

Skyler MacDougall

Homework 11: Due Friday 7/31/2020

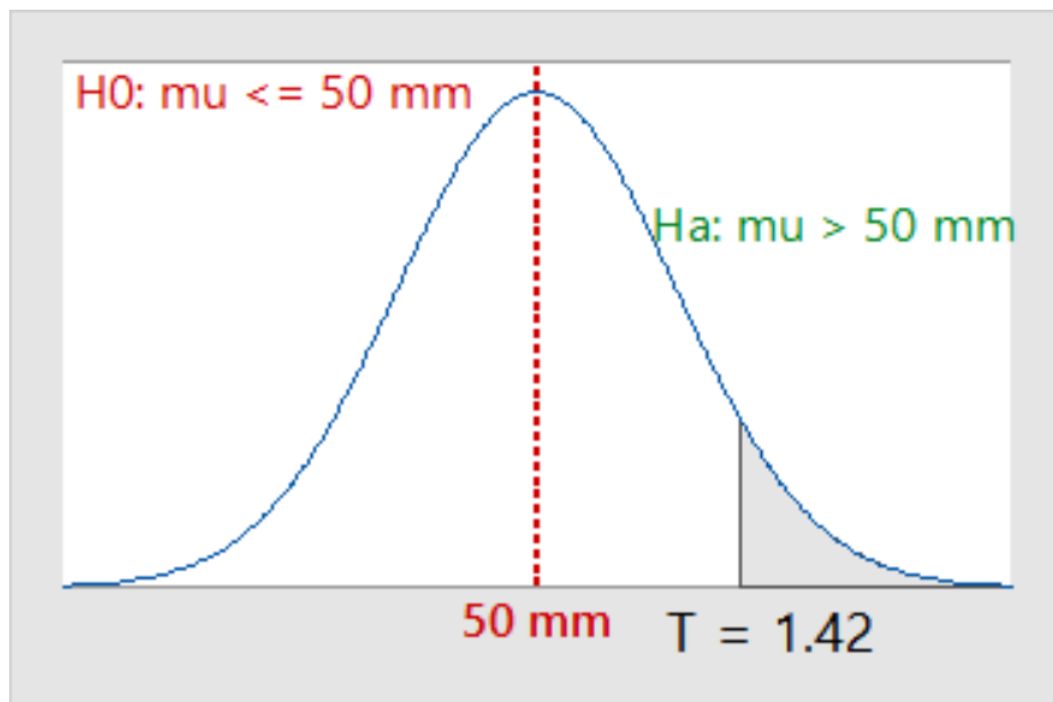
STAT-145-02

Part A: Multiple Choice

1. School district officials believe that students spend plenty of time reading at home. A teacher wants to convince these officials that, on average, students spend less than 90 minutes per week reading at home.

What is the alternative hypothesis?

1. ~~$H_a : p < 0.9$~~
 2. ~~$H_a : p > 0.9$~~
 3. ~~$H_a : \mu > 90$~~
 4. $H_a : \mu < 90$
2. Which statement provides a correct interpretation of the value of T test statistic?



1. My \bar{X} is 1.42 standard errors above 50.
 2. My \bar{X} is 1.42 mm above 50.
 3. My \bar{X} is 1.42 times as large as 50.
 4. My \bar{X} equals 1.42mm.
3. When the probability value is "small" in a test of hypotheses, this tells us that our sample mean is __.
1. Unusual for the curve.
 2. typical for the curve.
 3. computed incorrectly.
 4. below the center of the curve.
4. If your sample has sufficient evidence to reject H_0 , there is a small chance that a __ occurred.

1. ~~large probability value~~
2. **Type I error**
3. ~~Type II error~~
4. ~~correct decision~~

5. When testing the hypotheses

$$H_0 : p = 0.6 \quad (1)$$

$$H_a : p > 0.6$$

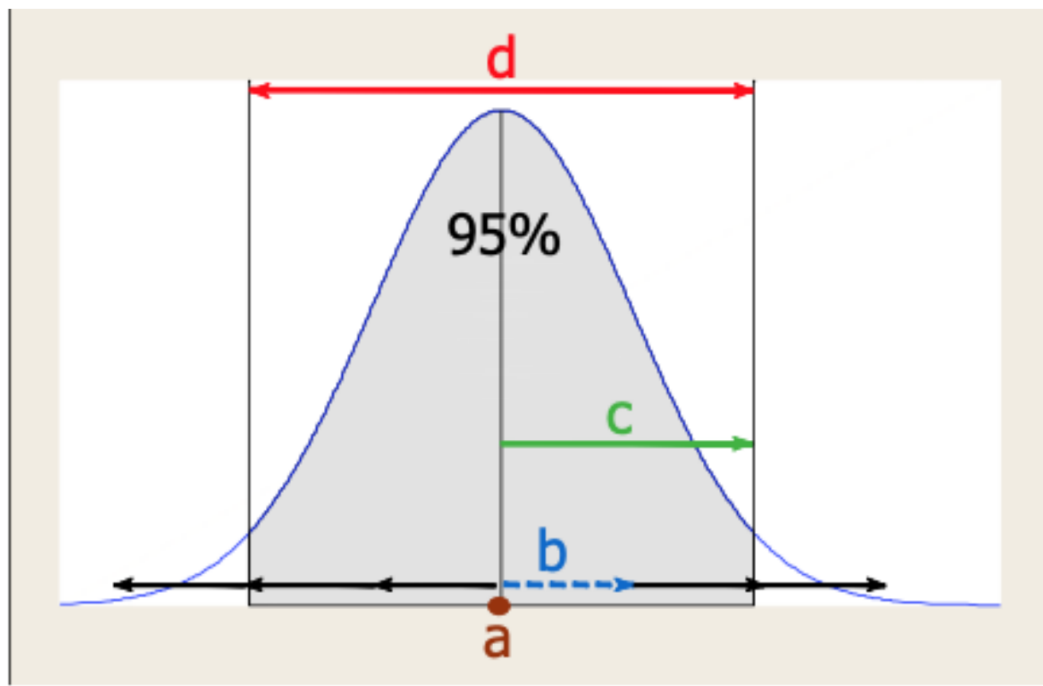
you check that the normal is appropriate by showing that:

1. ~~$p \geq 10$~~
2. ~~you have a random sample~~
3. ~~$n \geq 30$ OR NPP p -value > 0.05~~
4. $|n(0.6)(1 - 0.6)| \geq 10$

6. Researchers will create a confidence interval with the proportion of all first-grade children who are overweight. The chance that this method will provide a correct result is determined by the:

1. ~~sample size~~
2. **level of confidence**
3. ~~sample mean~~
4. ~~population standard deviation~~

7. See the confidence interval diagram below.



The margin of error is represented by:

1. ~~The dot labelled "a".~~
2. ~~the dashed arrow labelled "b".~~
3. **the arrow labelled "c".**
4. ~~the double arrow labelled "d".~~

8. A 95% confidence interval for the average speed of drivers on the New York State Thruway is (65mph, 75mph). What is the value of his point estimate?

1. ~~65 mph~~
2. ~~5 mph~~
3. ~~40 mph~~
4. **70 mph**

9. When creating a confidence interval for a numerical variable, you check that the “t-curve” is appropriate to use by showing that

1. ~~you have a random sample~~
2. ~~$|n \geq 30 \text{ OR } NPP \text{ } p - \text{value} > 0.05|$~~
3. ~~$n \geq 10$~~
4. ~~$n(p)(1-p) \geq 10$~~

10. A 95% confidence interval for the percentage of all Rochester area drivers who text while driving is (35%, 43%). Which statement is reasonable based on the CI result?

1. The percentage of Rochester area drivers who text while driving is equal to 37%
2. ~~The percentage of Rochester area drivers who text while driving is equal to 34%~~
3. ~~The percentage of Rochester area drivers who text while driving is equal to 30%~~
4. ~~The percentage of Rochester area drivers who text while driving is equal to 48%~~

11. Based on a random sample of 50 full-time college students, we can be 90% confident that for all college students the mean time spent studying per week is between 9.25 hours and 10.75 hours.

Which of the following intervals is a reasonable 95% confidence interval for this sample?

1. (9.10, 10.90)
2. ~~(9.30, 10.70)~~
3. ~~(9.45, 10.55)~~
4. ~~(9.00, 10.50)~~

12. If you want to estimate the proportion of all RIT students who smoke within 0.05 with 90% confidence, what is the minimum sample size you will need?

1. ~~1562~~
2. ~~2033~~
3. 271
4. ~~549~~

13. We are 95% confident that during October 2016 the mean water usage for all Rochester households was between 1250 and 1350 cubic feet.

In which statement can you have 95% confidence?

1. ~~Mean water usage is greater than 1300 cubic feet.~~
2. Mean water usage is less than 1400 cubic feet.
3. ~~Mean water usage is between 1200 and 1300 cubic feet.~~
4. ~~Mean water usage is less than 1300 cubic feet.~~

Part B: Test and CI

14. It is commonly thought that very few US adults believe in reincarnation (the rebirth of a soul into a new body). But a researcher thinks that group has been growing and wants to convince others that the percentage who believe in reincarnation is greater than 20%. In the researcher’s random sample of 942 US adults, 195 stated that they believe in reincarnation. Does the researcher’s sample provide sufficient evidence to support the idea that more than 20% of all US adults believe in reincarnation? Show the complete testing process and always include your statistical output.

Population

We are studying the percentage of US adults who believe in reincarnation.

p = the true proportion of US adults who believe in reincarnation.

Goal: Test to see if there is support for saying that p has increased from 20% of the American population.

Method

$$\begin{aligned}H_0 : p &= 0.20 \\H_a : p &> 0.20 \\ \alpha &= 0.05\end{aligned}\tag{2}$$

Sample

Interpretation for a 1-Sample Z-test

Decision Rule Based on p-value

Reject H_0 : p-value $\leq \alpha$

Fail to Reject H_0 : p-value $> \alpha$

p-value=0.2946

$\alpha = 0.050$

For the p-value approach:

Since $0.2946 > 0.05$, we fail to reject the null hypothesis.

There is not enough evidence to support the claim of the alternative hypothesis.

$$\begin{aligned}n(p_0)(1 - p_0) &\geq 10 \\ 942(0.207)(0.793) &\geq 10 \\ 154.63 &\geq 10\end{aligned}\tag{3}$$

\therefore

*The sample can be
considered normal*

Results

$$\begin{aligned}Z &= \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}\tag{4} \\ Z &= \frac{0.20 - 0.207}{\sqrt{\frac{(0.207)(1-0.207)}{942}}} \\ Z &= \frac{-0.007}{\sqrt{\frac{(0.207)(0.793)}{942}}} \\ Z &= \frac{-0.007}{\sqrt{\frac{0.164}{942}}} \\ Z &= -0.53\end{aligned}$$

My sample mean is 0.53 standard errors below 20%.

My p-value is 0.2946.

Assuming that the true proportion equals 20%, there is a 29.46% probability of getting a sample population (\hat{p}) at least as extreme as the one we got from sampling.

Conclusion

At the 5% level of significance, the sample data does not provide sufficient evidence to say that the true proportion has increased from 20% of US adults who believe in reincarnation.

15. How much caffeine is in *King of Caffeine* cola? A dozen randomly selected cans of *King of Caffeine* cola had the values of caffeine, measured in mg, noted in the provided excel sheet.

1. Estimate the mean caffeine level among all cans of *King of Caffeine* cola with a 95% confidence.

$$\mu \in (32.349, 33.685)$$

2. What minimum sample size would be needed to estimate the mean caffeine level within 0.4mg with 95% confidence? **Show your work.**

$$n \geq \left(\frac{z * \sigma}{MOE} \right)^2 \quad (5)$$

$$n \geq \left(\frac{1.96 * 1.181}{0.4} \right)^2$$

$$n \geq \left(\frac{2.315}{0.4} \right)^2$$

$$n \geq (5.7869)^2$$

$$n \geq 33.488$$

$$n \geq 34$$