Sl No of QP 4682

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

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt ***six*** questions in all. **Question no. 1** is compulsory.
3. Attempt ***five*** questions from the remaining.
4. Use of a simple calculator is allowed.

1. (a) Answer the following:
   (i) In a random sample of size n from a population with mean μ, the sample mean $(\bar{x})$ is an ---------- estimate of ----------.
   (ii) A sample is always ---------- estimate of population parameters.
   (iii) In any testing problem, we reject the null hypothesis if the p-value is ---------- the level of significance.
   (iv) The test statistic for the goodness of fit is ----------.
   (v) The ---------- is used as a nonparametric alternative to the one-sample t-test.
   (vi) If the variance of T_1 is less than the variance of T_2 then T_1 is said to be more ---------- than T_2.
   (vii) In a CRD with n plots and v treatments, the degrees of freedom for error are ----------.
   (viii) For testing a single proportion, the SE is ----------.
   (ix) In a 3×4 contingency table the degrees of freedom are ----------.
   (b) Name the basic principles of the design of experiments. Write a short note on each.
   (c) Define Type-I and Type-II error.

(9, 3, 3)

2. (a) Define unbiasedness, consistency and efficiency of an estimator.
   (b) Let X_1, X_2 and X_3 be a random sample of size 3 from a population with mean μ and variance σ^2. If $T_1 = 2X_1 - 4X_2 + 3X_3$ is an estimator for μ, check whether T_1 is unbiased. Find the value of α such that $T_2 = \frac{1}{3}(\alpha X_1 + X_2 + X_3)$ is also unbiased. With this value of α, which of the above two estimator is best?

(5, 7)

3. (a) Construct a $100(1-\alpha)\%$ confidence interval for the mean (μ) of the normal population when variance (σ^2) is (i) known and (ii) unknown.
   (b) If a random sample of size n = 25 from a normal population with variance $\sigma^2 = 16$ has mean $\bar{x} = 72.5$, then construct a 99% confidence interval for the population mean μ.

(7, 5)

4. (a) Describe Wilcoxon signed-rank test to test the null hypothesis $H_0: \mu = \mu_0$ against the alternative hypothesis $H_1: \mu > \mu_0$. Also, discuss the case of paired data.
   (b) The following are the weights in pounds, before and after, of 16 persons who stayed on a certain weight reduction diet for 4 weeks:

Before	47	83	32	61	97	27	77	71
After	37	76	19	63	93	22	80	73

Use the signed rank test to test at the 0.05 level of significance whether the weight-reducing diet is effective.

(6, 6)

5. (a) The following data pertain to the shipments received by a large firm from two different vendors:

	Number Rejected	Number imperfect but acceptable	Number Perfect
Vendor A	12	23	60
Vendor B	8	12	32

Test at 0.01 level of significance that both vendors ship products of similar quality.

(b) In a random sample of visitors to a famous tourist attraction, 84 of 250 men and 156 of 250 women bought souvenirs. Test the hypothesis at 5% level of significance that the men and women are equally interested to buy souvenirs at this tourist attraction.

(6, 6)

6. For a two-way classified data with one observation per cell:
   (a) Give the fixed effect mathematical model stating clearly:
      (i) the assumption used
      (ii) the hypothesis to be tested
      (iii) the test statistic to be used and
      (iv) the ANOVA Table.
   (b) Also obtain:
      (i) the estimates of the parameters in the model and
      (ii) the expectation of the mean square error.

(6, 6)

7. (a) What is meant '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?

   (b) Complete the following table for the analysis of variance of a fixed effects randomised block design:

Source of variation	Degree of freedom	Sum of Square	Mean sum of square	Variance Ratio
Blocks	5	41.71	-	-
Treatments	3		-	-
Error	-	-	7.12	
Total	-	496.96		

Test the hypothesis that the treatment effects are equal to zero, given that $F_{0.05}(5, 15) = 2.90$, $F_{0.05}(3, 15) = 3.29$.

(6, 6)