



*(Knowledge for Development)*

**KIBABII UNIVERSITY**  
**UNIVERSITY EXAMINATIONS**  
**2017/2018 ACADEMIC YEAR**  
**THIRD YEAR FIRST SEMESTER**  
**MAIN EXAMINATION**

**FOR THE DEGREE OF BACHELOR OF EDUCATION AND  
BACHELOR OF SCIENCE (MATHEMATICS)**

**COURSE CODE: STA 343**

**COURSE TITLE: SAMPLE SURVEY II**

**DATE: 11/01/18**

**TIME: 9 AM -11 AM**

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**INSTRUCTIONS TO CANDIDATES**

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 3 Printed Pages. Please Turn Over.

**QUESTION 1: ( 30 marks )**

- (a) For a population of size  $N$  from which a sample of size  $n$  is drawn, what would be the probability of selecting such a sample under,
- (i) Simple random sampling with replacement(SRSWR) ( 2 marks )
  - (ii) Simple random sampling without replacement (SRSWOR) ( 2 marks )
- (b) Three elements are to be drawn from a population of size 6. How many samples will we have under,
- (i) Simple random sampling with replacement (SRSWR) scheme? What would be the probability of selecting such a sample? ( 3 marks )
  - (ii) Simple random sampling without replacement (SRSWOR) scheme? What would be the probability of selecting such a sample? ( 3 marks )
- (c) Suppose we are willing to accept a margin of error of 5%, derive an expression we would use to obtain sample size  $n'$  for a prior knowledge of population proportion,  $P$ . ( 6 marks )
- (d) Use (c) above to obtain  $n'$  for a proportion,  $P= 0.5$  under SRSWR scheme. ( 4 marks )
- (e) Working under SRSWOR scheme and basing on the information in (d) above, obtain the sample Size one would draw from a population of size  $N=1500$ . ( 5 marks )
- (f) Describe cluster sampling. ( 5 marks )

**QUESTION 2: ( 20 marks )**

- (a) Illustrate how you would carry out a Stratified sampling scheme. How does it differ from a cluster sampling procedure? ( 8 marks )
- (b) In a population of size  $N=7$  and the number of strata is  $L=2$ , the response values  $y_{hi}$  are given as 0,1,2,3 for the first stratum and 4,7,9,10 for the second stratum. A random sample of size  $n=4$  is to be taken, find the suitable stratum size  $n_h$  under;
- (i) Neyman allocation ( 7 marks )
  - (ii) Proportional allocation ( 5 marks )

**QUESTION 3: ( 20 marks)**

- (a) State the advantages of using Stratified Sampling technique. ( 8 marks)
- (b) In a stratified sampling scheme, consider the sampling variance to be:

$$Var(\bar{y}) = \sum_{h=1}^L \frac{W_h^2 S_h^2}{n_h} \left( \frac{N_h - n_h}{N_h} \right) = \sum_{h=1}^L \frac{W_h^2 S_h^2}{n_h} - \sum_{h=1}^L \frac{W_h^2 S_h^2}{N_h}$$

Let the total cost  $C$  of conducting the survey be given by the function

$$C = C_0 + \sum n_h C_h$$

Where  $C_0$  is the overhead cost,  $C_h$  the cost of sampling one unit and  $n_h$  the  $h^{\text{th}}$  stratum Sample size.

By using the method of Lagrange's multipliers, minimize the sampling variance for a fixed cost with respect to  $n_h$  and hence derive the sample size allocation

( Hint: use optimum allocation procedure) ( 12 marks )

**QUESTION 4: ( 20 marks )**

- (a) Briefly describe any four methods you would use to determine sample size ( 8 marks )
- (b) In obtaining sample size based on sampling cost, a cost function is given as  $C = C_0 + nC_1$  and the loss function of the form,

$$L(e) = \lambda e^2$$

Where  $\lambda$  is a constant,  $C_0$  the overhead cost,  $C_1$  the cost of surveying a single unit and

$$e = \bar{y} - \bar{Y}.$$

Evaluate the necessary sample size,

- (i) Under the simple random sampling with replacement(SRSWR) scheme
- (ii) Under simple random sampling without replacement (SRWOR) scheme ( 12 marks )

**QUESTION 5: ( 20 marks )**

- (a) State the advantages of systematic over simple random sampling scheme. ( 4 marks )
- (b) Distinguish Linear systematic sampling(LSS) from Circular systematic sampling(CSS). ( 6 marks )
- (c) Prove that in LSS the population variance is the sum of the variations within the samples and between the samples ( 10 marks )