HW10 - Sampling Distributions

Stat 131A, Fall 2018

Due Nov-05

1) A university has 25000 students, of whom 10000 are older than 25. The registrar draws a simple random sample of 400 students.

a. Find the expected value for the proportion of students in the sample who are older than 25.

b. Using the finite population correction (f), find the SE for the proportion of students in the sample who are older than 25.

c. The percentage of students in the sample who are older than 25 will be around _____, give or take _____ or so.

2) According to the official M&M website, 24% of the plain milk chocolate M&M's produced by Mars Corporation are blue. Annie buys a large family-size bag of M&M's. Sarah buys a small fun-size bag. Which bag is more likely to have more than 40% blue M&M's?

a. Annie, because there are more M&M's in her bag, so she will have more blue ones.

b. Annie, because there is more variability in the proportion of blues among larger samples.

c. Sarah, because there is more variability in the proportion of blues among smaller samples.

d. Both have the same chance because they are both random samples.

3) During the 2008 presidential election, newspapers reported that Obama received 40% of the white male vote. If this is true, what is the probability that a random sample of 1,000 white male voters had less than 35% voting for Obama?

4) Recall the use of data from the National Health Survey to estimate behaviors such as alcohol consumption, cigarette smoking, and hours of sleep for all U.S. adults. In the 2005-2007 report, they estimated that 30% of all current smokers started smoking before the age of 16.

Suppose that we randomly select 100 U.S. adults who are smokers and find that 25% of this sample started smoking before the age of 16. Is this much error surprising? Find the

probability that a sample proportion will over or underestimate the parameter by more than 5%.

5) In a certain town, there are 30000 registered voters, of whom 12000 are Democrats. A survey organization is about to take a simple random sample of 1000 registered voters.

a. The expected value for the proportion of Democrats in the sample is: _____

b. The standard error for the proportion of Democrats in the sample is: _____

c. Find the chance that between 39% and 41% of the registered voters in the sample are Democrats.

6) The popular candy Skittles comes in five colors. According to the Skittles website, the five colors are evenly distributed in the population of Skittle candies, so each color makes up 20% of the population.

Suppose we purchase a large bag of Skittles. Assume that this size bag always has 100 candies. In this particular bag 30 are green. 30 out of 100 is 30%. Is this a surprising result? Choose an option, and explain.

a. Yes, this is surprising. Random samples with this much error are unusual.

b. Yes, this is surprising. We expect to see that 20% of candies are green.

c. No, this is not surprising. This is about one and a half standard errors above 20%.

d. No, this is not surprising. We expect random samples to vary.

7) A university has 30,000 registered students. As part of a survey, 900 of these students are chosen at random. The average age of the sample students turns out to be 22.3 years, and the SD is 4.5 years.

a. The average age of all 30,000 students is estimated as _____. This estimate is likely to be off by _____ or so. *(Use correction factor "f").*

8) Two hundred draws are made at random with replacement from `[1 2 2 3]`. True or False, and explain.

a. The expected value for the average of the draws is exactly 2.

b. The expected value for the average of the draws is around 2, give or take 0.05 or so.

c. The average of the draws will be around 2, give or take 0.05 or so.

d. The average of the draws will be exactly 2.

e. The average of the box is exactly 2.

f. The average of the box is around 2, give or take 0.05 or so.

9) Five hundred draws are made at random with replacement from a box with thousands of tickets (i.e. ignore population correction factor). The average of the box is unknown. However, the average of the draws was 71.3, and their SD was about 2.3. True or False, and explain:

a. The 71.3 estimates the average of the box, but is likely to be off by 0.1 or so.

b. About 68% if the tickets in the box are in the range 71.3 ± 0.1.

10) Suppose that a city manager wants to know the average income of the 25,000 families living in his town. He hires a survey organization to take a simple random sample of 1000 families. The total income of the 1000 sample families turns out to be \$62,396,714.

a. Find the estimate of the average income for all 25,000 families.

b. Knowing that the SD of the income for the 1000 families turns out to be \$53,000, find the SE of the average income for all 25,000 families. Use the finite population correction factor.

c. True or False. About 68% of the families in the sample have incomes between \$9,396.71 and \$115,396.7.

d. True or False. About 68% of all the families in the city have incomes between \$60,754.57 and \$64,038.85.