

## Assumptions for Testing Claims About a Population Proportion $p$




- 1) The sample observations are a simple random sample.
- 2) The conditions for a binomial experiment are satisfied (Section 4-3)
- 3) The condition  $np \geq 5$  and  $nq \geq 5$  are satisfied, so the binomial distribution of sample proportions can be approximated by a normal distribution

## Steps for Hypothesis Testing




1. State the null and alternative hypothesis in symbolic form. State claim in sentence form.
2. Verify assumptions are met; state given info.
3. Determine alpha level; sketch critical region(s)
4. Choose appropriate test statistic and formula;  
Calculate the test statistic
5. Reject null or do not reject null based on the test statistic
6. Write a conclusion sentence.

1. Harper's Index claims that more than 23% of people in the United States are in favor of outlawing cigarettes. A random sample of 200 people are selected. 27% are in favor of outlawing them. At  $\alpha = 0.05$ , test the claim that more than 23% of people in the United States favor outlawing cigarettes.

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| <p>1. State <math>H_0</math> &amp; <math>H_a</math>; write a sentence for the claim</p> <p><math>H_0: p = .23</math></p> <p><math>H_a: p &gt; .23</math></p> <p>claim: more than 23% of people in the U.S. favor outlawing cigarettes</p> | <p>2. State the assumptions.</p> <p>SRS</p> <p>binomial</p> <p><math>np \geq 5</math> <math>nq \geq 5</math></p> <p><math>46 \geq 5</math> <math>154 \geq 5</math></p> <p>✓ ✓</p> | <p>3. Sketch bell curve. Determine the critical value. State when to reject null.</p>  <p>reject if <math>z &gt; 1.645</math></p> |
| <p>4. Calculate the test statistic.</p> $Z = \frac{(\hat{p} - p)}{\sqrt{\frac{pq}{n}}} = \frac{(.27 - .23)}{\sqrt{\frac{.23 \times .77}{200}}} = 1.344$   | <p>5. Determine whether to reject the null. Explain.</p> <p>do not reject null. 1.344 is not in the critical region</p>   | <p>6. Conclusion <b>page 380</b></p> <p>There is not sufficient evidence to support the claim that more than 23% of people in the U.S. favor outlawing cigarettes</p>   |

3. A medical researcher states that 55% of U.S. adults eat breakfast every day. In a random sample of 250 U.S. adults, 56.4% say they eat breakfast every day. At  $\alpha = 0.01$ , test the claim that 55% of U.S. adults eat breakfast every day.

$\hat{p}$

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| <p>1. State <math>H_0</math> &amp; <math>H_a</math>; write a sentence for the claim</p> <p><math>H_0: p = .55</math><br/> <math>H_a: p \neq .55</math><br/>         Claim: 55% of U.S. adults eat breakfast daily.</p> | <p>2. State the assumptions.</p> <p>SRS<br/>         binomial<br/> <math>np \geq 5</math> <math>nq \geq 5</math><br/> <math>137.5 \geq 5</math> <math>112.5 \geq 5</math></p> | <p>3. Sketch bell curve. Determine the critical value. State when to reject null.</p>  <p>reject null if <math>z &lt; -2.576</math><br/>         or <math>z &gt; 2.576</math></p> |
| <p>4. Calculate the test statistic.</p> $Z = \frac{(\hat{p} - p)}{\sqrt{\frac{pq}{n}}} = \frac{(.564 - .55)}{\sqrt{\frac{.55 \times .45}{250}}} = .445$  | <p>5. Determine whether to reject the null. Explain.</p> <p>fail to reject null<br/> <math>z = .445</math> is not in the critical region.</p>                                 | <p>6. Conclusion</p> <p>There is not sufficient evidence to warrant reject of the claim that 55% of U.S. adults eat breakfast daily.</p>  |