MH4511 Sampling & Survey

Tutorial 7 AY2025/26 Semester 1

Problem 7.1

An inspector samples cans from a truckload of canned creamed corn to estimate the total number of worm fragments in the truckload. The truck has 580 cases; each case contains 24 cans. The inspector samples 12 cases at random, and subsamples 3 can randomly from each selected case.

Case	1	2	3	4	5	6	7	8	9	10	11	12
Can 1	1	4	0	3	4	0	5	3	7	3	4	0
Can 2	5	2	1	6	9	7	5	0	3	1	7	0
Can 3	7	4	2	6	8	3	1	2	5	4	9	0

Estimate the total number of worm fragments, along with a 95% confidence interval.

Problem 7.2

To improve the telephone service, an executive of a certain company wants to estimate the number of phone calls placed by secretaries in the company during one day. The company has 20 departments. Each department employs some secretaries, and the number of calls made varies considerably from secretary to secretary. The executive decides to employ two-stage cluster sampling, using a small number of departments and selecting a fairly large number of secretaries from each. Five departments are sampled. The data are summarized in the following table.

Department (i)	Number of Secretaries	Number of Secretaries Sampled	Sample Mean $\bar{y}_i$	Sample Variance s_i^2
1	45	9	102	20
2	36	7	90	16
3	20	4	76	22
4	18	4	94	26
5	28	6	120	12

We also have s_r^2 = 182,000 and s_t^2 = 1,600,000.

a) What's the psu?
b) What's the ssu?
c) Using unbiased estimator, estimate the total number of phone calls and calculate the standard error for your estimate.
d) Using the ratio estimator, estimate the mean number of phone calls and calculate the standard error for your estimate.

Problem 7.3

The circulation manager of a newspaper wishes to estimate the average number of newspapers purchased per household in a given community. There are 4,000 households in 40 blocks. As the travel costs from household to household are substantial, the manager decides to take a simple random sample of 8 blocks and interview every household in the selected blocks, the survey is conducted, with the results as shown in the table below.

Block	1	2	3	4	5	6	7	8
Number of households	80	85	100	125	120	125	130	95
Average number of newspapers purchased	1.4	1.6	1.5	1.8	1.4	1.2	1.0	1.4

a) What are the primary and secondary units in this estimation project?
b) Based on the data given in the table, use a ratio estimator to provide a 95%confidence interval for the average number of newspapers purchased per household in the community.