8.3 Testing a Claim About a Proportion

Requirements:
- Simple random sample
- The conditions for a binomial experiment are satisfied
- np ≥ 5 and nq ≥ 5

Cautions about rounding:
- Complete all calculations without rounding
- Only round the final answer
- Rounding early can lead to significant errors

Test Statistic: \[ z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}} \]  
Use Table A–2

- n = number of trials
- \( \hat{p} = \frac{x}{n} \) = sample proportion (round to 4 decimal places)
- p = population proportion
- q = 1 – p

Steps to perform a hypothesis test: (All of these steps must be included)
1. Write the original claim in symbolic form
2. Write the null \( H_0 \) and alternate \( H_1 \) hypothesis
3. Determine the type of test (2–tailed, right–tailed or left–tailed)
4. Draw the curve, find and label (on the curve) the critical value(s) based on \( \alpha \)
5. Compute the test statistic using the formula and draw a line to where it falls on the curve.
6. Compute the P–value using the table and compare to \( \alpha \) (include the P–value function)
7. Make a decision to Reject \( H_0 \) or Do Not Reject \( H_0 \)
8. Write the formal conclusion about the claim (see p. 403) Write the claim in symbolic form here.
9. Write an informal conclusion about the claim in the format “It appears that …”
   Never leave the conclusion as “It appears the population preparation is not…(or is different than…)” Always state if greater or less than the claim. Saying it is not the same or different does not give useful information. See example 1.
Example 1:
Suppose a nationwide survey showed that 70% of all the adult population favored the concept of euthanasia for the terminally ill. Test whether this also holds for the over–55 age group if 666 of a sample of 900 are found to support the concept. Use $\alpha = 0.05$.

Claim: $p = .70$

$H_0: p = .70$

$H_1: p \neq .70$

$x = 666$

$n = 900$

$\hat{p} = \frac{666}{900} = .74$

$p = .70$

$q = .30$

$\alpha = 0.05$

$\frac{.74 - .70}{\sqrt{(.7)(.3)/900}} = 2.62$

$P–value = 2P(z > 2.62) = 2(.0044) = .0088 < 0.05$

Reject $H_0$

There is sufficient evidence to reject the claim that $p = .70$

It appears that more than 70% of people over 55 favor euthanasia for the terminally ill.

(If you write It appears that the percentage of people over 55 favor euthanasia for the terminally ill is not 70% a deduction will be made.)

Example 2:
Before the introduction of a yearly emission inspection program, it was determined that 44% of a state’s autos failed to meet emission standards. One year after the test was instituted, it was found that in a random sample of 150 autos, only 38% failed to meet the standards. Test whether the program has been successful in improving compliance with emission standards, using a 1% significance level.

Claim: $p < .44$

$H_0: p = .44$

$H_1: p < .44$

$n = 150$

$\hat{p} = .38$

$p = .44$

$q = .56$

$\alpha = 0.01$

$z = \frac{.38 - .44}{\sqrt{(0.44)(0.56)/150}} = -1.48$

$P–value = P(z < -1.48) = .0694 > 0.01$

Do Not Reject $H_0$

There is not sufficient evidence to support the claim that $p < .44$

It appears that at least 44% of the state’s autos failed to meet emission standards and the program is not successful in improving emission standards.