

Q3-Part 1. (9 marks):

First, we conduct a simple random sampling of $n = 30$ households among N (sample S), and we survey all the individuals from each of the n households selected.

- (a) (1 mark) What do we call this type of sampling?

- (b) (2 marks) What are the selection probabilities of the households, and what are the selection probabilities of the individuals?

- (c) (3 marks) Let τ be the total number of men in the population.
 - (i) Give an unbiased estimate $\hat{\tau}$ of τ .

 - (ii) Estimate the variance of that estimator.

- (d) (3 marks) For this question, we are trying to estimate the total using a ‘ratio by size’ expression.
 - (i) Give ratio-type estimate $\hat{\tau}_r$ of τ .

 - (ii) Estimate the variance of that estimator.