# Section 8.4 – z Test for a Proportion

## Assumptions for Testing a Proportion

1. The sample is a random sample.
2. The conditions for a binomial experiment are satisfied.
3. $n \cdot p \geq 5$ and $n \cdot q \geq 5$

$$\text{Test value: } z = \frac{\hat{p} - p}{\sqrt{pq/n}}$$

**Example 1:** Of U.S. residents traveling overseas, 47% were women and 53% were men. A random sample of 500 travelers on a large airline revealed that of those 500, 263 were women. Does this differ from the national percentage at the 0.05 level of significance?

1. Check if $np \geq 5$ and $nq \geq 5$    $[n=500 \qquad p=0.47 \qquad q=0.53]$   $np = 235$ ✓

   $nq = 265$ ✓

2. State the hypothesis.

   $H_0: p = 0.47 \qquad H_1: p \neq 0.47$ (two-Tail)

3. Find the critical value(s).

   CRIT. VALUES $= \pm 1.96$

   

   0.025      0.025

   -1.96      1.96
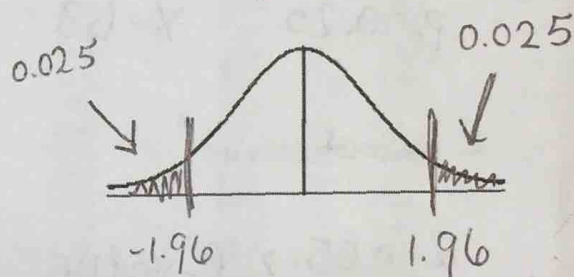
4. Compute the test value.   $\left[\hat{p} = \frac{263}{500} = 0.526\right]$

   $z = \dfrac{0.526 - 0.47}{\sqrt{(.47)(.53)/500}} = \underline{2.51}$

5. Make the decision.

   REJECT THE null hypothesis

6. Summarize the results.

   There's enough evidence to support the claim that the proportion of women traveling overseas differs from 47%.

P – VALUE METHOD FOR HYPOTHESIS TESTING

If P-value $\leq \alpha$, **reject** the null hypothesis.

If P-value $> \alpha$, **do not reject** the null hypothesis.

Example 8-20 (p. 440): An attorney claims that more than 25% of all lawyers advertise. A sample of 200 lawyers in a certain city showed that 63 had used some form of advertising. At $\alpha = 0.05$, is there enough evidence to support the attorney's claim? Use the $P$ – value method.

1. Check if $np \geq 5$ and $nq \geq 5$

$$(200)(.25) = 50 \qquad (200)(.75) = 150$$

2. State the hypothesis.

$$H_0 : p = 0.25 \qquad \left( H_1 : p > 0.25 \right) \quad \checkmark \text{ Claim}$$

3. Find the $P$ – value. $\left[ \text{USE } 1\text{- Prop Z TEST in CALC} \right]$

$$P_0 = 0.25 \qquad X = 63 \qquad n = 200 \qquad p > P_0$$

AREA = P-value
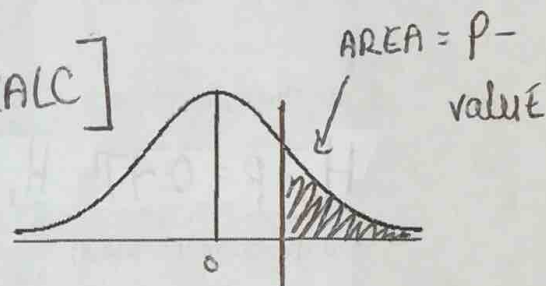
P-value $= 0.017$

4. Make the decision.

$$\alpha = 0.05 > P\text{-value}$$

REJECT THE null hypothesis

5. Summarize the results.

Enough evidence to support the claim that more than 25% of lawyers advertise