1: Question response correctly identifies the independent and dependent variables in the experiment.

The independent variables in the test are the colors of the text in the stroop test. The dependent variable is the response time. As we see that the response times are shorter than in the case of a congruent test when the letter and the color of the letter correlate, and the response times are longer when the letter and the color of the letter are different

Referred Source: Udacity Lectures

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 appropriate set of hypothesis for this task are the "Null Hypothesis" and the "Alternate Hypothesis".

- The Null Hypothesis assumes that there is no change in response times during Congruent test v/s Incongruent Test (or in other words $\mu_{congruent} = \mu_{Incongruent}$; $\mu_{congruent} - \mu_{Incongruent} = 0$)
- The Alternate Hypothesis assumes that there the two means are not equal (or in other words $\mu_{congruent} =! \mu_{Incongruent}$)

We don't have the whole population set, hence we cannot find the population parameters (population mean and the population standard deviation). That rules out the Z test. We are going to be make an assessment based on the sample population (24). Hence it makes sense to use the T Test. There are different type of t-tests but for this example it makes sense to use the paired sample t test.

The reason we use a paired sample t test is because we are comparing the groups of people who are related in some way, or in simpler words each participant participates in both the conditions of the experiment. Because each participant in each condition are related, they are actually the same exact participants in each condition we will use the paired Samples T-test.

Referred Source: Udacity Lectures, http://statistics-help-for-students.com/What_are_T_Tests_for_independent_and_paired_samples.htm#.WCzfbfkrI2w

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

Measures of Central Tendency

$Mean_{CongruentScores}$ = 14.05

$Mean_{IncongruentScores}$ = 22.02

$Median_{CongruentScores}$ = 14.36

$Median_{IncongruentScores}$ = 21.02

$Mode_{CongruentScores}$ = N/A

$Mode_{IncongruentScores}$ = N/A

Measures of Variability

$Variance_{Congruent\ Scores}$ = 12.14

$Variance_{Incongruent\ Scores}$ = 22.06

$StandardDeviation_{Congruent\ Scores}$ = 3.559

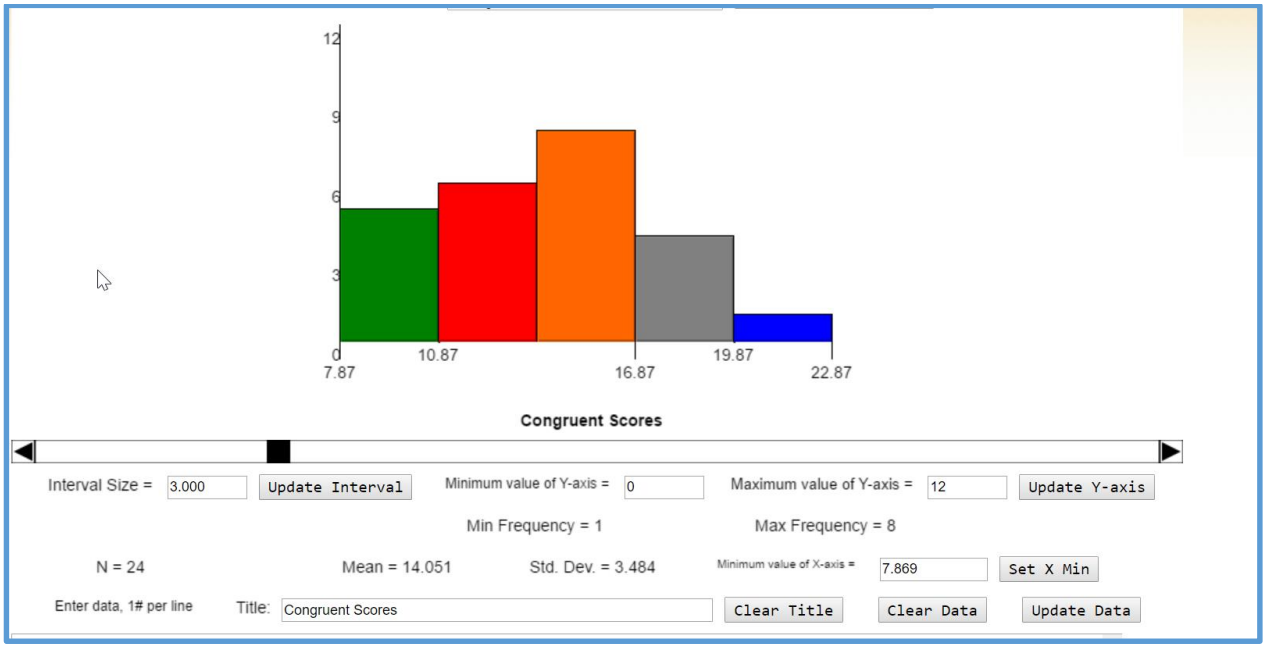
$StandardDeviation_{Incongruent\ Scores}$ = 4.797

Referred Source: Udacity Lectures

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.

Congruent Scores

- **Visualization (Histogram with Bin Size of 3)**

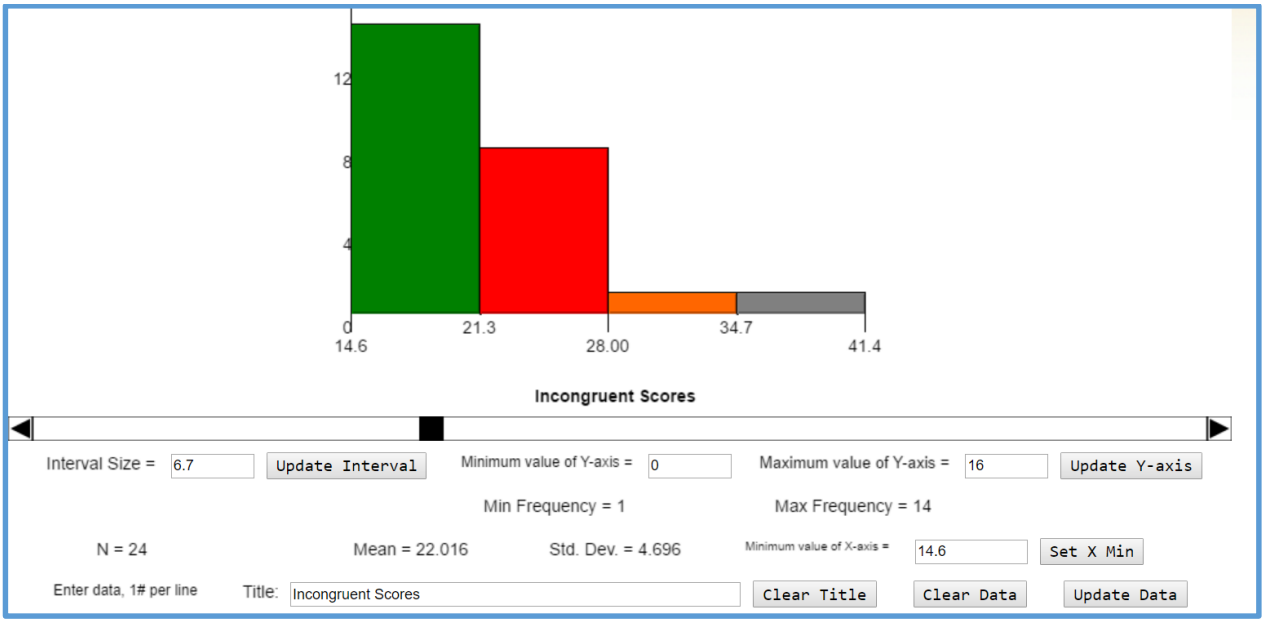


- **Description:** We see that the scores positively skewed with the sample mean of ~14.
- **Referred Source:** http://www.shodor.org/interactivate/activities/Histogram/

Incongruent Scores

- **Visualization (Histogram with Bin Size 3)**

- **Description: The bin size of 3 results in a gap in histogram, but we still** see that the scores positively skewed with the sample mean of ~22. Increasing the bin size to 6.7 gives a much smoother curve.



- **Referred Source:** http://www.shodor.org/interactivate/activities/Histogram/

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

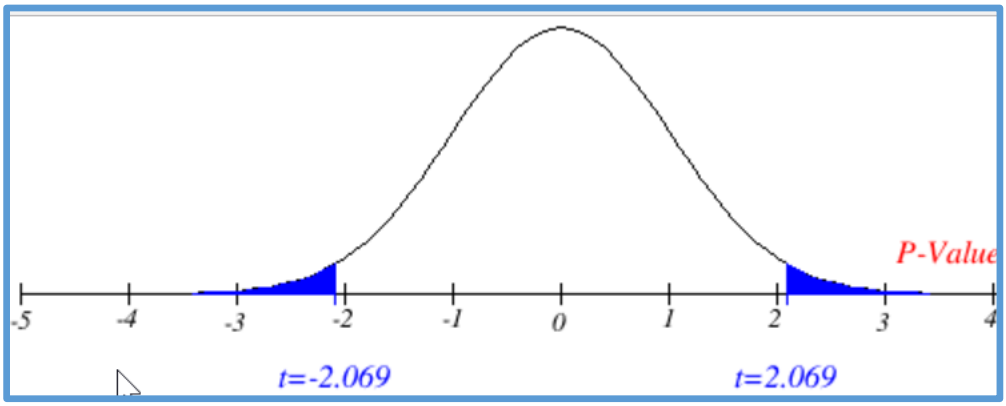
We are going to perform a two tail T Test, at a 95% confidence level

At 95% confidence level and with 23 degrees of freedom (24-1) the t statistic value from the table is 2.069

$Average_{Congruent-Incongruent} = Average_{ncongruent} - Average_{Incongruent}$
→14.05 – 22.01 = -7.94

$Standard\ Error = Standard\ Deviation_{Congruent-Incongruent}/SQRT(N)$
→4.86/SQRT(24) = 4.86

$T\ Statistic = Average_{Congruent-Incongruent} / (Standard\ Error/SQRT(N))$
→-7.94/4.86/(SQRT(24)) = -8.02



Based on the diagram above we see that the T Statistic value of -8.02 falls in the critical area (way to the left of the t critical value of -2.069). Hence we reject the null hypothesis

We conclude that there is a difference in mean based on the effect of the independent variable, and we accept the alternate hypothesis! Yes the results match up with the initial expectations.

Referred Source:

Udacity Lectures
http://www.imathas.com/stattools/norm.php
https://onlinecourses.science.psu.edu/stat500/node/51
https://www.youtube.com/watch?v=8ebXzSoR_E#t=618.457032

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? Some research about the problem will be helpful for thinking about these two questions!

The independent variable of the color of the text definitely has an effect on us rejecting the null hypothesis.