MOD 19 HYPOTHESIS TEST FOR A POPULATION PROPORTION

Learning Goals

- Carry out a significance test
- Apply one-sample *z* test for a proportion
- Calculate two-sided tests
- In Mod 18, we met a virtual basketball player who claimed to make 80% of his free throw shots. We thought he might be exaggerating. In a SRS (what does this stand for?) of 50 shots, the player made only 32. His sample proportion of made free throws was therefore

p̂ =

This result is much lower than what he claimed. Does it provide *convincing* evidence against the players claim? To find out we need to perform a significance test of

 H_o : H_a : where p =

- 2) **<u>Review</u>**: What are the three conditions needed to construct a confidence interval for an unknown population proportion?
 - 1. 2. 3.

What do we use for a **confidence interval** to check for the normal condition?

3) <u>Checking the three conditions for a significance test.</u> The three conditions for a significance test is the same as the three conditions for a confidence interval with one slight difference in the normal condition. Match the following p's with their definitions.

Р	The Sample Mean for a Proportion
ŷ	The Population Mean for a Proportion
po	The Hypothesized Value for a proportion significance test

- a) What is the equation used to check the normal condition for a **confidence interval**? Make sure you use the correct *p*.
- b) What is the equation used to check the normal condition for a **significance test**? (Hint: Use the p we haven't used before)

c) Check the conditions for carrying out a significance test of the virtual basketball player's claim.

Random:

Normal:

Independent:

- 4) **<u>Calculating the test statistic</u>** In our SRS of 50 free throws our virtual player made 32.
 - a) Calculate the z statistic for this proportion

b) Find and interpret the *P*-value

Group- Work Activities:

Significance Tests: A Four-Step Process

<u>Step 1</u>: State the *claim* and its opposite. Identify which is the *null hypothesis* and which is the *alternative hypothesis*. Some statisticians (and OLI on Canvas) change the null hypothesis to "strictly equals" at this point.

<u>Step 2</u>: Determine *which hypothesis test* you will use and *check conditions*.

<u>Step 3</u>: If the conditions are met, perform the *calculations* and *conduct the test*.

<u>Step 4</u>: State the result and *interpret* your result in the *context* of the problem.

One-Sided Tests

1) **One Potato, Two Potato** A potato-chip producer has just received a truckload of potatoes from its main supplier. If the producer determines that more than 8% of the potatoes in the shipment have blemishes, the truck will be sent away to get another load from the supplier. A supervisor selects a random sample of 500 potatoes from the truck. An inspection reveals that 47 of the potatoes have blemishes. Carry out a significance test at the α = 0.10 significance level. What should the producer conclude?

<u>Step 1</u>: State the *claim* and its opposite. Identify which is the *null hypothesis* and which is the *alternative hypothesis*.

<u>Step 2</u>: Determine *which hypothesis test* you will use and *check conditions*.

<u>Step 3</u>: If the conditions are met, perform the *calculations* and *conduct the test*. (Hint: See Calculator Directions at the end of this activity.)

<u>Step 4</u>: State the result and *interpret* your result in the *context* of the problem.

2) Think about it. Suppose the supervisor from the above problem had inspected a random sample of 500 potatoes from the shipment and found 33 with blemishes. Would we still need to conduct a significance test? Why or why not?

Two-sided tests

Both the free-throw shooter and blemished potato examples involved one-sided tests. Let's look at a situation that requires a two-sided test.

3) Nonsmokers According to the Center for Disease Control (CDC) Website 50% of high school students have never smoked cigarettes. Jayden wonders whether this national result holds true in his large high school. For his statistics project, Jayden surveys an SRS (What does SRS stand for?) of 150 students from his school. He gets responses from all 150 students, and 90 say that they have never smoked a cigarette. What should Jayden conclude? Give appropriate evidence to support your answer.

<u>Step 1</u>: State the *claim* and its opposite. Identify which is the *null hypothesis* and which is the *alternative hypothesis*.

<u>Step 2</u>: Determine *which hypothesis test* you will use and *check conditions*.

<u>Step 3</u>: If the conditions are met, perform the *calculations* and *conduct the test*. (Hint: See Calculator Directions at the end of this activity.)

<u>Step 4</u>: State the result and *interpret* your result in the *context* of the problem.

Why did the potato chip producer chose a significance level of α = 0.10, but we opted for α = 0.05 in the nonsmokers example? (Hint: Look at type I and type II errors to see which would be worse)

MOD 19 GRAPHING CALCULATOR DIRECTIONS (ONE-PROPORTION Z TEST)

One-proportion z test

Press stat then choose TESTS and 5: 1-PropZTest

Enter the values for p_o , x, and n where x is the number of successes and n is number of trials. Both numbers must be whole numbers!

Specify the **alternative** hypothesis (≠, <, or >)

If you select the "calculate" choice and press ENTER you will see the test statistic *z* and the *P*-value.

If you select the "draw" choice and press ENTER you will see a bell-shaped curve with the proper part shaded along with the test statistic *z* and the *P*-value.