Overview:

The objective of this research is to study the experimental data from a sample size of 24 and analyze if Stroop effect played a factor in the reaction time of reading the color of the print. This particular Stroop test involves color of the print matching the color words (congruent words) against the color of the print that does not match the color words.

Question 1:

a. What is our independent variable?
   Answer: Independent variable is the condition of the words. The study is understand if the condition of the words i.e. congruent or incongruent has any bearing on the reaction time.

b. What is our dependent variable?
   Answer: Dependent variable is the reaction time of the participants to read the color of the print.

Question 2:

a. What is an appropriate set of hypotheses for this task?
   Answer:
   My Null Hypothesis is that Stroop effect has no effect. Hence the Mean reaction time of the congruent words denoted by μ_c is equal to the Mean reaction time of the incongruent words denoted by μ_i
   $H_0 : \mu_c - \mu_i >= 0$

   Alternate Hypothesis is that Stroop effect is true and hence the Mean reaction time of the congruent words denoted by μ_c is less than the Mean reaction time of the incongruent words denoted by μ_i

   $H_A : \mu_c - \mu_i < 0$

b. What kind of statistical test do you expect to perform? Justify your choices
   Answer:
   1. The objective is to check how different the mean from 2 sample sets are, from each other. Also, the population parameter is not available. Thus t-test will be a suitable statistical test
   2. Here we are given a Paired Sample with tow condition, where the same set of participants are provided with two series of word i.e. both congruent and incongruent list of words. Hence, a dependent sample t-test is suitable
   3. Also, we need to determine if Stroop effect affected the reaction time adversely and hence, I am planning to use **one tailed dependent sample t-test with $\alpha = .05$**.

Assumptions for t-tests:
The dependent variable must be continuous (interval/ratio) - satisfied
The observations are independent of one another - assumed
The dependent variable should be approximately normally distributed – assumed (reference forum thread)

The dependent variable should not contain any outliers - satisfied

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

Answer:
I have listed below the Mean of the samples

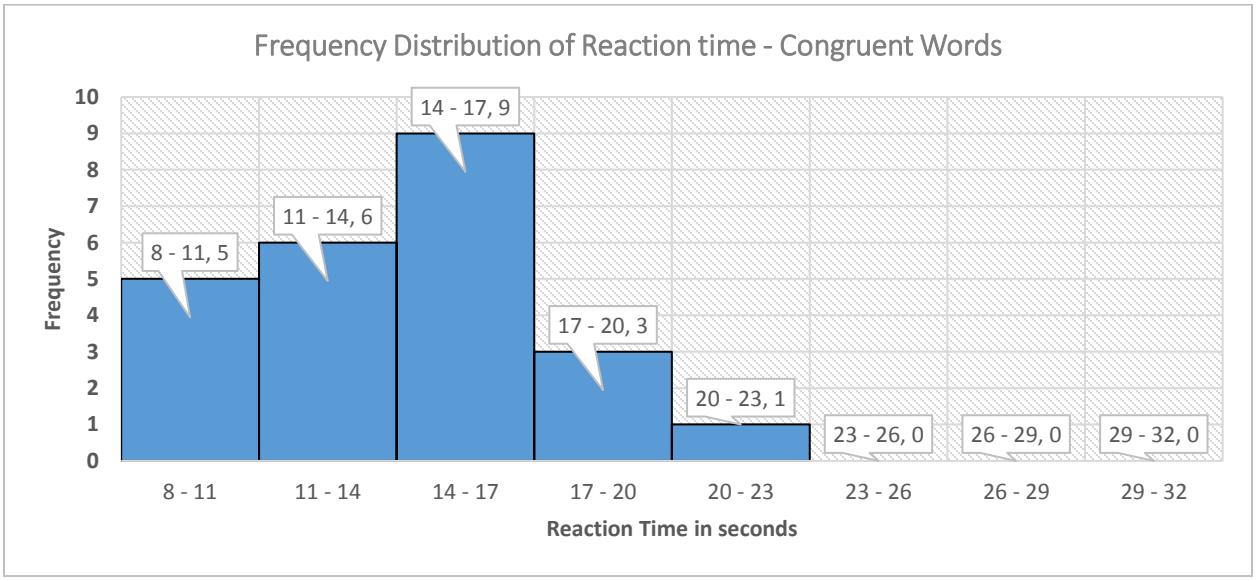
Congruent Word Sample Statistic:
$\bar{X}_c = 14.05$
$SD_c = 3.56$

Incongruent Word Sample Statistic:
$\bar{X}_i = 22.01$
$SD_i = 4.80$

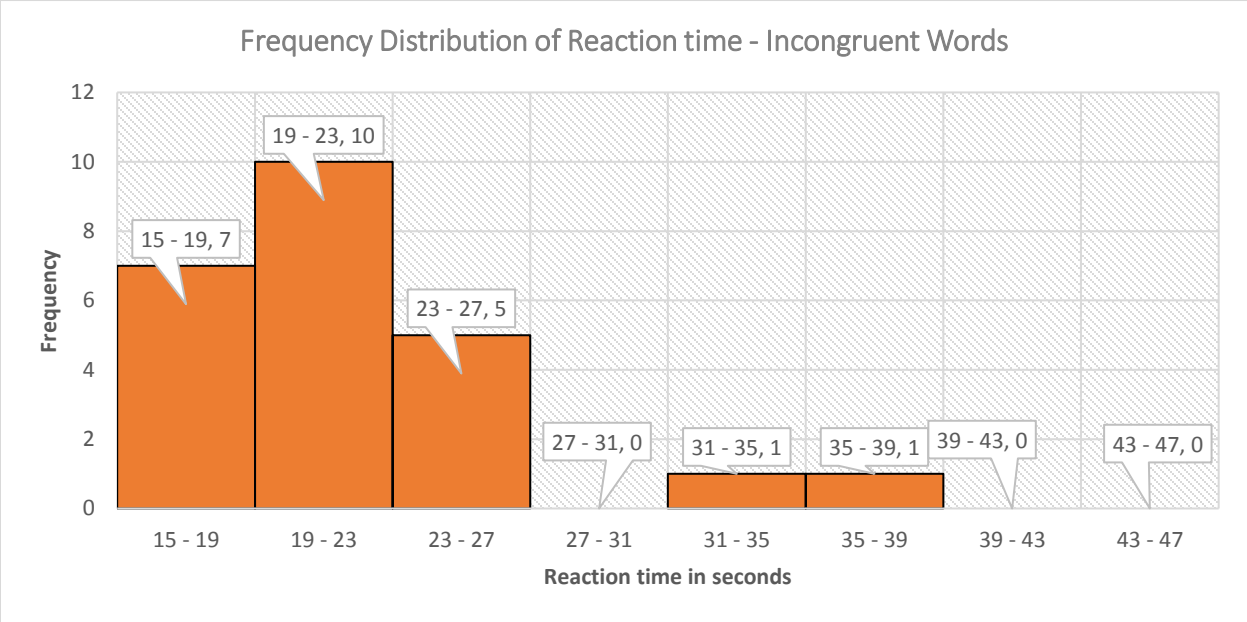
Question 4:
Provide one or two visualizations that show the distribution of the sample data. Write one or two sentences noting what you observe about the plot or plots.

1. Below chart shows the Frequency distribution of reaction time for Congruent and Incongruent words. Both the distributions are positively skewed. Hence Mode < Median < Mean

2. Sampling Distribution of Means pertaining to congruent words would be centered at 14.05 and 68% of the Mean from the sample would fall between 1 SD (3.56) i.e. between 10.49 and 17.61



3. Sampling Distribution of Means pertaining to incongruent words would be centered at 22.01 and 68% of the Mean from the sample would fall between 1 SD (4.80) i.e. between 17.21 and 26.81



Question 5:
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? Come to a conclusion in terms of the experiment task. Did the results match up with your expectations?

Hypothesis test ($\alpha = .05$)

$\mathbf{H_0 : \mu_c - \mu_i >= 0}$

$\mathbf{H_A : \mu_c - \mu_i < 0}$

Dependent sample t-test Results:

$t(23) = -8.02$, $p < .05$, one tailed
$t_{critical}$ (23) at 0.05 = $\pm$ 1.714
Confidence interval on the mean difference; 95% CI = (-9.66,-6.26)

Based on the one-tailed t-test where $t(23) < t_{critical}$ (23) at .05, I reject the Null Hypothesis. The results of the t-test matches with the experiment task.
Note: My reaction time with congruent and incongruent terms were 12.9 and 21.13 correspondingly.

Question 6. Optional: What do you think is responsible for the effects observed? Can you think of an alternative or similar task that would result in a similar effect?

r^2 = .73
The measure of variability in mean among the 2 sample set is 73.66% and this is due to the Stroop effect.

Warping of the words, emotional stroop produces similar findings per Wikipedia
One experiment that I can think of Shape sorter Toy where congruency is when shape and the color of the puzzle piece match the puzzle and in congruency condition shall be when the color of the shape of the puzzle piece matches the puzzle but not the shape.

Reference:

- Stroops effect: (https://en.wikipedia.org/wiki/Stroop_effect#Variations)
- Stroops effect experiement (https://faculty.washington.edu/chudler/java/ready.html)
- Calculating the Frequency distribution table: (https://www.easycalculation.com/statistics/frequency-distribution.php)
- Paired sample t-test assumptions (http://www.statisticssolutions.com/manova-analysis-paired-sample-t-test/)