

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2023)

CLASS: IMSc
BRANCH: QEDS

SEMESTER : IV
SESSION : SP/2023

SUBJECT: ED223 SAMPLING TECHNIQUES & DESIGN OF EXPERIMENTS
TIME: 02 Hours

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
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- Q.1 Consider the following population: CO BL
[5] 1
- | | | | | | |
|---|-----|-----|-----|-----|-----|
| i | 1 | 2 | 3 | 4 | 5 |
| y | 1.2 | 1.5 | 0.9 | 0.7 | 1.4 |
- Write down the sampling design when the samples, each of size 3, are drawn without replacement from this population, and each sample has the same probability of being selected. Find the probability unit 2 is selected in the sample, unit 5 is selected in the sample, and units 2 and 5 occur together in the sample.
- Q.2 In the above problem, by considering all the samples, verify that the sample mean is unbiased estimator of the population mean and that the sample variance is unbiased estimator of population variance. [5] 1
- Q.3 Suppose it is required to estimate the average value of a output of a group of 5000 factories in a region so that the sample estimate lies within 10% of the true value with a confidence coefficient of 95%. Determine the minimum sample size required. The population coefficient of variation is known to be 60%. [5] 2
- Q.4 In an SRSWOR (N,n) consider the class of estimators of \bar{Y} , $\bar{Y}' = \sum_{r=1}^n a_r y_r$, where a_r is a constant depending on the rth draw. Show that \bar{Y}' is unbiased estimator of \bar{Y} iff $\sum_{r=1}^n a_r = 1$. Also find $V(\bar{Y}')$. [5] 2
- Q.5(a) In the above problem, subject to the condition $\sum_{r=1}^n a_r = 1$ find the choice of a_r for which $V(\bar{Y}')$ is minimum. [3] 2
- Q.5(b) Hence, propose the minimum variance unbiased estimator of \bar{Y} in the above class. [2] 2

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