Homework 03 Answer Sheet

Psych 10C
Due: Sunday, October 9th (by 11:59pm PT)

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Submission Details

- Download *HW03AnswerSheet.Rmd* from the Canvas course space and open it RStudio.
- Enter your name in the *author* field at the top of the document.
- Complete the assignment by entering your answers in your *HW03AnswerSheet.Rmd* document.
- Once you have completed the assignment, click the *Knit* button to turn your completed answer document into a pdf file.
- Submit your HW03AnswerSheet.pdf file only (no other formats are acceptable) before the assignment's deadline.

Problems

For each problem, show/describe all of your work.

Problem #1 (4 points)

The Chancellor at Vanderbilt University is suspicious of the academic standards in the athletic departments of the Texas and Oklahoma, recent additions to the Southeastern Conference (SEC). Historically, student athletes attending SEC schools have a mean SAT score of 1060, though there is no valid measurement of the population standard deviation. Data from a sample of 50 University of Texas athletes shows a mean of 1000 with a standard deviation of 200. Is the Chancellor right to be suspicious (assuming a .05 significance level)? Conduct a one-sample t-test and report the following:

(a) Find the value of the t-statistic using RStudio.

ANSWER:

```
SampleMean<- 1000
SampleSD<- 200
PopMean<- 1060
N<- 50
(t<- (SampleMean-PopMean)/(SampleSD/sqrt(N)))
```

```
## [1] -2.12132
```

(b) Is this a one-tailed or two tailed test? Why?

ANSWER:
It is a two tailed test since we don't give the hypothesis a specific direction to the difference in the distribution.

(c) Find the correct critical value of t using RStudio.

ANSWER:

```
(CriticalV<- qt(0.975, 49))
```

```
## [1] 2.009575
```

(d) What is your conclusion? Should we reject the null hypothesis? Should the Chancellor be suspicious of the academic standards at the University of Texas?

ANSWER:

- Since the absolute value of t exceeds the critical value t, we reject the null hypothesis. The chancellor should be suspicious of the academic standards at the University of Texas.

Problem #2 (3 points)

In one study, young children under stress were shown to actually report fewer symptoms of anxiety and depression than one would expect. However, their scores on a Lie scale (a measure of the tendency to give socially desirable answers) were higher than expected. The population mean on the Lie scale is known to be 3.87. For a sample of 36 children under stress, researchers found a sample mean of 4.39 with a standard deviation of 2.61. From the data, can you conclude that children under stress tend to score higher on the Lie scale than the general population? Conduct a one-sample t-test and report the following:

(a) Find the value of the t-statistic using RStudio.

ANSWER:

```
PopMean2<- 3.87
N2<-36
SMean<- 4.39
SSD<- 2.61
(T2<- (SMean-PopMean2)/ (SSD/sqrt(36)))
```

```
## [1] 1.195402
```

(b) Based on the t-value calculated in part (a), what proportion of samples of size 36 from the general population would have means this high or higher?

ANSWER:

```
pt(1.195402, 35, lower.tail = FALSE)
```

```
## [1] 0.1199835
```

(c) What does your answer to part (b) tell you? Should we reject the null hypothesis? Is there evidence that children under stress score higher on the Lie school than the general population?

ANSWER:

- The answer in part b tells that 11.99835 percent of samples of size 36 have means high or higher than the t-value. Since 0.1199835 is higher than 0.05, we fail to reject the null hypothesis. There is no evidence that children under stress score higher on the Lie school than the general population.

Problem #3 (5 points)

A few years ago, noon bicycle traffic past a busy section of campus had a mean of $\mu = 300$. To see if any change in traffic has occurred, a count was taken for a sample of 19 weekdays. The sample had a mean of 340 and standard deviation of 30.

(a) (3 pts) Using RStudio, conduct a $\alpha = .05$ test of H0:$\mu = 300$, against the alternative that some change has occurred. Should we reject the null hypothesis? Based on the results of your t-test, justify your conclusion.

ANSWER:

```
SMean3<- 340
SSD3<- 30
PopMean3<-300
N3<- 19
(T3<- (SMean3-PopMean3)/(SSD3/sqrt(19)))
```

```
## [1] 5.811865
```

```
(TCritical3<- qt(.975,18))
```

```
## [1] 2.100922
```

```
cat("t-statistics:", T3, "\nCritical Value t:", TCritical3)
```

```
## t-statistics: 5.811865
## Critical Value t: 2.100922
```

- Since the value of t exceeds critical value of t, we can reject the null hypothesis.

(b) (2 pts) Using RStudio, obtain a 95% confidence interval for μ.

ANSWER:

```
SE3<- SSD3/sqrt(N3)
(CILow<- SMean3-TCritical3*SE3)
```

```
## [1] 325.5405
```

```
(CIHigh<-SMean3+TCritical3*SE3)
```

```
## [1] 354.4595
```

```
cat("CI= [", CILow,",", CIHigh, "]")
```

```
## CI= [ 325.5405 , 354.4595 ]
```

Problem #4 (4 points)

Heights were measured for 12 plants grown under the treatment of a particular nutrient. Load the data supplied on our course website (HW03_PlantData.csv) into a data frame named *PlantData*. The actual heights of the plants will be contained in the *Height* variable of the data frame (PlantData$Height).

(a) (2 pts) Could a claim that the population mean height is more than 175 inches be substantiated? Use a one-sample t-test with $\alpha = .05$.

ANSWER:

```
PlantData<-read.csv("/Users/zzze/Desktop/HW03_PlantData.csv")
PopMean4<- 175
SMean4<- mean(PlantData$Height)
SSD4<- sd(PlantData$Height)
N4<- 12
T4<- (SMean4-PopMean4)/(SSD4/sqrt(N4))
TCritical4<-qt(0.95,11)
cat("t-statistics:", T4, "\nCritical Value t:", TCritical4)
```

```
## t-statistics: 1.882664
## Critical Value t: 1.795885
```

- Since the t value exceeds the critical value, we should reject the null hypothesis. Therefore, the claim that the population mean height is more than 175 inches can be substantiated.

(b) (2 pts) Construct a 95% confidence interval for the population mean.

ANSWER:

```
SE4<- SSD4/sqrt(N4)
TCritical4new<- qt(0.975, 11)
(CILow<- SMean4-TCritical4new*SE4)
```

```
## [1] 174.1201
```

```
(CIHigh<-SMean4+TCritical4new*SE4)
```

```
## [1] 186.2879
```

```
cat("CI= [", CILow,",", CIHigh, "]")
```

```
## CI= [ 174.1201 , 186.2879 ]
```

Problem #5 (4 points)

Five years ago, the average size of farms in a state was 160 acres. A recent survey of the sizes of 27 farms was taken. Load the data supplied on our course website (HW03_FarmData.csv) into a data frame named *FarmData*. The sizes of the farms will be contained in the *Size* variable of the data frame (FarmData$Size).

(a) (2 pts) Is there strong evidence that the average farm size is larger than it was 5 years ago ($\alpha = .05$)?

ANSWER:

```
FarmData<- read.csv("/Users/zzze/Desktop/HW03_FarmData.csv")
PopMean5<- 160
SMean5<- mean(FarmData$Size)
SSD5<- sd(FarmData$Size)
N5<- 27
T5<- (SMean5-PopMean5)/(SSD5/sqrt(N5))
TCritical5<-qt(0.95,26)
cat("t-statistics:", T5, "\nCritical Value t:", TCritical5)
```

```
## t-statistics: 2.642442
## Critical Value t: 1.705618
```

Since the value of t exceeds the critical value, we should reject the null hypothesis. Therefore, there is strong evidence that the average farm size is larger than it was 5 years ago.

(b) (2 pts) Give a 98% confidence interval for the current average size.

ANSWER:

```r
SE5<- SSD5/ sqrt(N5)
TCritical5new<- qt(0.99, 26)
(CILow<- SMean5-TCritical5new*SE5)
```

```
## [1] 161.1354
```

```r
(CIHigh<-SMean5+TCritical5new*SE5)
```

```
## [1] 195.4941
```

```r
cat("CI= [", CILow,",", CIHigh, "]")
```

```
## CI= [ 161.1354 , 195.4941 ]
```