Week 11 Homework Problems SOLUTIONS

Complete the homework problems and submit to the appropriate drop box. You may work directly on this document or do you work on a separate document. Either way, be sure to show the complete testing process (including relevant statistical output) when asked to complete a hypothesis test. That is, you will only earn credit if you show the population, method, sample, results and conclusions steps.

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?**
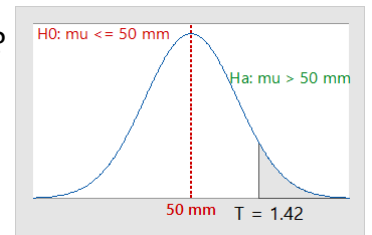   a. H_a: p < 0.90
   b. H_a: p > 0.90
   c. H_a: μ > 90   D
   d. H_a: μ < 90

2. Which statement provides a correct interpretation of the value of T test statistic?
   a.   My $\overline{X}$ is 1.42 standard errors above 50.   A
   b.   My $\overline{X}$ is 1.42 mm above 50.
   c.   My $\overline{X}$ is 1.42 times as large as 50.
   d.   My $\overline{X}$ equals 1.42 mm.

   H0: mu <= 50 mm
   Ha: mu > 50 mm
   50 mm   T = 1.42

3. When the probability value for the sample is "small" in a test of hypotheses, this tells us that our sample mean is _____.
   a.   unusual for the curve.   A
   b.   typical for the curve.
   c.   computed incorrectly.
   d.   below the center of the curve.

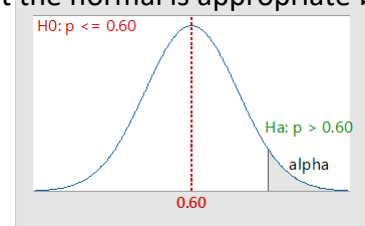4. If your sample had sufficient evidence to reject H_0, there is a small chance that a _____ occurred.
   a.   large probability value
   b.   Type I error
   c.   Type II error   B
   d.   correct decision

5. When testing the hypotheses H_0: p = 0.60 and H_a: p > 0.60, you check that the normal is appropriate by showing that
   a.   p $\geq$ 10
   b.   you have a random sample
   c.   n $\geq$ 30 OR NPP P-value > .05
   d.   n(0.60)(1 − 0.60) $\geq$ 10   D

   H0: p <= 0.60
   Ha: p > 0.60
   alpha
   0.60

6. Researchers will create a confidence interval for the proportion of all first-grade children who are overweight. The chance that this method will provide a correct result is determined by the
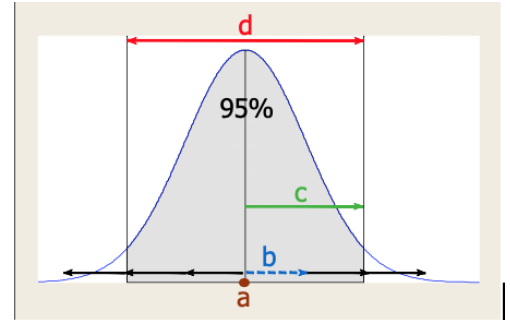   a.   sample size.   B
   b.   level of confidence.

c.   sample mean.
d.   population standard deviation.

7. See the confidence interval diagram. The margin of error is represented by
  a.   the dot labelled "a".
  b.   the dashed arrow labelled "b".
  c.   the arrow labelled "c".   C
  d.   the double arrow labelled "d".

8. A 95% confidence interval for the average speed of drivers on the New York State Thruway is: (65 mph, 75 mph). What is the value of the point estimate?
  a.   65 mph
  b.   5 mph
  c.   10 mph   D
  d.   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
  a.   you have a random sample
  b. $n \geq 30$ OR NPP P-value > .05   B
  c. $n \geq 10$
  d. $np(1 - p) \geq 10$

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?
  a.   The percentage of Rochester area drivers who text while driving is equal to 37%.   A
  b.   The percentage of Rochester area drivers who text while driving is equal to 34%.
  c.   The percentage of Rochester area drivers who text while driving is equal to 30%.
  d.   The percentage of Rochester area drivers who text while driving is equal to 48%.

11. Based on a random sample of fifty 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 interval (a – d) is a 95% confidence interval for the same sample?
  a.   (9.10, 10.90)   A—the wider interval is the 95% interval.
  b.   (9.30, 10.70)
  c.   (9.45, 10.55)
  d.   (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?
  a.   1562
  b.   2033   C
  c.   271 $N = (.5)(1 - .5)(1.645/.05)^2 = 270.6$ --approx 271

d.   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?
   a.   Mean water usage is greater than 1300 cubic feet.
   b.   Mean water usage is less than 1400 cubic feet.
   c.   Mean water usage is between 1200 and 1300 cubic feet.
   d.   Mean water usage is less than 1300 cubic feet.

B

Part B: Test and CI

14. It is commonly thought that very few U.S. adults believe in reincarnation (the rebirth of a soul in 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 U.S. 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 U.S. adults believe in reincarnation? Show the complete testing process and always include your statistical output.

Population
The variable is whether or not one believes in reincarnation. This is categorical (the responses are counted)
P = the true proportion of US adults who believe in reincarnation
GOAL: test to see if p > .20
Method
Ho: p = .20
Ha: p > .20
Alpha = .05
Z -curve
Sample
(942)(.20)(1 - .20) = 150. The sample size is large enough to assume a normal distribution.

WORKSHEET 1
Test and CI for One Proportion

Method

p: event proportion
Normal approximation method is used for this analysis.

Descriptive Statistics

N	Event	Sample p	95% Lower Bound for p
942	195	0.207006	0.185293

Test

Null hypothesis H_0: p = 0.2
Alternative hypothesis H_1: p > 0.2

Z-Value	P-Value
0.54	0.295

Results
Z = .54

The sample proportion is .54 standard errors above the hypothesized proportion, 0.20.

P-value = .295

Assuming the true proportion is .20, there is a .295 probability of getting a sample proportion at least as extreme as the one I got from sampling.

Conclusion

P-value is > 0.05. We cannot not reject the null.

At the 5% level of significance, the sample data DOES NOT provide sufficient evidence to say that the true proportion of US adults who believe in reincarnation is greater than 20%.

Everyday conclusion: The researcher is wrong. There is no evidence to say that the group is growing.

15. How much caffeine is in *King of Caffeine* cola? A dozen randomly selected cans of *King of Caffeine* cola had these caffeine (mg) values. The data can be found in the file: 11_Week 11 STAT 145 Data.xlsx under the sheet: **Caffeine**.

34.2	33.7	31.9	34.3	31.2	32.7
33.1	35.2	31.6	32.9	33.0	32.4

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

CAFFEINE
One-Sample T: Caffeine

Descriptive Statistics

N	Mean	StDev	SE Mean	95% CI for μ
12	33.017	1.181	0.341	(32.266, 33.767)

μ: population mean of Caffeine

==**We are 95% confident that the true mean amount of caffeine in King of Caffeine Cola is between 32.266 mg and 33.767 mg.**==

    B. What minimum sample size would be needed to estimate the mean caffeine level within 0.4 mg with 95% confidence? SHOW YOUR WORK.

We can use the sample standard deviation from earlier as an estimate for s. (s = 1.181)

$$n = \left(\frac{(1.96)(1.181)}{.4} \right)^2 = 33.49$$

==A minimum sample size of 34 is needed.==