

Campus Life Hypothesis Testing

- a) A university is evaluating whether freshmen are studying more than the historical average of 12 hours per week. A random sample of 50 freshmen shows an average of 14.5 hours with a standard deviation of 5 hours. Is there evidence that freshmen now study more than 12 hours per week? Perform a hypothesis test!

1. Lay out the problem & check tech cond

$$\mu = 12, \bar{x} = 14.5, s = 5, n = 50$$

Parameter μ = average study hours for freshmen. Population: all freshmen at the university.

Variable: Number of hours each student studies per week on average.

Conditions: SRS assumed, and $n > 30$.

2. State hypotheses

$$H_0: \mu = 12, H_1: \mu > 12$$

3. Set Sig-Level.

$$\alpha = 0.05$$

4. Find test statistic (t or z)

$$t = \frac{14.5 - 12}{\frac{5}{\sqrt{50}}} \approx 3.54$$

5. Find P-value

df=49, so using t-distr calculator w/right tail: $P = 0.0005$.

6. Conclusion: Evidence/Decision/In-Context Summary

With a P-value of 0.0005 which is less than $\alpha = 0.05$, we reject the null hypothesis ($H_0: \mu = 12$). We have evidence that freshmen study more than 12 hours/week.

- b) The school newspaper says that 40% of students prefer online textbook access over printed books. A random sample of 150 students shows that 51 prefer online access. Is there evidence that the true proportion is less than 40%?

1. Lay out the problem & check tech cond

Claimed proportion: $p_0 = 0.40$

Sample size: $n = 150$

Number of successes: $x = 51$

Sample proportion: $\hat{p} = \frac{51}{150} = 0.34$

Population: All students at the school.

Variable: Whether a student prefers online textbook access over printed books.

Parameter: p = the true proportion of students who prefer online textbook access.

Statistic: $\hat{p}$ = the sample proportion who prefer online textbook access.

Tech Conditions: Assume SRS. Sample size conditions:

$$np_0 = 150(0.40) = 60$$

$$n(1 - p_0) = 150(0.60) = 90$$

Both are at least 10, so conditions are met.

2. State hypotheses

$H_0: p = 0.4$, $H_1: p > 0.4$

3. Set Sig-Level.

$\alpha = 0.05$

4. Find test statistic (t or z)

$$t = \frac{0.34 - 0.40}{\sqrt{\frac{0.4(0.6)}{150}}} \approx -1.50$$

5. Find P-value

df=149, so using t-distr calculator w/right tail: $P = 0.067$.

6. Conclusion: Evidence/Decision/In-Context Summary

With a P-value of 0.067 which is more than $\alpha = 0.05$, we fail to reject the null hypothesis ($H_0: p = 0.4$). We do not have evidence that the true proportion of students who prefer online textbook access is less than 40%.

- c) The campus dining service claims that the average student spends \$85 per week on meals. A sample of 32 students shows an average of \$89 with a standard deviation of \$18. Is there evidence students are spending more than claimed? Perform a hypothesis test!

1. Lay out the problem

$$\mu = 85, \bar{x} = 89, n = 32, s = 18$$

Parameter μ = Average amount students spend per week on meals.

Variable: amount each student spends per week on meals.

Population: All students at the school.

Assume SRS. $n = 32$, which is greater than 30, so conditions are met.

2. State hypotheses

$$H_0: \mu = 85, H_1: \mu > 85$$

3. Set Sig-Level.

$$\alpha = 0.05$$

4. Find test statistic (t or z)

$$t = \frac{89 - 85}{\frac{18}{\sqrt{32}}} \approx 1.257$$

3. Find P-value

df=31, so distr calculator w/right tail reveals $P = 0.109$.

4. Conclusion

With a P-value of 0.109 which is more than $\alpha = 0.05$, we fail to reject the null hypothesis ($H_0: \mu = 85$). We have insufficient evidence to show that students spend more than \$85/week.

- d) A campus gym advertises that students spend an average of 45 minutes per visit. A sample of 20 students shows an average of 38 minutes with a standard deviation of 12 minutes. Is there evidence that students are spending less time than advertised? Perform a hypothesis test!

1. Lay out the problem

$$\mu = 45, \bar{x} = 38, n = 20, s = 12$$

Parameter μ = **average number of minutes all students spend at the gym per visit.**

Variable is the average **number of minutes each student spends at the gym per visit.**

Population is all students at the school.

We assume SRS. Also, $n = 20$, which is not greater than 30, so we must assume the population is normally distributed.

2. State hypotheses

$$H_0: \mu = 45, H_1: \mu < 45$$

3. Set Sig-Level.

$$\alpha = 0.05$$

4. Find test statistic (t or z)

$$t = \frac{38 - 45}{\frac{12}{\sqrt{20}}} \approx -2.61$$

3. Find P-value

df=19, so distr calculator w/left tail reveals P-val = 0.0086.

4. Conclusion

With a P-value of 0.0086 less than $\alpha = 0.05$, we reject the null hypothesis ($H_0: \mu = 45$). We have evidence that the students spend less time than advertised.