NTK/KW/15 – 5869

Fourth Semester B. Sc. Examination

STATISTICS

Paper - I

(Statistical Inference)

Time : Three Hours] [Max. Marks : 50

N. B. : All the **five** questions are compulsory and carry equal marks.

1. (A) Define: (i) Unbiased estimator, (ii) Bias in an estimator, (iii) Standard error of an estimator, (iv) Mean squared error. Show that variance is the smallest value of mean squared error.

(B) If the r. v. X has the following p. d. f.,

$$f(x) = \theta e^{-\theta x} \quad , \ x > 0$$
$$= 0 \quad , \ \text{otherwise}$$

then,

(i) Find E(X)

(ii) Show that $\overline{X}$ is the unbiased estimator of $\frac{1}{\theta}$

(iii) Show that $V(\overline{X}) = \frac{1}{n\theta^2}$ 5+5

OR

(E) Define :

(i) Null and Alternative Hypothesis,

(ii) Critical region and acceptance region,

(iii) Type I and Type II errors.

(F) To test the hypothesis

$H_0 : p = \frac{1}{2}$ against $H_1 : p = \frac{3}{4}$,

where p is the probability of a head a single toss of a coin. The coin is tossed 5 times and H_0 is rejected if more than 3 heads are obtained. Find the probability of type I, type II errors and power of the test. 5+5

2. (A) Describe the tests for comparison of means of two univariate normal populations with unknown variances and based on small samples and when the samples are :

(i) independent

(ii) Paired. 10

OR

(E) Describe F. test for testing equality of variances of two normal populations with unknown means. Also write the test-statistic when the population means are known. Develop 100 (1-α)% confidence interval for the ratio of two population variances when the means are unknown. 10

3. (A) Explain the Chi-square tests for testing :

(i) Goodness of fit,

(ii) Homogeneity of populations. 10

OR

(E) Derive the formula of Chi-square statistic in a 2x2 contingency table. Explain the need of Yates' correction and obtain the modified value of Chi-square after its application. 10

4. (A) State the central limit theorem and explain its use in testing of statistical hypothesis and Interval Estimation.

(B) Describe a test for testing

$H_0 : P_1 = P_2$ against $H_1 : P_1 > P_2$ where P_1 and P_2 are the proportions of units possessing certain attribute in two populations. Also construct 100 $(1-\alpha)\%$ confidence interval for $P_1 - P_2$.
5+5

OR

(E) Explain the large sample tests for testing :

(i) Specified value of a mean μ of a single population.

(ii) Difference in means of two populations - $(\mu_1 - \mu_2)$. Also obtain 100 $(1-\alpha)\%$ confidence limits for the mean μ and the difference $(\mu_1 - \mu_2)$. 10

5. Solve any **10** of the following :
Fill in the blanks in the following questions

(A) If T is an unbiased estimator of θ then MSE (T) = ——— .

(B) The Cramer-Rao inequality states the ——— ———— of the variance of an estimator and is called as the ——— ———— ——— .

(C) To test that the coin is unbiased, it is tossed 6 times. H_0 is rejected if there are no heads or 6 heads then the probability of Type - I error is ———.

(D) The statistic used for testing the significance of sample correlation coefficient, when the samples are small is ——— statistic with —— df.

(E) Two paired samples of size 15 are used to perform t-test. Then the degrees of freedom of the statistic are ——— .

(F) For testing a specified value of population variance, the test-statistic follows ———— distribution with ——— df.

(G) In 100 trials, 20 successes and in 50 trials, 13 successes were observed, Then the pooled proportion of successes is ——— .

(H) The R - commands for paired t-test is ——— .

(I) A test paper contains 10 questions. The expected frequencies are calculated using binomial distribution with unknown probability of solving a question correctly. For testing the goodness of fit, the test statistic has 7 degrees of freedom. Then the no. of expected frequencies which are less than 5 is ———.

(J) To test independence of two attributes in 4x4 contingency table, the test statistic follows ——— distribution with ——— d. f.

(K) In large sample tests, the probability distribution of test statistic is ——— with parameters ———.

(L) If P is the population proportion, then the standard error of sample proportion is given by ——.

1x10=10