Survey Sampling
Statistics 4234/5234 — Fall 2018

Assignment 6

Reading:

By Thursday, November 8, read Chapters 1 through 6 of *Sampling: Design and Analysis, second edition*; by Sharon L. Lohr.

Homework 6:

The following problems are due in class on Tuesday, November 13. Homework can also be submitted to the course mailbox in Room 904 SSW by 5:00pm on Wednesday, November 14.

1. A shipment of 100 boxes of frozen food (each box contains 8 separate packages of food) was allowed to thaw during transit. The shipper was worried that some of the boxes could be spoiled. So he took a random sample of 5 boxes and checked all the packages in each box: In 2 of the boxes there were 3 spoiled packages, in one of the boxes there were 2 spoiled packages, and in 2 of the boxes there were no spoiled packages.

   (a) Estimate the total number of spoiled packages in the entire shipment, and give a standard error for your estimate.

   (b) Suppose instead that the sampling plan took a simple random sample of size 40 from the population of 800 packages, and 8 spoiled packages were found in the sample. Under this sampling plan estimate the total number of spoiled packages in the shipment, and give a standard error.

2. Consider a population consisting of 20 clusters with a total population size of 940. Suppose we have a simple random sample of four of the clusters from the population which resulted in the following data.

cluster id	cluster size	sample size	sample man	sample var
13	17	10	32.7	26.3
7	56	25	36.1	21.4
3	23	12	30.3	23.6
4	64	30	33.4	29.1

   Estimate the poulation mean and give a standard error for your estimate.

3. A town has four supermarkets, ranging in size from 110 square meters (m^2) to 1265 m^2. We want to estimate the total amount of sales in the four stores for last month by sampling just two of the stores.

Store	Size (in m^2)	Sales (in \$1000s)
A	110	44
B	265	82
C	360	112
D	1265	362
Total	2000	600

Compare unequal-probability sampling with replacement to simple random sampling without replacement:

(a) Suppose we will select two stores with replacement, using ψ_i's proportional to store size. Find $E[\hat{t}_\psi]$ and $V[\hat{t}_\psi]$.

(b) Find $E[\hat{t}_{\text{SRS}}]$ and $V[\hat{t}_{\text{SRS}}]$.