

Exercise walk-through

6.3

Justifying a Claim Based on a Confidence Interval for a Population Proportion

AP Statistics

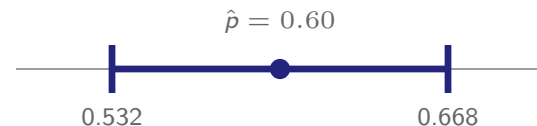
Confidence interval for a proportion

A **confidence interval** is estimate $\pm$ margin:

$$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1 - \hat{p})}{n}}$$

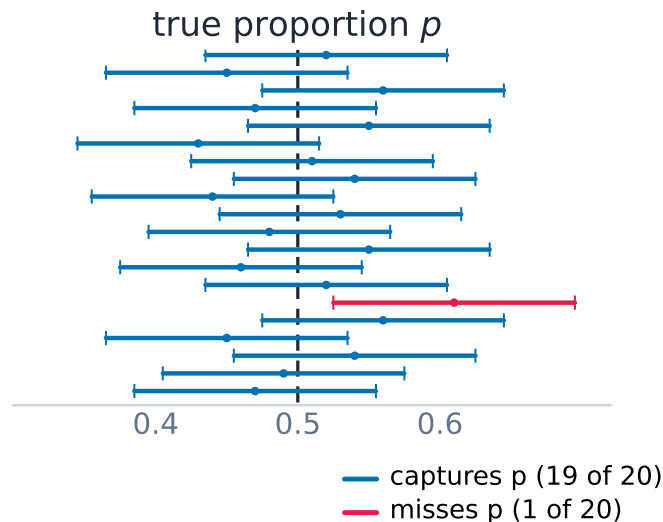
- **margin of error**
 $= z^* \cdot \text{standard error}$
- for 95%: **critical value**
 $z^* = 1.96$

Check: random, $\leq 10\%$ of population,
and large counts.



Over many samples

95% CI: the method captures p in $\sim 95\%$ of samples (not a 95% chance that this one does)



Over many samples, about 95% of 95% confidence intervals capture the true proportion

Worked example – choosing the sample size

How many people must be surveyed for a 95% interval with margin of error at most 0.03?

- $z^* \sqrt{\frac{\hat{p}(1 - \hat{p})}{n}} \leq m$, solved for n
- use $\hat{p} = 0.5$ (the **worst case**, which maximises the product) and $z^* = 1.96$
- $n \geq \left(\frac{1.96}{0.03}\right)^2 (0.25) = 1067.1$
- round **up**: $n = 1068$

Two things are always marked: using $\hat{p} = 0.5$ when no estimate is given, and **rounding up** – rounding down would leave the margin too wide.

Exercises 2.1-2.3

2.1 State how a confidence interval can be used to judge a claim. [1]

2.2 A 95% CI for p is $(0.45, 0.55)$. State whether the claim " $p = 0.5$ " is plausible. [1]

2.3 State what it means if a claimed value lies outside the interval. [1]

Exercises 2.1-2.3

2.1 State how a confidence interval can be used to judge a claim. [1]

2.1

- a value inside the interval is plausible; a value outside is not supported by the data
-

2.2 A 95% CI for p is $(0.45, 0.55)$. State whether the claim " $p = 0.5$ " is plausible. [1]

2.2

- yes, plausible (0.5 is inside the interval)
-

2.3 State what it means if a claimed value lies outside the interval. [1]

2.3

- the data do not support that claim

Exercises 3.1-3.2

3.1 A claimed value that lies inside a confidence interval is

[1]

☐

A rejected

B plausible

C impossible

D certainly correct

3.2 A 95% CI for p is $(0.60, 0.70)$. A claim that $p = 0.50$ is

[1]

☐

A plausible

B not supported (it is outside the interval)

C certainly true

D unknown

Exercises 3.1-3.2

3.1 A claimed value that lies inside a confidence interval is

[1]

☐

A rejected

B plausible

C impossible

D certainly correct

3.1 B

- plausible.

3.2 A 95% CI for p is $(0.60, 0.70)$. A claim that $p = 0.50$ is

[1]

☐

A plausible

B not supported (it is outside the interval)

C certainly true

D unknown

3.2 B

- not supported (it is outside the interval).

Exercise 3.3 (a)

3.3 A 95% CI for the proportion supporting a policy is $(0.52, 0.58)$.

(a) State whether "a majority ($p > 0.5$) support it" is plausible.

[1]

Exercise 3.3 (a)

3.3 A 95% CI for the proportion supporting a policy is $(0.52, 0.58)$.

(a) State whether "a majority ($p > 0.5$) support it" is plausible.

[1]

(a)

- yes (the whole interval is above 0.5)

Exercise 3.3 (b)

3.3 A 95% CI for the proportion supporting a policy is $(0.52, 0.58)$.

(b) State whether $p = 0.5$ is inside the interval.

[1]

Exercise 3.3 (b)

3.3 A 95% CI for the proportion supporting a policy is $(0.52, 0.58)$.

(b) State whether $p = 0.5$ is inside the interval.

[1]

(b)

- no

Exercise 3.3 (c)

3.3 A 95% CI for the proportion supporting a policy is $(0.52, 0.58)$.

(c) State the confidence level.

[1]

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3.3 A 95% CI for the proportion supporting a policy is $(0.52, 0.58)$.

(c) State the confidence level.

[1]

(c)

- 95%