Stat 140 - Quiz 5

What's Your Name? _____

This is a sample quiz. On the real quiz, I will pick a different example of inference for a population proportion, and ask a subset of 5 or 6 of the questions below.

Garden Seeds

A garden center wants to store leftover packets of vegetable seeds for sale the following spring, but the center is concerned that the seeds may not germinate at the same rate a year later.

The manager randomly selects 200 seeds from a variety of 1-year-old seed packets from different companies and different batches of seeds, and plants them. She carefully prepares similar soil for the seeds in a greenhouse, and randomizes where the seeds are planted within the greenhouse. She finds that 171 of the 200 test seeds grew. The seed packets all claimed that 95% of the seeds would grow.

In answering the questions below, use the following output from R:

```
binom.test(x = 171, n = 200, p = 0.95)
```

```
##
##  Exact binomial test
##
## data:  171 and 200
## number of successes = 171, number of trials = 200, p-value =
## 2.948e-07
## alternative hypothesis: true probability of success is not equal to 0.95
## 95 percent confidence interval:
##  0.7984385 0.9006914
## sample estimates:
## probability of success
##                  0.855
```

1) Describe the population parameter in a sentence. What symbol would you use for the population parameter?

The population parameter is the proportion of 1-year-old seeds that will germinate or grow. We use the letter p to denote this population proportion.

2) Describe the sample statistic in a sentence. What symbol would you use for the sample statistic?

The sample statistic is the proportion of 1-year-old seeds in our sample that grow. We use $\hat{p}$ ("p-hat") to denote the sample statistic.

3) Is the number 171/200 = 0.855 a sample statistic or a population parameter?

This is a sample statistic since it summarizes the data in our sample.

4) Suppose the manager wants to conduct a hypothesis test of whether the old seeds germinate at the advertised rate. Write down the null and alternative hypotheses for this test.

Null hypothesis: $p = 0.95$

Alternative hypothesis: $p \neq 0.95$

5) Check the conditions for performing inference about the population parameter based on the sample data.

Representative: the seeds in our sample were randomly selected from the population, so the results should be representative of the population.

Independent: An assumption of independence seems plausible. There is no specific connection between the different seeds in the sample.

Count: We have recorded a count of how many seeds in our sample germinated.

6) Draw a conclusion for the hypothesis test at the $\alpha = 0.05$ significance level. Explain/justify your answer. You do not need to define or interpret the p-value as a part of this explanation.

From the R output above, the p-value for this hypothesis test is 2.948e-07. Since the p-value is less than $\alpha = 0.05$, we reject the null hypothesis. The data offer strong evidence that the proportion of 1-year-old seeds that germinate is different from 0.95.

7) State a 95% confidence interval in the context of this problem. You do not need to explain what the phrase "95% confident" means as part of your answer.

We are 95% confident that the proportion of 1-year-old seeds that grow is between 0.798 and 0.901.

8) In your answer to part 6, what does the phrase "95% confident" mean?

If we were to take many different samples of seed packets and use the data in each of those samples to calculate a different 95% confidence interval for the proportion of 1-year-old seeds that grow, about 95% of those different confidence intervals would contain the true proportion of 1-year-old seeds that grow.