**STAT 350: Activity #1** Name: Model Solution answers will vary

Review of graphical displays, random sampling and one sample hypothesis tests.

Goal: To use a one sample hypothesis test to examine the mean reading level of a book

Set-up: A middle school teacher was concerned that the book, *The Little Prince* by Antoine de Saint-Exupéry, was not at the appropriate reading level for her class. She thought that the book might be too difficult for her students to read. She knows that if the mean number of letters per word is equal to four the book would be appropriate for her class. We are going to test the teacher’s suspicion that the textbook is too hard for the class.

Method: Select a random sample of 20 words from the first page of this book, attached, by using either a random number table or a random number generator. There are a total of 204 words on this page.

Data: Record your 20 randomly selected observations in the chart below. (50 points)

|  |  |  |  |
| --- | --- | --- | --- |
| Observation | Random Number  (sorted) | Word | Word Length |
| 1 | 2 | When | 4 |
| 2 | 19 | From | 4 |
| 3 | 41 | Is | 2 |
| 4 | 47 | In | 2 |
| 5 | 59 | Without | 7 |
| 6 | 70 | Able | 4 |
| 7 | 79 | Need | 4 |
| 8 | 81 | Digestion | 9 |
| 9 | 82 | I | 1 |
| 10 | 93 | After | 5 |
| 11 | 112 | Looked | 6 |
| 12 | 144 | Was | 3 |
| 13 | 154 | Picture | 7 |
| 14 | 168 | Able | 4 |
| 15 | 175 | I | 1 |
| 16 | 176 | Drew | 4 |
| 17 | 180 | Of | 2 |
| 18 | 188 | Could | 5 |
| 19 | 191 | Clearly | 7 |
| 20 | 196 | things | 6 |

Data Analysis:

1) Use your data to compute the following descriptive statistics. ( 10 points)

|  |  |  |  |
| --- | --- | --- | --- |
| Mean=4.350 | Minimum=1 | Q1=2.25 | Standard Deviation=2.183 |
| Median=4.0 | Maximum=9 | Q3=4.0 |  |
| Mode =4 | Range=8 | IQR=1.75 | UNITS = Letters Per Word |

2) Use the descriptive statistics to construct a boxplot of your data. Label completely. (2 points)



3) Set up the null and alternative hypothesis for this test. Remember to define the parameter of interest in this problem. (2 points)

**Ho: letters vs Ha: >4 letters where  is average word length**

4) Next, complete the remaining steps to conduct this test at the 0.05 level of significance.

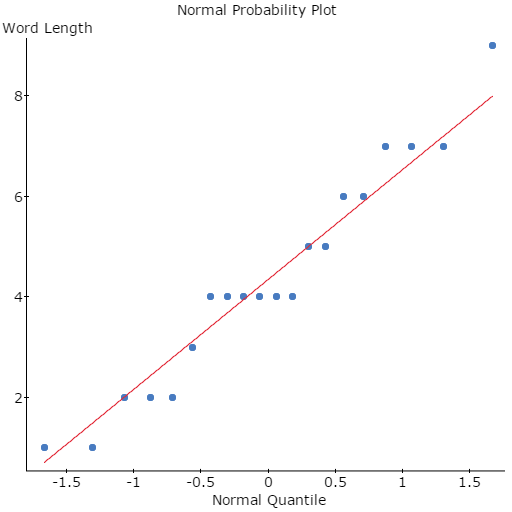
(36 points, 6 points per part)

a) State *n* and α for this problem and check that all assumptions for inference have been met.

n=20, =0.05

The words are a simple random sample from one page of the book.

The distribution of words lengths is symmetric with no outliers as seen in the boxplot above and a normal probability plots shows that the data comes from a normal population as the data follow a linear pattern.



b) Using your sample, compute the value of the test statistic – show all work including the sample mean and sample standard deviation.

**One-Sample T: Length**

Test of mu = 4 vs > 4

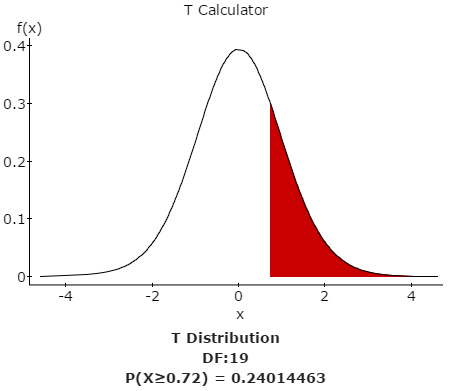
95% Lower

Variable N Mean StDev SE Mean Bound T P

Length 20 4.350 2.183 0.488 3.506 0.72 0.241

Test Statistic = 

c) Compute the p-value based on your test statistics.

p-value = .241 from either StatCrunch output or graph above.

d) Make your decision regarding this hypothesis using the p-value.

Fail to Reject the null hypothesis as the p-value is greater than 0.05

e) Interpret the result in context of the question.

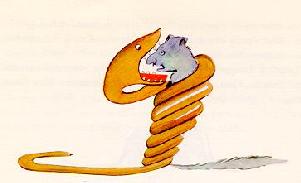
There is no evidence to suggest that the mean number of letters per word is not equal to four. This suggests that the book would be appropriate for her class at the =0.05 level.

f) If you have made an error in your decision, which type of error, Type 1 or Type 2, could you have made? State a consequence of this error for the teacher.

Type II error – fail to reject the null and the null is false.

The teacher would think that is book is at the appropriate level for her students but it is too hard which may frustrate some of her students.

# The Little Prince by Antoine de Saint-Exupéry



Once when I was six years old I saw a magnificent picture in a book, called *True Stories from Nature*, about the primeval forest. It was a picture of a boa constrictor in the act of swallowing an animal. Here is a copy of the drawing. (words 1-46)

In the book it said: "Boa constrictors swallow their prey whole, without chewing it. After that they are not able to move, and they sleep through the six months that they need for digestion." (words 47-80)

I pondered deeply, then, over the adventures of the jungle. And after some work with a colored pencil I succeeded in making my first drawing. My Drawing Number One. It looked like this: (words 81-113)



I showed my masterpiece to the grown-ups, and asked them whether the drawing frightened them. (words 114-128)

But they answered: "Frighten? Why should anyone be frightened by a hat?" (words 129-140)

My drawing was not a picture of a hat. It was a picture of a boa constrictor digesting an elephant. But since the grown-ups were not able to understand it, I made another drawing: I drew the inside of the boa constrictor, so that the grown-ups could see it clearly. They always need to have things explained. My Drawing Number Two looked like this: (words 141-204)

