Fourth Semester B. Sc. (CBS) 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) Point estimator and point estimate.
   - (ii) An unbiased estimator.
   - (iii) Bias of the estimator.
   - (iv) Mean squared error.
   - (v) UMVUE
   - (vi) Standard error of the estimator.

   (B) State Cramer Rao-inequality. Suppose random variable X has Bernoulli distribution for which the parameter $p\,(0 < p < 1)$ is unknown find (RLB for V(X). 5+5

OR

   (E) Define :—
   - (i) Null and alternative hypothesis.
   - (ii) Type I and Type II errors.

   - (iii) Critical region.
   - (iv) Level of significance and p-value.
   - (v) Power of the test.

   Let p be the probability of occurrenec of a head, when a coin is tossed. In order to test $H_0 : p = \frac{1}{2}$ against $H_1 : P = \frac{3}{4}$, the coin is tossed 2 times and it is decided to accept H_0 iff two heads occur. Determine α, β and power of the test. 10

2. (A) Explain t-test for testing whether the sample mean differs significantly from a hypothetical value of the population mean stating the assumptions clearly. Also construct 100 (1–α)% confidence interval for the population mean.

   (B) Explain F-test for equality of population variances when population means are unknown stating the assumption clearly. Also estimate 100(1–α)% confidence interval for the ratio of population variances. 5+5

OR

   (E) Explain the small sample test for testing the significance of the difference of two population means stating the assumptions. Also derive 100(1–α)% confidence interval for the difference of two population means.

   (F) Explain the following tests :–
   - (i) Paired t-test
   - (ii) t-test for testing the significance of the

sample correlation coefficient in sampling from bivariate normal population. 5+5

3. (A) Explain chi square test for testing the independence of attributes in r×s contingency table. Also explain how to calculate degrees of freedom for chi square statistics in this case.

(B) Explain chi squrare test for a single variance and construct 100(1–α)% confidence interval for the population variance on the basis of a sample taken from univariate normal population. 5+5

OR

(E) Explain chi square test of goodness of fit. How are the degrees of freedom calculated for chi square statistic in this test ?

(F) Derive simplified formula for chi square in 2×2 contingency table. When is Yates correction of continuity applied ? Modify the formula for chi square if Yates correction of continuity is applied. 5+5

4. (A) State the central limit theorem. Explain its use in large sample tests. Explain large sample test for testing

(i) A single population proportion.

(ii) Equality of two population proportions.

Also state 100(1–α)% confidence intervals for a population proportion and the difference of two population proportions. 10

OR

(E) Explain large sample test for single population mean. Also estimate 100(1–α)% confidence interval for population mean. Assume that the population mean is unknown.

(F) Explain large sample test for the difference of means when population variances are unknown but equal. Also estimate 100(1–α)% confidence interval for the difference of means in this case. 5+5

5. Solve any **10** questions from the following :—

(A) Define two-tailed and one-tailed test.

(B) If a random sample of size n is drawn from an infinite population with mean μ and variance σ^2, find the standard error of the sample mean.

(C) Define efficiency of an estimator.

(D) A sample of 16 specimen, taken from a normal population is expected to have a mean 50 mg/cc. The sample has a mean 64 mg/cc with a variance of 25. Write the null and alternative hypothesis to confirm the expectation. Also find the value of test statistic.

(E) State 100(1–α)% confidence interval for the difference of means in case of paired data.

(F) State R-command for testing the equality of population variances in case of small samples.

(G) State the test statistic for testing the hypothesis $H_0 : \sigma = 5$ against $H_1 : \sigma \neq 5$.

(H) What is a contingency table ?

(I) In a 4×5 contingency table, state the degrees of freedom for the chi-square test statistic.

(J) Comment on the following statement : "Large sample tests are exact tests."

(K) Obtain 95% confidence limits for the population proportion in case of large sample if $P_n = 0.6$, $p = 0.5$, $n = 100$, $Z_{0.025} = 1.96$ in usual notation.

(L) State the distribution of a test statistic in a large sample test. 1×10=10