

Inferential statistics



Chapter 1 : Introduction Learning goals – What is meant by Statistics –

What is meant by Descriptive Statistics and Inferential Statistics –

Difference between Parameter & Statistic – Types of Statistical Inferences

What is meant by Statistics ? Statistics is the science of collecting, organizing, presenting, analyzing, and interpreting numerical data to assist in making more effective decisions. Types of Statistics Descriptive Statistics :

- Methods of organizing, summarizing, and presenting data in an informative

way. Inferential Statistics: - A decision, estimate, prediction, or generalization

about a population, based on a sample. Population versus Sample - A

population is a collection of all possible individuals, objects, or

measurements of interest. - A sample is a portion, or part, of the population

of interest Parameter and Statistic - A measure found from the entire

population is called a population parameter or simply a parameter. (such as

μ , \bar{f} , \bar{f}^2) - A measure found from analysing sample data is called a sample

statistic or simply a statistic (such as \bar{x} , \bar{s} , \bar{s}^2) Types of Statistical Inferences

It refers to the process of selecting and using a sample statistic to draw

inference about a population parameter Two types of inferences : -

Estimation : To use the ' statistics' obtained from the sample (such as

sample mean & sample variance) as the ' estimate' of the unknown '

parameter' of the population (such as population mean and variance) - Tests

of significance and hypotheses : To test hypothesis about the population

Chapter 2 : Sampling Process Learning objectives - Why Sample the

Population ? - What is sampling process ? - What are sampling methods ?

Why Sample the Population? - The physical impossibility of checking all items

in the population. - The high cost of studying all the items in a population . -

The sample results are usually adequate. - Contacting the whole population

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would often be time-consuming. - The destructive nature of certain tests.

What is sampling process ? - In order that the statistical inference be valid, samples must be chosen so as to be a true representative of the population i. e. there should be a proper sampling or sample selection process - 7 steps

1. Define the population 2. Identify the sampling frame 3. Specify the sampling unit 4. Specify the sampling method 5. Determine the sample size 6. Specify the sampling plan 7. Select the sample

Probability sampling - Simple random sampling - Systematic random sampling - Cluster sampling -

Stratified sampling - Double sampling Simple Random Sample - A sample

formulated so that each item or person in the population has the same

chance of being included. - When the population is homogeneous — N slips -

shuffle - n to be drawn at random — Random number tables (no in any row

or column or diagonal selected at random) Non probability sampling -

Convenience sampling - Judgment sampling - Quota sampling - Snowball

sampling Determine the sample size - The larger is the sample size, the

lower is the likely error in generalizing to the population, but then amount of time and money invested in collecting, checking & analyzing the data will be

more. The choice of sample size will be governed by the compromise

between these two. Sampling error - The sampling error is the difference

between a sample statistic and its corresponding population parameter.

Chapter 3 : Sampling distribution Learning objectives

What is sampling distribution Standard error of statistic Sampling distribution of

sample mean When population has non-normal distribution o Central

limit theorem When population has normal distribution What is sampling

distribution It is a probability distribution consisting of all possible

values of a sample statistic If, from a given population of finite size N,

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sample of size n is drawn, then the total number of possible samples is given by ${}^M C_n$ or $\frac{M!}{n!(M-n)!}$. - For each of these ${}^M C_n$ samples, we can calculate some statistics ' t ' (say sample mean \bar{x}) - The set of values of the statistic ' t ', calculated from each of the sample, constitutes a sampling distribution of the statistic ' t '. - Just like any other distribution, a sampling distribution has also its Mean, Standard Deviation etc. What is Sampling distribution of sample mean $\hat{\mu}$ - The sampling distribution of the sample mean is a probability distribution consisting of all possible sample means of a given sample size selected from a population. $\hat{\mu}$ - If population is not normally distributed, then we make use of Central Limit Theorem to describe the sample mean for large samples without knowledge of population distribution $\hat{\mu}$ - $n \geq 30$, large sample size $\hat{\mu}$ \rightarrow normal distribution What is Standard Error σ The standard deviation of the sampling distribution of the statistic t is known as the standard error of ' t '. σ If population is normally distributed or if the sample size $n \geq 30$, Standard error (if σ is known) = σ / \sqrt{n} If σ not known, then computed standard error = Sampling Distribution of the Sample Mean (if Known) $\hat{\mu}$ - If a population follows the normal distribution, the sampling distribution of the sample mean will also follow the normal distribution. $\hat{\mu}$ - If the population does not follow the normal distribution, but if the sample size $n \geq 30$, the sample means will follow the normal distribution. $\hat{\mu}$ - To determine the probability a sample mean falls within a particular region, use: Sampling Distribution of the Sample Mean (if Unknown) To determine the probability a sample mean falls within a particular region, use: Sampling Distribution of the Sample Means — Example 2. 1 ABC Industries has seven production employees (considered the population). The hourly earnings of each employee are given in the table below. [pic] 1. What is the population

mean? 2. What is the sampling distribution of the sample mean for samples of size 2? 3. What is the mean of the sampling distribution? 4. What observations can be made about the population and the sampling distribution? [pic] [pic] [pic] [pic] ----- [pic] [pic] [pic] [pic]