NRJ/KW/17/3121

Bachelor of Science (B.Sc.) Semester—IV (C.B.S.) Examination

STATISTICS (Statistical Inference)

Paper—I

Time : Three Hours] [Maximum Marks : 50

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

1. (A) Define :
   (i) UMVUE of a parameter
   (ii) Relative efficiency of an estimator.

   Let X_1, X_2, ----- X_n be a random sample from a population with finite mean μ and variance σ^2. Find a linear combination of X_1, X_2, ------, X_n which is UMVUE for μ.

   (B) State CR-inequality.

   Let a random sample be drawn from

   $f(x, \theta) = \theta e^{-\theta x}, x \geq 0$

   Show that sample mean is UMVUE for $\frac{1}{\theta}$. 5+5

OR

   (E) Define the terms :
   (i) Level of significance
   (ii) p-value
   (iii) Power of a test.

   Let x be random variable whose probability distribution under H_0 and H_1 are as given below :

x	0	1	2	3	4	5	6
$P(x/H_0)$	0.02	0.03	0.20	0.30	0.40	0.04	0.01
$P(x/H_1)$	0.04	0.06	0.5	0.15	0.10	0.10	0.05

   Identify two critical regions of size 0.05. Which one of the two is better and why ? 10

2. (A) Stating the assumptions clearly, explain the small sample test for testing the specified value of a population mean. Assume that the population variance is unknown.

   (B) A random sample of 10 was surveyed for expenses incurred in cash before and after demonetisation. State and explain the test that can be used to study the effectiveness of demonetisation on cash expenditure. 5+5

OR

   (E) Explain the test and construction of $100(1 - \alpha)$ % confidence interval for :
   (i) The mean of Univariate normal distribution with unknown variance
   (ii) The difference between means of two Univariate normal distribution with equal but unknown variances. 10

3. (A) Explain Chi-square test for goodness of fit. State the assumptions involved.

   (B) Explain Chi-square test for testing independence of attributes in $(r \times s)$ contingency table. 5+5

OR

   (E) Explain the Chi-Square test for testing the homogeneity of populations.

   (F) Explain the Chi-Square test for testing the specified value of population variance. Also explain the construction of $100(1 - \alpha)$ % confidence interval for population variance. Assume that population mean is unknown. 5+5

4. (A) Explain the large sample tests for testing the equality of two population means at α % level of significance—when population variances are :

(i) Known

(ii) Unknown but equal

(iii) Unknown and not equal.

Also explain the construction of confidence interval for the difference between two population means. 10

OR

(E) State Central Limit theorem and explain its use in testing for a specified value of population mean. Also develop $100(1 - \alpha)$ % confidence interval for population mean.

(F) Explain the test for testing the equality of two population proportions. Also construct $100(1 - \alpha)$ % confidence interval for the difference of two population proportions. 5+5

5. Attempt any **ten** :

(A) If t_1 and t_2 are unbiased estimators of parameter Q, such that $\frac{V(t_1)}{V(t_2)} = \frac{n-k}{n}$ where k is a + ve constant, then which one is a better estimator and why ?

(B) How does the width of confidence interval depend on :

(i) Confidence coefficient and

(ii) Standard error of statistic used for estimating the interval ?

(C) How is p-value used to accept or reject null hypothesis ?

(D) State the test statistic and critical region for F-test for equality of two variances when population means are unknown.

(E) Which test is used to test the significance of sample correlation coefficient based on sample drawn from bivariate normal elistribution ? Write the test-statistic.

(F) What is Yates' correction ?

(G) In usual notation, show that

$F_{(n, m), \alpha} \times F_{(m, n), (1-\alpha)} = 1$

(H) Is it possible to have each expected frequency to be larger than observed, while testing goodness of fit ? Justify.

(I) If the observed value of Chi-square is zero in the test for goodness of fit, then what is the conclusion ?

(J) State the distribution of test statistic in large sample test.

(K) If Z' is such that P[| Z | > Z'] = α, then state with reason the critical value for left tailed test at $\alpha/2$ level of significance.

(L) In exit poll, a contestant secures 30 % of votes in a random sample of 100 voters. Name the statistical procedure that can be used to find whether his vote share will be more than 30 % ? 1×10=10