Stat 204
Quiz 2 2/1/18 Name: ______________________

1. Here are some definitions from the first four sections of Chapter 1. For each definition, fill in the blank(s) with the word(s) being defined.

   (a) A **binary variable** has only two possible outcomes.

   (b) The **p-value** is the probability of obtaining a result at least as extreme as that observed if the **null hypothesis** is true.

   (c) For a random process, a **parameter** is a long-run numerical property of the process.

   (d) A result is **statistically significant** if it is unlikely to occur by random chance.

   (e) A **statistic** is a number computed from a sample.

2. If you spin a coin on a table, is it more likely to land tails up than when you flip it? To investigate this, you spin a penny 50 times on a table and it lands tails up 29 times.

   (a) What are the observational units?

   The 50 spins of the penny are the observational units.

   (b) What is the observed statistic?

   There are two possible answers: the observed statistic is either the ***number*** *of tails, 29, or the* ***proportion*** *of tails,* $\widehat{p} = \frac{29}{50} = 58\%$.

   (c) Using the correct notation, state the relevant null and alternative hypotheses.

   The null hypothesis is $H_0 : \pi = \frac{1}{2}$ *; the alternative hypothesis is* $H_a : \pi > \frac{1}{2}$.

   (d) Use the applet to conduct a simulation with 1000 repetitions. What is your estimate of the p-value?

   In my simulation, about 16% of the samples had a sample proportion of 58% or more; the p-value is approximately 0.16 = 16%.

(e) Use the summary stats from your simulation to compute the standardized statistic (z-score). Show your work!

> *My simulated sample proportions had a mean of 0.5 and an SD of 0.07, so*
>
> $$z = \frac{.58 - .50}{.07} = 1.14 .$$

(f) Based on this observed statistic, the approximate p-value, and the z-score, what is your conclusion?

> *We do not have strong evidence against H_0; the difference between the observed proportion, 58%, and the hypothesized proportion, 50%, could just be due to chance.*

3. Your friend claims that he can shoot free throws as well as an NBA player; you don't think he's that good. Your friend shoots 20 free throws and makes 12 of them; the NBA average for shooting free throws is 75%.

(a) What are the observational units?

> *The 20 free throws are the observational units.*

(b) What is the observed statistic?

> *There are two possible answers: the observed statistic is either the **number** of made shots, 12, or the **proportion** of made shots, $\widehat{p} = \frac{12}{20} = 60\%$.*

(c) Using the correct notation, state the relevant null and alternative hypotheses.

> *The null is $H_0 : \pi = 75\%$; the alternative is $H_a : \pi < 75\%$.*

(d) Use the applet to conduct a simulation with 1000 repetitions. What is your estimate of the p-value?

> *In my simulation, about 10% of the samples had a sample proportion of 60% or less; the p-value is approximately 0.1 = 10% .*

(e) Use the summary stats from your simulation to compute the standardized statistic (z-score). Show your work!

My simulated sample proportions had a mean of 0.752 and an SD of 0.098, so

$$z \;=\; \frac{.60 - .752}{.098} \;=\; -\,1.55\ .$$

(f) Based on this observed statistic, the approximate p-value, and the z-score, what is your conclusion?

We have weak evidence against H_0 *and weak support for the alternative hypothesis. You may be right about your friend, but don't bet your life savings on it!*