

- Note: (i) Attempt any three questions from Q. 1-8, Q-9 is compulsory  
(ii) each question carry equal (14) Marks.  
(iii) total marks is 50

- Q. 1. (a) Explain the procedure of drawing a random sample by simple random sampling technique with replacement and without replacement in detail. Also give properties of both the methods. [7 marks]  
(b) For the simple random sampling without replacement show that: [7 marks]  
(i) Sample mean  $\bar{y}$  is an unbiased estimator of population mean  $\bar{Y}$ .  
(ii)  $V(\bar{y}) = \frac{N-n}{N} \frac{S^2}{n}$
- Q. 2. (a) Show that in simple random sampling without replacement the variance of  $\bar{y}$  is less than that of sampling with replacement. [7 marks]  
(b) In a population of size 5 the values of the variable are 2, 4, 6, 8, 10. Select a random sample of size 2 and show that sample mean is an unbiased estimator of the population mean. [7 marks]
- Q. 3. (a) Explain the method of drawing a sample by Stratified random sampling. [7 marks]  
(b) In usual notation prove that: (i)  $E(\bar{y}_{st}) = \bar{Y}_{st}$  and (ii) obtain variance of  $\bar{y}_{st}$ . [7 marks]
- Q. 4. (a) With usual notations, if finite population correction is ignored then prove that  
 $V_{opt}(\bar{y}_{st}) \leq V_{prop}(\bar{y}_{st}) \leq V_{ran}(\bar{y}_{st})$  [7 marks]  
(b) In stratified random sampling with linear cost function  $C = C_0 + \sum_h C_h n_h$  the variance of the estimate mean  $\bar{y}_{st}$  is minimum for a specified cost C, and the cost is minimum for a specified variance when  $n_h \propto \frac{n_h S_h}{\sqrt{C_h}}$ . [7 marks]
- Q. 5. (a) Discuss the situations where systematic sampling is used and explain the method of data collection. [7 marks]  
(b) Discuss sampling and non-sampling errors. [7 marks]
- Q. 6. (a) Discuss the procedure for the estimation of population mean in case of systematic sampling when  $N=nk$ . Also obtain its variance. [7 marks]  
(b) Give comparison of variances under systematic sampling with stratified sampling. [7 marks]
- Q. 7. (a) Describe the procedure of two stage sampling and discuss its advantages and disadvantages. [7 marks]  
(b) Obtain mean and variance of two stage sampling with equal first stage units. [7 marks]
- Q. 8. (a) Discuss comparison of two stage sampling with one stage sampling when sampling  $m$  elements in one single stage. [7 marks]  
(b) Obtain mean and variance of two stage sampling with unequal first stage unit. [7 marks]

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Q. 9. Attempt any Four.

[8 marks]

- (i) Define Strata.
  - (ii) Give two characteristics of Stratified random sampling.
  - (iii) State the formula for mean of  $h^{\text{th}}$  strata.
  - (iv) State the formula for  $V(\bar{y}_h)$
  - (v) What is the probability of selecting a unit out of  $N$  units in SRS?
  - (vi) With simple random sampling state the estimate of population total.
  - (vii) State one characteristic of good sample.
  - (viii) Explain difference between SRSWR and SRSWOR.
  - (ix) Give one example where you need to use systematic sampling.
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