STA304/1003 H1F - Summer 2014:
Surveys, Sampling, and Observational Data

Supplementary Exercises # 4

1. Briefly explain 4 different reasons why we use ratio estimation and give a specific example for each.

2. Explain why we estimate $\bar{x}_U$ with $\bar{x}$ in the ratio estimator even though we assume that we know the population quantities for x.

3. If we have an auxiliary variable x and a response variable y, in which case is ratio estimation most appropriate to use (as opposed to regression estimation or SRS)?

4. In a small town, a pilot survey of 21 households gave the following data: number of household members (y_1), number of primary school children (y_2), number of cars (y_3), number of television sets (y_4).

y_1	y_2	y_3	y_4
5	3	1	3
2	0	0	1
6	1	2	3
2	0	1	1
3	1	1	1
4	2	1	1
4	1	3	2
2	0	2	2
4	2	1	1
4	2	1	1
6	4	2	1
3	1	1	2
6	4	1	1
3	1	2	3
2	0	2	1
3	0	2	2
4	2	1	1
4	2	1	1
5	2	2	2
5	1	1	1
3	1	2	1

The local school records show that there are 7,526 children registered in primary school.

(a) Approximate the total number of households in the town.

(b) Approximate the total number of people in the town.

(c) Approximate the total number of television sets per household in the town.

(d) Approximate the total number of cars in the town.

(e) Approximate the total number of households in the town that have primary school children.

(f) Approximate the MSE for the total number of cars in the town.

(g) Suppose you are now given the information that there are 6342 households in the town. Use this information to:

i) Give an SRS estimate for the total number of cars in town

ii) Approximate the variance of the estimate from part i)

iii) Compare the MSE of the ratio estimator and SRS estimator for the total number of cars.

iv) Which estimator (ratio or SRS) for the total number of cars would you use and why? (Hint: Use CV)