

**M. SC. (APPLIED STATISTICS)
(MSCAST)**

Term-End Examination

December, 2025

MST-016 : STATISTICAL INFERENCE

Time : 3 Hours

Maximum Marks : 50

Note : (i) *Question No. 1 is compulsory.*

(ii) *Attempt any **four** questions from the remaining question nos. 2 to 6.*

(iii) *Use of scientific (non-programmable) calculator is allowed.*

(iv) *Symbols have their usual meanings.*

1. State whether the following statements are True or False. Give reasons in support of your answers : 5×2=10

- (a) If a researcher increases the confidence level, then the width of the confidence interval will decrease.

- (b) The maximum likelihood estimators are always unbiased.
 - (c) The shape of sampling distribution of a statistic does not depend on the form of the population.
 - (d) If p -value is greater than the level of significance, then we reject the null hypothesis.
 - (e) Type of a test (one-tailed or two-tailed) depends on null hypothesis.
2. The Systolic Blood Pressures (SBP) of five women are given as follows : $3+2+3+2$
120, 110, 130, 140, 100
- (i) How many samples of size 2 can be drawn without replacement ? Write them.
 - (ii) Compute the mean of all samples of size 2 and set up the sampling distribution of the mean.
 - (iii) Obtain the mean of the sampling distribution computed in part (ii) and show that it is unbiased for the population mean.
 - (iv) Calculate standard error.

3. A market researcher proposed the following estimators for estimating the life of the LED bulbs produced by a company as follows :

$$T_1 = \frac{1}{2}X_1 + \frac{1}{4}X_2 + \frac{1}{4}X_3 + 2$$

and $T_2 = \frac{1}{2}X_1 - X_2 + X_3 + \frac{1}{2}X_4$

where X_1, X_2, X_3, X_4 represent the life of the selected LED bulbs in the sample. It is known that the life of the LED bulbs has mean μ and variance 2. 3+6+1

- (i) Check whether the estimators are unbiased.
- (ii) Find the bias, variance and mean squared error.
- (iii) Which one is more efficient estimator ?
4. (a) A cigarette manufacturing firm claims that its Brand A of the cigarette is more depended than its Brand B. The firm conducted a survey and found that 42 out of a sample of 200 smokers prefer Brand A and 18 out of another random

sample of 100 smokers prefer Brand B. Test whether Brand A is more popular than Brand B at 5% level of significance. 6

(b) Describe Type-I and Type-II errors. 4

5. (a) In medical research, suppose a treatment response rate in a clinical trial follows a distribution, whose p.d.f. is given as follows : 4+2

$$f(x) = \theta x^{\theta-1}; \quad 0 < x < 1, \theta > 0$$

(i) Find an estimator of θ using method of moments.

(ii) Let $x_1 = 0.3$, $x_2 = 0.5$, $x_3 = 0.6$, $x_4 = 0.2$, $x_5 = 0.1$ be a random sample of size 5. Then find the moment estimate of θ .

- (b) A consumer group wants to estimate the monthly electricity consumption of households in a city. What sample size of the households should be selected to estimate the monthly average

household electricity consumption within 1 kWh having 95% confidence ?

Given that : $\sigma = 4$ kWh. (Given $Z_{0.025}^2 = 1.96$) 4

6. A group of 10 rats fed on diet A and another group of 8 rats fed on diet B. After certain days, the following increase in weight (in gram) are observed : 10

Diet A	Diet B
15	12
16	13
18	16
10	18
12	10
14	10
13	12
19	14
16	
20	

It is known that the increase in weight follows normal distribution with equal variances. To test whether diet A is better than diet B.

- (i) Formulate null and alternative hypotheses.
- (ii) Which test is appropriate for testing the claim and why ?
- (iii) Conduct the test at 5% level of significance.
- (iv) What conclusion would be drawn from the findings ?

(Given : $t_{(16), 0.05} = 1.796, t_{(18), 0.05} = 1.734$)

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