[This question paper contains 7 printed pages]

Your Roll No. : .....

Sl. No. of Q. Paper : **7489**

Unique Paper Code : 32375301

Name of the Course : **Statistics : Generic Elective for Honours**

Name of the Paper : Basics of Statistical Inference

Semester : III

Time : 3 Hours ***Maximum Marks : 75***

Instructions for Candidates :

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Attempt **six** questions in all. Question no. **1** is compulsory.

(c) Attempt **five** questions from the remaining questions.

(d) Use of Simple calculator is allowed.

1. (a) Fill in the blanks :

(i) For a sample of size $n<30$, $\frac{\bar{x}-\mu_o}{\sqrt{s^2/n}}$ follows ..... distribution with ..... degrees of freedom.

P.T.O.

(ii) Level of significance and power of a test are denoted by ..... and ..... respectively.

(iii) The non-parametric test statistic for the significance of correlation coefficient is given by ..... and it follows ..... distribution.

(iv) If X follows N (μ,σ^2), then the 95% confidence interval for population mean μ, when variance σ^2 is unknown, is given by ..... .

(v) The test statistic for testing H_0: $\sigma^2=\sigma_0^2$ is given by ..... .

(vi) The null and alternative hypotheses for Wilcoxon signed rank test for one sample is given by 9

(b) In case of one way classification (fixed effect model) if ANOVA is performed for :

(i) Given observations y_{ij}'s,

(ii) $U_{ij}=y_{ij}-A$ (A is a constant).

How are the various sum of squares and variance ratio (F_0) affected in each case ? 3

(c) Outline the merits and demerits of the completely randomised design. 3

2. (a) Explain the following terms : 6

(i) Null and alternative hypotheses

(ii) Level of significance

(iii) Power of a test

(b) Explain the method of constructing a 95% confidence interval for mean of a population following normal distribution with mean μ and variance σ^2 if

(i) σ^2 is known,

(ii) σ^2 is unknown but sample size is large(i.e. $n\geq 30$),

(iii) σ^2 is unknown but sample size is small(i.e. $n<30$). 6

3. (a) Show that $s^2=\frac{1}{n}\sum(X_i-\bar{X})^2$ is a biased estimator of σ^2, where $\bar{X}$ is the mean of the random sample $X_1, X_2,...,X_n$. Also, show that $S^2=\frac{n}{n-1}s^2$ is an unbiased estimator of σ^2. 6

(b) In a sample of 600 men from a certain large city, 400 are found to be smokers. In another sample of 900 from another large city, 450 are smokers. Do the data indicate that the cities are significantly different with respect to prevalence of smoking among men ? 6

4. (a) Describe the Chi square test of goodness of fit. 6

(b) 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. (Given that $\chi_{0.05}^2$ for 2 d.f.= 5.99) 6

5. (a) Explain, with the help of examples, where would you use parametric tests and where would you use non-parametric tests. Derive the sign test, stating clearly the assumptions made. 6

(b) The following are measurements of the breaking strength of a certain kind of 2-inch cotton ribbon in pounds;

163 165 160 189 161 171 158 151 169 162

163 139 172 165 148 166 172 163 187 173

Use the sign test to test the null hypothesis $\mu=160$ against the alternative hypothesis $\mu>160$ at 0.05 level of significance.($P(X\geq 15)=0.0095$ for $\theta=1/2$) 6

6. (a) In the usual notations for a one way classification, derive : 6

(i) $E\left[\frac{1}{k-1}\sum_{i=1}^{k}(\bar{y}_{i0}-\bar{y}_{00})^2\right]$,

(ii) $E\left[\frac{1}{n-k}\sum_{i=1}^{k}\sum_{j=1}^{ni}(y_{ij}-\bar{y}_{i0})^2\right]$.

(b) Given the following information :

	A	B	C
No. of observations, n	6	6	6
Sum of observations	120	132	114
Sum of squares of observations	2408	2118	260

Test whether the observed difference between the mean yields obtained for the three varieties may be attributed to chance

($F_{0.05}(6,15)=2.79$, $F_{0.05}(2,15)=3.68$) 6

7. (a) Discuss the basic principles of design of experiments, pointing out their salient features. 6

(b) Complete the following table for ANOVA for a fixed effects randomized block design :

Source of variation	Degrees of freedom	Sum of squares	Mean sum of squares	Variance Ratio
Blocks	4	26.8	-	-
Treatment	3	-	-	-
Error	-	-	2.5	-
Total	-	85.3		

Test the hypothesis that the treatment effects are equal to zero, showing all the steps in the test procedure. 6

($F_{0.05}(4,12)=3.26$, $F_{0.05}(3,12)=3.49$)