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**JOMO KENYATTA UNIVERSITY**

**OF**

**AGRICULTURE AND TECHNOLOGY**

**UNIVERSITY EXAMINATIONS 2014/2015**

 **THIRD YEAR SECOND SEMESTER EXAMINATION FOR THE**

**DEGREE OF BACHELOR OF SCIENCE IN STATISTICS**

**STA 2402: DESIGN AND ANALYSIS OF SAMPLES SURVEYS (DASS)**

**DATE: APRIL 2015 TIME: 2 HOURS**

**INSTRUCTIONS:**

1. Answer Questions ONE and any other TWO Questions
2. No SMP or Actuarial or Statistical Tables or mobile phones or i-Pads

or i-pods or any other illegal acids are allowed, but you may use a non-pre-programmable calculator.

1. NO writing is allowed on any paper a part from the answer booklet. In particular, marks will be deducted if any writing is done on the question paper or on the formula sheet.
2. The question paper should be placed inside the answer booklet, when this is handed in

**FAILURE TO COMPLY WILL RESULT IN THE DEDUCTION OF THE MARKS**

**QUESTION ONE (30 MARKS)**

1. Define the following terms as used in sample surveys:
2. Sampling Unit [1 mark]
3. Sampling Frame [1 mark]
4. Sampling Scheme [1 mark]
5. Non-Response [1 mark]
6. Standard Error [1 mark]
7. i) Besides direct observation and measurement, state the other two main

 methods of collecting data or information in sample surveys. [2 marks]

ii) State the advantages and disadvantages of each of the two methods

 of collecting data (information) stated in b (i) above. [8 marks]

1. i) What is the difference between probability sampling and non-probability

 sampling methods. [2 marks]

ii) What are the requirements for the probability sampling method? [3 marks]

1. Statisticians have shown that the “Representativeness” of the sample and

the “Accuracy” of the estimators, based on the probability sampling

methodology can easily be discussed. Explain how this could be done. [4 marks]

1. i) Describe briefly the advantages of carrying out a sample survey in

 preference to complete enumeration. [4 marks]

ii) Under what circumstances can complete enumeration be recommended

 in preference to a sample survey? [2 marks]

**QUESTION TWO (20 MARKS)**

1. i) Show that in simple random sampling without replacement (s.r.w.o.r.)

 the sample mean is an unbiased estimate of the population mean. [3 marks]

ii) Show that in a s.r.w.o.r., the sample mean square (i.e. sample variance)

 is an unbiased estimate of the population mean square (i.e. population

 variance). [9 marks]

1. Consider a simple random sample of n = 10 households drawn from a large

population of N=10,000 households. The data collected are presented in the

following table, where the variable X denotes weekly household expenditure

on food, and the variable W indicates whether or not a household possesses

TV ( = 1 if Yes, and 0 otherwise).

|  |  |  |
| --- | --- | --- |
| Household (i) | Xi | Wi |
| 1 | 5 | 0 |
| 2 | 10 | 1 |
| 3 | 5 | 0 |
| 4 | 9 | 1 |
| 5 | 5 | 1 |
| 6 | 6 | 1 |
| 7 | 7 | 0 |
| 8 | 15 | 1 |
| 9 | 12 | 1 |
| 10 | 8 | 0 |

1. Find or compute the estimate of the population mean monthly

expenditure on food. [1 mark]

1. Compute the estimated variance of the estimated mean. [2 marks]
2. Computer the 95% confidence interval for the population mean. [1 mark]
3. Compute the estimate of the population total monthly household

expenditure on food. [1 mark]

1. Compute the estimate of population proportion of household that

possess a TV. [1 mark]

1. Compute the estimated variance of the estimated proportion of the [2 marks]

households with TV.

**QUESTION THREE (20 MARKS)**

1. i) Discuss briefly proportional allocation (under stratified random

 sampling scheme). [2 marks]

ii) Show that under proportional allocation the variance of the stratified

 mean is given as:

 Var st)Prop = (1 - f)  Where f =  [8 marks]

1. A stratified population has 5 strara. The stratum sizes, Ni, and means

i), and stratum variance Si, as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Stratum | Ni | i) |  |
| 1 | 200 | 7.8 | 1.36 |
| 2 | 100 | 7.2 | 2.04 |
| 3 | 80 | 11.8 | 1.18 |
| 4 | 50 | 10.2 | 1.96 |
| 5 | 60 | 10.8 | 1.86 |

1. Calculate the overall population mean. [2 marks]
2. For a stratified random sample of size 100, determine the appropriate

sample size (under proportional allocation). [5 marks]

1. Calculate the variance of st) under proportional allocation. [3 marks]

**QUESTION FOUR (20 MARKS)**

1. x1, x2, ……., xn are total measures of the characteristics under investigation

taken on a sample of n clusters, from a population of size N clusters. The ith

cluster in the population comprise - Mi elementary units. Each cluster is

completely enumerated from the measure xi. Show that the estimated mean:

  =  is unbiased estimator of the population mean 

 [5 marks]

1. An investigation was carried out to estimate average number of cattle per

farm and variance of the estimate using data of the total cattle (=Xi) in each of

the sample clusters. There are 50 clusters in the population, the ith cluster

comprising Mi farms. Simple random sample of 7 clusters was selected and the

following data obtained:.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Sample cluster (i) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| No. of Farms (Mi) | 32 | 83 | 18 | 30 | 55 | 24 | 99 |
| No. of cattle (Xi) | 352 | 906 | 316 | 284 | 914 | 284 | 598 |

Using these data, give a solution to this problem. [15 marks]