Unique Paper Code : 32375301
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 do you understand by point estimation? Explain the four properties of a good estimator with one example each. In a sample of 1000 people in Maharashtra, 540 are rice eaters and the rest are wheat eaters. Can we assume that both rice and wheat are equally popular in this State at 5% level of significance? ($Z_{0.025} = 1.96$)

2. Explain the method of constructing a 95% confidence interval for difference of means of two population following normal distribution with means μ_1, μ_2 and variances σ_1^2, σ_2^2 if (i) σ_1^2 and σ_2^2 are known but sample sizes n_1 and n_2 are large and (ii) $\sigma_1^2 = \sigma_2^2 = \sigma^2$ is unknown and sample sizes n_1 and n_2 are small. To estimate the average time required for certain repairs, an automobile manufacturer had 40 mechanics, a random sample, timed in the performance of this task. If it took them on the average 24.05 minutes with a standard deviation of 2.68 minutes, construct a 95% confidence interval for the mean time required to perform the given repairs.

3. Explain what is meant by non-parametric methods. How do they differ from parametric methods? Develop the Wilcoxon signed rank test for one sample. How do you proceed to test for paired data? Consider the following data: 4, 5, 8, 8, 14, 9, 6, 10, 7, 7, 6. Test the hypothesis that the median value M of a continuous distribution is 5 against the alternative hypothesis that it is more than 5 at the 0.05 level of significance.

4. What is contingency table? Describe how the chi-square distribution may be used to test whether the two criteria of classification in an $m \times n$ contingency table are independent. 200 college students were classified according to their intelligence and economic conditions. Test whether there is any association between intelligence and economic conditions. ($\chi^2_{0.05, 3} = 7.815$, $\chi^2_{0.05, 2} = 5.991$, $\chi^2_{0.05, 1} = 3.841$)

		Intelligence			Total
		Excellent	good	Mediocre	
Economic	Good	24	43	13	80
conditions	Bad	31	57	32	120
Total		55	100	45	200

5. For a two-way classified data with one observation per cell, give the fixed effects mathematical model, stating clearly the assumptions used, the hypotheses to be tested, the test

statistics to be used and the ANOVA Table. Also obtain (i) the estimates of the parameters in the model and (ii) the expectation of the mean square error.

6. What do you understand by 'Experimental error'? What are its main sources? What methods are adopted to increase the accuracy of an experiment? How do shape and size of the plots and blocks influence the experimental error? Complete the following table for the analysis of variance of a fixed effects randomized block design:

Source of variation	Degrees of freedom	Sum of squares	Mean sum of squares	Variance ratio
Blocks	2	3.2947	-	-
Treatments	3	-	-	-
Error	-	-	0.5461	
Total	-	72.4631		

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)