2026

STATISTICS — MINOR

Paper : MN-3

(Statistical Inference - I)

Full Marks : 75

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer ***any five*** questions : 2×5

(a) Distinguish between parameter and statistic with suitable examples.

(b) Write down the p.d.f. of a chi-square distribution with n degrees of freedom.

(c) How is t-distribution related to F-distribution?

(d) What is the basic difference between the point estimation and interval estimation?

(e) Define two types of errors in testing of hypothesis.

(f) What do you mean by the level of significance of a test?

(g) What is the p-value of a test?

(h) Distinguish between simple hypothesis and composite hypothesis.

2. Answer ***any four*** questions : 5×4

(a) Let T_1, T_2, T_3 be three independent unbiased estimators of a parameter θ each with same variances σ^2. Which of the estimators $(T_1 + T_2 + T_3)/3$ and $(T_1 + 2T_2 + 3T_3)/6$ would you prefer for estimating θ and why?

(b) Define minimum variance unbiased estimator (MVUE). Show that if MVUE exists then it is unique.

(c) Discuss an example where the maximum likelihood estimator is biased but a slight modification can make it unbiased.

(d) Let p be the probability of getting a head in a single tossing of a coin. For testing the null hypothesis $H_0 : p = 1/2$ against the alternative hypothesis $H_1 : p = 3/4$, the coin is tossed 5 times and H_0 is rejected if the number of heads to appear is greater than 3. Find the probabilities of type-I error and type-II error of the test.

(e) If λ be the average number of street accidents per day in a busy road with a good traffic system, suggest an exact test for testing $H_0 : \lambda = 2$ against $H_1 : \lambda < 2$.

(f) Write a note on combination of probabilities in tests of significance.

3. Answer ***any three*** questions :

(a) Describe the method of moments and the method of maximum likelihood in estimation with suitable examples. Give an example where we can not apply the method of moments. Write some properties of maximum likelihood estimator. 8+2+5

(b) If $X_1, X_2, .., X_n$ is a random sample of size n drawn from $N(\mu, \sigma^2)$ population, find the maximum likelihood estimators of μ and σ^2. Also verify whether these estimators are unbiased or not for the respective parameters. Suggest how to get the maximum likelihood estimator of $\frac{\mu}{\sigma}$. 8+4+3

(c) Define the best linear unbiased estimator (BLUE). How does it differ from the MVUE? Let $T_1, T_2, ..., T_k$ be k independent unbiased estimators of a parameter θ each with same variances σ^2. Find the BLUE of θ on the basis of these estimators. 3+2+10

(d) Random samples of sizes n_1 and n_2 are drawn from two independent normal populations with means μ_1 and μ_2 and variances $\sigma^2{}_1$ and $\sigma^2{}_2$ respectively. Suggest exact tests for testing null hypotheses $H_0 : \mu_1 = \mu_2$ assuming $\sigma^2{}_1 = \sigma^2{}_2$. Also find a $100(1 - \alpha)\%$ confidence interval for the difference $\mu_1 - \mu_2$. 10+5

(e) Discuss the use of Pearsonian chi-square statistic for testing the association of two attributes in a $k \times l$ contingency table. Derive a simpler form of the statistic when $k = l = 2$. 10+5