KABARAK **UNIVERSITY**

EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF SCIENCE IN ECONOMICS AND MATHEMATICS

COURSE CODE: MATH 324

COURSE TITLE: SAMPLE SURVEYS

STREAM: Y3S2

DAY: WEDNESDAY

TIME: 2.00 – 4.00 P.M.

DATE: 25/03/2009

INSTRUCTIONS:

Answer questions **ONE** and any other **TWO** questions.

PLEASE TURN OVER

QUESTION ONE (30 MARKS)

a) Define the following terms;
   - i) Sample   **(2 marks)**
   - ii) Population characteristic   **(2 marks)**
   - **iii)** Sample units   **(2 marks)**

b) Briefly describe what you understand by a pilot survey   **(8 marks)**

c) By taking a random sample of size n from a population of size N using the SRSWR procedure, proof that the sample mean is an unbiased estimate of the population mean
        (6 marks)

d) Show that in stratified sampling $\overline{y}_w$ is unbiased estimate of $\overline{Y}$ **(6 marks)**

e) Show the relationship between Y and auxiliary variable X in ratio estimation **(4marks)**

QUESTION TWO (20 MARKS)

a) Under Simple random sampling without replacement show that

$$Var(\overline{y}) = \frac{N-n}{N}\frac{S^2}{n}$$
        (10 marks)

b) A simple random sample of students is poststratified into those who live at home and those who live on campus and the data recorded are the weekly expenditures on travel

	Number	Mean	S.D
Home	10	15.67	3.65
Campus	12	8.89	2.08

Estimate the population mean and variance given the extra information that there are 325 at home and 400 on campus and give a 95% confidence interval.   **(10 marks)**

QUESTION THREE(20 MARKS)

a) Show that the optimal allocation(Neyman) is $n_h \alpha N_h S_h$

b) A further sample of n=50 students is to drawn from the remaining population using stratified random sampling with optimal (Neyman) allocation based on the above S.D.s and stratum sizes from question 2(b).
   - (i) How many home based students would you sample
   - (ii) What is the (estimate of the) achieved variance of your unbiased estimator $\bar{y}_{st}$ based on this sample

QUESTION FOUR (20 MARKS)

a) Give the formulae with the usual notation for
   - i) The ratio estimator of the population mean $\bar{Y}$. Is it unbiased under SRS (**1marks**)
   - **ii)** The variance of this estimator under SRS. Is this formula Exact (**2 marks**)
   - **iii)** An approximately unbiased estimator of this variance (**2 marks**)

b) A simple random sample of 4 households gave the following data

Number of voters(X)	2	1	3	4
No. supporting Tioko(Y)	1	1	3	0

Given that there are 10000 households with 22000 voters in the constituency, and the sample moments are $s_X{}^2 = 1.\dot{6}$, $s_Y{}^2 = 1.58\dot{3}$ $s_{XY} = -0.1\dot{6}$, find an estimate for the proportion of voters R supporting Tioko , giving the corresponding variance estimate in each case
   - i) based on ratio estimator (**2 marks**)
   - ii) based on the unbiased estimator $\dfrac{\bar{y}}{\bar{x}}$ (**3 marks**)
   - iii) based on an unbiased estimator if the sample had been selected by PPS(with replacement) rather than by SRS (**5 marks**)
   - **iv)** based on the proportion if the 10 voters in the sample had been selected at random, rather than by households (**5 marks**)

QUESTION FIVE (20 MARKS)

a) Describe clearly how double sampling is carried out (**5 marks**)

b) Under double sampling, $\bar{y}_{st} = \sum_{h=1}^{H} W_h \bar{y}_h$ is unbiased estimator of $\bar{Y}$ (**7 marks**)

c) Explain clearly the use of random numbers and lottery methods in drawing samples from a population (**8 marks**)