DATA ANALYST NANODEGREE - UDACITY
5TH PROJECT

TEST A PERCEPTUAL PHENOMENON

THE STROOP EFFECT

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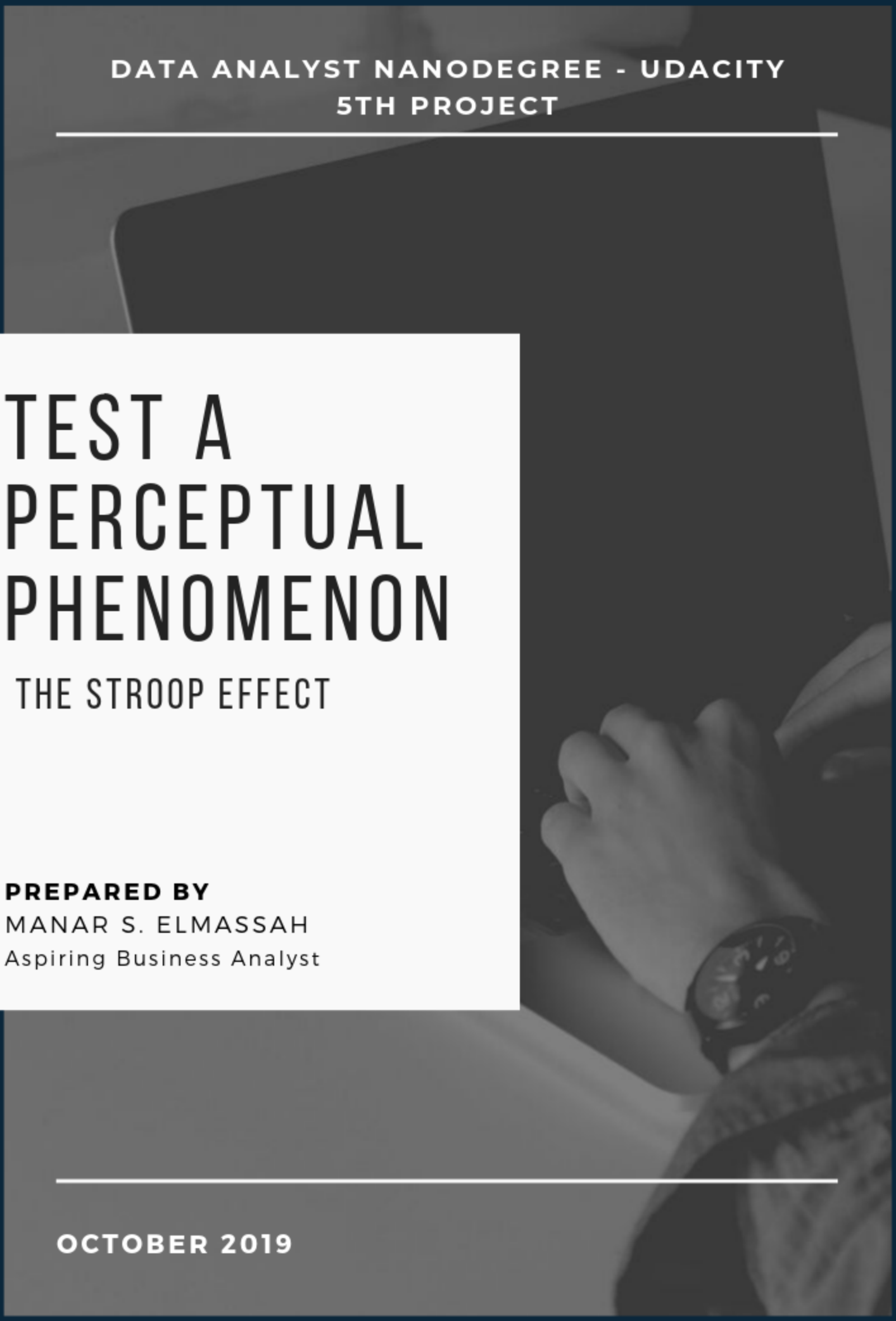

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Analyzing the Stroop Effect

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, upload that PDF/HTML into the workspace here (click on the orange Jupyter icon in the upper left then Upload), then use the Submit Project button at the bottom of this page. This will create a zip file containing both this .ipynb doc and the PDF/HTML doc that will be submitted for your project.

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

The independant value : Congruncy of word and color.

The dependant value : The time taken to read the list of words.

(2) What is an appropriate set of hypotheses for this task? Specify your null and alternative hypotheses, and clearly define any notation used. Justify your choices.

$$H_0: Time Read Congrant >= Time Read Incongrant $$
$$H_1: Time Read Congrant < Time Read Incongrant $$

(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 [13]:

```
# Import Libraries

import pandas as pd
import numpy as np
import math
import matplotlib.pyplot as plt
# Import Dataset
df= pd.read_csv('stroopdata.csv')
df.head()
```

Out[13]:

	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

In [2]:

```
#OverView on dataset
df.info()

# Statistical Overview on dataset
df.describe()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 24 entries, 0 to 23
Data columns (total 2 columns):
Congruent      24 non-null float64
Incongruent    24 non-null float64
dtypes: float64(2)
memory usage: 464.0 bytes
```

Out[2]:

	Congruent Congruent	Incongruent Incongruent
count	24.000000	24.000000
mean	14.051125	22.015917
std	3.559358	4.797057
min	8.630000	15.687000
25%	11.895250	18.716750
50%	14.356500	21.017500
75%	16.200750	24.051500
max	22.328000	35.255000

Answer Q3

From what we can see from our sample is that the mean $TimeReadCongrant$ is 14.05 sec while the mean for □ □$imeReadIncongrant$ is 22.01

Also the standard deviation for TRC is less than this of $TimeReadIncongrant$ at 3.56 and 4.79 respectively.

In [3]:

```
# Compute Read time mean for Congruent
con_mean = df['Congruent'].mean()

# Display Read time mean
con_mean
```

Out[3]:

```
14.051124999999999
```

In [4]:

```
# Compute Read time mean for Incongruent
incon_mean = df['Incongruent'].mean()


# Display Read time mean
incon_mean
```

Out[4]:

```
22.015916666666666
```

In [5]:

```
#Compute Observed Difference for the phenomenon

obs_diff = incon_mean- con_mean

# Display observed difference in completion rates
obs_diff
```

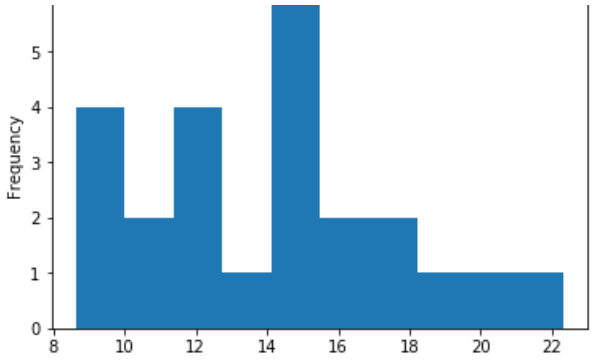
Out[5]:

```
7.9647916666666667
```

(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 [6]:

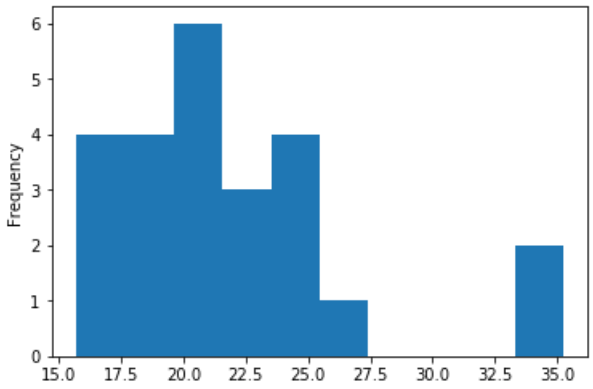
```
# Build the visualizations for Congruent

df["Congruent"].plot.hist();
```



From what's noticed in this graph is that the spread for Congruent reads is wide but the most values are around 15 secs

In [7]:

```
# Build the visualizations for Incongruent
df["Incongruent"].plot.hist();
```



From what's noticed in this graph is that the spread for Incongruent reads is narrow and the most values are around 20 secs.

There are also some outliers around 35 secs

(5) Now, perform the statistical test and report your results. What is your confidence level or Type I error associated with your test? What is your conclusion regarding the hypotheses you set up? Did the results match up with your expectations? **Hint:** Think about what is being measured on each individual, and what statistic best captures how an individual reacts in each environment.

Statistical Test

Since we don't have the population's standard divitation and our sample size is less than 30, It's better to run a T-Test rather than a Z-Test.
"Referring to Ref(1)"

and since we want to check whether our *Congrant* group took less time than the *Incongrant* group it's better to run a one-Tailed T-Test.
"Referring to Ref(2)"

In [9]:

```
#Sample size
print(df['Congruent'].size)
print(df['Incongruent'].size)
```

```
24
24
```

In [10]:

```
#Referring to the t-table of critical values "in Ref3"
#that for a 95% confidence level and 23 degrees of freedom "sample-size -1".
t_critical = 1.714
```

In [12]:

```
#Retreaving the difference between the means of the two groups from Q3
print(obs_diff)
```

```
7.96479166667
```

In [16]:

```
# To find the standard diviation of the differences between the groups
diff_df= df['Congruent'] - df['Incongruent']
diff_std= diff_df.std(axis=0)
print(diff_std)
```

```
4.86482691036
```

In [17]:

```
# Find t-statistic
obs_diff/(diff_std / math.sqrt(24))
```

Out[17]:

```
8.020706944109957
```

Result

Our t-statistic (8.02) is greater than our critical value (1.7139),So we **reject the null hypothesis.** and confirms that

$$H_1: Time Read Congrant < Time Read Incongrant $$

Solving Question 5 using bootstrapping

In [5]:

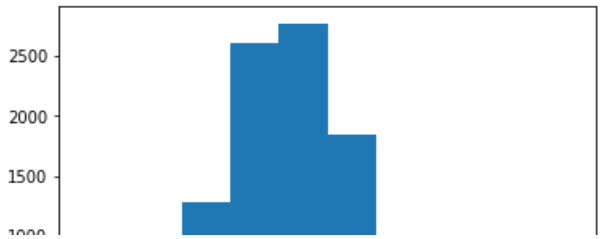
```
# Create sampling distribution for with boostrapping
bootmeans_con=[]
bootmeans_inc=[]

for _ in range(10000):
    bootsample= df.sample(10, replace = True)
    bootmeans_con.append(np.mean(bootsample["Congruent"]))
    bootmeans_inc.append(np.mean(bootsample["Incongruent"]))
```

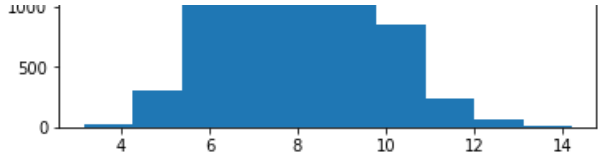
In [6]:

```
#difference in mean of the reading times of each state
diffs=[]
bootmeans_inc = np.array(bootmeans_inc)
bootmeans_con = np.array(bootmeans_con)
diffs.append(bootmeans_inc-bootmeans_con)
```

In [7]:

```
# plot distribution
plt.hist(diffs);
```





In [17]:

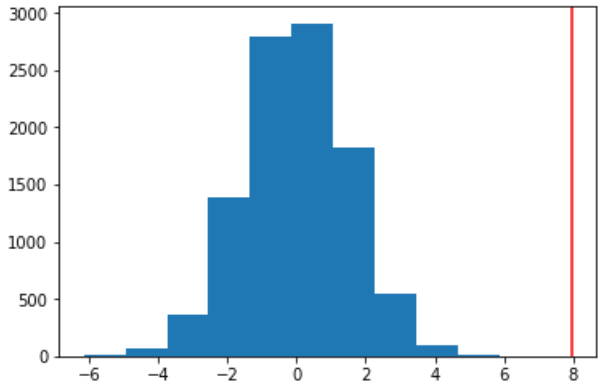
```
# convert to numpy array
diffs = np.array(diffs)
```

In [18]:

```
# create distribution under the null hypothesis
null_vals = np.random.normal(0, diffs.std(), diffs.size)
```

In [19]:

```
# plot null distribution
plt.hist(null_vals);

# plot line for observed statistic
plt.axvline(obs_diff, c='red');
```



In [22]:

```
# compute p value
(null_vals > obs_diff).mean()
```

Out[22]:

```
0.0
```

From what's shown above, as the P value is less than Alpha (0.05) we reject the null hypotheses.and confirm that as per the alternate hypotheses Which matches up with what we expected that

$$H_1: Time Read Congrant < Time Read Incongrant $$

Refrences

1- Choosing which statistical test to run: https://www.statisticshowto.datasciencecentral.com/probability-and-statistics/hypothesis-testing/t-score-vs-z-score/

2- Choosing T-Test Type: https://www.statisticssolutions.com/should-you-use-a-one-tailed-test-or-a-two-tailed-test-for-your-data-analysis/

3- How to run the T-Test using Python and T-Table: https://towardsdatascience.com/inferential-statistics-series-t-test-using-numpy-2718f8f9bf2f