



B. Sc. Examination by course unit 2010

**MTH 5119 Sampling, Surveys and Simulation:
Coursework 3**

Date and time: October 30th, 12noon

Hand in (GREEN box, ground floor) by 1145 Friday 6th November. Solutions to aid revision will appear on the web shortly afterwards. Feedback will be given to partial, but not blank, attempts. This counts 4% of the overall assessment (answers correct to 4 significant figures please).

Question 1 (a) Find the optimal allocation under StRS for a population with 3 strata as follows (with the usual notation) if the budget is £3000 (overheads of £500):

h	N_h	S_h	c_h
1	300	30	25
2	500	40	49
3	200	20	36

Find also the achieved variance. [8]

(b) There are TWO allocations which are nearly proportional for the same sample size. Compare their variances with those in (a). [4]

(c) If we wish to achieve a lower variance of 15 say, what is now the optimal allocation and what is the actual overall cost? (HINT: substitute back into the variance equation, not the cost equation, to get the overall sample size) [4]

Question 2 Examine whether it is better (in terms of precision) to use the sample mean or the poststratified estimator with your observed SRS of size 4 for estimating the overall population mean of the TEXTS population (see the last two courseworks). (Give both estimators and their estimated variances) [12]

Question 3 In Lab 4,

(a) Compare the *exact* variances for the three estimators so far with SRS and $n = 4$. [5]

(b) Compare the % coverages. [5]

(c) The bias of the ratio estimator looks small for each sample size (3,4,6,8) but the *relative bias*=bias/s.d. is more important, particularly if it is more than 10%. Comment on the relative bias for these sample sizes. [6]

(d) Show the bias in the variance estimator (for the ratio estimator) for sample sizes 3,4,6, and 8 and comment. [6]

End of Paper