Test a Perceptual Phenomenon

November 20, 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?

In the 'stroopdata' data set, the 'Time' in the 'Congruent' and 'Incongrent' column is the dependent variable and the word collection given in the stroop effect test is the independent variable.

(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 set of hypothesis for this data set is found to be,
Null Hypothesis: The mean time difference between the 'Incongruent' and 'Congruent' is less than or equal to zero. Alternative Hypothesis: The mean time difference between the 'Incongruent' and 'Congruent' is greater than zero.
$H\_0 = \_ic - \_c <= 0$;
$H\_1 = \_ic - \_c > 0$;
where H0 is the Null hypothesis, H1 is the alternate hypothesis, _ic is the Mean of Incongruent and _c is the Mean of Congruent.

I perform Paired-T test since the data follows Normal distribution and the person undergoing the stroop effect is same under different conditions.

(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 [1]: # Perform the analysis here
        import pandas as pd
        import numpy as np
        import scipy
        df= pd.read_csv('stroopdata.csv')
        mean_congruent , mean_incongruent = df['Congruent'].mean(), df['Incongruent'].mean()
        variance_congruent, variance_incongruent = df['Congruent'].var(), df['Incongruent'].var(
        print(df)
        print(mean_congruent , mean_incongruent)
        print(variance_congruent, variance_incongruent)
```

```
     Congruent  Incongruent
0       12.079       19.278
1       16.791       18.741
2        9.564       21.214
3        8.630       15.687
4       14.669       22.803
5       12.238       20.878
6       14.692       24.572
7        8.987       17.394
8        9.401       20.762
9       14.480       26.282
10      22.328       24.524
11      15.298       18.644
12      15.073       17.510
13      16.929       20.330
14      18.200       35.255
15      12.130       22.158
16      18.495       25.139
17      10.639       20.429
18      11.344       17.425
19      12.369       34.288
20      12.944       23.894
21      14.233       17.960
22      19.710       22.058
23      16.004       21.157
14.051125 22.0159166667
12.6690290707 23.0117570362
```

From the observed dataset, the mean time of 'Congruent' and 'Incongruent' is found to be 14.051125 and 22.0159166667 respectively. The variance of 'Congruent' and 'Incongruent' is found to be 12.6690290707 and 23.0117570362 respectively.

(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.

```python
In [4]:  # Build the visualizations here
         #importing packages
         import matplotlib.pyplot as plt
         import seaborn as sns
         #bar graph to show the difference between mean time difference
         plt.title("Mean time of Congruent and Incongruent")
         plt.bar([0,1],[mean_congruent , mean_incongruent], tick_label=['Congruent','Incongruent'
         plt.ylabel('Time')
         plt.show()
         #histogram to visualize the confidence interval
         plt.hist(mean_diff)
         plt.axvline(x=low,color='red')
```

```
plt.axvline(x=up,color='red')
plt.title("Confidence level graph showing the mean time difference")
plt.xlabel('Time')
plt.show()
```


Mean time of Congruent and Incongruent

Confidence level graph showing the mean time difference
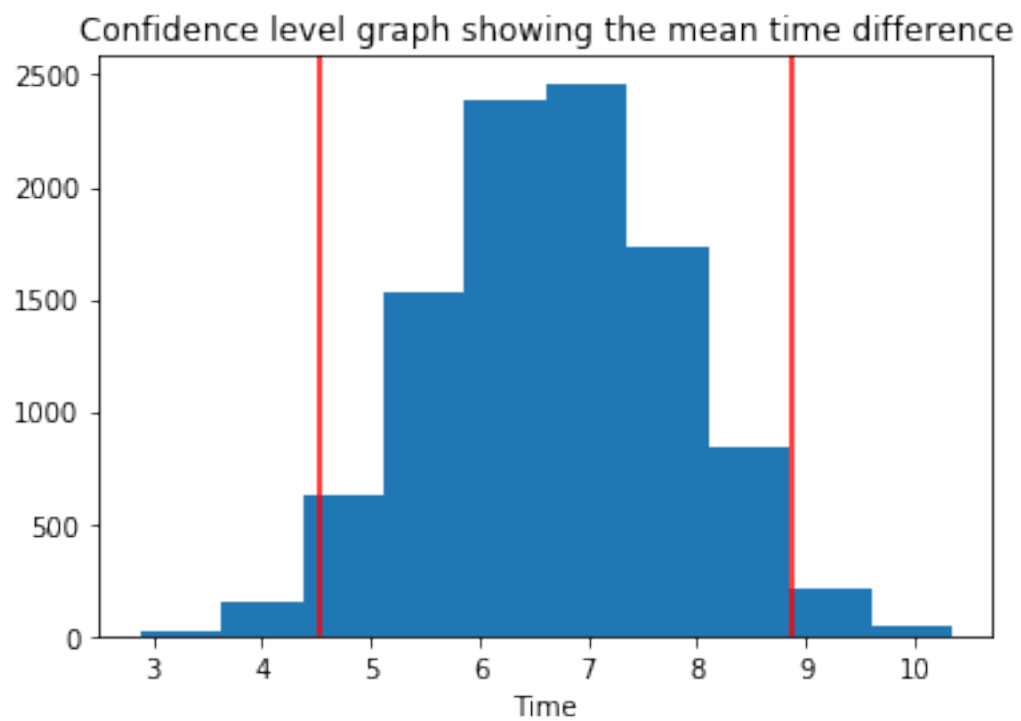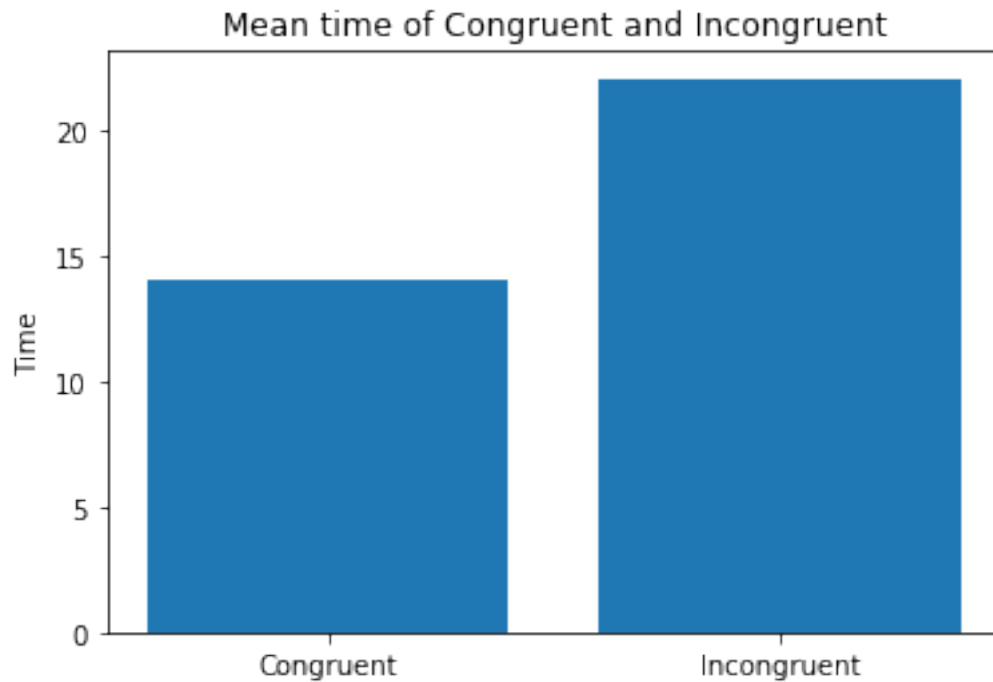
Here, the graphs shows the first bar graph shows that the mean time for 'Incongruent' is greater than the 'Congruent'. And, the second grapgh shows the confidence interval.

(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 [6]: # Perform the statistical test here
        #getting sample from the population
        sample_data = df.sample(10)
        #bootstraping
        mean_diff = []
        for _ in range(10000):
            boot_sample = sample_data.sample(10, replace=True)
            mean_diff.append(boot_sample.Incongruent.mean()-boot_sample.Congruent.mean())
        low, up= np.percentile(mean_diff,2.5), np.percentile(mean_diff,97.5)
        #finding p-value
        scipy.stats.ttest_ind(df['Congruent'], df['Incongruent'])

Out[6]: Ttest_indResult(statistic=-6.5322505539032285, pvalue=4.5949489622951854e-08)
```

The confidence level is 95% and the critical value I have taken is 0.05. I have obtained the 'statistic' value as -6.5322505539032285 and the 'p-value' as 4.5949489622951854e-08. The obtained the p-value which approximately 0.001 which is less than 0.05.

Conclusion: Therefore, I reject the null hypothesis. Thus, the conclusion I have arrived is, the mean time difference between the 'Incongruent' and the 'Congruent' is greater than zero.

Result: Yes, the results match up with my expectation.