

Unique Paper Code : 32375301_OC
 Name of the Paper : Basics of Statistical Inference
 Name of the Course: Statistics: Generic Elective for Honours (GE-III) under CBCS
 Semester : III
 Duration : 3 Hours
 Maximum Marks : 75

Instructions for Candidates

Attempt any *four* questions. All questions carry equal marks. Use of simple calculator is allowed.

1. What is meant by a statistical hypothesis? Explain the concepts of level of significance, Type I and Type II errors. Let X_1, X_2, X_3 be independent variables such that each X_i , has mean μ and variance σ^2 . If T_1, T_2 and T_3 are the estimators used to estimate μ , where (i) $T_1 = X_1 + X_2 - X_3$, (ii) $T_2 = (X_1 + X_2 + X_3)/3$ and (iii) $T_3 = (2X_1 - X_2 + X_3)/2$. Are T_1, T_2 and T_3 unbiased estimators for μ ? Which is the efficient estimator?
2. Explain the method of constructing $100(1-\alpha)$ % confidence interval for μ of normal population with mean μ and variance σ^2 . How do you proceed if σ^2 is (i) known and (ii) unknown? Independent random samples of sizes $n_1 = 16$ and $n_2 = 25$ from normal populations with $\sigma_1 = 4.8$ and $\sigma_2 = 3.5$ have the means $\bar{x} = 18.2$ and $\bar{y} = 23.4$, find 95% confidence interval for $\mu_1 - \mu_2$. ($Z_{0.025} = 1.96$)
3. Distinguish between ‘Sign test’ and ‘Wilcoxon signed rank test’. Derive the sign test for one sample. How do you proceed for paired data? Test the hypothesis that the median value μ of a continuous distribution is 15 against the alternative hypothesis $\mu > 15$, given the data: 17, 18, 16, 19, 14, 21, 19, 13, 17 and 14. (Use $\alpha = 0.05$).
4. Discuss the Chi-square test of goodness of fit of a theoretical distribution to an observed frequency distribution. What are the other applications of Chi-square distribution? An opinion poll was conducted to find the reaction to a proposed civic reform in 100 members of each of the two political parties. The information is tabulated below:

	Favourable	Unfavourable	Indifferent
Party A	40	30	30
Party B	42	28	30

Test for the independence of reactions with the party affiliations. ($\chi^2_{0.05, 3} = 7.815$, $\chi^2_{0.05, 2} = 5.991$, $\chi^2_{0.05, 1} = 3.841$)

5. Describe the technique of analysis of variance. Derive the analysis of variance table for a two-way classified data with one observation per cell under fixed effects model.
6. In a randomized block design there are only two blocks. Let k be the number of treatments and \bar{x}_1 and \bar{x}_2 be the average yields of two blocks. Show that the between blocks sum of squares can be expressed as $(k/2)(\bar{x}_1 - \bar{x}_2)^2$.

An experiment was carried out on wheat with three treatments in four randomised blocks. Complete the following table for the analysis of variance of a fixed effects randomised block design:

Source of variation	Degrees of freedom	Sum of squares	Mean sum of squares	Variance ratio
Treatments	2	-	-	-
Blocks	3	4.67	-	-
Error	-	-	0.9717	
Total	-	26		

Test the hypothesis that the treatment effects are equal to zero, showing all the steps in the general test procedure. ($F_{0.05}(2, 6) = 5.14$, $F_{0.05}(3, 6) = 4.76$)