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 questions are compulsory and carry equal marks.

1. (A) Define MVUE. State CRLB. If $x_1, x_2, \ldots, x_n$ is a random sample from a normal population with mean μ and variance σ^2, then show that sample mean $\bar{x}$ is MVUE for population mean μ.

(B) What are the different types of errors involved in testing of hypothesis ? Let X be random variable, whose values and the densities under H_0 and H_1 are as follows. Determine the best critical region of size 0.1.

X	:	1	2	3	4	5	6	7
$f(x, H_0)$	:	0.01	0.02	0.03	0.05	0.05	0.07	0.77
$f(x, H_1)$	:	0.03	0.09	0.10	0.10	0.20	0.18	0.30

5+5

OR

(E) Define :

(i) Statistical hypothesis

(ii) Null hypothesis

(iii) Critical region

(iv) Level of significance

(v) Critical value.

(F) Let p be the probability that a coin will show head in a single toss. In order to test $H_0 : p = ½$ against $H_1 : p = 3/4$ the coin is tossed 4 times and H_0 is rejected, if more than 3 heads occur. Find α, β and power of test. 5+5

2. (A) Explain (i) Paired t-test (ii) t-test for testing the significance of the sample correlation coefficient in sampling from bivariate normal population.

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

OR

(E) Explain t-test for a single mean, stating the assumptions. Also construct 100$(1 - \alpha)$% confidence interval for the population mean.

(F) Explain t-test for testing the equality of population means of two populations. 5+5

3. (A) Explain Chi-square test for testing the specified value of population variance. Also develop 100$(1 - \alpha)$% confidence interval for population variance.

(B) Explain the test for testing independence of two attributes in an $r \times s$ contingency table. 5+5

OR

(E) Derive the formula for Chi-square test statistic in a 2×2 contingency table. Explain Yates' correction and obtain the modified formula after application for Yates' correction. 10

4. (A) Explain the large sample test for testing the equality of two population proportions. Also develop $100(1 - \alpha)\%$ confidence interval for the difference between two population proportions. 10

OR

(E) Explain large sample test for testing :

(i) Specified value of population mean

(ii) Equality of two population means. 10

5. Solve any ***ten*** of the following :

(A) When will mean squared error of a statistic be same as its standard error ?

(B) Let C be a critical region for which probability of type I and II error are α and β. Let C_1 be a proper subset of C with α_1 and β_1 being the corresponding errors. Compare α and α_1 and β and β_1.

(C) If t is an unbiased estimator of parameter θ then show that t^2 is not an unbiased estimator of θ^2.

(D) State the assumptions of small sample tests.

(E) If m and n are sample sizes of two random samples from univariate normal populations and a statistic is formed by taking the ratio of these two sample variances. Then state the probability distribution of the statistic.

(F) Define pooled sample variance of two independent samples drawn from two normal populations.

(G) Fill in the blank :

If 'P' is the constant probability of success in independent Bernoulli trials then the standard error of sample proportion is ______.

(H) If a coin tossed 100 times give 20 'heads', then state the value of test statistic used to test whether the coin is unbiased.

(I) State central limit theorem.

(J) State the test statistic used for testing goodness of fit.

(K) If x_1, x_2, ... x_n are iid normal variates with mean μ and known variance σ^2, then identify distributions of $\sum_{i=1}^{n}\left(\frac{x_i - \mu}{\sigma}\right)^2$ and $\sum_{i=1}^{n}\left(\frac{x_i - \bar{x}}{\sigma}\right)^2$.

(L) In testing goodness of fit, what is the minimum value of the Chi-square statistic ? When will it be attained ? 1×10