LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – **NOVEMBER 2022**

UST 3501 – SAMPLING THEORY

Date: 24-11-2022   Dept. No.   Max. : 100 Marks
Time: 09:00 AM - 12:00 NOON

SECTION – A

Answer ALL the Questions

1.	**Answer the following Questions**		**(5 x 1 = 5)**
a)	Sampling Frame.	K1	CO1
b)	Ratio Estimator.	K1	CO1
c)	Confidence Interval.	K1	CO1
d)	Stratified Sampling.	K1	CO1
e)	Systematic Sampling.	K1	CO1
2.	**Fill in the blanks**		**(5 x 1 = 5)**
a)	Simple random sample can be drawn with the help of _____.	K1	CO1
b)	If 'n' units are selected in a sample from 'N' population units, the sampling fraction is given as _____	K1	CO1
c)	Variance of $\overline{y_{st}}$ under random sampling, Proportional allocation and optimum allocation hold the correct inequality as _____.	K1	CO1
d)	Circular Systematic sampling is used when _____.	K1	CO1
e)	If the sample size $n \geq 30$, then it is said to be ____	K1	CO1
3.	**Match the following**		**(5 x 1 = 5)**
a)	PPSWOR - Proportional allocation	K2	CO1
b)	Finite Population correction - Two Phase sampling	K2	CO1
c)	n/N - Probability Proportional size without Replacement	K2	CO1
d)	Double Sampling - $(\frac{N-n}{N})$	K2	CO1
e)	Sample size allocation - Sampling fraction	K2	CO1
4.	**True or False**		**(5 x 1 = 5)**
a)	Random sample depends on size and nature of the population.	K2	CO1
b)	Stratified sampling doesn't provide estimates with increased precision.	K2	CO1
c)	Simple Random Sampling is more representative of the population.	K2	CO1
d)	Neyman's optimum allocation provides better estimates.	K2	CO1
e)	Ratio estimators are not biased.	K2	CO1

1

SECTION - B

	Answer any TWO of the following Questions	**(2 x 10 = 20)**		
5.	Explain in detail Sampling and Non-sampling error.		K3	CO2
6.	Consider a population consisting of the following 5 units:2,4,6,8 and 10. Suppose, a sample of size 2 is to be selected from it by the method of simple random sampling without replacement. We want to obtain the sampling distribution of the sample mean and its standard error.		K3	CO2
7.	Estimate Population proportion with respect to SRSWOR and SRSWR.		K3	CO2
8.	(i)Explain Systematic sampling. **(5+5)** (ii)Explain Ratio and Regression estimation under Stratified random sampling.		K3	CO2

SECTION - C

	Answer any TWO of the following Questions	**(2 x 10 = 20)**		
9.	Explain in detail the three important principles of sampling.		K4	CO3
10.	(i) In SRSWOR show that the sample mean is an unbiased estimator of population mean, i.e., $E(\bar{y}_n) = \overline{Y_N}$. **(5+5)** (ii)Explain Equal allocation,Proportional allocation and Neyman optimum allocation.		K4	CO3
11.	Scores on an exam are normally distributed with a population standard deviation of 5.6. A random sample of 40 scores on the exam has a mean of 32. Estimate the population mean with (i)80%confidence (ii)90% confidence(iii)98% confidence		K4	CO3
12.	The ratio estimator $\widehat{Y}_R = \frac{\widehat{Y}}{\widehat{X}}$ X is more efficient than the expansion estimator $\widehat{Y}$ if $\rho > \frac{1}{2}\frac{C_x}{C_y}$ where $C_y = \frac{S_y}{\overline{\overline{Y}}}$ C; $C_x = \frac{S_x}{\overline{\overline{X}}}$ and ρ is the coefficient of correlation. Prove.		K4	CO3

SECTION - D

	Answer any ONE of the following Question	**(1 x 20 = 20)**		
13.	(i)In SRSWOR,prove that $\text{var}(\bar{y}_n) = (\frac{N-n}{Nn}) S^2$. **(15+5)** (ii)In a small private college students are classified as follows: 	Classification	B.Sc	B.A	B.com	M.Sc
No.of students	150	163	195	220 | If we wish to select a stratified random sample of size n=40 by proportional allocation, how large a sample must we take from each stratum.		K5	CO4
14.	(a) If the population consists of a linear trend , Y_i= I; (i=1,2,…N), then prove that $\text{Var}(\bar{y}_{st}) \leq \text{Var}(\bar{y}_{sys}) \leq \text{Var}(\bar{y}_n)$R **(15+5S)** (b)Compare Neyman's allocation vs Simple Random Sampling		K5	CO4

SECTION - E

	Answer any ONE of the following Question	**(1 x 20 = 20)**		
15.	(i)Prove , $E(s^2) = S^2$ under SRSWOR. **(12)** (ii)Explain cluster sampling and multistage sampling **(8)**		K6	CO5
16.	(i)Var$(\bar{y}_{st})$ is minimum for specified cost function, $n_i \propto \frac{N_i S_i}{\sqrt{C_i}}$ - Prove. **(10)** (ii)Give the difference between,(a) SRSWOR and SRSWR (b) Systematic sampling and Stratified sampling. **(10)**		K6	CO5

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