Statistical Inference

Statistical Inference

The process of drawing inferences about a population on the basis of information contained in a sample taken from the population is called statistical inference.

Statistical Inference is divided into two major areas

- Estimation of parameters
- Testing of hypothesis

Statistical Inference

Estimation is a procedure by which we obtained an estimate of the true but unknown values of a population parameter by using the sample observations form the population.

Testing of hypothesis is a procedure which enables us to decide on the basis of information obtained by sampling whether to accept or reject any specific statement or hypothesis regarding the value of the parameter in a statistical problem.

Estimation

- *Estimator*
- *Estimates*
- An estimator stands for the rule or method that is used to estimate a parameter.
- Estimate is a numerical value obtained by substituting the sample observations in the rule or the formula.
- *Estimator is always a statistic which is function of the sample observation and hence is a random variable.*

Estimation

POPULATION PARAMETER ?

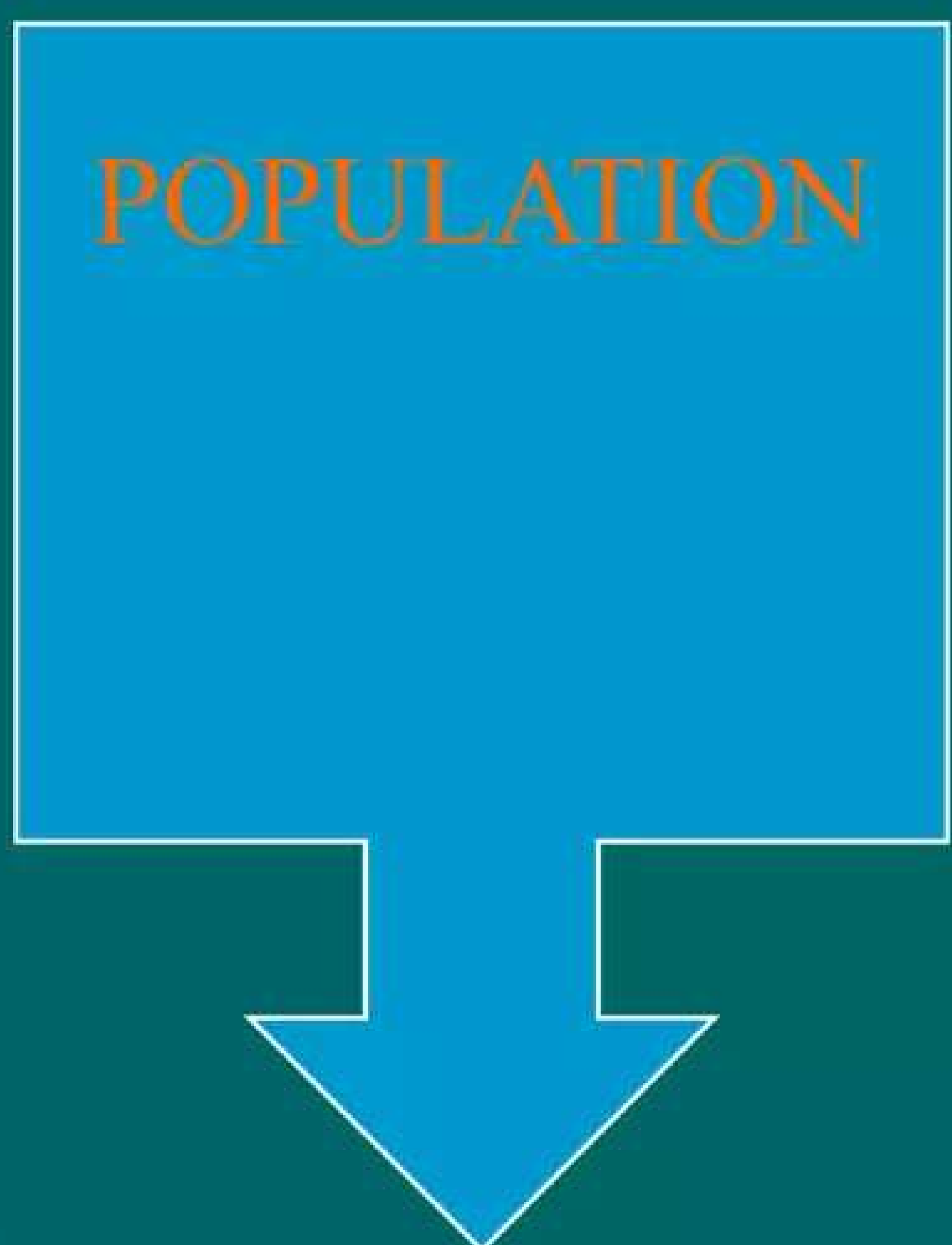
Point Estimate
(Single value)

Interval Estimate
(Range of Values)

INTERVAL ESTIMATE

An interval estimation for population parameter is a rule for determining an interval in which the parameter is likely to fall. The corresponding estimate is called interval estimate. Usually a probability of some confidence is attached with the interval estimate when it is formed.

Example:- A researcher wishes to estimate the average amount of money that a student from university spends for food per day. A random sample of 36 students is selected and the sample mean is found to be Rs 45 with standard deviation of Rs.3. Estimate 90 % confidence limits for the average amount of money that the students from the university spend on food per day.



SAMPLE

n=36 **90% C.I**

X=45 $\alpha = 10\%$

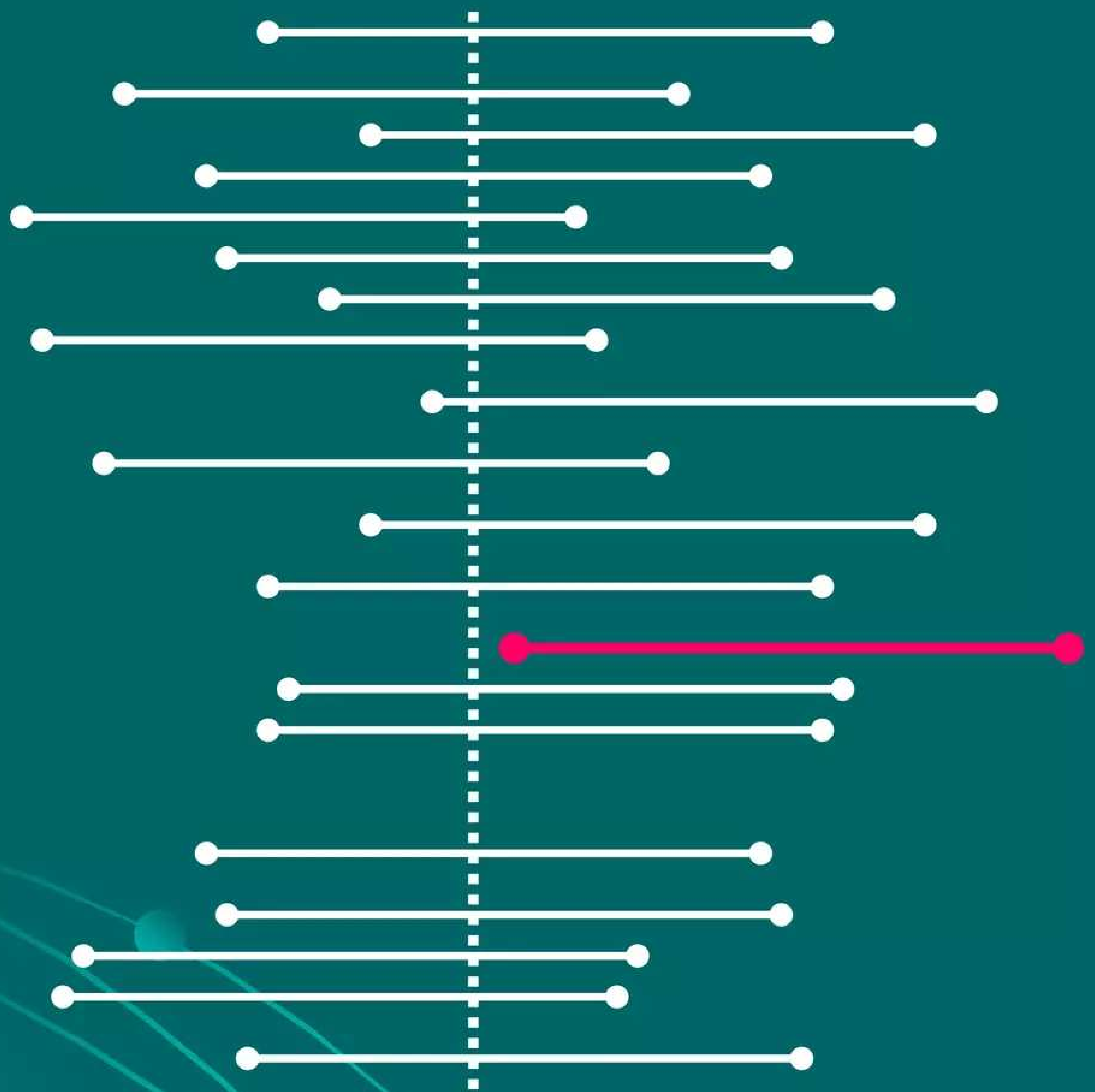
S=3

$$\bar{X} \pm Z_{\alpha/2}\left(\sqrt{\frac{S^2}{n}}\right)$$

$$45 \pm Z_{0.05}\left(\sqrt{\frac{3^2}{36}}\right)$$

$45 \pm (1.645)(0.5) =$ **(44.18 , 45.82)**

Interpretation of Confidence Interval



Some 95% C.Is for the population mean

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If we construct 100 C.Is ,one from each sample of the same size, then 95 of such constructed C.Is will contain unknown parameter and 5 C.Is may not contain parameter

Example:-**The following data represents the daily milk production of a random sample of 10 cows from a particular breed 12,15,11,13,16,19,15,16,18,15. Construct 90% C.I for the average milk production of all the cows of that particular breed.**

POPULATION

SAMPLE

n=10 **90% C.I**

X=15 $\alpha = 10\%$

S^2=22.89

$$\bar{X} \pm t_{\alpha/2(n-1)}\left(\sqrt{\frac{S^2}{n}}\right)$$

$$15 \pm t_{.05(9)}\left(\sqrt{\frac{22.89}{10}}\right)$$

$15 \pm (1.833)(1.51) =$ **(12.23 , 17.77)**

Example:-**A test in Statistics was given to 50 girls and 75 boys. The girls made an average grade of 76 with a standard deviation of 6, while boys made grade of 82 with a standard deviation of 8. Find 96% confidence interval for the difference between μ1-μ2. Where μ1 is the mean of all boys and μ2 is the mean of all girls who might take this test**

POPULATION

SAMPLE

n1=75 n2=50

X1=82 X2=76

S_1=8 S_2=6

96% C.I

α = 4%

$$(\bar{X}_1 - \bar{X}_2) \pm Z_{\alpha/2}\left(\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}\right) = (82 - 76) \pm 2.054\left(\sqrt{\frac{8^2}{75} + \frac{6^2}{50}}\right)$$

6±(2.054)(1.254) = **(3.42 , 8.58)**