Chapter 12.2 Homework
ALL FULL PROCESSES!

1) In a consumer taste test, a random sample of 100 regular Pepsi drinkers are given blind taste of Coke and Pepsi; 48 of these subjects **preferred Coke**. ← so 52 preferred Pepsi !!!

   a. a. Give a 90% confidence interval for the percent of consumers **who still prefer Pepsi.**

   p = the true proportion of regular Pepsi drinkers **who prefer Pepsi** when given a blind taste of Coke and Pepsi

   1 sample z interval for proportions (90% Confidence Level)

   Conditions/Assumptions

   1) The problem stated that this was a random sample

   2) n$\hat{p}$≥10 n$(1-\hat{p})$≥10

   (100)(.52) ≥10 (100) (1-.52) ≥10

   52 ≥10 48 ≥10

   The condition for Normality is met (we have at least 10 successes and failures)

   3) Because the experimenters sampled without replacement, assume that there are at least 10(100) Pepsi drinkers in the population. Also assume that the preference of each subject was independent of other subjects.

   CI = $\hat{p} \pm z * \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = .52 \pm 1.645\sqrt{\frac{.52(1-.52)}{100}}$ = (.43782, .60218)

   We are 90% Confident that the true proportion of regular Pepsi drinkers who prefer Pepsi when given a blind taste of Coke and Pepsi is between .43782 and .60218.

   b. At the 10% level of significance, write a pair of hypotheses and then use your confidence interval to test the claim that ~~Coke~~ **PEPSI** is preferred by 50% of Pepsi drinkers who participate in such blind taste tests.

   $H_0: p = 0.50$

   $H_A: p \neq 0.50$

   Because 0.50 is included in our interval, we fail to reject the null hypothesis. We do not have evidence that the true proportion of Pepsi drinkers who prefer Pepsi is not 0.50.

   c. How large a sample would be needed to reduce the margin of error for part "a" to 1%?

   $1.645\sqrt{\frac{.52(1-.52)}{n}}$ ≤ 0.01 n = 6755 subjects

2) According to the article “Which Adults Do Underage Youth Ask for Cigarettes?” 43.6% of the 149 18-to-19 year olds in a random sample have been asked to buy cigarettes for an underage smoker. Is there convincing evidence that an underage smoker has approached fewer than half of 18- to 19-year olds to buy cigarettes?

p = the true proportion of all 18-19 year olds who have been asked to buy cigarettes for an underage smoker.

$H_0: p = 0.30$
$H_A: p < 0.30$

1 sample z test for proportions α=0.5

Conditions/Assumptions
1) The problem stated that this was a random sample

2)	np_0≥10	n$(1 - p_0)$≥10
	(149)(.30) ≥10	(149) (1-.30) ≥10
	44.7 ≥10	44.7 ≥10

The condition for Normality is met (we expect at least 10 successes and failures)

3) Because the subjects were sampled without replacement, assume that there are at least 10(149)= 1490 18-19 year olds in the population. Also assume that the answer of each subject to the given question was independent of other subjects’ answers.

$z = \frac{\hat{p}-p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} = \frac{.436-0.3}{\sqrt{\frac{0.3(1-0.3)}{149}}}$ = 3.62 p-value = 0.00015 **don’t forget your sketch!**

Because our p-value of 0.00015 is less than our significance level of 0.05 we can reject our null hypothesis. We have statistically significant evidence that the true proportion of all 18-19 year olds who have been asked to buy cigarettes for an underage smoker is greater than 0.3.

3) Mrs. Skaff is running against Ryker for President of the United States. Data from an exit poll shows 53% of voters voting for Mrs. Skaff. The exit poll asked a total of 1,500 voter. Pretend the electoral college does not exist and a candidate only needs a simple majority to win the presidency. Do we have evidence at the 5% level of significance that Mrs. Skaff is going to be the next president of the United States?

p = the true proportion of all voters who voted for Mrs. Skaff

$H_0: p = 0.50$
$H_A: p > 0.50$

1 sample z test for proportions α=0.5

Conditions/Assumptions

1) Assume that the sample was an SRS. (exit polling actually uses systematic random sampling but it's all good)

2) $np_0 \geq 10$ $n(1-p_0) \geq 10$

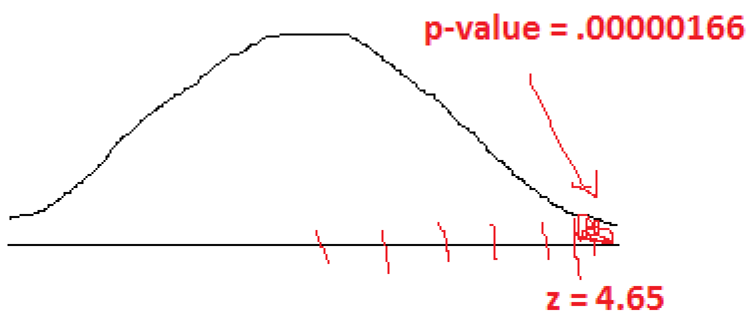
$(1500)(.5) \geq 10$ $(1500)(1-.5) \geq 10$

$750 \geq 10$ $750 \geq 10$

The condition for Normality is met (we expect at least 10 successes and failures)

3) Because the subjects were sampled without replacement, assume that there are at least 10(1500)= 15000 voters in the population. Also assume that the voting choice of each subject was independent of the others.

$$z = \frac{\hat{p}-p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} = \frac{.53-0.5}{\sqrt{\frac{0.5(1-0.5)}{1500}}} = 4.65$$



Because our p-value of 0.00000166 is less than our significance level of 0.05, we can reject our null hypothesis. We have strong evidence that the true proportion of all voters who voted for Mrs. Skaff is greater than 50% (we have evidence that she will be elected).

4) Mrs. Skaff believes that chin-ups are much easier than pull-ups. To test her claim, she decides to take her students out on two different days, have them complete chin-ups and pull-ups, and then compare the differences in their totals. She has a total of 62 students.
   a. Describe how randomization should play a role in her study design.
   b. Describe another way that Mrs. Skaff could have designed her experiment (still using matched-pairs!)
   c. Mrs. Skaff finds that the mean difference (#chin-ups – #pull-ups) is 2.5. The standard deviation of the differences is 5.104. Does she have evidence to support her claim?

5) Rachel has started a company manufacturing love potions. For quality control purposes, she routinely analyzes bottles from each batch of her potions to verify the concentration of the active ingredient. If

the concentration is too high, the product results in unhealthy obsession. If the concentration is too low, the product does not work. The ingredient should be present at a concentration of 0.79 grams per liter. The distribution of the concentrations is known to be Normal, with a standard deviation of 0.0068 grams per liter. Rachel test 10 random bottles of her potions from her most recent batch and gets the following concentrations:

0.82 0.83 0.80 0.82 0.79 0.81 0.71 0.72 0.88 0.76

Is there evidence that the concentration of the concentration of the active ingredient in this batch is not .79?