*YOUR TA’S NAME*:

*Lecture Worksheet*

*Tuesday 10/13/2020*

**MAIN POINTS OF LECTURE**

1. When we conduct hypothesis testing (or significance testing) we use sample data to test particular claims about the value of a population parameter
2. BEFORE THE BREAK: Hypothesis tests for proportions
3. Hypothesis tests involve two competing (mutually exclusive and exhaustive) hypotheses … usually called the “null” and the “alternative” hypotheses
	1. What these hypotheses are depends on the question at hand
	2. If we are asking whether a population value is higher/lower than a certain threshold, then we use a one-sided test
	3. If we are asking whether a population value is different from a certain threshold, then we use a two-sided test
4. **We always operate under the assumption that the null hypothesis is true in the population**
5. “Rejecting” and “failing to reject” the null are the only possible outcomes of a hypothesis test
6. Hypothesis testing involves six steps:
7. State the null (H0) and alternative (H1) hypotheses
8. Check that the sample data conform to basic assumptions; if they do not, then do not go any further. (For hypothesis tests about proportions: (1) The sample must have been randomly selected from the population and (2) np0 and n(1-p0) must both be at least 10, where p0 is the proportion we assume to be correct based on the null hypothesis)
9. Choose an  probability level … that is, a probability associated with incorrectly rejecting the null hypothesis
10. Determine the “critical value” … that is, how large the test statistic must be in order to reject the null hypothesis at the given a level … it can be helpful to re-write the hypotheses in terms of the critical values. (For hypothesis tests about proportions: These will be Z values)
11. Calculate the test statistic. For hypothesis tests about proportions: $Z=\frac{sample estimate-null value}{null s\tan(d)ard deviation}=\frac{\hat{p}-p\_{0}}{\sqrt{\frac{p\_{0}(1-p\_{0})}{N}}}$
12. Compare the test statistic to the critical value
	* If the test statistic is as large or larger than the critical value, then reject H0 (with probability of a of doing so even though H0 should not actually be rejected)
	* If the test statistic is less than the critical value, then do not reject H0 (with probability of b of doing so even though H0 should be rejected)
13. All hypothesis tests can lead to one of two types of errors:
14. Type I Error: Rejecting the null when it should not be rejected (probability that this happens = )
15. Type II Error: Failing to reject the null when it should be rejected (probability that this happens = )

**QUESTIONS**

1. [From the recorded lecture]:

Does the average dog weigh less than 20 pounds?

H0: m≥20 Ha: m<20

Do Americans typically have 3 credit cards?

H0: m=3 Ha: m≠3

Are more than 10% of women in abusive relationships?

H0: p≤0.10 Ha: p>0.10

Is it true that 5% of kids are in street gangs?

H0: p=0.05 Ha: p≠0.05

1. [From the recorded lecture]: I think that 5% of people in Minneapolis own RVs. To see whether this is true, I randomly sampled 2,310 people in Minneapolis and asked them whether they own an RV. I found that 110—or 4.76%—of the 2,310 people own RVs. Is this evidence sufficient to confidently (use a=0.01) conclude that the population proportion of people in Minneapolis who own RVs is different from 0.05?

Hypotheses: H0: p=0.05 H1: p≠0.05

Assumptions: N(p0)=2310(0.05)=115.5; N(1-p0)=2310(0.95)=2194.5

Confidence Level: a=0.01

Critical Value: 2.57 (Reject H0 if |Z| > 2.57)

Test Statistic: $Z=\frac{\hat{p}-p\_{0}}{\sqrt{\frac{p\_{0}(1-p\_{0})}{N}}}=\frac{0.0476-0.05}{\sqrt{\frac{0.05(1-0.05)}{2310}}}=\frac{-0.0024}{0.00453}=-0.53$

Conclusion: Fail to Reject H0

1. [From the recorded lecture]: I think the poverty rate is more than 20%. To see whether this is true, I randomly sampled 1,100 people and determined whether they were below the poverty line. I found that 242—or 22.0%—of the 1,100 people were poor. Is this evidence sufficient to confidently (use a=0.05) conclude that the population proportion of people who is poor is more than 0.20?

Hypotheses: H0: p≤0.2 H1: p>0.20

Assumptions: N(p0)=1100(0.2)=220; N(1-p0)=1100(0.8)=880

Confidence Level: a=0.05

Critical Value: 1.65 (Reject H0 if Z > 1.65)

Test Statistic: $Z=\frac{\hat{p}-p\_{0}}{\sqrt{\frac{p\_{0}(1-p\_{0})}{N}}}=\frac{0.22-0.20}{\sqrt{\frac{0.2(1-0.2)}{1100}}}=\frac{0.0200}{0.0121}=1.653$

Conclusion: Reject H0

1. [From the synchronous session]: In the synchronous lecture, we worked through an example of a hypothesis test about whether more than 90% of a college’s alumni got jobs right after graduation. What did we conclude?
	1. We rejected H0
	2. We failed to reject H0