No. of Printed Pages : 8 **MST–016**

M. SC. (APPLIED STATISTICS) (MSCAST)

Term-End Examination

June, 2026

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 probability density function of a random variable X, which follows F-distribution, as :

$$f(x) = \frac{1}{(1+x)^2};\ 0 < x < \infty$$

then the degrees of freedom of the distribution will be (2, 2).

(b) A sufficient estimator is always minimal sufficient estimator.

(c) If population is normally distributed and population variance is known with small sample size, then we use *t*-test for testing the hypothesis about population mean.

(d) The least square estimates are always unbiased.

(e) If a researcher finds the confidence interval for population proportion as :

$$P\,[0.35 \le p \le 0.72] = 0.95,$$

then confidence coefficient will be 0.05.

2. (a) The reduced weight (in kg) of 15 persons after a diet plan are recorded as follows :

6.5, 7.7, 5.6, 7.3, 6.7, 7.8, 6.7, 6.2, 5.2, 6.6, 6.0, 7.0, 7.2, 6.8, 7.2

It is observed that reduced weight follows normal distribution with mean μ

and standard deviation σ whose pdf is given as follows :

$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{1}{2\sigma^2}(x-\mu)^2} ; -\infty < x < \infty$$

(i) Find the maximum likelihood estimators of μ and σ^2. 6

(ii) Determine the maximum likelihood estimate of μ using the given data. 2

(b) Differentiate between parameter and statistic. 2

3. An online retailer claims that 90% of all orders are shipped within 24 hours of being received. A consumer group placed 250 orders at different times of a day and 210 orders were shipped within 24 hours. Then :

(i) Compute the sample proportion of items shipped within 24 hours. 1

(ii) Check whether the sample (250) ordered is large enough to assume that the sample proportion is normally distributed, use P = 0.90, corresponding to the assumption that the retailer's claim is valid. 2

(iii) Find the mean, standard deviation and standard error of the sampling distribution of proportion. 3

(iv) Find the probability that the sample proportion lies between 0.85 and 0.95. Given : 4

$$P[Z < 2.63] = 0.9943$$

$$P[Z < -2.63] = 0.0043$$

4. An experiment was conducted to compare the defective items produced by two different machines A and B. The data on number of defective items produced by both

machines were observed and are given in the following table :

A	B
26	19
37	22
40	24
35	27
30	24
30	18
40	20
26	19
30	25
35	
45	

Assuming that the defective items produced by both machines follow normal distribution.

To test whether the variance of the defective items produced by machine A is greater than machine B at 1% level of significance :

(i) Formulate null and alternative hypotheses. 1

(ii) Which parametric test is applied and why ? 2

(iii) Conduct the test. 6

(iv) What conclusion would be drawn from the findings ? (Given $F_{(10,8)0.01} = 5.81$) 1

5. (a) A researcher wants to investigate whether a new diet plan is effective or not in lowering cholesterol level. He randomly selected 11 cholesterol patients and kept them under the new diet plan. The data given below show the cholesterol level before and after the new diet :

Patient ID	**Before**	**After**
1	250	192
2	225	210
3	285	210
4	237	210

5	295	235
6	245	230
7	210	185
8	225	235
9	220	195
10	214	198
11	231	218

If the difference in the cholesterol level before and after the new diet plan follows a normal distribution, then construct a 95% confidence interval to estimate the differences to cholesterol levels for the patients.

(Given $t_{(10),\,0.025} = 2.228$). 7

(b) Differentiate between parametric and non-parametric tests. 3

6. The magnitude of earthquakes recorded in a region modelled as an exponential distribution with an unknown parameter θ whose pdf is given as follows :

$$f(x,\theta) = \frac{1}{\theta} e^{-\frac{x}{\theta}};$$

$$x > 0,$$

$$\theta > 0$$

A researcher proposed two estimators for θ;

$$T_1 = \frac{1}{n}\sum_{i=1}^{n} X_i$$

and $$T_2 = \frac{1}{n+1}\sum_{i=1}^{n} X_i$$

Check whether both estimators are unbiased and consistent. 10

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