NRT/KS/19/5903

Bachelor of Arts (B.A.) Fourth Semester Examination
STATISTICS (STATISTICAL INFERENCE)
Optional Paper—1

Time : Three Hours] [Maximum Marks : 50

N.B. :— ALL questions are compulsory and carry equal marks.

1. (A) Define :

(i) an unbiased estimator

(ii) UMVUE

(iii) Efficiency of an estimator.

Does an unbiased estimator always exist ? Justify the answer.

(B) X_1, X_2, X_3 is a random sample of size 3 from a population with mean μ and variance σ^2, T_1, T_2 and T_3 are estimators of μ such that :

(i) $T_1 = X_1 + X_2 - X_3$

(ii) $T_2 = 2X_1 + 3X_2 - 4X_3$ and

(iii) $T_3 = \frac{1}{3}(aX_1 + X_2 + X_3)$

(a) Are T_1 and T_2 unbiased estimators of μ ?

(b) Find the value of 'a' such that T_3 is unbiased estimator of μ.

(c) Find the best estimator among T_1, T_2 and T_3. 5+5

OR

(E) Define :

(i) Simple and composite hypothesis.

(ii) Null and alternative hypothesis.

(iii) Significant and insignificant difference.

(iv) Critical value.

(v) Level of significance.

(vi) Type I and Type II errors.

(vii) Power of the test.

Let X be a r.v. with p.m.f. p(x). Let $H_0 : X \sim p_0(x)$ and $H_1 : X \sim p_1(x)$.

x	:	0	1	2	3	4
$p_1(x)$	:	0.4	0.3	0.1	0.15	0.05
$p_0(x)$	:	.02	.03	.05	0.7	0.2

If critical region is {0, 1}, find probability of type I error, type II error and power of the test. 10

2. (A) Describe t test for testing :

(i) the equality of two population means, when the population variance is unknown, and

(ii) the difference of means for a paired sample drawn from bivariate normal population.

Also construct 100 $(1 - \alpha)$% confidence interval for the difference of means in the above case (i). 10

OR

(E) Explain t-test for testing the significance of specified value of population mean, when population variance is unknown. Also construct $100(1 - \alpha)\%$ confidence interval for the population mean.

(F) Explain F-test for testing equality of population variances when means are known. Also construct $100(1 - \alpha)\%$ confidence interval for the ratio of variances when the means are known. 5+5

3. (A) Explain Chi-square test for testing the significance of specified value of the population variance, when population mean is known and construct $100(1- \alpha)\%$ confidence interval for population variance under the above case.

(B) Explain Chi-square test for homogeneity of populations. 5+5

OR

(E) Describe Chi-square test for independence of attributes in $r \times s$ contingency table. Explain the calculation of degrees of freedom in the above case. Derive Brandt-Snedecor formula for Chi-square. 10

4. (A) Describe large sample test for testing :

(i) the significance of specified value of population mean when population variance is unknown.

(ii) the equality of two population means when population variances are unknown.

Also construct $100\ (1 - \alpha)\%$ confidence interval for the difference of two population means under case(i) and case(ii). 10

OR

(E) Describe large sample tests for testing :

(i) the significance of population proportion.

(ii) the equality of two population proportions.

Also develop $100\ (1 - \alpha)\%$ confidence interval for the difference of proportions. 10

5. Solve any **TEN** from the following :—

(A) Define p value.

(B) State Carmer Rao inequality.

(C) Define an interval estimator for a parameter.

(D) State assumptions for small sample tests.

(E) State the test statistic used for testing the significance of the sample correlation coefficient.

(F) If $P[|t| > t_{\alpha/2}] = 0.95$, what is the $P[t < -t_{\alpha/2}]$?

(G) State the conditions for validity of Chi-square test for testing the goodness of fit of a distribution.

(H) What is meant by degrees of freedom ?

(I) Explain the need of Yates correction of continuity in 2×2 contingency table.

(J) State Central limit theorem.

(K) State the assumptions for large sample tests.

(L) State the $100(1 - \alpha)\%$ confidence interval for the population proportion in case of large sample. 1×10=10