KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2009/2010

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF MASTER OF SCIENCE

SMA 564: SAMPLE SURVEYS

DATE: **Friday 9th April 2010** **TIME: 9.00a.m – 12.00p.m**

INSTRUCTIONS:

ANSWER ANY THREE QUESTIONS

Q1. a) Discuss with examples the circumstances which lead to sampling with varying inclusion probabilities.

b) i) Define the Horvitz-Thompson estimator of the population mean $\bar{y}$ and derive its variance.

ii) Give two unbiased estimators of the variance of the Horvitz-Thompson estimator and give condition of their validity.

c) Show that the Horvitz-Thompson estimator is the best unbiased estimator in the class of estimators of the form.

$$Ts = \sum_{iex} B_i \, y_i$$

where B_i is a coefficient associated with observation Y_i, ies.

d) Describe Midzuno's sample selection technique and derive the first order inclusion probability.

Q2. a) Describe the variance estimation method

i) Using independent random groups

ii) Dependent random groups

b) Describe the balance-half sample techniques in variance estimation.

c) Suppose there are three strata where the following observations have been made.

St 1 (5, 2) Stv 2 (8, 12) Stv 3 (1, 7) each stration is of size 25.

Assuming simple random sampling without replacement was applied in selecting the samples,

i) Obtain all possible half samples.

ii) Estimate from the sample the population total

iii) Estimate the variance of the estimator of population total.

Q3. a) i) Describe the concept of self-weighting in survey designs.

ii) Give two designs that achieve self weighing.

b) i) Describe the process of double sampling for stratification.

ii) Give the estimator of the population mean under (i) above, and derive its variance.

c) In repeated sampling, describe the composite estimator and derive its variance.

Q4. a) Describe the various types of non-response.

b) i) Suppose a simple random sample of size n is selected without replacement and r units responded while m $(v + m = n)$ did not. Derive the bias under a fixed population model.

ii) Derive the bias in (i) under population weighted estimation.

c) Define sample weighing estimation and give the sample weighted estimation.

Q5. a) Briefly describe

i) Panel (Longitudinal) survey designs.

ii) Repeated cross-section survey designs.

b) Simple random samples of size n each are selected on two occasions with a common subsample of size m. Let $\bar{y}_1$ $\bar{y}_2$ be the sample means for the two occasions respectively. Assume that population variance $s_1^2 = s_2^2 = s^2$. Assuming a positive correlation between observations on the same subject between the occasions obtain

$$V\left(\frac{\bar{y}^1 + \bar{y}^2}{2}\right) \text{ and } V\left(\bar{y}_1 - \bar{y}_2\right)$$

and give the optimal conditions for the variance in relation to the common sample.

c) Describe Brewers sample selection method.

END.