# Hypothesis Testing for Proportions

7.4

For population proportion, if np≥5 and nq≥5, then:

$$z = \frac{\hat{p} - p}{\sqrt{pq/n}}$$

# Hypothesis Testing: Rejection Regions

| Steps | |
|---|---|
| 1 | Verify that $np \geq 5$ and $nq \geq 5$. |
| 2 | State the claim mathematically and verbally. Identify the null and alternative hypotheses. |
| 3 | Specify the level of significance ($\alpha$). |
| 4 | Determine the critical value(s) and the rejection region(s). |
| 5 | Find the standardized test statistic (z). |
| 6 | Make a decision to reject or fail to reject the null hypothesis.Interpret the decision in the context of the original claim. |

# Example

**A researcher claims that less than 45% of U.S. adults use passwords that are less secure because complicated ones are too hard to remember. In a random sample of 100 adults, 41% say they use passwords that are less secure because complicated ones are too hard to remember. At $\alpha$ = 0.01, is there enough evidence to support the researcher's claim?**

np = 100(0.45) = 45 and nq = 100(0.55) = 55

$H_0$: $p \geq 0.45$

$H_a$: $p < 0.45$ (claim)

$\alpha = 0.01$

Using the table for $z_0$ values, we get $z_0$=-2.33 and the rejection region is any z-value less than this

$$z = \frac{0.41 - 0.45}{\sqrt{(0.45)(0.55)/100}} \approx -0.80$$

Our $z > z_0$, so we fail to reject $H_0$ (i.e. there is not enough evidence to support the claim)

# Example

**A researcher claims that 51% of U.S. adults believe, incorrectly, that antibiotics are effective against viruses. In a random sample of 2202 adults, 1161 say antibiotics are effective against viruses. At $\alpha = 0.10$, is there enough evidence to support the researcher's claim?**

np = 2202(0.51) = 1123 and nq = 2202(0.49) = 1079

$H_0$: p = 0.51 (claim)

$H_a$: p ≠ 0.51

$\alpha$ = 0.10

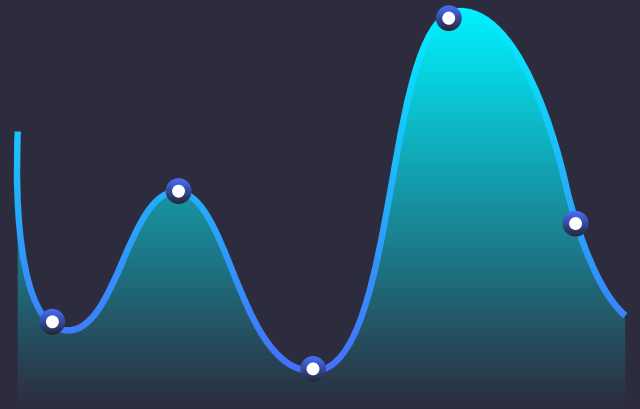
$\hat{p}$ = 1161/2202 ≈ 0.527

Using the table for $z_0$ values, we get $-z_0 = -1.645$, $t_0 = 1.645$, and the rejection region is any t-value less than -1.645 or greater than 1.645

$$z = \frac{0.527 - 0.51}{\sqrt{(0.51)(0.49)/2202}} \approx 1.60$$

Our z is not in the region of rejection, so we fail to reject $H_0$ (i.e. there is not enough evidence to reject the claim)

# Thanks!



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