

AP Statistics - Inference for the Difference of Two Proportions - Answer Key

Common Core AP STAT 6.8, AP STAT 6.9, AP STAT 6.10, AP STAT 6.11, HSS-IC.B.5 · maths-pdf.fr/en/

Each solution lists the conditions, the sample proportions, the standard error, the interval or test statistic, and a conclusion in context. Values are rounded to four decimals for standard errors and p-values.

AP Statistics · Common Core State Standards: **AP STAT 6.8, AP STAT 6.9, AP STAT 6.10, AP STAT 6.11, HSS-IC.B.5**

Exercise 1 - State the parameters

p_A = true proportion of all students at School A who support the proposal; p_B likewise at School B.

$$H_0: p_A = p_B; H_a: p_A \neq p_B.$$

Exercise 2 - Check conditions

Random assignment: given. Counts: new app 52, 28; old app 45, 45, all at least 10. (The 10% condition is not needed with random assignment.)

Conditions are met.

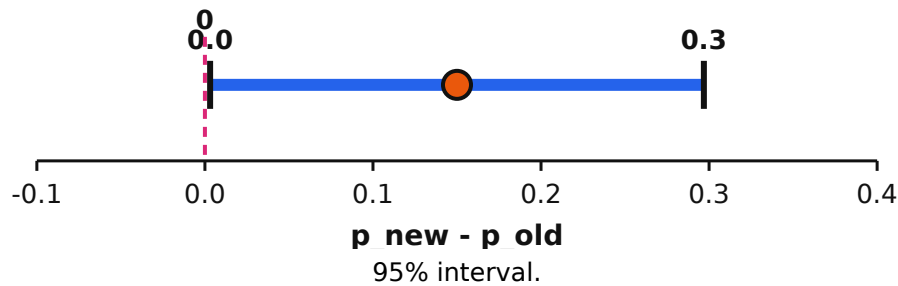
Exercise 3 - Difference and standard error

$$\hat{p}_1 = \frac{52}{80} = 0.650, \hat{p}_2 = \frac{45}{90} = 0.500. \text{ Difference } 0.150.$$

$$SE = \sqrt{\frac{0.650(1-0.650)}{80} + \frac{0.5(0.5)}{90}} = 0.0750.$$

Difference 0.150; SE 0.0750.

Exercise 4 - Confidence interval



$$ME = 1.96(0.0750) = 0.1470. \text{ Interval: } 0.150 \pm 0.147.$$

(0.003, 0.297).

Exercise 5 - Interpret the interval

The interval does not contain 0 and is entirely positive.

We are 95% confident that the interval from 0.003 to 0.297 captures the true difference (new minus old) in the proportions of volunteers who improve. Since 0 is not in the interval, there is convincing evidence that the new app is better.

Exercise 6 - 90 percent interval

$$\hat{p}_1 = 0.45, \hat{p}_2 = 0.375, SE = 0.0347. ME = 1.645(0.0347) = 0.0571.$$

(0.018, 0.132).

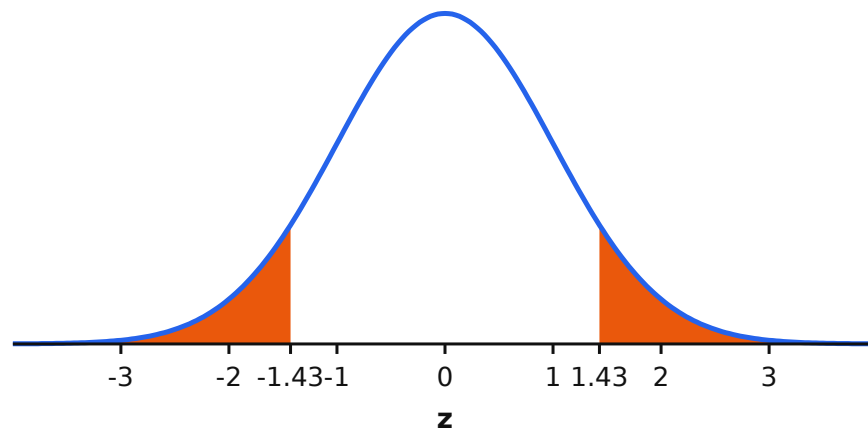
Exercise 7 - Pooled proportion

$$\hat{p}_c = \frac{126+90}{300+250} = \frac{216}{550} = 0.3927.$$

$$SE = \sqrt{0.3927(1-0.3927)\left(\frac{1}{300} + \frac{1}{250}\right)} = 0.0418.$$

0.3927 and 0.0418.

Exercise 8 - z statistic and p-value



Two-sided p-value for $z = 1.43$: 0.1527.

$$z = \frac{0.42 - 0.36}{0.0418} = 1.43. \quad p\text{-value} = 2P(Z > 1.43) = 0.1527.$$

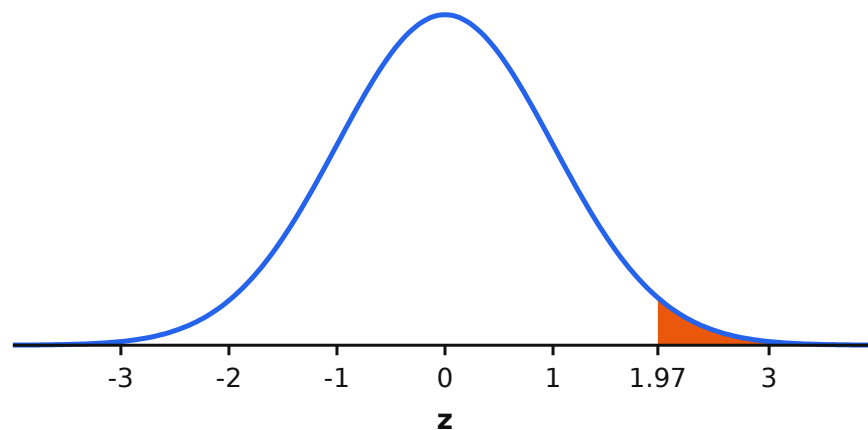
$z = 1.43$; p-value = 0.1527.

Exercise 9 - Conclusion

$0.1527 > 0.05$.

We fail to reject H_0 . There is not convincing evidence that the proportions of students who support the later start time differ between School A and School B.

Exercise 10 - One-sided test



Right-tailed p-value.

$$H_0: p_{\text{new}} = p_{\text{old}}, \quad H_a: p_{\text{new}} > p_{\text{old}}. \quad \hat{p}_c = \frac{97}{170} = 0.5706. \quad SE = 0.0761, \quad z = 1.97, \quad p\text{-value} = 0.0244.$$

Reject H0: convincing evidence that the new app helps a greater proportion.

Exercise 11 - Interval and test agree

0 is not in the interval.

Reject H0; there is convincing evidence that p1 and p2 differ (p1 appears larger).

Exercise 12 - Two-way table

Placebo $\frac{45}{300} = 0.15$, vaccine $\frac{18}{300} = 0.06$.

$$SE = \sqrt{\frac{0.15(0.85)}{300} + \frac{0.06(0.94)}{300}} = 0.0248.$$

Interval (0.041, 0.139), all positive: the vaccine seems to lower the flu rate.

Exercise 13 - Significance in the flu study

$$P(Z < -3.60) = 0.000159.$$

The p-value is tiny, so reject H0. Because the volunteers were randomly assigned, there is convincing evidence that the vaccine reduces the chance of getting the flu.

Exercise 14 - Large counts fails

Successes: 4 and 9; failures: 56 and 41.

The large counts condition fails because 4 and 9 are less than 10.

Exercise 15 - Dependent samples

The same students are measured twice, so the samples are not independent.

The two groups are dependent (paired data), so the independence condition fails.

Exercise 16 - Margin of error comparison

Larger samples reduce the standard error and narrow the interval.

With larger samples, the same difference of 0.06 could give an interval that excludes 0 and a significant test result.

Exercise 17 - Sample proportions

$$\hat{p}_{men} = \frac{90}{200} = 0.45, \hat{p}_{women} = \frac{130}{250} = 0.52.$$

Difference 0.07 (women minus men).

Exercise 18 - Interval for the electric car survey

$$SE = \sqrt{\frac{0.52(0.48)}{250} + \frac{0.45(0.55)}{200}} = 0.0473. ME = 0.0927.$$

(-0.023, 0.163). 0 is inside, so there is not convincing evidence that the proportions differ.

Exercise 19 - Test for the electric car survey

$$\hat{p}_c = \frac{220}{450} = 0.4889. SE = 0.0474, z = 1.48, \text{p-value} = 0.1389.$$

Fail to reject H0: not convincing evidence that the proportions differ.

Exercise 20 - Multi-step

$$SE = 0.0559, ME = 2.576(0.0559) = 0.1441.$$

(-0.039, 0.249). 0 is in the interval, so at 99% confidence there is no convincing evidence of a difference.