

Reg. No. :

M 11987

Name :

Second Semester M.Sc. Degree Examination, May 2006
STATISTICS

Paper – 2.2 : Sampling Theory

Time: 3 Hours

Max. Marks:70

Instruction : Answer any five questions without omitting any unit. All questions carry equal marks.

UNIT – I

1. a) Distinguish between sampling and non-sampling errors and explain how they are controlled in practice.
- b) Compare the simple random sampling techniques with and without replacement. Obtain the estimators of population mean in both the cases and derive the expressions for their standard errors. Discuss about the efficiency of these estimators. (6+9=15)
2. a) Show that in simple random sampling without replacement, the probability of drawing a specified unit at the r^{th} draw is equal to the probability of drawing it at the first draw. And also show that the probability of including a specified unit in a sample of size n is $\frac{n}{N}$.
- b) Show that the sample proportion $P_i = \frac{n_i}{N}$ is an unbiased estimator of the population proportion $P_i = \frac{N_i}{N}$ based on a sample of size n with n_i units from the i^{th} class; the variance of the estimator is $\frac{N-n}{N-1} \frac{P_i(1-P_i)}{n}$ with an unbiased estimator $\frac{N-n}{N} \frac{P_i(1-P_i)}{(n-1)}$. (7+8=15)

c) Denote by $\sigma_k^2 = V(X_k)$. Show that the weak law of large numbers holds for a sequence of independent random variables $\{X_k\}$ if $\sum_1^n \sigma_k^2 / n^2 \rightarrow 0$.

- 8. a) State and prove Kolmogorov's three series theorem.
- b) If the mutually independent random variable X_k have a common distribution $\{f(x_j)\}$ and if $\mu = E(X_k)$ exists, then show that the strong law of large numbers applies to the sequence $\{X_k\}$.

UNIT - 5

- 9. a) What is a central limit Problem ? State and prove the Lindberg-Levy form of the central limit theorem.
 - b) Let $\{X_n\}$ be a sequence of independent random variables such that X_k is normal with mean zero and variance $\frac{1}{2^n}; n \geq 1$. Show that $\{X_n\}$ obeys the C.L.T., but the Lindberg-Teller condition fails.
10. Write short notes on:
- i) Infinitely divisible distribution
 - ii) Multivariate central limit theorems
 - iii) Implications between the Liapnov, Lindberg-Levy and Lindberg-Feller conditions for the C.L.T.
 - iv) Law of iterated logarithms.
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