Chapter 19
TESTING HYPOTHESES ABOUT PROPORTIONS

HYPOTHESES

- An hypothesis is a claim or statement about an attribute of a population.
- The null hypothesis is the statement that there is nothing happening
  - Notation: \( H_0 \) = null hypothesis statement
- The alternative hypothesis is a statement that something is happening
  - Notation: \( H_a \) = alternative hypothesis statement

HYPOTHESIS TESTING

- In a one-tailed hypothesis test, the alternative hypothesis specifies a single direction
- In a two-tailed hypothesis test, the alternative hypothesis includes values in either direction from a specified standard
HYPOTHESIS TESTING

- When hypothesis testing, we are answering the question: “If the null hypothesis is true about the population, what is the probability of observing sample data like that observed?”
- Based on our answer, we either reject or fail to reject the null hypothesis.

A test statistic is a data summary that we use to evaluate the two hypotheses.

The P-value is computed by assuming the null hypothesis is true and then determining the probability of a result as extreme (or more extreme) as the observed test statistic in the direction of the alternative hypothesis.

The level of significance is the predetermined probability cutoff we use.
- Notation: \( \alpha = \) level of significance.

TESTING HYPOTHESES ABOUT A PROPORTION

- The three possible choices for hypotheses are:
  1. \( H_0: p = p_0, \ H_A: p \neq p_0 \)
  2. \( H_0: p \geq p_0, \ H_A: p < p_0 \)
  3. \( H_0: p \leq p_0, \ H_A: p > p_0 \)

- \( p_0 \) is the null value.
**ONE-PROPORTION Z-TEST**

- The conditions for the one-proportion z-test are the same as for the one proportion z-interval. We test the hypothesis $H_0: p = p_0$
  
  using the statistic $$z = \frac{\hat{p} - p_0}{SD(\hat{p})}$$

  where $SD(\hat{p}) = \sqrt{\frac{p_0(1-p_0)}{n}}$

- When the conditions are met and the null hypothesis is true, this statistic follows the standard Normal model, so we can use that model to obtain a $P$-value.