

Model Question Paper-II

Ph. D. Entrance Test

STATISTICS

(Subjective)

Time: 02 Hours

M.M. 100

Note: Attempt any Four questions selecting one from each unit. All questions carry equal marks.

Unit-I

1.
 - a) Give a brief account of Kolmogorov inequality.
 - b) State and prove Borel-Contelli lemma.
 - c) Discuss the various modes of convergence giving their inter-relationship.
2.
 - a) What are consistent estimators and show that sample mean is a consistent estimator .
 - b) Obtain minimum variance bound estimator of θ in the binomial distribution
$$L(r/\theta) = \binom{n}{r} \theta^r (1-\theta)^{n-r} \quad , \quad r = 0, 1, 2, \dots, n.$$
 - c) State and prove Rao-Blackwell theorem.

Unit-II

3.
 - a) A variable takes value 0, 1, 2, ..., n with frequencies proportional to the Binomial coefficients

$$1, \binom{n}{1}, \binom{n}{2}, \dots, \binom{n}{n}.$$

find the Mean and Variance of the distribution and show that the variance is half to the mean.

- b) Find the Mean and Variance of the exponential distribution with parameter $\lambda > 0$.
 - c) What is Beta distribution of the second kind? Find its various moments.

4. a) Show that the Student's t-distribution tends to Normal distribution as d.f. $v \rightarrow \infty$.
- b) If χ_1 and χ_2 are independent χ^2 – variates with n_1 and n_2 d.f's, then find the distribution of $\frac{\chi_1^2}{\chi_2^2}$.
- c) State and prove Snedecor's F-distribution.

Unit-III

5. a) Define SRSWOR and SRSWR. Show that in SRSWOR, the probability of selecting a specified unit of the population at any given draw is equal to the probability of selecting it at the first draw.
- b) Explain the sampling technique of drawing the stratified random sample. Define the estimator of population mean under this scheme and show that it is unbiased. Also obtain its sampling variance.
6. a) Define Latin square design. What are its advantages?
- b) Give the analysis of Randomised block design (RBD). Discuss its advantages and disadvantages.
- c) Define main effects and interaction effects in a 2^3 factorial experiment. What is confounding? Distinguish clearly between the terms 'Total confounding' and 'Partial confounding'.

Unit-IV

7. a) Write down the p-variate normal distribution. Show that the marginal distribution of a subset, and the conditional distribution of a subset given the other set are also normal. Give an interpretation to the mean of the conditional distribution.
- b) Show that multiple correlation coefficient is invariate under a non-singular linear transformation.
8. a) Obtain the distribution of sample mean vector when the sample is drawn from multivariate normal population.
- b) Define T^2 -statistic and prove that its invariance property. Discuss its uses in testing of hypotheses including Behren's Fisher problem.