, case study in a live environment.
- d) **Laboratory Research:** Using equipments to analyze the characteristic changes of a people in a lab set up.
- e) **Historical research:** Researching using historical sources, documents so on.

#### CHARACTERISTICS OF A RESEARCH

##### ⇒ Controlled:

The research problem should not be affected or influenced by external factors (i.e. variables other than the participating facts).

##### ⇒ Rigorous:

The procedures followed to **find answers to questions** should be **relevant, appropriate & justified**. But the degree of rigor may vary from one problem to another problem.

⇒ **Systematic:**

The investigation should follow a **certain logical sequence** (Not in a haphazard manner)

⇒ **Valid & Verifiable:**

The findings should be valid & can be verified by you or others at any time.

⇒ **Empirical:**

The conclusions drawn should be based on **hard evidence, gathered from real life experiences or observations.**

⇒ **Critical:**

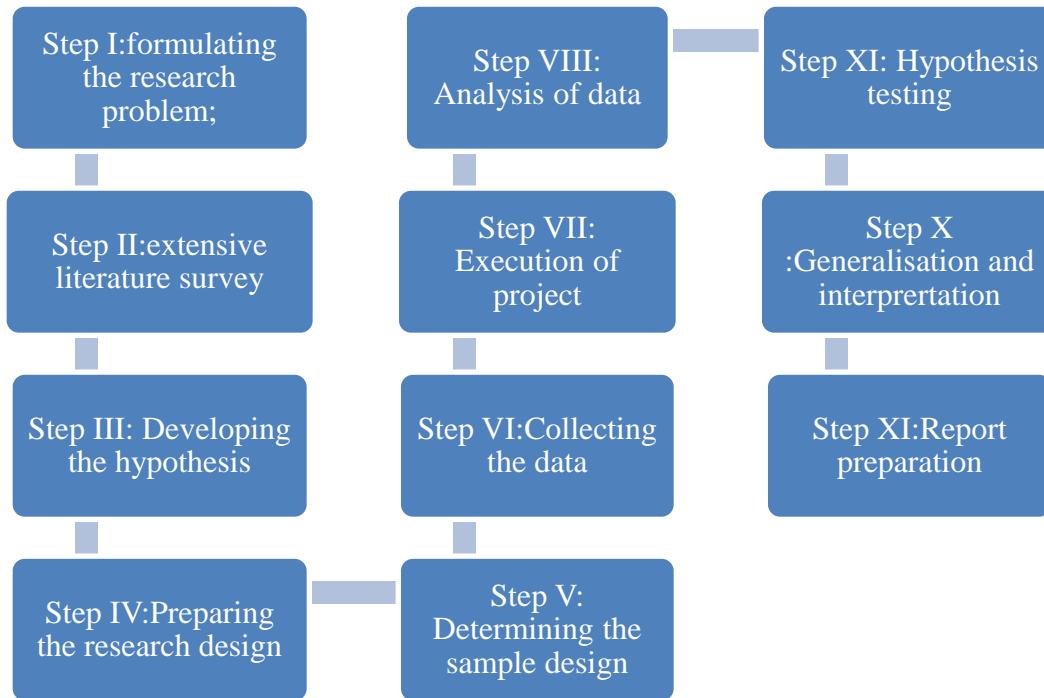
The process of investigation **must be foolproof and free from drawbacks.** The process adopted and the procedures used must be able to withstand any critical scrutiny.

### **SIGNIFICANCE OF A GOOD RESEARCH**

- ❖ Research inculcates scientific and inductive thinking and promotes the development of logical habits of thinking and organization.
- ❖ Research plays a dynamic role in several fields and it has increased significantly in recent times, it can be related to small businesses and also to the economy as a whole.
- ❖ Most of the government regulations and policies are based on and are a result of intensive research.
- ❖ Its significance lies in solving various planning and operational problems
- ❖ It aids in decision making
- ❖ It involves the study of cause and effect relationships between various variables and helps to identify behavior/patterns/trends in certain variables.

### **RESEARCH PROCESS**

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



### **I. Formulating the Research Problem:**

There are two types of research problems namely

- (a) those which relate to states of nature and
- (b) Those which relate to relationships between variables.

Essentially two steps are involved in formulating the research problem.

Step 1: understanding the problem thoroughly, and

Step 2: rephrasing the same into meaningful terms from an analytical point of view..

### **II.Extensive Literature Survey:**

Once the problem is formulated, a brief summary of it should be written down.

At this juncture the researcher should undertake extensive literature survey connected with the problem from

- ✓ Academic journals,
- ✓ conference proceedings,
- ✓ government reports,
- ✓ Books etc

### **III.Development of Working Hypotheses:**

- ❖ After extensive literature survey, researcher should state in clear terms the working hypothesis or hypotheses.
- ❖ Working hypothesis is **tentative assumption** made in order to draw out and test its logical or empirical consequences.
- ❖ Hypothesis should be very specific and limited to the piece of research in hand because it has to be tested.
- ❖ The role of the hypothesis is to guide the researcher by delimiting the area of research and to keep him on the right track

### **IV.Preparing the Research Design:**

The research problem having been formulated in clear cut terms, the researcher will be required to prepare a research design.

Research purposes may be grouped into four categories, viz.,

- (i) Exploration,
- (ii) Description,
- (iii) Diagnosis, and

(iv) Experimentation.

There are several research designs, such as,

- ✓ experimental and
- ✓ Non-experimental hypothesis testing.

**V.Determining Sample Design:**

- ❖ The researcher must decide the way of selecting a sample or what is popularly known as the sample design.
- ❖ In other words, a sample design is a definite plan determined before any data are actually collected for obtaining a sample from a given population.
- ❖ Samples can be either probability samples or non-probability samples.
- ❖ With probability samples each element has a known probability of being included in the sample but the non-probability samples do not allow the researcher to determine this probability.
- ❖ Probability samples are those based on simple random sampling, systematic sampling, stratified sampling, cluster/area sampling whereas
- ❖ Non-probability samples are those based on convenience sampling, judgment sampling and quota sampling techniques.

(Use methods of sampling notes- Unit II for elaborated content)

**VI: Collecting the Data:**

There are several ways of collecting the appropriate.

Primary data can be collected either through experiment or through survey.

- (i) **By observation:** This method implies the collection of information by way of investigator's own observation, without interviewing the respondents.
- (ii) **Through personal interview:** The investigator follows a rigid procedure and seeks answers to a set of pre-conceived questions through personal interviews.
- (iii) **Through telephone interviews:** This method of collecting information involves contacting the respondents on telephone itself.
- (iv) **By mailing of questionnaires:** Questionnaires are mailed to the respondents with a request to return after completing the same.



- (v) **Through schedules:** Under this method the enumerators are appointed and given training. These enumerators go to respondents with these schedules. Data are collected by filling up the schedules by enumerators on the basis of replies given by respondents

### VII. Execution of the Project:

Execution of the project is a very important step in the research process.

The researcher should see that the project is executed in a systematic manner and in time

Occasional field and a careful watch should be kept for to keep the survey as much realistic as possible.

### VIII. Analysis of Data:

- ❖ After the data have been collected, the researcher turns to the task of analysing them.

Thus, researcher should classify the raw data into some purposeful and usable categories.

- (a) **Coding** operation is usually done at this stage through which the categories of data are transformed into symbols.
- (b) **Editing** is the procedure that improves the quality of the data for coding. With.
- (c) **Tabulation** is a part of the technical procedure wherein the classified data are put in the form of tables.
- ❖ A great deal of data, especially in large inquiries, is tabulated by computers. Computers not only save time but also make it possible to study large number of variables affecting a problem simultaneously.

### IX. Hypothesis-Testing:

- ❖ After analyzing the data as stated above, the researcher is in a position to test the hypotheses, if any, she had formulated earlier.
- ❖ Various tests, such as **Chi square test, t-test, F-test, have** been developed by statisticians for the purpose. Hypothesis-testing will result in either accepting the hypothesis or in rejecting it

### X. Generalisations and Interpretation:

- ❖ If a hypothesis is tested and upheld several times, it may be possible for the researcher to arrive at generalization, i.e., to build a theory.
- ❖ If the researcher had no hypothesis to start with, he might seek to explain his findings on the basis of some theory. It is known as interpretation.

### XI. Preparation of the report or the thesis:

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

**The layout of the report should be as follows:**

- (i) The preliminary pages;**
- (ii) The main text, and**
- (iii) The end matter.**

**Preliminary page:**

In its preliminary pages the report should carry

- ✓ title and date followed by
- ✓ acknowledgements and
- ✓ Foreword.
- ✓ a table of contents followed by
- ✓ a list of tables and list of graphs and charts, if any, given in the report.

**Main text:**

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

**(a) *Introduction:***

It should contain

- ✓ a clear statement of the objective of the research
- ✓ The scope of the study and
- ✓ Various limitations .

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

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

**(d) *Conclusion:*** Towards the end of the main text, researcher should again put down the results of his research clearly and precisely.

**End matter:**

- . At the end of the report,
  - ✓ Appendices should be enlisted in respect of all technical data.

- ✓ Bibliography, i.e., list of books, journals, reports, etc., consulted, should also be given in the end. I
- ✓ Index should also be given specially in a published research report.

### CRITERIA OF GOOD RESEARCH

One expects scientific research to satisfy the following criteria

- ❖ The purpose of the research should be clearly defined and common concepts be used.
- ❖ The research procedure used should be described in sufficient detail
- ❖ The procedural design of the research should be carefully planned to yield results.
- ❖ The analysis of data should be sufficiently adequate to reveal its significance.
- ❖ The methods of analysis used should be appropriate.
- ❖ The validity and reliability of the data should be checked carefully.
- ❖ Conclusions should justified by the data of the research

#### We can state the qualities of a good research as under:

- 1. Good research is systematic:** It means that research is structured with specified steps to be taken in a specified sequence in accordance with the well defined set of rules.
- 2. Good research is logical:** This implies that research is guided by the rules of logical reasoning and the logical process of induction and deduction are of great value in carrying out research.
- 3. Good research is empirical:** It implies that research is related basically to one or more aspects of a real situation and deals with concrete data that provides a basis for external validity to research results.
- 4. Good research is replicable:** This characteristic allows research results to be verified by replicating the study and thereby building a sound basis for decisions.

### RESEARCH PROBLEM

- ❖ A research problem, **in general, refers to some difficulty which a researcher experiences in the**
- ❖ **context of either a theoretical or practical situation and wants to obtain a solution for the same.**
- ❖ Thus, a research problem is one which requires a researcher to **find out the best solution for the**
- ❖ **given problem**, i.e., to find out by which course of action the objective can be attained optimally in the
- ❖ context of a given environment.

### SELECTING THE PROBLEM

The following points may be observed by a researcher in selecting a research problem or a subject for research:

- (i) **Subject which is overdone should not be normally chosen**, for it will be a difficult task to throw any new light in such a case.
- (ii) Controversial subject should not become the choice of an average researcher.
- (iii) Too narrow or too vague problems should be avoided.
- (iv) The subject selected for research should be **familiar and feasible**

The importance of the subject, the qualifications and the training of a researcher, the costs involved, the time factor are few other criteria that must also be considered in selecting a problem

### NECESSITY OF DEFINING THE PROBLEM

- ❖ Quite often we all hear that a problem **clearly stated** is a problem half solved. This statement signifies the need for defining a research problem.
- ❖ The problem to be investigated must be defined **unambiguously** for that will help to discriminate relevant data from the irrelevant ones.
- ❖ A proper definition of research problem will enable the researcher **to be on the track** whereas an ill-defined problem may create hurdles.

**Questions like:** What data are to be collected?

- ✓ What characteristics of data are relevant and need to be studied?
- ✓ What relations are to be explored?

What techniques are to be used for the purpose? and similar other questions crop up in the mind of the researcher who can well plan his strategy and find answers to all such questions only when the research problem has been well defined.

### TECHNIQUE INVOLVED IN DEFINING A PROBLEM

The technique for the purpose involves the undertaking of

**The following steps generally one after the other:**

- (i) statement of the problem in a general way;
- (ii) understanding the nature of the problem;
- (iii) surveying the available literature
- (iv) developing the ideas through discussions; and
- (v) Rephrasing the research problem into a working proposition.

A brief description of all these points will be helpful.

**(i) Statement of the problem in a general way:**

- ❖ First of all the problem should be stated in abroad general way.
- ❖ For this purpose, the researcher must immerse himself thoroughly in the subject matter concerning which he wishes to pose a problem.
- ❖ The researcher can himself state the problem or he can seek the guidance of the guide or the subject expert in accomplishing this task.
- ❖ **Often, the guide puts forth the problem in general terms, and it is then up to the researcher to narrow it down and phrase the problem in operational terms.**

**.(ii) Understanding the nature of the problem:**

- ❖ The next step in defining the problem is to understand its **origin and nature** clearly.
- ❖ The best way of understanding the problem is to discuss it with those who first raised it in order to find out how the problem originally came about and with what objectives in view.
- ❖ For a better understanding of the nature of the problem involved, **he can enter into discussion with those who**
- ❖ **Have a good knowledge of the problem concerned or similar other problems.**

**(iii) Surveying the available literature:**

- ❖ All available literature concerning the problem at hand must necessarily be surveyed and examined before a definition of the research problem is given.
- ❖ Studies on related problems are useful for indicating the type of difficulties that may be encountered in the present study as also the possible analytical shortcomings.

**(iv) Developing the ideas through discussions:**

- ❖ Discussion concerning a problem often produces useful information.
- ❖ Various new ideas can be developed through such an exercise.
- ❖ Hence, **a researcher must discuss his problem with his colleagues** and others who have enough experience in the same area or in working on similar problems.

**(v).Rephrasing the research problem:**

- ❖ Finally, the researcher must sit to rephrase the research problem into a working proposition.
- ❖ Through rephrasing, the researcher inputs the research problem in as specific terms as possible so that it may become operationally viable and may help in the development of working hypotheses.\*

## **ETHICAL CONSIDERATION IN PSYCHOLOGICAL RESEARCH**

Ethics refers to the correct rules of conduct necessary when carrying out research. We have a moral responsibility to protect research participants from harm.

**The following are the ethical issues which need to be considered during psychological research**

1. Informed Consent
2. Debrief
3. Protection of Participants
4. Deception
5. Confidentiality
6. Withdrawal

**Informed consent:**

Before the study begins the researcher must outline to the participants what the research is about, and then ask their consent (i.e. permission) to take part. An adult (18ys +) capable of giving permission to participate in a study can provide consent. Parents/legal guardians of minors can also provide consent to allow their children to participate in a study.

**Participants should be informed about the following:**

- A statement that participation is voluntary.
- Purpose of the research.
- All foreseeable risks and discomforts to the participant (if there are any). These include not only physical injury but also possible psychological.
- Procedures involved in the research.
- Benefits of the research to society and possibly to the individual human subject.

- Length of time.
- Person to contact incase of injury or emergency.
- Subjects' right to confidentiality and the right to withdraw from the study at any time without any consequences.

### **Debriefing:**

- The purpose of debriefing is to remove any misconceptions and anxieties that the participants have about the research and to leave them with a sense of dignity, knowledge, and a perception of time not wasted

### **Protection of Participants**

- Researchers must ensure that those taking part in research will not be caused distress. They must be protected from physical and mental harm. This means you must not embarrass, frighten, offend or harm participants.

### **Deception**

- This is where participants are misled or wrongly informed about the aims of the research.

### **Types of deception include**

- (i) deliberate misleading, e.g. using confederates, staged manipulations in field settings, deceptive instructions;
- (ii) deception by omission, e.g., failure to disclose full information about the study, or creating ambiguity.
- The researcher should avoid deceiving participants about the nature of the research unless there is no alternative – and even then this would need to be judged acceptable by an independent expert.

### **Confidentiality**

- Participants, and the data gained from them must be kept anonymous unless they give their full consent. No names must be used in a lab report.

### **Withdrawal**

- Participants should be able to leave a study at any time if they feel uncomfortable. They should also be allowed to withdraw their data. They should be told at the start of the study that they have the right to withdraw.

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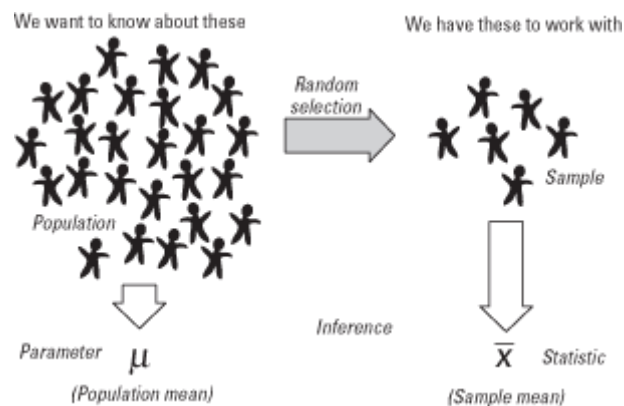
## UNIT-II

### SAMPLING

*Population and Sample- Types of sampling: Probability and non-probability sample-  
Sources of data collection: Primary data, Secondary data-Experimental method of data  
collection*

### POPULATION

- ❖ Population is the entire pool from which a statistical sample is drawn.
- ❖ The information obtained from the sample allows statisticians to develop hypotheses about the larger population

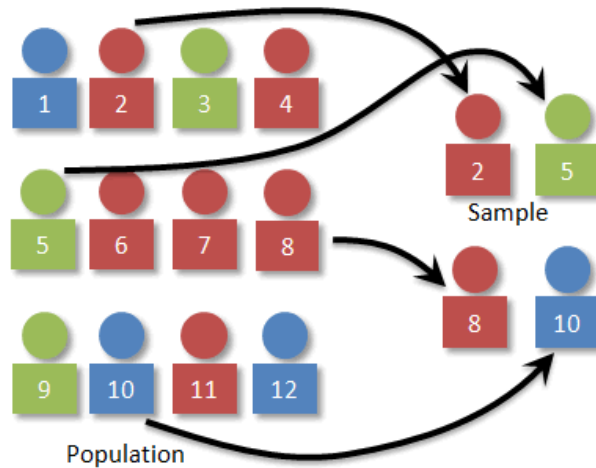


- ❖ In simple terms, population means the aggregate of all elements under study having one or more common characteristics.
- ❖ The population does not include only people but it may also include animals, events, objects etc.
- ❖ The population can be of any size. The number of elements and members in a population is known as population size.

**Eg: if there are hundred million people in India, then the population size is 100 million  
i.e: N(Population Size)=100 million.**

### SAMPLE

- ⇒ The sample reflects the characteristics of the population from which it is drawn.
- ⇒ A sample is a smaller group of members of a population selected to represent the population.
- ⇒ The selected **respondents** constitute what is technically called a 'sample'
- ⇒ The selection process is called 'sampling technique.'



### **Merits of sample:**

- ❖ It saves time.
- ❖ It reduces cost
- ❖ It provides more reliable results.
- ❖ Also helps in providing detailed information.
- ❖ The organization and administration of sample is easy.
- ❖ The degree of accuracy is higher than census method.

### **Demerits of sample:**

- ❖ To make a representative sample is a difficult task.
- ❖ The sample survey may not be satisfactory without expert support.
- ❖ Sampling plan is a difficult task.
- ❖ More chances for personal bias.
- ❖ Accuracy is tough if sample size is wrong.

### **SAMPLE DESIGN:**

- A sample design is a definite plan for obtaining a sample from a given population.
- It refers to the technique or the procedure the researcher would adopt in selecting items for the sample.

### **SAMPLING UNIT:**

Sampling unit may be a geographical one such as state, district, village, etc., or a construction unit such as house, flat, etc., or it may be a social unit such as family, club, school, etc

Eg: A study on girl children safety at Vellore Government Schools

### **SIZE OF SAMPLE OR SAMPLE SIZE:**

This refers to the number of items to be selected from the population to constitute a sample. The size of sample should neither be excessively large, nor too small. It should be optimum.

### METHODS OF SAMPLING

The two methods of sampling are

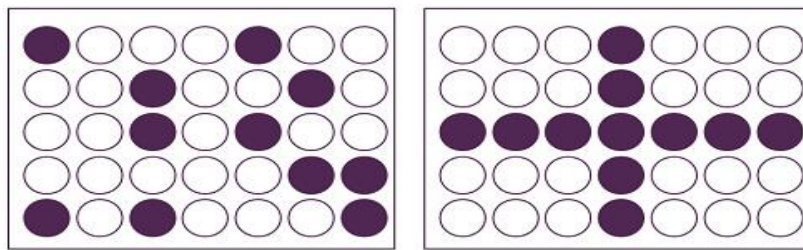
- ⇒ **Probability Sampling**
- ⇒ **Non Probability sampling**

#### Probability Sampling:

- ✚ This is a sampling technique where every member of the population has equal chance to participate as sample.

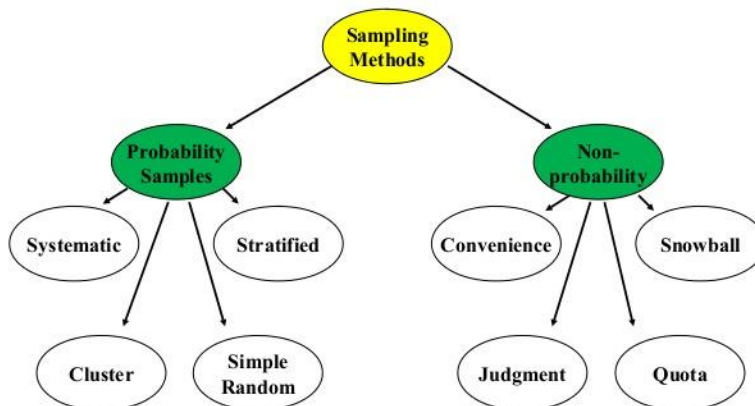
#### Non Probability Sampling:

- ✚ Another sampling technique where the members of the population are selected as sample based on personal judgment or systematic process.



Probability Sampling Vs Non-Probability Sampling

### Classification of Sampling Methods



## **PROBABILITY OR RANDOM SAMPLING**

This is further divided into

1. Simple or unrestricted random sampling
  - a. Lottery method
  - b. Table of random numbers
2. Restricted random sampling
  - a. Stratified sampling
  - b. Systematic sampling
  - c. Cluster sampling

### **I.SIMPLE OR UNRESTRICTED RANDOM SAMPLING:**

It is a technique in which sample is drawn where each and every member in the population has an equal and independence chance to be included in the sample.

Methods of simple random sampling:

- ⇒ Lottery method
- ⇒ Table of random numbers

#### **a.Lottery method:**

- This is the most popular and simplest method.
- Here all the units of the population are numbered on a separate slip on a paper of same size, shape and color.
- That will be folded and put in a container. A blindfold selection is made and required number of sample size is selected.

**Eg: if we need 5 students as sample out of 50 students, all the 50 names will be written and chosen the needed 5 through lottery selection.**

- It is called as unrestricted as here there is no restriction or rule to select samples.
- This is inappropriate for large population.
- Accuracy of the result is not assured.

#### **b.Table of random numbers:**

**Random number tables** have been in statistics for tasks such as selected random samples. This was much more effective than manually selecting the random samples (with dice, cards, spins etc.).

Eg: Let's assume that we have a population of 185 students and each student has been assigned a number from 1 to 185. Suppose we wish to sample 15 students. We write all the 15 in a sample and close eye then spot the numbers which we want to pick randomly

## II.RESTRICTED RANDOM SAMPLING:

The restricted random sampling is sub divided into

### a. Stratified sampling:

- ⇒ When the population is heterogeneous or of different segments or strata in character then it is stratified.
- ⇒ First the population is divided into a number of sub groups that's homogenous in nature, then sample is drawn from each sub group.

Stratified sampling is divided into

1. Proportional stratified sampling
2. Non proportional stratified sampling.

**Eg: If we have to research on importance of degree in a college, then each department have to be consider as each strata and then sample have to be drawn as 10% from each department equally.**

#### Merits:

- Provided accuracy.
- It is easy to administer.

#### Demerits:

- Requires more time and money to divide heterogeneous group into homogenous sub group.
- There are chances for personal bias.

### b.Systematic sampling:

- ⇒ It is also known as quasi random sampling.
- ⇒ This is systematic or logical or orderly way of drawing sample from the target population.

The following formulae are used here to draw the sample.  $K=N/n$

$K$ =Sampling interval , $N$ =Size of the population., $n$ = Sample size.

**Eg: if the target population is 1500,and the sample size is 150 then the sampling interval will be**

**$K = \frac{1500}{150} = 10$ . So every 10<sup>th</sup> student will be taken as sample.**

#### Merits:

- This is simple and convenient.
- Time and work is reduced.

#### Demerits:

- This does not represent whole population.

### C.Cluster sampling or multistage sampling:

- ⇒ It is also called as sampling stages.

- ⇒ The whole population is divided into sampling units, and these units are again divided into sub units.
- ⇒ This will continue when we reach a lease number.

**Eg: If we want to take 5000 students from Madhya Pradesh. We must take universities at the first stage , then the number of colleges at the second stage ,selection of students from the colleges at the third stage etc.**

**Merits:**

- It is flexible.
- It is helpful in large scale survey.

**Demerit:**

It is less accurate

**NON-RANDOM SAMPLING METHOD OR NON PROBABILITY SAMPLING:**

Another sampling technique where the members of the population are selected as sample based on personal judgment or systematic process.

**a.Judgement sampling:**

The sample is selected based on the judgment of the investigator.

**Eg: if a sample of 5 students is to be selected from a B.Com class of 50 students fro analyzing the habit of picture seeking, the investigator would select 5 students who, according to his opinions are the representative of the class.**

**Merits:**

- It is simple method.
- This is helpful to make public policies and so on.

**Demerits:**

- Personal bias is high in nature.
- Sampling error will be high.
- Inaccurate results may occur

**b.Quota sampling:**

- ⇒ This is similar to stratified sampling.
- ⇒ The population is decided into different quota according to same characteristics. Then from there sample from ach quota is based on personal judgment.
- ⇒ Thus this is stratified cum judgmental sampling.
- ⇒ Personal bias is more in this method.

**c.Convenience or chunk sampling:**

- ⇒ Selecting the sample based on the convenience of the researchers.
- ⇒ Mostly samples are drawn from the population which is readily accessible.

**Suitability:**

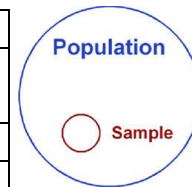
- when the population unit is nearby.
- When sample unit is unclear.
- When complete source list is unavailable.

**d.Snowball sampling:**

- ⇒ Snowball sampling is usually done when there is a very small population size.
- ⇒ In this type of sampling, the researcher asks the initial sample to identify another potential sample who also meets the criteria of the research.

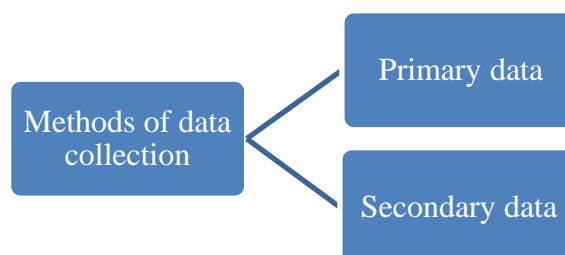
**DIFFERENCE BETWEEN POPULATION AND SAMPLE**

Attributes	POPULATION	SAMPLE
<b>Definition</b>	Population refers all the characters of the universe	Sample is drawn out of population
<b>Data collection</b>	Uses census method	Uses sampling survey
<b>Characteristics</b>	A measurable characteristic of a <u>population</u> , such as a <u>mean</u> or <u>standard deviation</u> , is called a <u>parameter</u>	a measurable characteristic of a <u>sample</u> is called a <u>statistic</u> .
<b>Focus</b>	Identifying different characters	Draw inferences out of sample.
<b>Symbol</b>	$\mu$	$\bar{X}$



**SOURCES OF DATA**

Data collection is the systematic approach to gathering and measuring information from a variety of sources to get a complete and accurate picture of an area of interest.



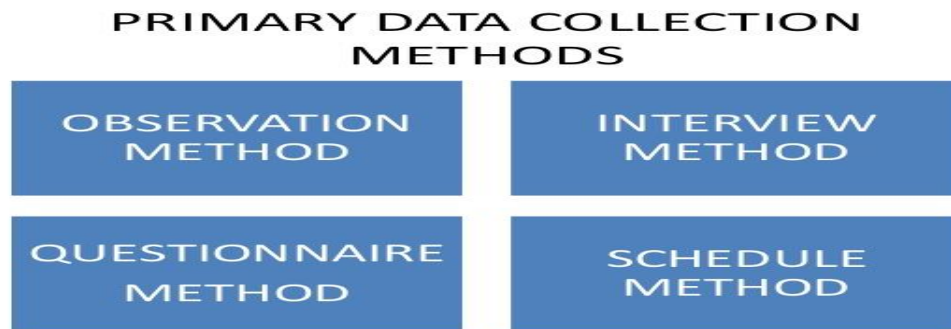


## **Primary data:**

Primary data are those which are collected for the first time and they are original in character.

### **Methods of collecting primary data:**

The several methods to collect primary data are



### **A.Observation method:**

- The data is collected by the researcher personally.
- The researcher must be a keen observer and skillful in collecting data.
- The researcher can question and cross examine the respondents to collect direct information.

**Eg: In a study relating to consumer behavior, the investigator instead of asking the brand of wrist watch used by the respondent, may himself look at the watch.**

### **Types of observations:**



- 1. Structured or controlled observation** - When observation takes place according to definite pre-arranged plans
- 2. Unstructured or Uncontrolled observation** - If the observation takes place in the natural setting without any pre plans to get spontaneous reaction of respondents
- 3. Participant observation** - If the observer observes by making himself, more or less, a member of the group
- 4. Disguised observations** - When the observer is observing in such a manner

that his presence may be unknown to the people

**Merits:**

- First-hand information are collected
- True and reliable data will be collected.
- A high degree of accuracy will be obtained.

**Demerits:**

- Unsuitable for large area.
- It is expensive
- This is time consuming.

## **B.Interview method:**

- ❖ The interview method of collecting data involves presentation of oral-verbal stimuli and reply in terms of oral-verbal responses.

### **Types of interview:**



- |                                  |   |
|----------------------------------|---|
| 1. <b>Personal interview</b>     | - a person known as the interviewer asking questions generally in a face-to-face contact to the other person or persons |
| 2. <b>Structured interview</b>   | - The use of a set of predetermined questions and of highly standardized techniques of recording                        |
| 3. <b>Unstructured interview</b> | - do not follow a system of pre-determined questions and standardized techniques of recording information               |
| 4. <b>Focused interview</b>      | - meant to focus attention on the given experience of the respondent  |
| 5. <b>Clinical interview</b>     | - concerned with broad underlying feelings or motivations of individual's life experience                               |
| 6. <b>Stress interview</b>       | - Intended to check the stress, anger, pressure level of the respondents.   |
| 7. <b>Telephonic interview</b>   | - This method of collecting information consists in contacting respondents on telephone                                 |

### **Merits:**

- It is simple and easy.
- It Saves time and money.
- Observation method can as well be applied.
- Personal information can as well be obtained

### **Demerits:**

- The possibility of the bias of interviewer.
- Skill of the interviewer is important.

## **C.Questionnaire method:**

- ❖ A questionnaire consists of a number of questions printed or typed in a definite order on a form or set of forms.

- ❖ The questionnaire is mailed to respondents who are expected to read and understand the questions and write down the reply in the space.

**Questionnaire format:**

- Question forms: any questionnaire must start with
- Demography- to get the personal details of the respondents  
Eg: Age, Name, gender so on
- Structured or unstructured questions: the remaining questions can be already planned questions with options or open choices and let the respondent answer on own. It includes
  - ✓ Dichotomous (Yes or No type)
  - ✓ 5 degree rating scale ( Agree, disagree, strongly agree, strongly disagree, neutral)
  - ✓ Open end questions (suggestions)
  - ✓ Closed end questions (options)

**Mail questionnaire:**

- This is the recent methodology of collecting data, where the researcher can mail the questionnaire to particular unit and collect the sample.
- This method is simple, easy and convenient for the researcher who is distance apart.

**Merits:**

- It is most economical
- It suits for wide coverage

**Demerits:**

- Accuracy is not assured always.
- This is helpful only for literate samples.
- The delay in receiving filled questionnaire is common.

**D. Schedules**

- ❖ This is similar to questionnaire but the only difference is, here the questionnaire will be filled by the enumerators based on the reply given by the samples.
- ❖ The enumerator explains each question and records the answer given.

**Merit:**

It is quite suitable for illiterate respondents.

**Demerit:**

It is time consuming

**SECONDARY SOURCES**

- ❖ Secondary sources are data that already exists. Secondary
- ❖ data are those which are collected from published or unpublished sources.
- ❖ Such data are also known as the second hand data.

**Factors to be considered before collecting secondary data:**

The three factors to be considered are

- ❖ The suitability of the data
- ❖ Adequacy of data
- ❖ Reliability of data.

**Sources of collecting secondary data:**

The secondary data will be collected from

Internal source

External source

**Internal Sources:**

The internal sources of secondary data are:

- Sales Report
- Financial Statements
- Customer details, like name, age, contact details, etc.
- Company information
- Reports and feedback from a dealer, retailer, and distributor
- Management information system

**External sources:**

<b>01</b>	<b>Published Data</b>	<p>It is the most basic secondary source of information for data collection.</p> <p>Published data can be obtained from</p> <ul style="list-style-type: none"><li>❖ books,</li><li>❖ magazines,</li><li>❖ newspapers,</li></ul>
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		<p>❖ journals and periodicals etc.</p> <p>Published data is the most reliable and the validity is greater than unpublished data</p>
02	<b>Personnel records</b>	<p>It can also be very useful in research if data is unavailable in published form.</p> <p>Eg: Letters and diaries.</p>
03	<b>Electronic Data</b>	<p>Electronic data like movies, documentaries and television programs can also be used for recording data in secondary research</p>
04	<b>Government Records</b>	<p><b>Government Records</b> are available in the form of</p> <ul style="list-style-type: none"> <li>❖ government surveys,</li> <li>❖ tax records,</li> <li>❖ Census data and other statistical reports.</li> </ul> <p>They are easily available and widely used in research studies.</p>
05	<b>Internet</b>	<p><b>Internet</b> in today's world is the fastest growing source of information. The information can be obtained faster than we can obtain from any other source.</p> <p>Eg: e book e journals e publishers, websites, blogs social media so on</p>

### Merits

- ❖ It saves time .
- ❖ It is economical and convenient
- ❖ It aids along with primary data to solve the problem.

### Demerits

- ❖ It is very difficult to find sufficiently accurate secondary data.
- ❖ Extra caution is required to use secondary data.

## **EXPERIMENTAL METHOD OF DATA COLLECTION**

- ❖ The experimental method involves manipulating one variable to determine if changes in one variable cause changes in another variable.
- ❖ A variable is anything in an experiment that can change or vary. •

**There are 3 kinds of variables: –**

1. Independent Variable –
2. Dependent variable –
3. Controlled Variables or Controlled Environment

Example: **Experiment: The taste of a plain tea was tested by using different levels amounts of sugar.**

Independent Variable      • Level of sugar

Dependent Variable        • Taste

Controlled Variable        • Same Cup, Same sugar brand, same tea leaves, same temperature level of hot water

### **Characteristics of an Experiment**

- ❖ Should Test one variable at a time.
- ❖ Experiment must be fair and unbiased.
- ❖ It Does not allow any outside factor to affect the final out come
- ❖ Experiment should be a valid test. (proving a hypothesis)
- ❖ Should repeated trials. to minimizing outcome errors

### **Two methods of experimental research:**

- ❖ Field research
  - ❖ Laboratory research
- Field research takes place in live physical set up with no pre plans
  - Laboratory research takes place in lab set up with pre-planned structure.

<u>Merits</u>	<u>Demerits</u>
<ul style="list-style-type: none"><li>▪ Helps to find actual cause-and effect relationship between the two given variables</li></ul>	<ul style="list-style-type: none"><li>▪ It is time consuming</li><li>▪ It costlier to administer.</li></ul>

**Example: Bobo doll experiment, Milgram experiment.**

### UNIT-III

#### INTRODUCTION TO STATISTICS

*Meaning of statistics- Definition-Functions and limitations of statistics –Discrete and continuous variables- Descriptive and inferential statistics- Applications of statistics in Psychology*

#### DEFINITION

- ❖ Croxton and Cowden defines it as, “Statistics is a branch of mathematics dealing with the collection, analysis, interpretation, and presentation of masses of numerical data”.

#### MEANING OF STATISTICS

- Statistics, a branch of applied Mathematics that dealing with the collection, processing, analysis and interpretation of numerical data belongs to the domain of statistics.
- In this sense, it is a branch of applied mathematics and helps us to know the complex social phenomena in a better way and lends precision to our ideas.

#### FUNCTIONS OF STATISTICS

Important functions of statistics are given below:

1. **Statistics simplifies complexity:** The complex mass of figures can be made simple and understandable with the help of statistical techniques such as averages, dispersion, graph, diagram etc.
2. **Statistics presents fact in a definite form:** One of the important functions of statistics is to present the general statements in a precise and definite form. The conclusion stated numerically is definite and hence more convincing than the conclusions stated wordly. *This fact can readily be understood by the following example: "The population of Nepal is 1981 has been increased than in 1971". There will be no clear idea about this statement. Everybody wants to know to what extent the population of Nepal has increased. But the statement that "the population of Nepal has increased from 11555983 in 1971 to 15022839 in 1981" is a definite form.*
3. **Statistics facilities comparison:** The science of statistics does not mean only counting but also comparison.. Statistical methods such as averages, ratios, percentages, rates, coefficients etc. offer the best way of comparison between two phenomena which will enable to draw valid conclusion.
4. **To help in formulation of policies:** Statistics helps in formulating the policies in different fields mainly in economics, business etc. The government policies are also framed on the basis of statistics. In fact, without statistics, suitable policies cannot be framed. *For example: The quantity of food grains to be imported in a particular year depends upon the expected internal production and the expected consumption. That is if the*



*expected wheat production in the particular year be 701 thousands metric tons and that of consumption 710 thousand metric tons so we must import 9 thousand metric tons of food grains.*

5. **Statistics helps in forecasting:** Statistical methods provide helpful means in forecasting the future by studying and analyzing the tendencies based on passed records. *For example: Suppose a businessman wants to know the expected sales of T.V. for the next year, the better method for him would be to analyze the sales data of the past years for the estimation of the sales volume for the next year.*

6. **Statistics helps in formulating and testing hypothesis:** Statistical methods are helpful not only in estimating the present forecasting the future but also helpful in formulating and testing the hypothesis for the development of new theories. *Hypothesis like 'whether a particular fertilizer is effective for the production of a particular commodity' 'whether a dice is biased or not' can be tested with the help of statistical tools.*

### **LIMITATIONS OF STATISTICS**

Besides the importance of statistics in every field of life, it has some limitations. The following are the main limitations of statistics are:

1. **Statistics does not deal with individuals:** A part of the definition of statistics is that it must be the aggregates of facts. That is, it deals only with the mass phenomena. A single item or the isolated figure cannot be regarded as statistics. *This is a serious limitation of statistics. For example: the mark obtained by a student in English is 75 does not constitute statistics but the average of a group of students in English is 75 forms statistics.*

2. **Statistics does not study qualitative phenomena:** The science of statistics studies only the quantitative aspect of the problem. Statistics cannot directly be used for the study of qualitative phenomena such as honesty, intelligence, beauty, poverty etc. however, some statistical techniques can be used to study such qualitative phenomena indirectly by expressing them into numbers. *For example: the intelligence of the boys can be studied with the help of marks obtained by them in an examination.*

3. **Statistical laws are not exact:** 100% accuracy is rare in statistical work because statistical laws are true only on the average. They are not exact as, are the laws of Physics and Mathematics. *For example: the probability of getting a head in a single toss of a coin is  $\frac{1}{2}$ . This does not imply that 3 heads will be obtained if a coin is tossed 6 times. Only one head, 2 times head or all the times head or no head may be obtained.*

4. **Statistics is only a means:** Statistical methods provide only a method of studying problem. There are other methods also. *These methods should be used to supplement the conclusions derived with the help of statistics.*

5. **Statistics is liable to be misused:** . Statistical methods if properly be used, may conclude useful results and if misused by inexpert, unskilled persons, it may lead to fallacious conclusion. We have the following example consisting the result concluded by an inexpert and unskilled person.

### DISCRETE AND CONTINUOUS VARIABLE

The quantitative data of statistics is sub divided into

- ❖ Discrete variable
- ❖ Continuous variable.

#### DISCRETE VARIABLE:

- If the quantitative variable can take only an at most countable number of values, then such data is called discrete data.
- The term discrete implies distinct or separate.
- It contains only finite values, whose subdivision is not possible.
- It includes only those values that can only be counted in whole numbers or integers and
- The data cannot be broken down into fraction or decimal.

#### Example:

**Number of quarters in a purse, No of students, No of animals in zoo**

**Numbers of coins: 1, 2, 3, 4, 5.... (Coins don't come in amounts of 2.3 coins or 10.5 coins)**

**The number of cars in parking.( cars can be counted as full and cannot be counted as 9.5 Or 10.5 cars)**

**Ages on birthday cards. (Ages will be given in cards as 13<sup>th</sup>, 60<sup>th</sup>birthday...It will not specify the age in deep)**

#### CONTINUOUS VARIABLE

- If a variable can take on any value between its minimum value and its maximum value, it is called a continuous variable
- A continuous variable that has an infinite number of possible values.
- Here any value is possible for the variable.
- Continuous variables can take any numerical value and are measured.

- Statistically, range refers to the difference between highest and lowest observation.
- The continuous data can be broken down into fractions and decimal.

**Examples:**

**Time it takes a computer to complete a task.** You might think you can count it, but time is often rounded up to convenient intervals, like seconds or milliseconds. Time is actually a continuum: it could take 1.3 seconds or it could take 1.33333333333333... seconds.

**A person's weight.** Someone could weigh 180 pounds, they could weigh 180.10 pounds or they could weigh 180.1110 pounds. The number of possibilities for weight are limitless.

**Income.** You might think that income is countable (because it's in dollars) but who is to say someone can't have an income of a billion dollars a year? Two billion? Fifty nine trillion? And so on...

**Age.** So, you're 25 years-old. Are you sure? How about 25 years, 19 days and a millisecond or two? Like time, age can take on an infinite number of possibilities and so it's a continuous variable.

## DIFFERENCE BETWEEN DISCRETE AND COTINUOUS

BASIS FOR COMPARISON	DISCRETE DATA	CONTINUOUS DATA
Meaning	Discrete data is one that has only finite values	Continuous data is one that Has finite and infinite
Nature	Countable	Measurable
Values	It can take only separate values.	It can take any value
Graphical Representation	Bar Graph	Histogram

Tabulation is known as	Ungrouped frequency distribution.	Grouped frequency distribution.
Example	No of animals in zoo	Height and weight.

### DESCRIPTIVE AND INFERENTIAL STATISTICS

- ✓ The study of statistics can be categorized into two main branches.
- ✓ These branches are descriptive statistics and inferential statistics.
- ✓ To collect data for any statistical study, a population must first be defined.
- ✓ '**Population**' indicates a group that has been designated for gathering data from.
- ✓ The **data** is information collected from the population. A population is not necessarily referring to people.

### DESCRIPTIVE STATISTICS

- **Descriptive statistics** give information that describes the data in some manner.

**For example, suppose a pet shop sells cats, dogs, birds and fish. If 100 pets are sold, and 40 out of the 100 were dogs, then one description of the data on the pets sold would be that 40% were dogs.**

- A graphical representation of data is another method of descriptive statistics.

**Examples of this visual representation are histograms, bar graphs and pie graphs, to name a few. Using these methods, the data is described by compiling it into a graph, table or other visual representation.**

#### Merits:

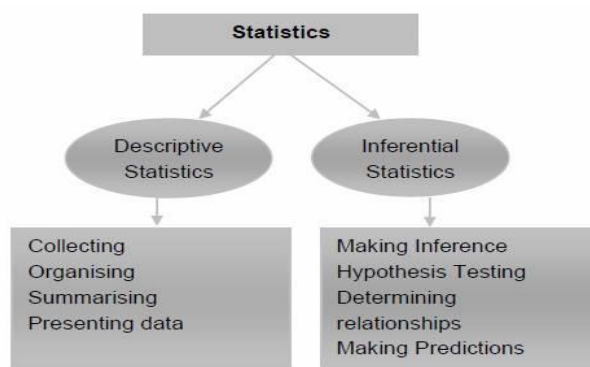
- ✓ This provides a quick method to make comparisons between different data sets .
- ✓ To spot the smallest and largest values and trends or changes over a period of time.

**Eg:If the pet shop owner wanted to know what type of pet was purchased most in the summer, a graph might be a good medium to compare the number of each type of pet sold and the months of the year.**

- Descriptive research include data collection and life experiences

**Demerits:**

- ✓ The sense of confidentiality and objectivity and error.
- ✓ You cannot identify the cause behind a phenomenon.
- ✓ Descriptive research requires more skills.



## INFERENCE STATISTICS

- Now, suppose you need to collect data on a very large population.

**For example, suppose you want to know the average height of all the men in a city with a population of so many million residents. It isn't very practical to try and get the height of each man. This is where inferential statistics comes into play.**

- **Inferential statistics** makes inferences about populations using data drawn from the population.
- Instead of using the entire population to gather the data, the statistician will collect a sample or samples from the millions of residents and make inferences about the entire population using the sample.
- The sample is a set of data taken from the population to represent the population.

### Categories of inferential statistics:

- ✓ Probability distributions,
- ✓ hypothesis testing,
- ✓ Correlation testing and regression analysis all fall under the category of inferential statistics.

### Merit:

One advantage of inferential statistics is that large predictions can be made from small data sets

### Demerit:

- ✓ In inferential statistics, the answers are never 100% accurate.

## **APPLICATIONS OF STATISTICS IN PSYCHOLOGY**

- ❖ Psychological statistics is application of statistical formulae, theorems and laws of statistics to Psychology.
- ❖ Statistical tools can be used to check effectiveness of a drug or placebo.
- ❖ Statistics helps with measuring how one variable impact other variable.
- ❖ Statistics allows psychologists to :

- ✓ Make inferences based upon data
  - ✓ Describe data
  - ✓ Organize data
- 
- ❖ Statistics are essential for determining if certain treatments are effective.
  - ❖ One of the most challenging aspects of Psychology is deciding how diseases, disorders and other problems should be categorized.
  - ❖ By using advanced statistical analyses, experts can determine which symptoms seem to cluster together.
  - ❖ Descriptive statistics help psychologists get a better understanding of the general trends in their data, while inferential statistics help them draw conclusions about how their variables relate to one another.
  - ❖ Psychologists use statistics for a number of reasons, including finding relationships between different variables, identify correlations among different things and to use data to draw more general conclusions about our society.
  - ❖ Statistics allow psychologists to present data in ways that are easier to comprehend. Visual displays such as graphs, pie charts, frequency distributions, and scatter plots allow researchers to get a better overview of data.
  - ❖ In the world of psychology the terms “normal” and “abnormal” appear very often. To define a mental “abnormality” all one has to do is find out if the observed behaviour is uncommon enough to be considered “abnormal.” To do that there is a need for statistical data.

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## UNIT-IV

### DATA ANALYSIS

**Frequency distribution- Graphical representation of data- Types of Diagrams.**

**Measures of central tendency: Mean-Median-Mode- Computation, Uses and Application of mean, median, mode in Psychology.**

### FREQUENCY DISTRIBUTION

The repetition of number in a data is termed as frequency of that particular number. This is called as frequency

Frequency distribution, in statistics, **a graph or data set organized to show the frequency of occurrence of each possible outcome of a repeatable event observed many times.**

#### Types of Frequency Distribution Table

There are two types of frequency distribution tables.

1. **Ungrouped frequency distribution table:** This is a simplest form of frequency distribution. We just have to count the number of times a value is repeated and have to prepare a table.

**Eg:**

In a survey of 35 families in a village, the no: of children per family was recorded and the following obtained

**1 0 2 3 4 5 6 2 3 4 0 2 5 8 4 5 12 6 3 2 7 6 5 3 3 7 8 9 7 9 4 5 5 4 3**

2. **Grouped frequency distribution table:** To arrange a large number of observations or data, we use grouped frequency distribution table. We form class intervals to tally the frequency for the data that belongs to that particular class interval.

#### **Class limits:**

It includes the lowest and highest values in the class :Eg: in the class limit 20-30 20 is lowest limit and 30 is upper limit

#### **Class interval:**

The differences between lower and upper limit is called class interval

**$i = L - S / K$**

i= class interval, L-Largest value, S-Smallest value K- No: of classes

Eg:  $i = 30 - 20 / 2$   $i = 2$

#### **class midpoint:**

It is the value lying between lower and upper class limit

$$\text{midpoint} = \frac{\text{upper limit of the class} + \text{lower limit of the class}}{2}$$

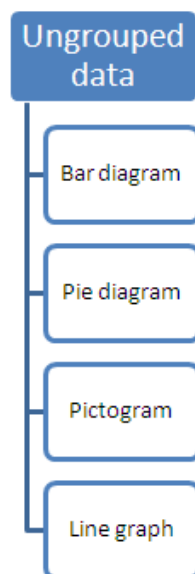
## GRAPHICAL REPRESENTATION OF DATA

- ❖ Graphical representation is the geometrical image of a set of data. It is the mathematical picture that let us to solve a statistical problem through visual terms.

### Merits:

- ❖ It end up more attractive
- ❖ It stores in brain with lasting effect
- ❖ It is easy to consolidate large amount of data in presentation
- ❖ Comparison and interpretation is made easy
- ❖ It helps in communicating and forecasting.

### TYPES OF DIAGRAM



### BAR DIAGRAM /GRAPH

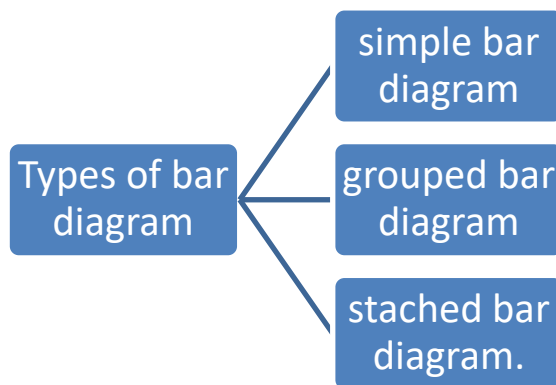
- ❖ It is a visual tool that uses bars to compare data. The data are represented by bars or sometimes using graph. Hence it is also names as bar graph.
- ❖ The bars are used for the series of data to compare over time.
- ❖ The length and breadth of the bars are totally based on the amount of variables.

Data represents in bar diagram:

The data are represented in the form of

- ⇒ Raw scores
- ⇒ Total scores on frequency
- ⇒ Percentage and
- ⇒ Average.

### TYPES OF BAR DIAGRAMS



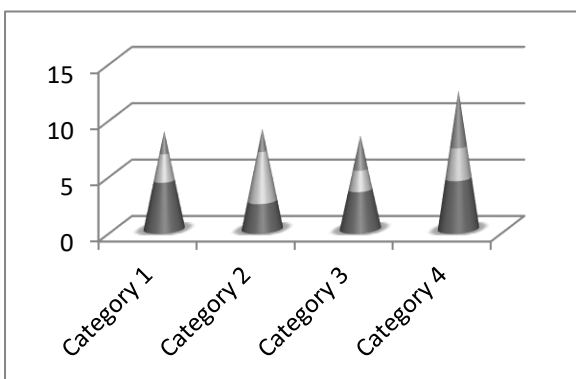
#### Simple Bar diagram:

- ❖ The simple bar diagram is further divided into
- ❖ Horizontal and vertical bar diagram.
- ❖ The longer the bar, the larger the category is.

#### Uses:

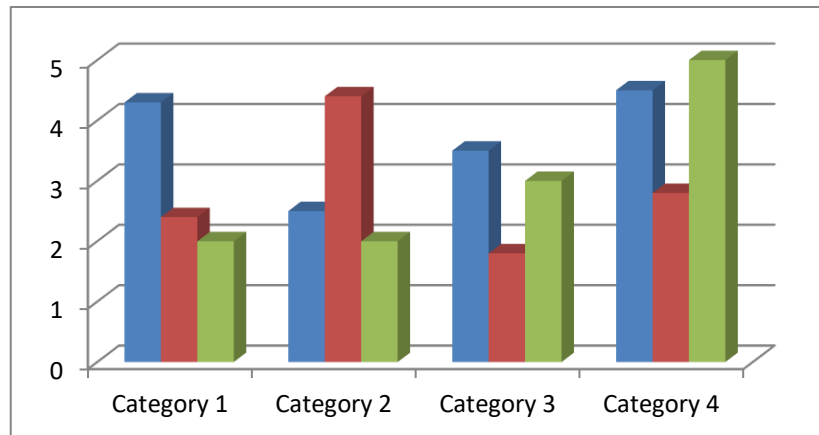
- ⇒ Vertical bar is used for the series of data to compare over time.
- ⇒ Horizontal bar is used when vertical bar has no room at the bottom to write titles of the axis.

Also when the number of data is larger, horizontal is preferred.



#### Grouped bar diagram:

- ❖ The multiple bar diagram is the sub group of grouped bar diagram. It is used to show different sub fields during the same year . When there is more than one bar, it is referred as multiple bar diagram.
- ❖ Different shades and colors are used to distinguish.



### Stacked bar diagram:

- ❖ The sub groups are placed on top of each other. It looks like a storey building.

The two sub groups of stacked bar diagram are

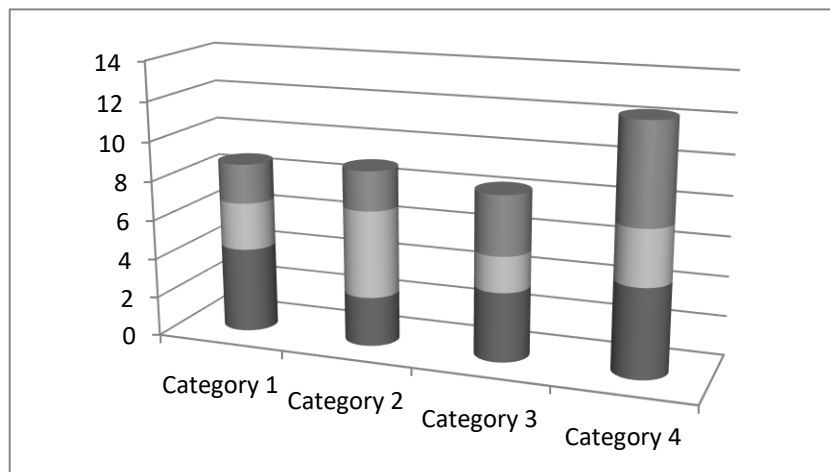
1. Compound bar diagram
  2. Percentage compound bar diagram.
- ❖ The over all height and length shows the total size of the category.

### Merits of bar diagram:

- ⇒ It helps to summarize large data .
- ⇒ It helps in comparison
- ⇒ Estimation can be made easy
- ⇒ Accuracy is high.

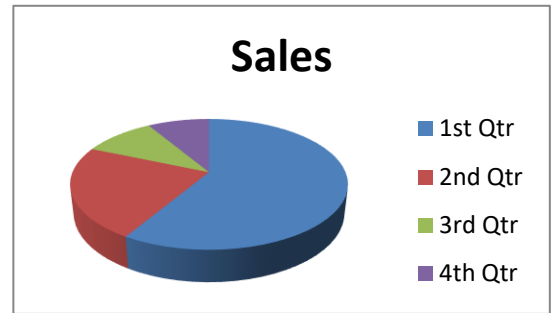
### Demerits:

- ⇒ It is easy to manipulate.
- ⇒ It may lead to false impression
- ⇒ Too many bars may look clumsy.



### **PIE DIAGRAM**

- ❖ The data is represented through the sections or portions of a circle
- ❖ It is denoted as pie ( $\pi$ ) the circumference of the circle.



### **Merits:**

- ⇒ It is easy to understand
- ⇒ It is used as good communicating tool
- ⇒ We can understand information quickly.

### **Demerits:**

- ⇒ Too many pie looks ineffective
- ⇒ Comparison is difficult as the pie is not bars to do proper comparison

## **PICTOGRAM**

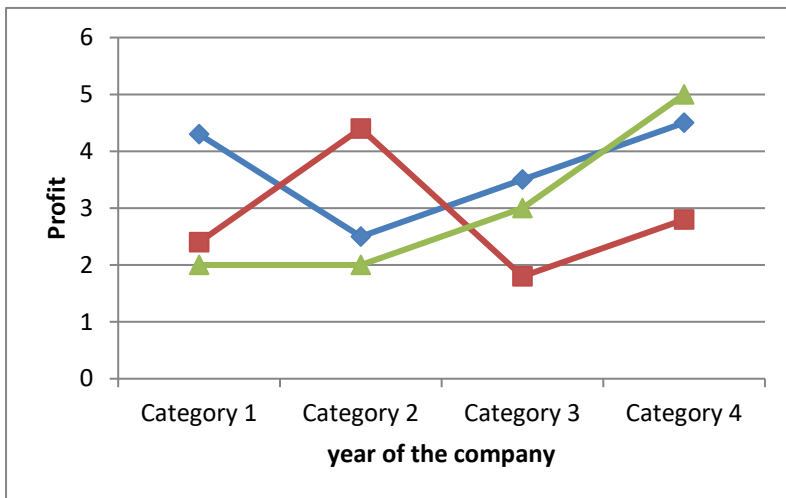
- ❖ It is also called as pictograph, picto, pictogramme.
- ❖ Pictogram is one form of graphical representation where the pictures are being drawn in charts with icons.

### Merits:

- ⇒ It looks attractive
- ⇒ It is easy to understand
- ⇒ It looks interesting to learn.

### **LINE GRAPH**

It is also known as line chart. It is used to visualize something over time.



Eg: Finance department, uses line chart to plot changes in amount of cash that company got in hand.

### Merits:

- ⇒ It creates good visual impression.
- ⇒ It is easy to identify positive and negative vales.
- ⇒ It is simple to construct.

### Demerits:

- ⇒ It looks clumsy over too many lines
- ⇒ It leads to confusion
- ⇒ Uneven lines made it complicate to understand.

### **MEASURES OF CENTRAL TENDENCY**

- ❖ These measures also called as statistical averages or averages.
- ❖ A measure of central tendency is a value around which all the observations have a tendency to cluster.

The major measures of central tendency are

Mean

Median

Mode

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### ARITHMETIC MEAN OR MEAN

It is the most common measure of central tendency and

It is defined as the value which we get by dividing the total of the values of various given items in a series by the total number of items. It is denoted by  $\bar{x}$

#### Computation:

$$\text{Mean or } (\bar{x}) = \frac{\sum X}{n} \quad n = \text{Total no: of items} \quad \text{and} \quad \sum X = \text{total values given}$$

For example, the arithmetic mean of five values: 4, 6, 3, 5, 7 is:  $4+6+3+5+7 \div 5 = 25 \div 5 = 5$ , so the mean is 5

#### Merits:

- ❖ It is easy to understand
- ❖ It is easy to calculate
- ❖ It provides good comparison

#### Demerits:

- ❖ It may give false calculation
- ❖ It cannot be represented in graphs.
- ❖ It cannot be accurate.

#### Applications of mean

- ❖ The mean is often used as if it is a good representation of a group of scores.
- ❖ The mean is helpful because it provides a single, typical value to represent an entire data set.
- ❖ It is best of all averages. Hence it is ideal average
- ❖ It is used for social, economic and business

#### **Sums:**

### **Simple arithmetic method**

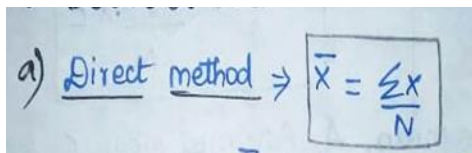
1. Calculate mean from the following using simple arithmetic mean (direct and shortcut method).

Roll number	1	2	3	4	5	6	7	8	9	10
marks	40	50	55	78	58	60	73	35	43	48



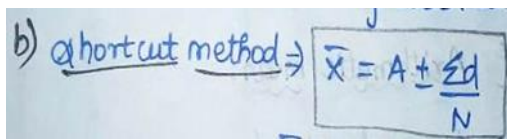
Roll number	Marks	D= X-A (A is Assumed mean) lets assume 40 as A
1	40	40-40= 0
2	50	50-40=10
3	55	55-40=15
4	78	78-40=38
5	58	58-40=18
6	60	60-40=20
7	73	73-40=23
8	35	35-40= -05
9	43	43-40=03
10	48	48-40=08
Total	540	$\sum d = 140$

#### Direct method



$$\sum X = 540, N = 10 \quad \bar{X} = 540/10 = 54$$

#### Short cut method:



$$A = 40, \sum d = 140, N = 10, \bar{X} = 40 + 140/10 = 54$$

## MEDIAN

- ❖ The median has its name indicates is the value of the middle item in a series when items are arranged according to magnitude.
- ❖ It is denoted by M

#### Merits:

- It is easy to understand
- It is easy to calculate
- It need simple inspection

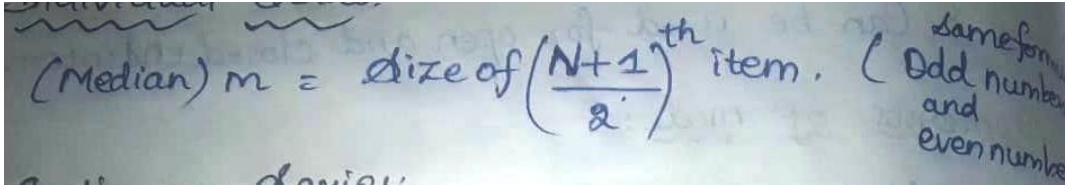
#### Demerits:

- It ignores the extreme distraction
- It is not possible for algebraic manipulation
- It is just estimated not calculated.

#### Computation for median :

**Individual series:** find by ascending the number and select centre value as median (M)

**Individual series and Discrete series:**



Handwritten formula for finding the median in an individual series:

$$\text{(Median) } m = \text{size of } \left( \frac{N+1}{2} \right)^{\text{th}} \text{ item.}$$

Same formula for odd numbers and even numbers.

### **Applications of Median**

- ❖ The median is an important metric to calculate because it gives us an idea of where the “centre” of a dataset is located.
- ❖ It also gives us an idea of the “typical” value in a given dataset.

### **Sums:**

#### **Individual series:**

1.Find out the median of the following:

X= 10,15,9,25,19

Ascending order 9,10,**15**,19,25 so Centre value 15 is the median

2..Find out the median of the following:

X= 10,5,24,12,20,13,100

#### **Individual series: Odd number**

**1.Find out the median of the following:**

X= 10,15,9,25,19

M= size of  $(N+1/2)^{\text{th}}$  item

M=  $(5+1/2)$

M=3

Ascend the order X= 9,10,**15**,19,25 ,so M= 15

**2.Find out the median of the following:**

X= 10,5,24,12,20,13,100

M= size of  $(N+1/2)^{\text{th}}$  item

M=  $(7+1/2)$

M=4

Ascend the order X=5,10,12,13,20,24,100, so M= 13

#### **Even number:**

**1.Find out the median of the following:**

X= 57,58,61,42,38,65,72,66

M= size of  $(N+1/2)^{\text{th}}$  item

M=  $(8+1/2)$

M=4.5<sup>th</sup> item

Ascend the order X= 38,42,57,**58,61**,65,72

**2.Find out the median of the following:**

X= 10,5,24,12,20,13,

M= size of  $(N+1/2)^{\text{th}}$  item

M=  $(6+1/2)$

M=3.5<sup>th</sup> item

Ascend the order X=5,10,**12,13**,20,24,

$$M = \frac{58+61}{2} \therefore M=59.5$$

$$M = \frac{12+13}{2} \therefore M= 12.5$$

## **MODE**

- ❖ Mode is defined as the value of variable which is frequently repeated.
- ❖ It is denoted by Z

Eg: 2,55,6,7,8 here mode is 5 as it is repeated twice.

### **Merits**

### **Demerits**

### **Application**

It is simple and precise

It is not suitable for math treatments

It helps in decision making

It is easy to understand and calculate

It is difficult to calculate bimodal

It is useful in everyday life

It can be used for both open and closed intervals

It is used in industry and business

### **Computation of Mode**

1. Individual series- by mere observation
2. Discrete series- by analysis table
3. Continuous series- by analysis table and 
$$Z = L_1 + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

Z= mode

L= lower limit of the class

$f_1$ = frequency of the modal class

$f_0$ = frequency of the class preceding the modal class

$f_2$  = frequency of the class succeeding the modal class

i= class interval

### **Sums:**

#### **Individual series**

1. Find the mode for the following income 750,850,600,825,850,725,600 and the *Mode is 850*
  2. In some cases there may be no mode or more than one mode
- 40, 44,57,78,48 here the answer is *No mode*
- 45,55,45,55,67,78,89 here it is bimodal and the answer is *Z= 45 and 55*

## APPLICATIONS OF MEASURES OF CENTRAL TENDENCY IN PSYCHOLOGY

- ❖ The three measures of central tendency are: the mean, the median, and the mode.
- ❖ Researchers in Psychology use each of these measures *to understand samples and the populations that the samples represent.*
- ❖ Central tendency is important in psychology because *a measure can indicate a typical score.*
- ❖ It let a researcher know what is most likely going to happen or has the highest probability of occurring
- ❖ It can *help a psychologist make sense of the data collected through research*
- ❖ It determine *what is typical or normal for a particular group as a whole from the sample collected .*
- ❖ The most common form of the mean that is used in psychology is the **arithmetic mean**. This *represents the sum of all of the values in a set* divided by the number of values in the set.
- ❖ Mean is used to measure *a group of humans on some variable and calculating the mean of the values. This mean value is then discussed as representing the average performance of the group,* as if this value provides a representative substitute for the group's data.
- ❖ The Median is **the score that divides the numerical distribution in half**, where 50% of the values fall below and 50% fall above.
- ❖ The median is usually preferable, **because it's more informative than the mode**. The scores can be ordered from smallest to largest and this is meaningful,
- ❖ Mode is especially useful *when the values or observations are not numeric* but can be used for quantitative also. For example, the mode of {apple, apple, banana, orange, orange, orange, peach} is orange.

## UNIT-V MEASURES OF VARIABILITY

### QUANTITATIVE ANALYSIS (Theory and Sums) AND CORRELATION (Theory)

**Measures of Variability: Range- Standard Deviation-Computation, Uses and Application of range and standard deviation in Psychology**

**Correlation: Meaning- Types of Correlation: Positive-Negative-Zero correlation.**

### RANGE

- The range is the difference between the largest and smallest values in a set of values.

For example, consider the following numbers: 1, 3, 4, 5, 5, 6, 7, 11. For this set of numbers, the range would be 11 - 1 or 10.

#### Merits

It is simple to compute  
It is easy to understand and calculate  
It gives quick answer

#### Demerits

It is not reliable  
It cannot apply to open end classes  
It is indefinite and not suitable for math treatment

#### Uses

It helps in weather forecasting  
It is useful in studying variation from one period to another  
It is used in industry and business

### Formulae for range:

#### **Range**

$R = \text{largest value} - \text{smallest value} (L-S)$   
Also known as absolute measures

#### **Coefficient of range**

$\text{Coefficient of range} = \frac{L-S}{L+S}$   
Also known as relative measures.

### **Sums:**

#### **Range:**

1.Find the range and coefficient of range  
41,11,14,65,73,64,53,35,71,55

**$R = L-S$**

$R = 73-11$

**$R=62$**

**$\text{Coefficient of range} = \frac{L-S}{L+S}$**

$= \frac{73-11}{73+11}$   
 $= \frac{62}{84}$

**$R=0.738$**

2.Find range and coefficient of range

Size	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45
Frequency	20	24	32	28	20	16	34	10	08
Range=L-S				Coefficient of Range= $\frac{L-S}{L+S}$					
= 45-0				$R = \frac{45-0}{45+0}$					
<b>R= 45</b>				$R = \frac{45}{45}$					
				<b>R=1</b>					

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### STANDARD DEVIATION

- Standard deviation is also known as root mean or square mean or mean square deviation.
- It is a measure that is used to quantify the amount of variation or dispersion of a set of data values.
- A low standard deviation indicates that the data points tend to be close to the mean (also called the expected value) of the set, while a high standard deviation indicates that the data points are spread out over a wider range of values.
- It is denoted by Sigma  $\sigma$

#### Merits:

- It is the most important measures of dispersion
- It is possible for further algebraic treatment
- It is basis for measuring the coefficient of correlation

#### Demerits:

- It is rigidly fixed
- It is not easy to understand
- It is difficult to calculate

#### Uses:

- It is widely used in statistics
- It is used in sampling theory
- It is used to study frequency distribution

### Variance

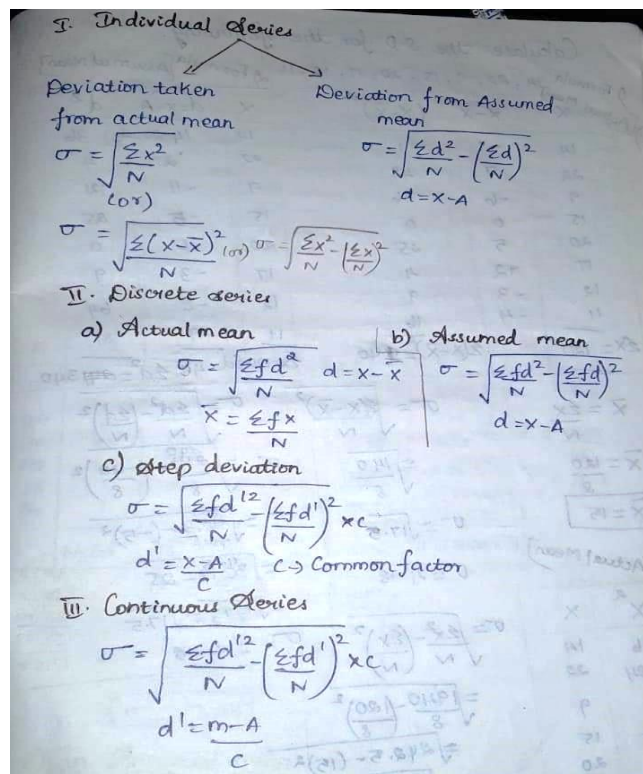
- Variance is the average squared deviation from the population mean.

**Variance** =  $(\sigma)^2$      $\sigma = \sqrt{V}$

**Coefficient of S.D** =  $\text{S.D} / \text{Mean}$   
=  $\sigma / X$

**Coefficient of variance** =  $\text{S.D} / \text{Mean} \times 100 = \sigma / X \times 100$

#### Formulae for S.D





## APPLICATIONS OF RANGE AND STANDARD DEVIATION IN PSYCHOLOGY

The range and standard deviation share the following **similarity**:

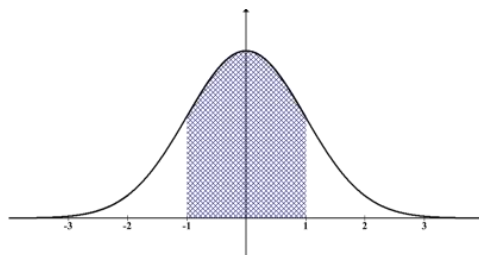
- Both metrics measure the spread of values in a dataset.

However, the range and standard deviation have the following **difference**:

	<b>Range</b>	<b>Standard deviation</b>
<b>Meaning</b>	Range tells us the <b>difference between the largest and smallest value of the data set</b>	Standard deviation tells us the typical <b>deviation of individual values from the mean value in the dataset</b>
<b>When to use range</b>	To understand the difference between the largest and smallest values in a dataset.	To know how far the typical value in a dataset deviate from the mean value.
<b>Example</b>	suppose a professor administers an exam to 100 students. She can use the range to understand the difference between the highest score and the lowest score received by all of the students in the class.	if a professor administers an exam to 100 students, she can use the standard deviation to quantify how far the typical exam score (actual score of the students) deviates from the mean exam score (Minimum pass mark).

### Applications of Standard Deviation:

- Standard Deviation (often abbreviated as “Std Dev” or “SD”) provides an indication of how far the individual responses to a question vary or “deviate” from the mean.
- SD tells the researcher how spread out the responses are — are they concentrated around the mean, or scattered far & wide.
- It shows how much variation there is from the “average” (mean).
- A low standard deviation indicates that the data points tend to be very close to the mean, whereas high standard deviation indicates that the data are spread out over a large range of values.*  
Eg: if one standard deviation above the mean of 100, the score will be 115. if standard deviation below the mean, you get a score of 85.
- Acceptable Standard Deviation (SD) is A smaller SD represents data where the results are very close in value to the mean. The larger the SD the more variance in the results.*
- Data points in a normal distribution are more likely to fall closer to the mean.



- 
- Normal Distribution
- 68%
- 95%
- 99.7%
- one standard deviation
- 85 100 115
- x
- y

## CORRELATION

**Definition:**

- ❖ **Correlation** is a **statistical** measure that indicates the extent to which two or more variables fluctuate together.

**Meaning of correlation:**

- If the change in one variable comes with a change in the other variable, the two variables are said to be correlated and this interdependence is called correlation or covariation.
- To measure the degree of association or relationship between two is termed as co-efficient of correlation.
- The co-efficient of correlation is always symbolized either by  $r$  or  $\rho$  (Rho).

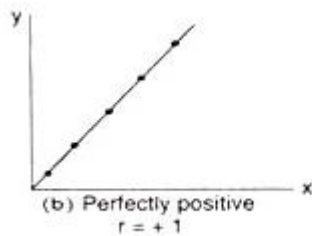
- The notion 'r' is known as product moment correlation co-efficient or Karl Pearson's Coefficient of Correlation.
- The symbol 'ρ' (Rho) is known as Rank Difference Correlation coefficient or spearman's Rank Correlation Coefficient.
- Correlation can be positive or negative or zero
- The size of 'r' indicates the amount (or degree or extent) of correlation-ship between two variables.
- If the correlation is positive the value of 'r' is + ve and
- If the correlation is negative the value of V is negative. If there is no relationship then it means no correlation.
- Thus, the sign of the coefficient V varies from +1 to -1.

### **Types of Correlation:**

In, the correlation may be:

1. **Positive,**
2. **Negative or**
3. **Zero Correlation**

#### **Positive correlation:**

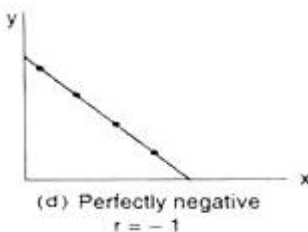


of correlation.

*For example "Heat" and "Temperature" have a perfect positive correlation.*

- ❖ When **the increase in one variable (X) is followed by a corresponding increase in the other variable (Y)**; the correlation is said to be positive correlation.
- ❖ The positive correlations range from 0 to +1.
- ❖ The upper limit i.e. +1 is the perfect positive coefficient

#### **Negative correlation:**



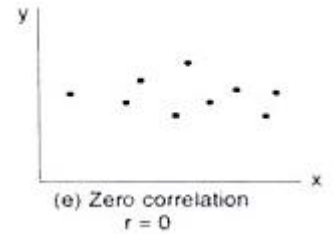
- ❖ If, on the other hand, **the increase in one variable (X) results in a corresponding decrease in the other variable (Y)**, the correlation is said to be negative correlation.
- ❖ The negative correlation ranges from 0 to -1;
- ❖ The lower limit giving the perfect negative correlation.

*Eg: Number of graduates coming out every year and availability of job*

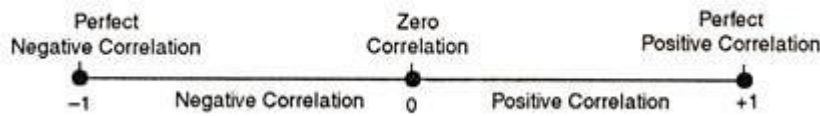
*vacancies*

**Zero correlation:**

- ❖ Zero correlation means **no relationship between the two variables X and Y**;
- ❖ i.e. The change in one variable (X) is not associated with the change in the other variable (Y).
- ❖ The zero correlation is the mid-point of the range  $-1$  to  $+1$



*For example, body weight and intelligence.*



### Methods of finding Co-Efficient of Correlation:

The following three methods are used to compute the value of co-efficient of correlation

1. Scatter diagram method. (graphical method)

2. Pearson's Product Moment Co-efficient of Correlation. (Mathematical method)

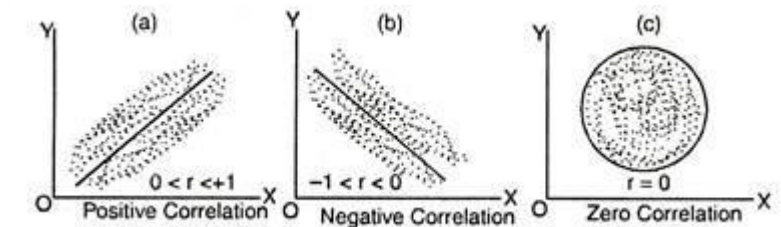
3. Spearman's Rank Order Co-efficient of Correlation (Mathematical method)

### SCATTER DIAGRAM METHOD

- ❖ Scatter diagram or dot diagram is a graphic device for drawing certain conclusions about the correlation between two variables.
- ❖ In preparing a scatter diagram, the observed pairs of observations are plotted by dots on a graph paper with x and y axis

Eg: Noon temperature and ice cream scales, height and weight, salary and experience.

- ❖ The line of best fit' is drawn with a free hand and its direction indicates the nature of correlation.




- ⇒ The three types of scatter diagram are positive correlation, negative and zero correlation.
- ⇒ If the line goes upward and this *upward movement* is from *left to right* it will show *positive correlation*.
- ⇒ Similarly, if the lines move *downward* and its direction is from *left to right*, it will show *negative correlation*.
- ⇒ If the plotted points are *scattered widely*, it will show *zero correlation*.

### KARL PEARSON'S PRODUCT MOMENT CO-EFFICIENT OF CORRELATION

#### Definition

- 🌈 Karl Pearson's Coefficient of Correlation is widely used mathematical method wherein the numerical expression is used to calculate the degree and direction of the relationship between linear related variables.

 The coefficient of correlation is denoted by “r”.

**Formula:**

$$r = \frac{\sum(X-\bar{X})(Y-\bar{Y})}{\sqrt{\sum(X-\bar{X})^2} \sqrt{\sum(Y-\bar{Y})^2}}$$

Where,  $\bar{X}$  = mean of X variable  
 $\bar{Y}$  = mean of Y variable

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**Properties of Coefficient of Correlation**

The value of the coefficient of correlation (r) always lies between  $\pm 1$ . Such as:

- ❖  $r=+1$ , perfect positive correlation
- ❖  $r=-1$ , perfect negative correlation
- ❖  $r=0$ , no correlation

**SPEARMAN'S RANK ORDER CO-EFFICIENT OF CORRELATION**

**Definition:**

- ❖ The Spearman's Rank Correlation Coefficient is the non-parametric statistical measure used to study the strength of association between the two ranked variables.
- ❖ This method is applied to the ordinal(ordered) set of numbers i.e. one after the other so that ranks can be given to each.
- ❖ It is denoted by Rho symbol

**Formula:** 
$$\rho = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}$$