



'समानो मन्त्रः समितिः समानी'

UNIVERSITY OF NORTH BENGAL
B.Sc. Programme 3rd Semester Examination, 2022

DSC1/2/3-P3-STATISTICS

METHODS OF SAMPLING AND SAMPLING DISTRIBUTION

Time Allotted: 2 Hours

Full Marks: 40

The figures in the margin indicate full marks.

GROUP-A

1. Answer any **five** questions from the following: 1×5 = 5
- (a) What is meant by stratified random sampling?
 - (b) Distinguish between sample and population.
 - (c) State the formula for standard error of sample mean.
 - (d) What is bias and how does it arise in sampling?
 - (e) Distinguish between 'standard error' and 'standard deviation'.
 - (f) What is a random number?
 - (g) Write down two uses of chi-square distribution.
 - (h) What is standard error?

GROUP-B

2. Answer any **three** questions from the following: 5×3 = 15
- (a) Describe important characteristics of Chi-square and F-distribution.
 - (b) A random sample of two individuals is to be drawn from a population of size 40. What is the possible number of distinct samples when sampling is (i) with replacement (ii) without replacement?
 - (c) The safety limit of a crane is known to be 32 tons. The mean weight and S.D. of a large number of iron rods are 0.3 ton and 0.2 ton respectively. 100 rods are lifted at a time. Find the probability of an accident. [Given that $\phi(1) = 0.8413$ where $\phi(t)$ denotes the area under standard normal curve to the left of the ordinate at t .]
 - (d) If a random variable X is distributed normally around a mean 20 with S.D. 3, describe the important characteristics of the probability distribution of $Y = \frac{X - 20}{3}$.
 - (e) State the situation when stratified samples will be suitable.

GROUP-C

3. Answer any *two* questions from the following: 10×2 = 20

(a) Derive the formulae for expectation and standard error of sample mean in both simple random sampling with replacement (SRSWR) and simple random sampling without replacement (SRSWOR) from a finite population.

(b) If a random sample of size n is drawn from a normal population with mean μ and S.D. σ , then show that $\frac{\bar{x} - \mu}{s/\sqrt{n-1}}$ follows t -distribution with $(n-1)$ degrees of freedom, where \bar{x} and s denote the mean and S.D. of the sample.

(c) If X_1, X_2, \dots, X_n is a simple random sample of size n from a finite population N units with mean μ and variance σ^2 , then show that—

(i) $\text{var}(X_i) = \sigma^2$

(ii) $\text{cov}(X_i, X_j) = 0$ in SRSWR

$$= -\frac{\sigma^2}{N-1} \text{ in SRSWOR}$$

where X_i and X_j denote the sample units obtained at the i^{th} and j^{th} drawing respectively.

(d) Describe the important characteristics of standard normal distribution and t -distribution.

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