STAT 215: HW4 (DUE 9/26/17)

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1. The figure below contains sample proportions of one value of a binary response variable based on many random samples of size $n = 35$ from a population.

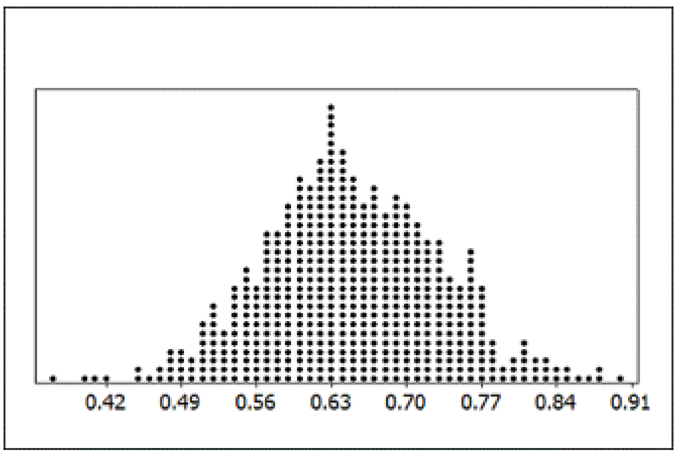

Figure 1. Sample Proportions from Samples of Size $n = 35$

(a) What is the "case" corresponding to one dot on the sampling distribution? What does the value of the dot represent?

(b) Estimate the standard error of the proportions and describe in a sentence what it tells us.

(c) If samples of size $n = 70$ had been used instead of $n = 35$, which of the following would be true?

(A) The sample statistics would be centered at a larger proportion.

(B) The sample statistics would be centered at roughly the same proportion.

(C) The sample statistics would be centered at a smaller proportion.

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(d) If samples of size $n = 70$ had been used instead of $n = 35$, which of the following would be true?

(A) The sample statistics would have more variability.

(B) The variability in the sample statistics would be about the same.

(C) The sample statistics would have less variability.

2. When getting voters to support a candidate in an election, is there a difference between a recorded phone call from the candidate or a flyer about the candidate sent through the mail? A sample of 500 voters is randomly divided into two groups of 250 each, with one group getting the phone call and one group getting the flyer. The voters are then contacted to see if they plan to vote for the candidate in question. We wish to see if there is evidence that the proportions of support are different between the two methods of campaigning.

(a) Define the relevant parameter(s) and state the null and alternative hypotheses.

(b) Possible sample results are shown in the following table. Compute the two sample proportions: $\hat{p}_c$, the proportion of voters getting the phone call who say they will vote for the candidate, and $\hat{p}_f$, the proportion of voters getting the flyer who say they will vote for the candidate. What is the difference in the success rates for phone calls vs. flyers? Can we conclude from this difference alone that phone calls are more effective? Why or why not?

Sample A	Will Vote for Candidate	Will Not Vote for Candidate
Phone Call	152	98
Flyer	145	105

(c) Suppose 5000 voters, rather than 500 voters, were sampled, yielding the following counts. Note that the proportions are the same as in the first table. Which of the two samples (this one or the first one) seems to offer stronger evidence of a difference in effectiveness between the two campaign methods? Explain your reasoning.

Sample A	Will Vote for Candidate	Will Not Vote for Candidate
Phone Call	1520	980
Flyer	1450	1050

3. If a restaurant chain finds significant evidence that the mean arsenic in chicken level is above 80, the chain will stop using that supplier of chicken meat. The hypotheses are

$$H_0 : \mu = 80 \qquad H_1 : \mu > 80$$

where μ represents the mean arsenic level in all chicken meat from that supplier. Samples from two different suppliers are analyzed, and the resulting P-values are given:

Sample from Supplier A: P-value is 0.0003
Sample from Supplier B: P-value is 0.3500

(a) Interpret each P-value as a probability of something, assuming something else. Be precise and indicate when you are talking about a sample vs. a population.

(b) Which P-value shows stronger evidence for the alternative hypothesis? What does this mean in terms of arsenic and chicken?

(c) Which supplier, A or B, should the chain get chickens from in order to avoid too high a level of arsenic? If you do not have enough information, what else would you need to know?

4. Explain why the area in the tail of a randomization distribution is used to compute a P-value.

5. The Centers for Disease Control and Prevention (CDC) conducted a randomized trial in South Africa designed to test the effectiveness of an inexpensive wipe to be used during childbirth to prevent infections. Half of the mothers were randomly assigned to have their birth canal wiped with a wipe treated with a drug called chlorohexidine before giving birth, and the other half to get wiped with a sterile wipe (a placebo). The response variable is whether or not the newborns develop an infection. The CDC hopes to find out whether there is evidence that babies delivered by the women getting the treated wipe are less likely to develop an infection.

(a) If the results are statistically significant, what would that imply about the wipes and infections?

(b) If the results are not statistically significant, what would that imply about the wipes and infections?

(c) What does it mean (in context) to make a Type I error in this situation?

(d) What does it mean (in context) to make a Type II error in this situation?

(e) In which of the following two situations should we select a smaller significance level:

- The drug chlorohexidine is very safe and known to have very few side effects.
- The drug chlorohexidine is relatively new and may have potentially harmful side effects for the mother and newborn child.

(f) The P-value for the data in this study is 0.32. What is the conclusion of the test?

(g) Does this conclusion mean that the treated wipes do not help prevent infections? Explain.

6. A random sample of $n = 755$ US cell phone users age 18 and older in May 2011 found that the average number of text messages sent or received per day is 41.5 messages with standard error about 6.1.

(a) State the population and parameter of interest. Use the information from the sample to give an estimate of the population parameter.

(b) Find and interpret a 95% confidence interval for the mean number of text messages. Be precise, be clear when referring to the sample vs. population, and put your interpretation in the context of real quantities.

7. Bisphenol A (BPA) is in the lining of most canned goods, and recent studies have shown a positive association between BPA exposure and behavior and health problems. How much does canned soup consumption increase urinary BPA concentration? That was the question addressed in a recent study in which consumption of canned soup over five days was associated with a more than 1000% increase in urinary BPA. In the study, 75 participants ate either canned soup or fresh soup for lunch for five days. On the fifth day, urinary BPA levels were measured. After a two-day break, the participants switched groups and repeated the process. The difference in BPA levels between the two treatments was measured for each participant. The study reports that a 95% confidence interval for the difference in means (canned minus fresh) is 19.6 to 25.5 $\mu g/L$.

(a) What parameter are we estimating?

(b) Interpret the confidence interval in terms of BPA concentrations.

(c) If the study had included 500 participants instead of 75, would you expect the confidence interval to be wider or narrower? Why?