

St.815 Assignment #1 Due: Friday, June 13, 2008

You should submit only your solutions to the following problems. You do not have to include the problem description given on this sheet.

1. (4pt) Occasionally, when an airline flight is not full, the flight attendants may have time to ask passengers to fill out a customer satisfaction survey questionnaire. (This has happened twice to me.)
 - (a) What is a major flaw with the validity of estimates generated from these customer satisfaction surveys?
 - (b) What type of bias would you expect to appear in the estimates – an over or underestimate of true customer satisfaction? Why?

2. The following figure contains the counts of the objects pictured in Figure 2.3 on page 27 in the Thompson’s (2002) text *Sampling*.

10	10	11	10	15	14	11	5	10	14
(9)	10	11	5	9	15	8	14	14	11
11	(16)	11	8	14	15	12	4	10	7
5	16	13	14	15	8	(7)	12	13	(4)
12	10	11	14	6	(8)	10	9	13	9
13	10	14	7	15	6	10	14	17	11
10	11	16	12	7	11	13	9	(6)	11
9	11	(13)	10	7	12	8	7	(5)	15
8	6	10	7	14	12	9	14	13	16
8	12	9	(13)	10	12	7	18	(8)	10

- (a) (2pt) A simple random sample of $n = 10$ units was selected from the population. The sampled units appear in (). Using this sample, calculate $\hat{\tau}$ and $\widehat{\text{var}}(\hat{\tau})$.
- (b) (.5pt) Select a new sample of size $n = 10$. Circle your sampled units in the figure below.

10	10	11	10	15	14	11	5	10	14
9	10	11	5	9	15	8	14	14	11
11	16	11	8	14	15	12	4	10	7
5	16	13	14	15	8	7	12	13	4
12	10	11	14	6	8	10	9	13	9
13	10	14	7	15	6	10	14	17	11
10	11	16	12	7	11	13	9	6	11
9	11	13	10	7	12	8	7	5	15
8	6	10	7	14	12	9	14	13	16
8	12	9	13	10	12	7	18	8	10

- (c) (2pt) Using this new sample, calculate $\hat{\tau}$ and $\widehat{\text{var}}(\hat{\tau})$.
- (d) (.5pt) How many possible samples of size $n = 10$ are there?
- (e) (.5pt) What is the probability of selecting the sample you selected?
- (f) (.5pt) For any unit in the population, what is the probability that it is included in a sample of size $n = 10$?

3. Suppose a population has $N = 5$ units, and the units are labeled $i = 1, 2, 3, 4, 5$. The y_i values are 3, 1, 0, 1, 5.
- (2.5pt) What are the values of the population parameters τ , μ , and σ^2 ?
 - (2pt) List every possible simple random sample without replacement of size $n = 3$.
 - (4pt) For each sample of size $n = 3$, calculate $\hat{\tau}$ and $\hat{\sigma}^2$.
 - (1.5pt) Show that $\hat{\tau}$ and $\hat{\sigma}^2$ are unbiased estimators for τ and σ^2 .
 - (1.5pt) Determine if the sample median m is an unbiased estimator for the population median.
4. In a library, the books are kept on $N = 150$ shelves of similar size. The number of books from a SRS of $n = 15$ shelves were found to be

28 23 25 33 31 18 22 29 30 22 26 20 21 28 30.

Let μ be the mean number of books per shelf and let τ be the total number of books on the 150 shelves.

- (1pt) Calculate $\hat{\mu}$ and $\hat{\tau}$.
- (1.5pt) Calculate the standard errors of $\hat{\mu}$ and $\hat{\tau}$.
- (1pt) Calculate a two-sided 95% confidence interval for μ .
- (1pt) Calculate a two-sided 95% confidence interval for τ .
- (.5pt) Interpret this two-sided confidence interval for τ as it pertains to the library.
- (1pt) Calculate an upper one-sided 95% confidence interval for τ .
- (.5pt) Interpret this one-sided confidence interval for τ as it pertains to the library.