

Exercise walk-through

6.4

Setting Up a Test for a Population Proportion

AP Statistics

Setting up a test

A **significance test** weighs evidence against a claim.

■ **null** $H_0 : p = p_0$ (“no effect”)

■ **alternative** $H_a : p >, <, \text{ or } \neq p_0$

The **test statistic** (one-sample z-test), using p_0 :

$$z = \frac{\hat{p} - p_0}{\sqrt{p_0(1 - p_0)/n}}$$

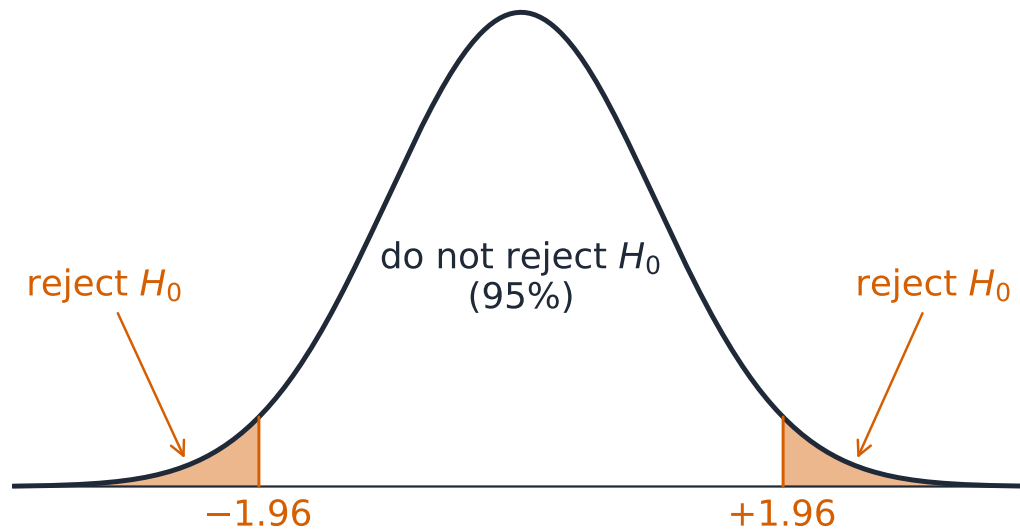
Check conditions with the **assumed** p_0 , not $\hat{p}$.

A coin

58 heads in 100: $\hat{p} = 0.58$, $H_0 : p = 0.5$, $H_a : p > 0.5$.

$$z = \frac{0.58 - 0.50}{0.05} = 1.6$$

Setting Up a Test for a Proportion



A two-tailed 5% test rejects the null hypothesis in the shaded tails

Worked example – a one-proportion z-test

A company claims 90% satisfaction. A sample of 100 finds 84 satisfied. Test $H_0 : p = 0.90$ against $H_a : p < 0.90$.

- $\hat{p} = 0.84$; use p_0 in the standard error, not $\hat{p}$
- $SE = \sqrt{\frac{0.90(0.10)}{100}} = 0.03$
- $z = \frac{0.84 - 0.90}{0.03} = -2.0$, so $p \approx 0.023$
- $0.023 < 0.05$: **reject H_0**

A *test* uses the **claimed** p_0 in the standard error; an *interval* uses $\hat{p}$. Mixing them is the commonest error here.

Exercises 2.1-2.3

2.1 State the null hypothesis for a test about a proportion.

[1]

2.2 Write the test-statistic formula for a proportion.

[1]

2.3 State one condition needed to run the test.

[1]

Exercises 2.1-2.3

2.1 State the null hypothesis for a test about a proportion.

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- $H_0 : p = p_0$ (a specific value)

2.2 Write the test-statistic formula for a proportion.

[1]

2.2

- $z = \frac{\hat{p} - p_0}{\sqrt{p_0(1 - p_0)/n}}$

2.3 State one condition needed to run the test.

[1]

2.3

- any one of: random sample, independence (10% rule), large counts

Exercises 3.1-3.2

3.1 The null hypothesis H_0 usually states that

[1]

☐

A there is an effect

B there is no effect (a specific value)

C the sample is biased

D nothing at all

☐

A $\hat{p}$

B p_0 (the null value)

C zero

D the sample size only

3.2 The test statistic for a proportion computes the standard error using

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3.2 B

- p_0 (the null value).

Exercise 3.3 (a)

3.3 A test checks whether $p \neq 0.5$, using $\hat{p} = 0.6$ and $n = 100$.

(a) Write H_0 .

[1]

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(a)

- $H_0 : p = 0.5$

Exercise 3.3 (b)

3.3 A test checks whether $p \neq 0.5$, using $\hat{p} = 0.6$ and $n = 100$.

(b) Write H_a .

[1]

Exercise 3.3 (b)

3.3 A test checks whether $p \neq 0.5$, using $\hat{p} = 0.6$ and $n = 100$.

(b) Write H_a .

[1]

(b)

- $H_a : p \neq 0.5$

Exercise 3.3 (c)

3.3 A test checks whether $p \neq 0.5$, using $\hat{p} = 0.6$ and $n = 100$.

(c) Compute the test statistic z .

[2]

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(c)

- $$z = \frac{0.6 - 0.5}{\sqrt{0.5(0.5)/100}} = \frac{0.1}{0.05} = 2.0$$