

B. Sc. Examination by course unit 2010

MTH 5119 Sampling, Surveys and Simulation

Duration: 40 minutes

Date and time: Nov 12th 2009, 1010–1050

Apart from this page, you are not permitted to read the contents of this question paper until instructed to do so by an invigilator.

You should attempt all questions. Marks awarded are shown next to the questions.

Statistical functions provided by the calculator may be used provided that you state clearly where you have used them.

Question 1 State Theorem 2.1 and the key step in its proof. [10]

Question 2 Use Waterman's algorithm to draw a SRS of size $n = 6$ from a population size $N = 9$ using the random string 48332507912... as economically as possible. [10]

Question 3 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 given the extra information that there are 325 living at home and 400 on campus, giving an appropriate variance estimate. [10]

Question 4 A simple random sample size $n = 5$ was taken from a very large population of small businesses to estimate the population mean (R) number of hours overtime worked per employee. The sample data gave the the following (raw) sums where y_i is the total hours overtime and m_i is the number of employees for the i^{th} small business:

$$\sum y_i = 50, \quad \sum m_i = 10, \quad \sum y_i^2 = 634, \quad \sum m_i^2 = 26, \quad \sum m_i y_i = 127.$$

Calculate the ratio estimate and an appropriate estimate of its variance given that the population mean number of employees per business is 2. [10]

End of Paper