MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR
FOURTH YEAR SECOND SEMESTER

SCHOOL OF SCIENCE AND INFORMATION SCIENCES
BACHELOR OF SCIENCE & EDUCATION

COURSE CODE: STA 3227
COURSE TITLE: SAMPLING THEORY & METHODS I

DATE: 18/04/2019   **TIME: 11:00 AM – 1:00 PM**

INSTRUCTIONS TO CANDIDATES

1. Answer **Question ONE** and any other **Two** questions.

2. Show all the workings clearly
3. Do not write on the question paper

4. All Examination Rules Apply.

Question One (30 Marks)

a) Briefly discuss the advantages and disadvantages of sampling
   (4 Marks)

b) Describe how Random number table method is used to select a simple random sampling.
   (4 Marks)

c) A population of size 450 is divided into two colleges A and B. Their sizes, mean and standards are as follows:

College	No. of students	Means	Standard deviation
A	300	60	15
B	150	45	20

A stratified random sample of size 30 is to be drawn from the population. Determine the sizes of samples from the strata for

   i) Neyman allocation **(5 Marks)**

   ii) Proportional Allocation **(4 Marks)**

d) A sociological study conducted in a small town calls for an estimation of the proportion of households that contains at least one member who is over 65 years of age. The city has 621 households according to the most recent census. A simple random sample of 60 was selected from the list. Out of the 60 sampled, 11 had at list one member over 65 years of age. Estimate the true population proportion and place a bound on

the error of estimation

(5 Marks)

e) A large construction firm has 120 houses in various stages of completion. For estimation of the total amount of construction in the process, a simple random sample of 12 houses is selected and the accumulated costs determined on each. The following costs were obtained.

| 35.5 | 30.2 | 28.9 | 36.4 | 29.8 | 34.1 |
| 32.6 | 26.4 | 38.0 | 38.2 | 32.2 | 27.5 |

  i) Calculate the sample mean and variance

(5 Marks)

  ii) Estimate the total number of houses in the area and its approximate 99% Confidence Interval **(3 Marks)**

Question Two (20 Marks)

A cooperation desires to estimate the total number of man-hours lost for a given month because of among all employees. The firm consists of a casual workers, technicians and administrators and they different accident rates, then the researcher decides to use stratified random sampling with each group forming a separate stratum. The stratum sizes are 132, 92 and 27 respectively and a simple random sample is taken from each stratum with the following results.

Casual workers	Technicians	Administra

			tors
8	24	4	1
0		5	8
16	0	0	
32		24	
6	16	8	
0		12	
7	4	3	
4		2	
9	5	1	
8		8	
18	2		
0			

a) Calculate $\bar{y}_{st}$ $\ and\ V\left(\bar{y}_{st}\right)$ **(14 Marks)**

b) Estimate the total number of man-hours lost and the estimated variance.

(6 Marks)

Question Three (20 Marks)

a) The highway patrol of a particular city is concerned about the proportion of motorists who carry their licenses. A checkpoint is up on a major highway and the driver of every 7th car was questioned. From a total of 2,800 cars that pass the highway

during the sampling period, the following response were

obtained. $\sum_{i=1}^{400} y_i = 324$

i) Estimate the proportion of drivers carrying their licenses and place a bound on the error of estimation.

(5 Marks)

ii) Find the 99% confidence interval for the total number of drivers carrying their licenses.

(5 Marks)

b) A dentist is interested in the effectiveness of a new toothpaste. A group of 1000 school children participated in the study. The pre-study records showed that there was an average of 2.2 cavities every six months. After three months of the study, the dentist sampled 10 children to determine how they were progressing on the new toothpaste. The following results were obtained.

Child	1	2	3	4	5	6	7	8	9	10
No. of cavities	0	4	2	3	2	0	3	4	1	1

i) Calculate $\bar{y}$ and $V(\bar{y})$ **(5 Marks)**

ii) Estimate the total number of cavities in the whole group and place a bound on the error of estimation.

(5 Marks)

Question Four (20 Marks)

a) Briefly describe the stratified random sampling method.
(5 Marks)

b) A market research firm conducted a survey in a city for the purpose of estimating the total monthly household expenditure on Compact Discs (CDs) and the total number of households owning a Compact Disc Player (CDP). The city was divided into four areas and a random sample of households was selected from each area. The results of the survey are shown below.

Area	N_i	n_i	Sample Average Monthly expenditure	Sample proportion owning CDP
1	20,000	100	10.40	0.150
2	10,000	100	6.10	0.083
3	35,000	100	4.05	0.042
4	15,000	100	8.24	0.075

i) Estimate the average monthly household expenditure on CDs in the city and the proportion of households in the city that owns CDP. **(9 Marks)**

ii) Calculate the total monthly expenditure on CDs and the total number of households owning a CDP in the city.
(6 Marks)