Test a Perceptual Phenomenon

December 16, 2017

0.0.1 Analyzing the Stroop Effect

Perform the analysis in the space below. Remember to follow the instructions and review the project rubric before submitting. Once you've completed the analysis and write up, download this file as a PDF or HTML file and submit in the next section.

(1) What is the independent variable? What is the dependent variable?

words condition is the independent condition, time is the dependent condition

(2) What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform? Justify your choices.

The mean time consumed by recognizing a word in congruent condition is t_0. The mean time consumed by recognizing a word in incongruent condition is t. The difference between t and t_0 is μ, which follows $\mu = t - t_0$.

H_0: $\mu = 0$.

H_A: $\mu > 0$.

As there are 24 individuals in the sample, which is less than 30, and the population's standard deviation is not given and the distributions are assumed to be Gaussian, we will choose T-test. According to the alternative hypothesis, the test will be a right tailed one sample T-test.

(3) Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability. The name of the data file is 'stroopdata.csv'.

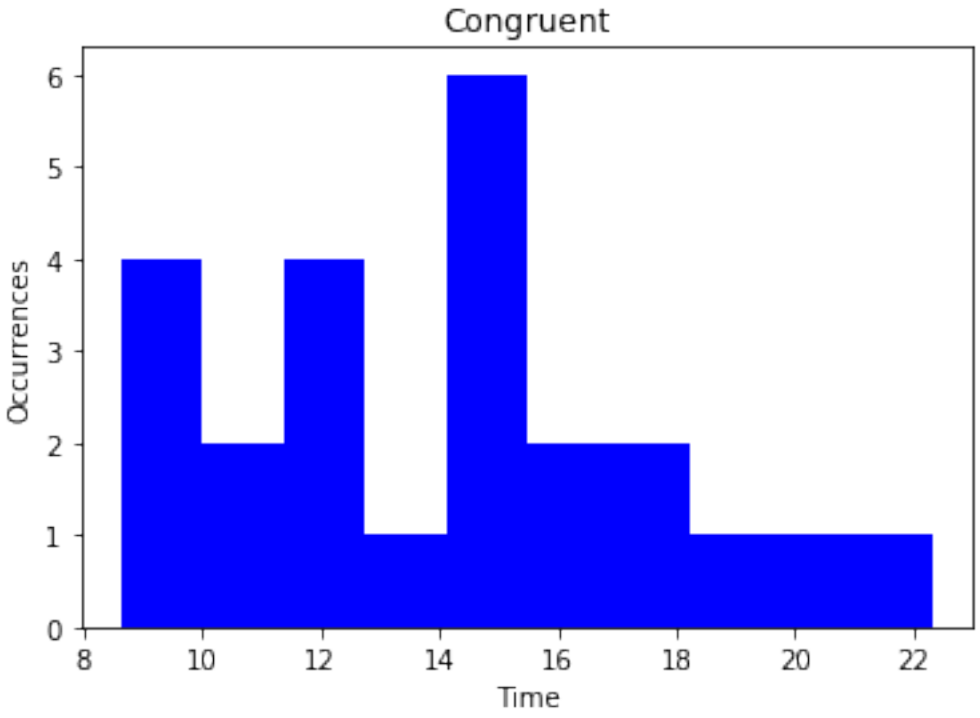
```
In [12]: import pandas as pd
         import scipy.stats as stats

         df = pd.read_csv('stroopdata.csv')
         congruent = df['Congruent']
         incongruent = df['Incongruent']
         congMean = congruent.mean()
         incongMean = incongruent.mean()
         congStd = congruent.std()
         incongStd = incongruent.std()
         print(congMean, incongMean, congStd, incongStd)
```

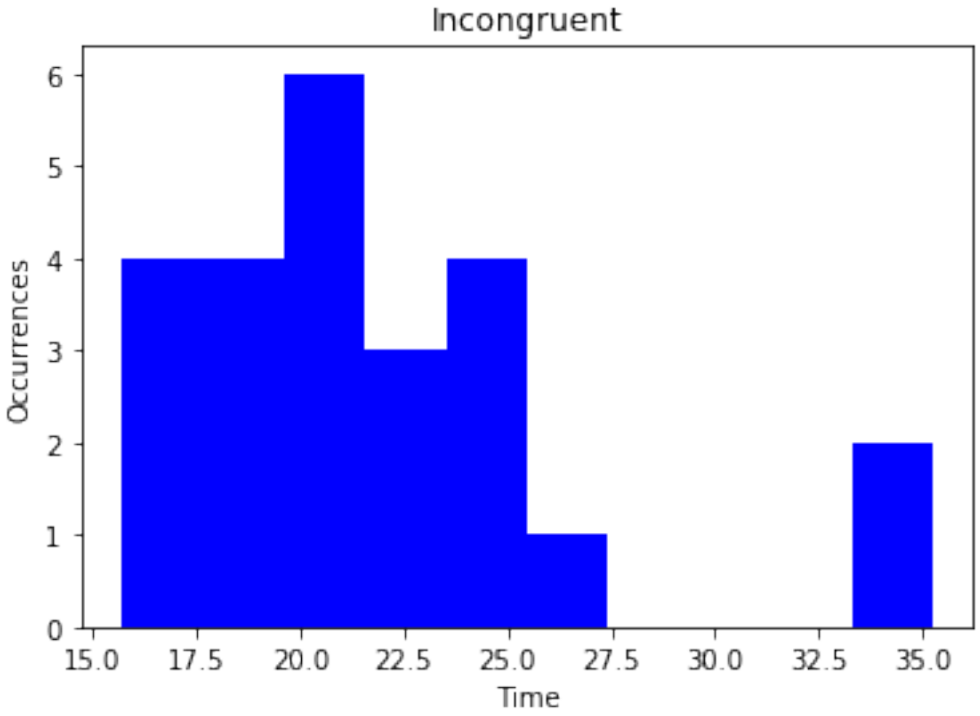
```
14.051125 22.0159166667 3.55935795765 4.79705712247
```

The mean of the 'Congruent' is 14.0511, the standard deviation is 3.5593; the mean of the 'Incongruent' is 22.0159, the standard deviation is 4.7970.

(4) Provide one or two visualizations that show the distribution of the sample data. Write one or two sentences noting what you observe about the plot or plots.

```
In [13]: import matplotlib.pyplot as plt
         %matplotlib inline

         nBins = 10

         plt.figure()
         plt.hist(congruent.tolist(), nBins, facecolor = 'blue')
         plt.xlabel('Time')
         plt.ylabel('Occurrences')
         plt.title('Congruent')

         plt.figure()
         plt.hist(incongruent.tolist(), nBins, facecolor = 'blue')
         plt.xlabel('Time')
         plt.ylabel('Occurrences')
         plt.title('Incongruent')

Out[13]: Text(0.5,1,'Incongruent')
```





The center of the 'Congruent' distribution is smaller than the center of the 'Incongruent' distribution, and the variance of the 'Congruent' distribution is also smaller than the 'Incongruent'

(5) Now, perform the statistical test and report the results. What is the confidence level and your critical statistic value? Do you reject the null hypothesis or fail to reject it? Come to a conclusion in terms of the experiment task. Did the results match up with your expectations?

```
In [14]: import math

         #difference between incongruent and congruent
         diff = incongruent - congruent

         #mean
         mDiff = diff.mean();

         #standard deviation
         stdDiff = diff.std();

         #standard deviation of the difference
         n = len(diff)
         seDiff = stdDiff / math.sqrt(n)
```

```
        #calculate t-statistics
        t = mDiff / seDiff

        #calculate p value
        p = 1-stats.t.cdf(t, n - 1)

        print('T value: ', t, ', P value: ', p)
```

```
T value:  8.02070694411 , P value:  2.05150029187e-08
```

The confidence level is 0.05 and the p-value of the test is 2.0515×10^{-8}, which is significantly smaller than the confidence level. Therefore, the null hypothesis can be rejected.