

Statistical Methods

Time : 3 Hours]

[Max. Marks : 40

Note : Attempt all five questions. Each question carries equal marks.

1. Explain the problem of estimation in statistical theory, with a suitable example.

If $x_1, x_2, x_3, \dots, x_n$ are independent random observations from a normal population with mean μ and variance σ^2 , where σ^2 is finite, and

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i, s^2 = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2$$

state, giving reasons, which of the

following statements is true :

- (a) \bar{x} is an unbiased estimator of μ
 (b) s^2 is an unbiased estimator of σ^2 .
 (c) $\bar{x} + \frac{1}{n}$ is a consistent estimator of μ .
 (d) \bar{x} is a sufficient estimator of μ .

OR

- (a) What are maximum likelihood estimators? State their important properties.
 (b) State cramer Rao inequality.
2. (a) What is the procedure for testing a statistical hypothesis? Explain with an illustrative example.
 (b) Define the terms : (i) Critical Region (ii) Level of Significance (iii) Size of a Test (iv) Power of a Test. What happens to probability of type II error as the probability of type I error is reduced. Why?

OR

State Neymann-pearson's Fundamental Lemma.

The Breaking Strength of pieces of a type of string has mean 18.2 lb and standard deviation 2.1 lb. A new method of manufacture of string gives the same standard deviation. 15 pieces manufactured by the new method have the following breaking strength.

(in lbs) : 17.9 21.0 20.5 16.8 19.2 17.4 18.4 15.9
16.9 18.0 19.8 17.6 21.8 19.3 21.9

Do these results indicate that the new method gives a higher mean breaking strength? (For a standard normal variable z , $P\{z > 2.33\} = 0.01$ and $P\{z > 1.645\} = 0.05$).

3. Define χ^2 distribution. Write short notes on the tests of statistical hypotheses based on χ^2 distribution.

OR

The following data give the lives in hours of 2 batches of electric lamps. Test whether there is a significant difference between the average lengths of life of the two batches :

Batch 1 : 1505 1556 1801 1629 1644 1607 1825 1748

Batch 2 : 1799 1618 1604 1655 1708 1675 1728

4. What are non-parametric tests? When these applied? Explain in detail, when and how wilcoxon's Signed Rank is applied?

OR

(a) Lengths of 20 ear-heads of a variety of wheat (in cms) are :

9.3 8.8 10.7 11.5 8.2 9.7 10.3 8.6 11.3 10.7

11.2 9.0 9.8 9.3 9.9 10.3 10.0 10.1 9.6 10.4

Using Sign test, can we say that the median length of ear-heads is 9.9 cms?

(b) The weights of ten boys before they are subjected to a change of diet, and after a lapse of six months are recorded below :

S.No.	1	2	3	4	5	6	7	8	9	10
Wt. in lbs										
Before	109	112	98	114	102	97	88	101	89	91
After	115	120	99	117	105	98	91	99	93	89

Use Sign test to test whether there has been any significant gain in weight as a result of change of diet.

5. An experiment was conducted to determine the effects of different dates of planting and different methods of planting on the yield of sugar-cane, as shown in the following table.

Method of Planting	Date of Planting			
	October	November	February	March
I	7.10	3.69	4.70	1.90
II	10.29	4.79	4.58	2.64
III	8.90	3.58	4.90	1.80

Carry out the analysis of the above data and test whether mean yield differs with date of planting or method of planting.

OR

What are Latin Square Designs? How is analysis of variance of carried out for a Latin square design?

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