



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2011/2012
SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE
SMA 365: DESIGN AND ANALYSIS OF SAMPLE SURVEYS

DATE: THURSDAY, 29TH MARCH 2012

TIME: 2.00 P.M – 4.00 P.M

INSTRUCTIONS

Answer question ONE and any other TWO questions.

Q1 Compulsory (30 marks)

- a) Define the following terms
- i) Census
 - (ii) Sampling frame
 - (iii) Pilot survey
- [30 marks]

- b) Define a simple random sampling. Show that the probability of selecting a random sample of size n from a population of size N is given by $1/\binom{N}{n}$

When sampling is done without replacement [5 marks]

- c) In a private library books are kept on 130 shelves of similar sizes. The number of books on 15 shelves picked at random were found to be

28	23	25	33	31
18	22	29	30	22
26	30	21	28	25

Calculate

- (i) The sample mean and sample variance
 - (ii) The estimate of the total number of books in the library
 - (iii) The 95% confidence interval of the total of books
 - (iv) The large a sample should be if the estimate is within 5% margin of error of the mean value $\bar{x} = 25$ with 95% assurance
- [3 marks]
- d) State the advantages of using stratified random sampling [4 marks]

Q2. a) Briefly describe how you obtain a systematic sample from a finite population, [4 marks]

b) Show that

$$Var(\bar{y}_{sy}) = \left(\frac{N-1}{Nn} \right) (1 + (n-1)\ell) \quad [9 \text{ marks}]$$

c) In an agricultural experiment carried out in India, out of 225 holding in two villages, 45 holdings were selected by systematic sampling with 5 as the sampling interval.

The total arable land for the 45 selected holdings are given below

S No.	1	2	3	4	5	6	7	8	9
Total arable land	60	50	14	19	1	0	0	0	0
S No.	10	11	12	13	14	15	16	17	18
Total arable land	0	150	150	100	20	0	25	192	25
S No.	19	20	21	22	23	24	25	26	27
Total arable land	0	13	0	0	50	0	10	0	0
S No.	28	29	30	31	32	33	34	35	36
Total arable land	0	85	30	30	70	30	35	0	30
S No.	37	38	39	40	41	42	43	44	45
Total arable land	0	0	10	0	20	70	16	15	35

Estimate (1) Total arable land

(ii) Standard error of the estimate of total [7 marks]

Q3. a. Distinguish and describe the following terms

(i) Stratification

(ii) Post stratification [4 marks]

b. Show that stratification with Neyman optimum allocation with fixed sample size is more efficient than stratification of the same sample size. [6 marks]

c. Consider a population with the following characteristics

Structure (h)	Nh	Sh	Ch
1	200	10	1
2	800	1	16
3	1000	4	25

i) Obtain the Neyman and proportional allocation of this population for a sample size n=600

ii) Compare the efficiency of these two allocation [10 marks]

Q4. a. Under what circumstances would you use a ratio estimate of a population total [2 marks]

- b. Assuming that a simple random sample of size n has been drawn from a population of size N , derive the bias of the ratio estimator of a population total and its variance [9 marks]
- c. A simple random of s village taken from 30 villages in a given area gave the following results from the number of households in each village(X) , the number of persons in each village (Y) and number of persons at a previous census(Z)

Village	Number of Households (x)	Number of persons in Survey (Y)	Number of persons in Census (z)
1	25	127	122
2	18	105	97
3	23	114	102
4	20	105	98
5	16	93	91

The total population in 30 villages at the census was 2815 . Using the ratio estimate c Calculate

- (i) Estimate of the population total
- (ii) 95% confidence limits for the estimate of population total [9 marks]

- Q5. a) Describe one method of selecting a two stage sample of 10 primary sampling units (Psu's) from a population of 30 (Psu's) each having 10 secondary units. Sampling should be with equal probability at each stage and without replacement. [5 marks]
- b) It is desired to estimate the population mean $\bar{Y}$ of some characteristics Y by taking a sample in two stages. First a random sample of size n of first stage units is taken from the N first stage units constituting stage unit selected containing M second units a sample of size m second stage units are taken. Derive
- (i) An estimate of the population mean and show that it is unbiased [6 marks]
- (iii) The variance of the estimator in(1) [9 marks]