Take Home Exam 3

Due Sunday, November 20th, 2016

STAT 4013: Statistical Methods I (FALL 2016)

Directions: This paper is to be the cover page of your exam. All questions are to be typed and attached to the end of this document. You must submit it to D2L **Dropbox** no later **than November 20th, 2016** at **11:59 pm**. This portion of the exam is to test your knowledge of both statistical concepts learned thus far and how to effectively use statistical software (in this case R). All work submitted must be your own. You may use anything at your disposal except another human being. Solutions should be written following all rules of English, and points will be deducted as needed**. Graphics should appear within the solutions, and an appendix with just your R code should be attached at the end.**

**You are allowed only one submission to Dropbox, so make sure your answers are as complete as you want them to be before submitting because there is no going back!!!!**

**Failing to submit your code will result in a reduction of your grade by 20 points.**

***Question:***

1. Jim and Joyce recently purchased two non-descript looking restaurants here in town. They heard rumors that restaurant A makes more money on average than restaurant B. They decided that they wanted to test that theory out, so they hired you as their statistician to collect and analyze the data. The data is provided below, and shows the bill without tip of paying customers. Test at a significance level of .05. **(50 points)**

|  |  |
| --- | --- |
| **Restaurant A** | **Restaurant B** |
| 19, 25, 55, 14, 19, 60, 77, 91 | 10, 8, 19, 22, 30, 29, 44, 49 |
| 20, 16, 29, 33, 71, 39, 48, 42 | 32, 19, 11, 16, 45, 66, 70, 71 |
| 51, 61, 40, 44, 88, 71, 29, 18 | 17, 15, 22, 29, 40, 35, 19, 33 |
| 39 | 16, 19, 64, 40, 9, 15, 22, 37 |

Hint 1: You will need to perform multiple hypothesis tests, and show all four steps of the test.

Hint 2: There is more than one way to meet certain assumptions.

1)

a.

1. *Hypotheses*:

**Ho**: **Ha**:

1. *Test* *Statistic* *Calculation*:

**Ftest** to compare two variances.

F = 1.6014, df1 = 24, df2 = 31, p-value = 0.2163

P- value (0.2163) is less than 0.05.

1. *Decision*: Reject **Ho**
2. *Contextual conclusion*: We have enough evidence that the variance in bill without tip of Restaurant A and the variance in bill without tip of Restaurant B are not equal with 95% confidence level.

b. Now we know that our variances are not equal.

1. *Hypotheses*:

**Ho**: **Ha**:

2. *Test* *Statistic* *Calculation*:

**Welch two sample ttest** to compare means of two small samples with unequal standard deviations.

t = 2.4237, df = 44.863, p-value = 0.009729

P – value(0.0097) is less than 0.05.

Mean of Restaurant A: 43.96000

Mean of Restaurant B: 30.40625

3. *Decision*: Reject **Ho**

4. *Contextual* *conclusion*: With 95% confidence level, we have enough evidence that restaurant A

makes more money on average than restaurant B.

**Appendix**

A =

c(19,25,55,14,19,60,77,91,20,16,29,33,71,39,48,42,51,61,40,44,88,71,29,18,39)

B=c(10,8,19,22,30,29,44,49,32,19,11,16,45,66,70,71,17,15,22,29,40,35,19,33,16,19,64,40,9,15,22,37)

sort(A)

sort(B)

shapiro.test(A)

#p-value = .1177 therefore reject h0 and implies not normal data.

shapiro.test(B)

#p-value = .0041 therefore reject h0 and implies not normal data.

#Variance Test

var.test(A,B, ratio = 1)

#Mean Test

t.test(A, B, alternative = "greater", var.equal = F, conf.level = .95)