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MST–016

M. SC. (APPLIED STATISTICS)
(MSCAST)
Term-End Examination
June, 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 calculator (non-programmable) 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 variance of normal population is known, then for testing the hythothesis about population mean, we apply the *t*-test.

(b) Rejecting the null hypothesis H_0 when it is true is called Type-II error.

(c) If estimators T_1 and T_2 of a parameter θ, calculated from a random sample of size n, have variances $\frac{10}{n}$ and $\frac{6}{n}$, respectively, then T_2 is more efficient than T_1.

(d) If the probability density function of a t-distribution is given by

$$f(t) = \frac{1}{\sqrt{5}\,\beta\left(\frac{1}{2}, \frac{5}{2}\right)\left(1 + \frac{t^2}{5}\right)^3}; -\infty < t < \infty$$

then the degrees of freedom of the distribution will be 5.

(e) If a researcher obtained the 95% confidence interval of the proportion of smokers in a city as (0.25, 0.47), then the length of confidence interval will be 0.22.

2. The age (in years) of five employees of a company are as follows : 10

28, 24, 30, 26, 32

(i) How many samples of size 2 are possible with replacement ? Write them.

(ii) Prepare the sampling distribution of sample mean.

(iii) Prepare the graph of the sampling distribution obtained in part (ii) and comment on the shape of the distribution.

(iv) Show that sample mean is unbiased estimate of population mean on the basis of the sampling distribution.

3. A physical fitness test was conducted to check that the village boys, in general, are physically more fit than the town boys. Fitness test scores of the six randomly chosen village boys and six town boys are as follows :

Village Boys	15.7	8.2	6.5	7.2	9.0	8.5
Town Boys	11.7	3.2	8.8	7.9	5.6	6.7

If the test scores follow normal distribution with equal variances, test whether the village boys are more fit than the town boys at 5% level of significance. 10

4. (a) A researcher wants to estimate the average mileage of cars of a company. How large a sample of cars should be taken such that he is 95% confident that the estimate average mileage is within the range of ± 5 km/litre ? Assume that a reasonable estimate of the population standard deviation of mileage is 6 km/litre. 3

   (b) Show that moment estimator and maximum likelihood estimator are same for the parameter θ of a geometric distribution whose p.m.f. is : 7

$$P[X = x] = \theta(1 - \theta)^x; \; x = 0, 1, 2, \ldots\ldots; \; \theta > 0$$

5. A company produces battery of Laptops and interested to estimate the average life of the batteries. For that the statistician of the company randomly selected 5 batteries and noted their lives. The statistician suggested

two estimators (T_1 and T_2) which are as follows :

$$T_1 = \frac{X_1 + X_2 + X_3 + X_4 + X_5}{5}$$

$$T_2 = \frac{X_1 + 2X_2 + X_3 + X_4 + 5X_5}{5}$$

where X_i's represent the lives of selected batteries. It is known that the lives of batteries follows normal distribution with mean μ and variance σ^2. 3+5+2

(i) Are both estimators unbiased ?

(ii) Which one is more efficient ?

(iii) Which has mean square error ?

6. (a) The p.d.f. of a Chi-square distribution is given as : 4

$$f(\chi^2) = \frac{1}{96} e^{-\chi^2/2} f(\chi^2)^3; \chi^2 > 0$$

(i) Obtain degrees of freedom of the distribution.

(ii) Find mean and variance of the given distribution.

(b) The temperature (in ^{o}F) of the coffee sold at 16 coffee shops was measured which are given as follows :

160,160, 156, 170, 176, 175, 170, 150,
160, 176, 175, 150, 170, 165, 165, 150

Construct a 95% confidence interval for the population mean of temperature of coffee sold. Assume that the temperature of coffee is approximately normally distributed : 6

Table Values

(Some values for use, if required)

Z-value	***t*-value**
$Z_{0.005} = 2.58$	$t_{(10),\,0.05} = 1.81$
$Z_{0.025} = 1.96$	$t_{(12),\,0.05} = 1.78$
$Z_{0.05} = 1.645$	$t_{(16),\,0.025} = 2.12$
	$t_{(15),\,0.025} = 2.13$

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