LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **STATISTICS**

THIRD SEMESTER – **APRIL 2024**

UST 3501 – SAMPLING THEORY

Date: 16-04-2024 Dept. No. Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

	SECTION A - K1 (CO1)
	Answer ALL the Questions **(10 x 1 = 10)**
1.	**Define the following**
a)	Census Method.
b)	SRSWR.
c)	Confidence limit.
d)	Circular systematic sampling.
e)	Regression Estimator.
2.	**MCQ**
a)	A sample consists of (a) All units of the population (b) 5% units of the population (c) 10% units of the population (d) Any fraction of the population.
b)	The number of possible samples of size 2 out of 5 population size in SRSWOR is equal to (a) 10 (b) 4 (c) 2 (d) 12
c)	In a Sampling, f stands for (a) Limits (b) Facts (c) Fraction of n by N (d) Fraction of N by n
d)	Systematic sampling is used (a) when data are on cards (b) when the items are in row (c) when the items are given in a sequential order (d) all the above.
e)	The sample units of Stratified Sampling is selected by using (a) Circular method (b) Purposive (c) Simple random (d) Alls.
	SECTION A - K2 CO1)
	Answer ALL the Questions **(10 x 1 =10)**
3.	**True or False**
a)	Sample Size is always greater than 10 units.
b)	In SRS, Estimation of sample variance is always unbiased.
c)	Proportional value is always greater than one.
d)	In circular systematic Sampling the probability of inclusion of every pairs of unit will be not equal to zero.
e)	Ratio estimator is always best linear unbiased estimator.
4.	**Answer the following**
a)	What is mean by unbiased?
b)	Outline simple random sampling without replacement
c)	Write a general equation of Confidence limit for proportion.
d)	Give any one use of Systematic sampling.
e)	What is mean by Ratio Estimator?
	SECTION B - K3 (CO2)
Answer any TWO of the following	**(2 x 10 =20)**
5.	Explain about the principal steps involved in a sample survey.

6.	Derive the variance of the mean from a simple random sample $\text{var}(\bar{y}_n) = \left(\frac{N-n}{Nn}\right)S^2$
7.	(i) Explain Cost Function. (3) (ii) Scores on an exam are normally distributed with a population standard deviation of 5.5. A random sample of 40 scores on the exam has a mean of 32. Estimate the population mean with 90% and 95% Confidence Intervals. (7)
8.	Explain the ratio method of estimation. Assume an SRSWOR sample, and let $\hat{R} = \bar{y}/\bar{x}$ is the estimator of R, the population ratio.
SECTION C – K4 (CO3)	
Answer any TWO of the following	**(2 x 10 = 20)**
9.	Explain sampling and non-sampling errors with suitable example.
10.	Derive the Variance of the sample mean in case of SRSWOR.
11.	Prove that $(\overline{V(y}_{Ran}) \geq V(\bar{y}_{Prop}) \geq V(\bar{y}_{St)Neyman}$
12.	Prove that the sampling units are selected with varying probabilities and without replacement, then the ratio estimator of population total is unbiased.
SECTION D – K5 (CO4)	
Answer any ONE of the following	**(1 x 20 = 20)**
13.	Assume that in a population there are n=3 units. The values of the characteristic under study if these three units are 4, 6 and 8. (i) Draw all possible SRS of size n = 2 for both with replacement and without replacement (4) (ii) Show that sample mean is an unbiased estimator of population mean.(5) (iii) Show that sample variance is an unbiased estimator of population variance.(6) (iv) Find $V(\bar{y}),\ and\ S.E(\bar{y})$ (5)
14.	(i) Explain the selection procedure of the sample with probability proportional to size. (ii) In a simple random sample of size 100 from a population of size 500 there are 37 units in class C. Find the 95% Confidence limits for the proportion and for the total number in class C in the population.
SECTION E – K6 (CO5)	
Answer any ONE of the following	**(1 x 20 = 20)**
15.	(i) Prove that Neymen's allocation against proportional allocation $\text{var}(\bar{y}_{st})_p \geq \text{var}(\bar{y}_{st})_{Ney}$ (ii) If the population consists of linear trend, Prove that $\text{var}(\bar{y}_{st}) \leq \text{var}(\bar{y}_{sys}) \leq \text{var}(\bar{y}_{srs})$
16.	(i) Prove that $V(\bar{y}_{sys}) = \left(\frac{k-1}{nk}\right) s^2_{wst}[1 + (n-1)\rho_{wst}]$ (ii) Compare Neyman's Allocation with Proportion Allocation using standard notations.

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