Test a Perceptual Phenomenon

The purpose of this project is to investigate a classic phenomenon from experimental psychology, called the **Stroop Effect** (https://en.wikipedia.org/wiki/Stroop_effect).

In psychology, the Stroop effect is a demonstration of interference in the reaction time of a task. When the name of a color (e.g., "blue", "green", or "red") is printed in a color that is not denoted by the name (e.g., the word "red" printed in blue ink instead of red ink), naming the color of the word takes longer and is more prone to errors than when the color of the ink matches the name of the color.

Incongruent words condition: Green Red Blue
congruent words condition: Green Red Blue

To test this effect, we analyzed a data set, which has times recorded, by participants, during congruent and incongruent experiment. Data set can be downloaded from **stroopdata.csv** (https://drive.google.com/file/d/0B9Yf01UaIbUgQXpYb2NhZ29yX1U/view). Based on this analysis here are the answers of some of the questions.

1. What is our independent variable? What is our dependent variable?

Independent variable: Reading words from equally sized lists based on congruent and incongruent words conditions.

Dependent variable: Time taken, while read through the lists.

2. What is an appropriate set of hypotheses for this task?

Here population parameters (mean & standard deviation) are not known and we are using sample of size 24. As the sample size is less than 30, the sample data no longer approximate a normal distribution. These factors make use of T-Test more appropriate than Z-value.

A one-tailed test is appropriate under the assumption that incongruent word conditions will not improve recognition times. The one-tailed test allows examination of the negative impact of incongruent word conditions. Here samples (self-pairing) are dependent becaue same subjects are assigned to two different conditions and tested for each, which area defining criteria for "repeated-measures"

Null hypothesis: The mean time for colour recognition for congruent words is equal to or greater than the mean time for incongruent words.
$$H_0 : \mu_C \geq \mu_I$$

Alternate hypothesis: The mean time for colour recognition for congruent words is equal to or greater than the mean time for incongruent words.
$$H_A : \mu_C < \mu_I$$

This is going to be a one-tailed test and I have taken alpha level of .05.

3. Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability.
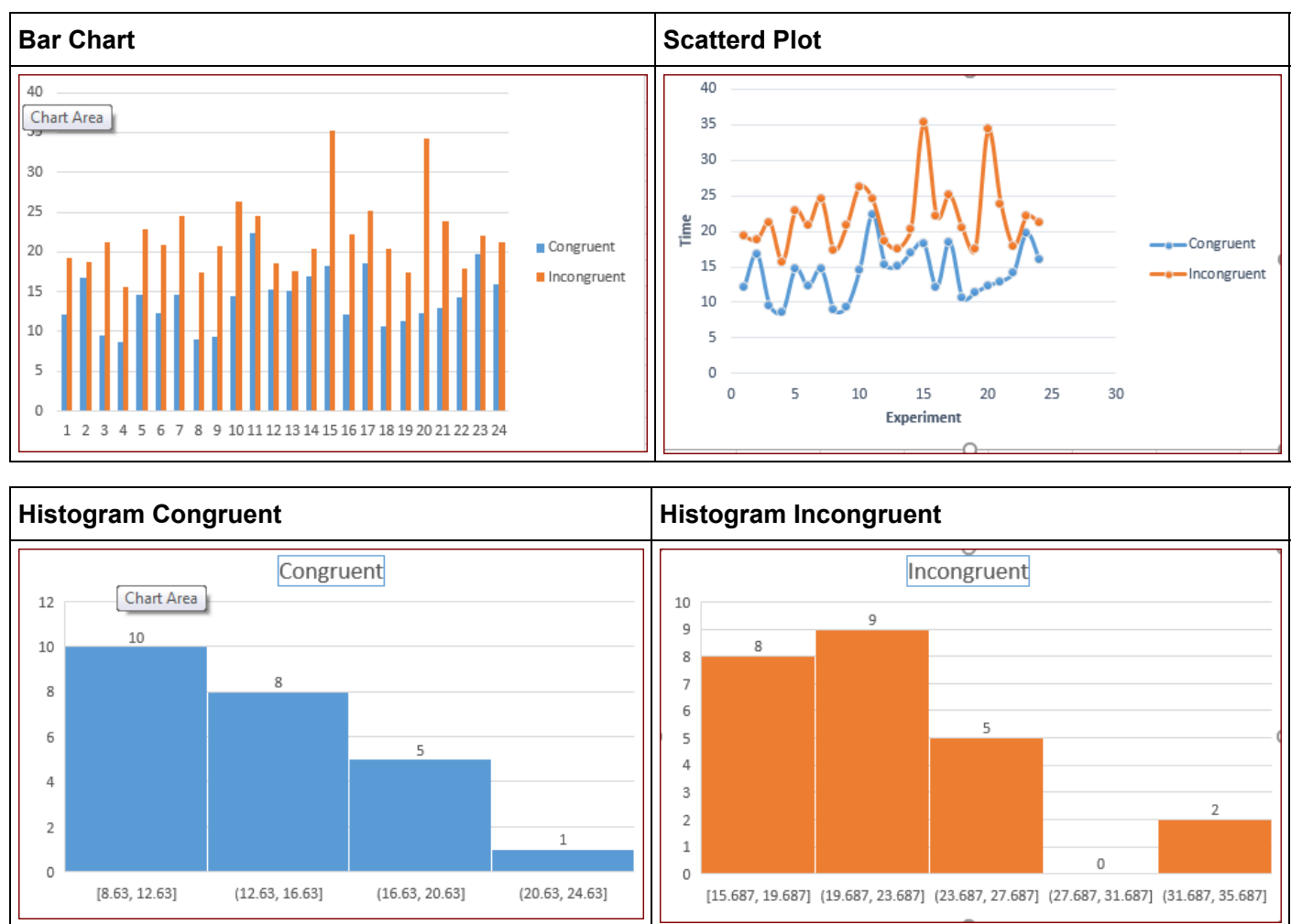
For Incongruent:

$$Mean(\bar{X}_I) = 22.02, \text{Standard deviation}(S_I) = 4.80, \text{Sample size}(n) = 24$$

For Congruent:

$$Mean(\bar{X}_C) = 14.05, \text{Standard deviation}(S_C) = 3.56, \text{Sample size}(n) = 24$$

4. One or two visualizations have been created that show off the data, including comments on what can be observed in the plot or plots.

Bar Chart	Scatterd Plot

Histogram Congruent	Histogram Incongruent

The congruent words sample has a distribution which is between 8 and 22 seconds and has a lower average completion time compared to the incongruent words scatterplot which shows the distibtuion is between 15 to about 36 seconds. The average completion time is definitely higher.

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

Here $\alpha = .05$ (1-tailed test), $n = 24$ (Sample size), $df = 23$ (Degree of freedom)

$\bar{X}_C = 14.05, \bar{X}_I = 22.02$

Point Estimate $= \bar{X}_C - \bar{X}_I = -7.97$

Standard Error of differences $= S_D = 4.86$

t-Critical $= -1.714$

t-Statistic $= \dfrac{(\bar{X}_C - \bar{X}_I)}{\dfrac{S_D}{\sqrt{n}}} = -8.03$

As we found that t-Statistic< t-critical so we reject the null hypotheses. We conclude that the congruent/incongruent condition does affect the time it takes to name the ink colors, and incongruent condition takes more time than congruent condition test.