CIS MCTC Statistics **Ch. 9 Review** **Name** KEY

LT 9.A – *I can define the parameter and create hypotheses for a hypothesis test.*

1. Describe each alternative hypothesis as left-tailed, right-tailed, or two-tailed.

   a) H_a: $\mu < 477$ Left-tailed

   b) H_a: $p \neq .64$ Two-tailed

   c) H_a: Twix candy bars have a mean caloric content that is different than 250 calories.

   Two-tailed

   d) H_a: The majority of Washburn students know what the term "filibuster" means.

   Right-tailed

2. In a study of smokers who tried to quit smoking with nicotine patch therapy, 39 were smoking one year after the treatment, and 32 were not smoking one year after the treatment. We want to use a 0.05 significance level to test the claim that among smokers who try to quit with nicotine patch therapy, the majority are smoking a year after the treatment. Describe the population parameter, state the null and alternative hypotheses, and describe if it is left-tailed, right-tailed, or two-tailed. more than 50 %

   Population parameter: $p =$ proportion of all smokers who tried to quit with nicotine patch therapy who are smoking a year after the treatment.

   The null hypothesis: $p = 0.5$

   The alternative hypothesis: $p > 0.5$

   Tailed: Right-tailed

3. Medical students learning about the brain are trying to guess the average size of an adult brain. After one student guesses that that average volume is 1,126 cm^3, another student claims that the average volume is larger than 1,126. Describe the population parameter, state the null and alternative hypotheses, and describe if it is left-tailed, right-tailed, or two-tailed.

Parameter: μ = mean size of all adult brains

H_0: $\mu = 1126$

H_a: $\mu > 1126$

Tailed: Right-tailed

LT 9.B – *I can use a z-score and P-value to make a decision for a hypothesis test.*

4. The Food and Drug Administration claims that a pharmaceutical company is producing aspirin tablets with a mean amount of aspirin that is less than 350 milligrams. Hypotheses for this test are:
   H_0: $\mu = 350$
   H_a: $\mu < 350$
   State clearly the two possible conclusions in context that could be made.

   Reject H_0: We have evidence that the pharmaceutical company is producing aspirin tablets with a mean less than 350 milligrams.

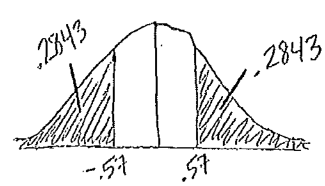
   Don't reject H_0: We don't have evidence that the mean is less than 350 mg.

5. In a study of smokers who tried to quit smoking with nicotine patch therapy, 39 were smoking one year after the treatment, and 32 were not smoking one year after the treatment. We want to use a 0.05 significance level to test the claim that among smokers who try to quit with nicotine patch therapy, the majority are smoking a year after the treatment. The P-value is calculated to be approximately 0.20 for this test. Use the P-value to make a decision about the null hypothesis and write a conclusion in terms of the alternative hypothesis.
   H_0: $p = 0.5$
   H_a: $p > 0.5$

   Because the P-value is not significant, we don't reject H_0. There is not evidence that the majority are smoking a year after the treatment.

6. A random sample of 40 new baseballs is obtained. Each ball is dropped onto a concrete surface, and the bounce heights have a mean of 92.67 inches with a standard deviation of 1.79 inches. Test the claim that the new baseballs have a mean bounce height that is different than the mean bounce height of 92.84 inches found for older baseballs. Calculate a P-value to make a decision about the null hypothesis and write a conclusion in terms of the alternative hypothesis.
   H_0: $\mu = 92.84$
   H_a: $\mu \neq 92.84$

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{92.67 - 92.84}{1.79/\sqrt{40}} \approx \frac{-.16}{.283} = -.57$$



$z = -.57 \rightarrow$ P-value $= 2(.2843) = .5686$

Because the P-value is not significant, we don't reject H_0. There is not evidence that the mean bounce height of all new baseballs is different than 92.84 in.

LT 9.C – *I can describe type I and type II errors in context.*

7. The Ohio Department of Health claims that the average stay in Ohio hospitals after childbirth is greater than the national mean of 2.0 days. Describe a type I and type II error in context based on the hypotheses:
   H_0: $\mu = 2.0$
   H_a: $\mu > 2.0$

Type I: We think the average stay in Ohio is more than 2 days, but it's really not more than 2 days.

Type II: We don't think the average stay in Ohio is more than 2 days, but it really is.

8. The manufacturer of a new model of hybrid car advertises that the mean fuel consumption is equal to 62 miles per gallon on the highway. A consumer group claims that the mean is different from 62 mpg. Describe a type I and type II error in context based on the hypotheses:
   H_0: $\mu = 62$
   H_a: $\mu \neq 62$

Type I: We think the mean fuel consumption is different from 62 mpg, but in fact it's not different.

Type II: We don't think the mean fuel consumption is different from 62 mpg, but it really is different.

9. In clinical tests of the drug Lipitor, patients were treated with the drug and researchers recorded how many experienced flu symptoms. Researchers are testing the claim that the percentage of treated patients with flu symptoms is less than the 2% rate for patients not given the drug. Following their sample, the P-value was calculated to be 0.18. Describe which error (type I or type II) could have been made using the P-value. Describe that error in context based on the hypotheses:
   H_0: $p = 0.02$
   H_a: $p < 0.02$

Since the P-value is not significant, we don't reject the null hypothesis. Therefore we could have made a type II error, where we don't think less than 2% of patients experienced flu symptoms, but the truth is that less than 2% of patients experienced flu symptoms.

LT 9.D – *I can carry out the entire four-step process for a hypothesis test.*

For each problem, carry out the complete four-step process for a hypothesis test (identify the parameter, state hypotheses, state sample data, calculate a z-score and P-value, and make a decision based on the P-value).

10. A company has developed a new AAA battery that is supposed to last longer than its regular AAA battery. Based on years of experience, the company knows that its regular AAA batteries last for 30 hours of continuous use on average with a standard deviation of 2 hours. The company selects a random sample of 50 new batteries and uses them continuously until they are completely drained. The batteries in this sample last an average of 30.48 hours. Is there evidence that the new batteries last longer than the regular batteries?

1) μ = mean lasting time of all new AAA batteries

$H_0: \mu = 30$

$H_a: \mu > 30$ Right-tailed

2) $n = 50$, $\bar{x} = 30.48$, $\sigma = 2$

3) $z = \dfrac{30.48 - 30}{2/\sqrt{50}} = 1.7 \xrightarrow{\text{Table}}$ P-value $= 1 - .9554 = .0446$

4) Because the P-value is significant, we reject H_0. There is strong evidence that the new AAA batteries last longer than the regular AAA batteries.

11. Some boxes of a certain brand of breakfast cereal include a voucher for a free DVD rental inside the box. The company that makes the cereal claims that a voucher can be found in 20 percent of the boxes. However, based on their experiences eating this cereal at home, a group of students believes that the proportion of boxes with vouchers is less than 0.2. This group of students purchased 65 boxes of the cereal to investigate the company's claim. The students found a total of 11 vouchers for free DVD rentals in the 65 boxes. Suppose it is reasonable to assume that the 65 boxes purchased by the students are a random sample of all boxes of this cereal. Based on this sample, is there support for the students' belief at the 5% level that the proportion of boxes with vouchers is less than 0.2?

1) p = proportion of all boxes of this cereal with a free DVD rental voucher.

$H_0: p = 0.2$ Left-tailed

$H_a: p < 0.2$

2) $n = 65$, $\hat{p} = \frac{11}{65} = .1692$

3) $z = \dfrac{.1692 - .2}{\sqrt{\dfrac{.2(1-.2)}{65}}} = -.62 \xrightarrow{\text{Table}}$ P-value $= .2676$

4) Because the P-value is not significant, we fail to reject H_0. There is not strong evidence that the proportion of boxes with free DVD vouchers is less than 0.2.