

Statistics for Decision Making – II, 2026

Full Marks: 50 Time : 2 hrs 30 minutes

Answer 1 to 4 and any 2 from the rest

1. A random sample of scores of 10 students is drawn from a college. The scores are as follows: 62, 63, 64, 65, 67, 67, 66, 69, 72, 70. Another random sample of the scores of 12 students from a different college are collected as 60, 62, 63, 66, 64, 66, 69, 67, 72, 71, 70, 71. (Assume normality of the data distribution) (5+3 = 8)
- i) Test whether the students of the two colleges perform consistently?
- ii) Obtain 95% confidence interval for the corresponding parametric function.

Variety	Chemists			
	1	2	3	4
A	8	5	5	7
B	7	6	4	4
C	3	6	5	4

Consider $t_{0.05} = 1.645$, $t_{0.025} = 1.96$, $t_{0.05,20} = 1.725$, $t_{0.025,20} = 2.086$, $F_{0.05,9,11} = 3.10$, $F_{0.05,9,11} = 5.20$

2. 3 varieties of coal were analysed by 4 chemists and the ash content in the varieties were found as follows.
- i) Do the varieties differ significantly in ash content?
- ii) Do the Chemists differ regarding their analysis?
- iii) What will be the estimated interaction between the two factors?

Consider $F_{0.05,2,6} = 5.14$, $F_{0.05,3,6} = 4.76$, $F_{0.05,2,6} = 5.14$, $F_{0.05,3,5} = 9.01$, $F_{0.05,4,5} = 6.26$ (10)

3. The following data pertains to the hair colour and eye colour of a set of individuals. Test whether these two traits can be considered to be independent. (6)

Eye Colour	Hair Colour	
	Light	Dark
Blue	26	9
Brown	4	21

$\chi^2_{0.05,1} = 3.841$, $\chi^2_{0.05,2} = 5.991$, $\chi^2_{0.05,4} = 9.488$.

4. Let $X_1, X_2, \dots, X_n \sim P(\lambda)$ iid. Then derive the expression for the MVUE of $(1 - e^{-\lambda})$. (6)
5. Let $X_i \sim N(i\theta, 1)$, independently, for $i = 1, 2, \dots, n$. Then discuss an UMP test for $H_0: \theta = 0$ Vs. $H_1: \theta > 0$. (10)
6. i) Let X_1, X_2, \dots, X_n be a random sample from the pdf

$$f(x, \theta) = \begin{cases} \frac{1}{\theta}, & -\frac{\theta}{2} \leq x \leq \frac{\theta}{2} \\ 0, & \text{otherwise} \end{cases}$$

Find the sufficient statistic(s) for the parameter. (5)

ii) A researcher wants to compare the effectiveness of a study method on student performance from two different colleges. Due to the limited sample size, normality can not be ensured. Analyse the data.

College A: 78, 85, 82, 88, 75

College B: 80, 83, 77, 90, 79

At 5% level of significance, consider the critical value to be 2 for the appropriate test. (5)

7. i) Suppose $(X, Y) \sim \text{BN}(\mu_x, \mu_y, \sigma_x, \sigma_y, \rho)$. Derive the expression for the interval estimator of $\frac{\sigma_x^2}{\sigma_y^2}$. (5)

ii) Define a) Uniformly most powerful unbiased critical region, b) Ideal test. (2+3)