P1: Testing a perpetual phenomenon

1.) In the Stroop Task, the dependent variable is *the time it takes to name the ink colors in equally-sized lists*. The independent variable is the *congruency of the list of words*.

2.) Null Hypothesis (H_0): The average time taken to read out the congruent list of words is equal to the average time taken to read out the list of incongruent list of words.

H_0: $\mu_{congruent} = \mu_{incongruent}$ (or, $\mu_D = 0$)

Alternate Hypothesis (H_A): The average time taken to read out the congruent list of words is not equal to the average time taken to read out the list of incongruent list of words.

H_A: $\mu_{congruent} \neq \mu_{incongruent}$ (or, $\mu_D \neq 0$)

Note: $\mu_{congruent}$ is the population mean time to read out the congruent list of words in seconds.

$\mu_{incongruent}$ is the population mean time to read out the incongruent list of words in seconds.

μ_D is the difference between the two population means ($\mu_D = \mu_{incongruent} - \mu_{congruent}$)

Statistical Test: We will perform a *paired-sample t-test (or dependent-sample t-test)*.

- This is a paired sample test because the same individual is taking test for both congruent and incongruent list of words.
- This is a t-test because, we don't know the population parameters. All we have is a sample of people taking the test.

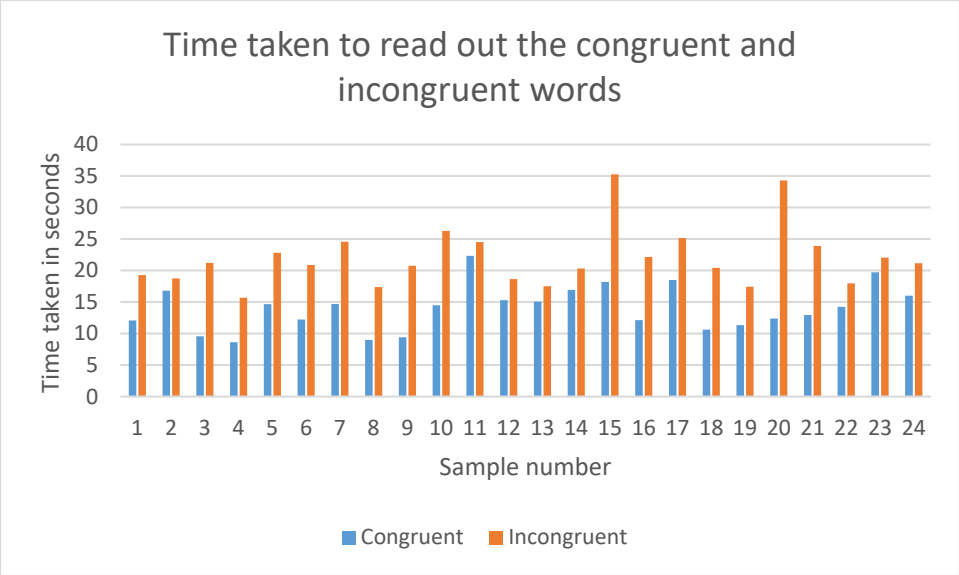
3.) Measures of Central Tendency:

- Mean of the time taken to read out the congruent list of words = 14.05s
- Mean of the time taken to read out the incongruent list of words = 22.016s
- Mean of the difference of samples ($\bar{x}_D$) = 7.96s
- Median of the difference of samples = 7.67

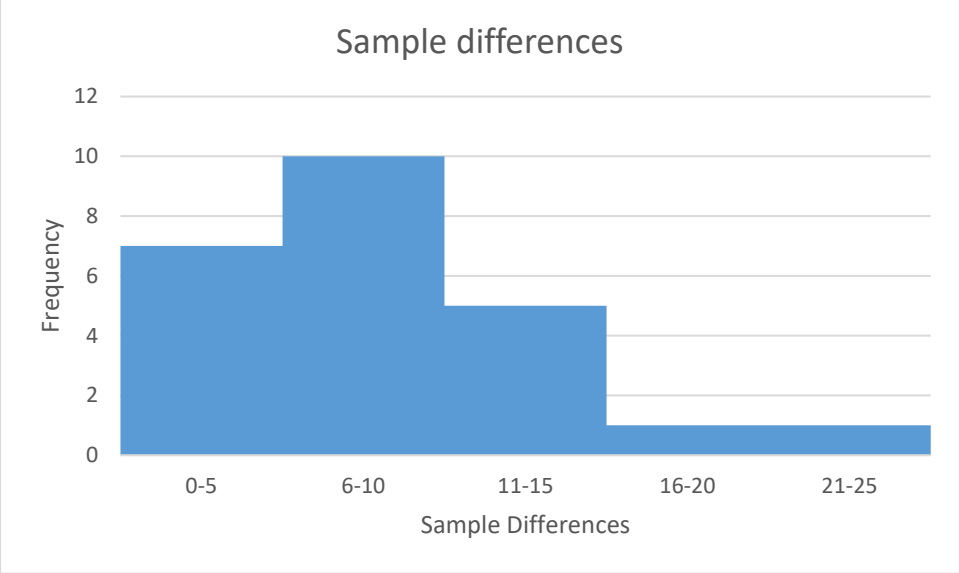
Measures of Variability:

- Variance of the difference of samples = 23.67
- Standard Deviation of difference of samples = 4.86

4.) Visualizations:



The above plot is a chart showing the time taken to read out the congruent and incongruent list of words by each person. We observe that in all cases, the time taken to read the incongruent list of words is greater than that of the congruent list.



The above plot is a histogram showing the frequency of the sample differences for all the people. We observe that most number of sample differences lie between 6 to 10 seconds, i.e. this is the interval in which the mode of the sample differences lies (the mean being 7.96s and the median being 7.67s).

5.) Results of the statistical test:

Descriptive statistics: Mentioned above part (3)

Inferential statistics: Hypothesis test ($\alpha = 0.05$)

- Type of test: Dependent-Sample t-test
- Direction of the test: 2-tailed
- Degrees of freedom = 23
- t-statistic: t = 8.024
- t-critical value: $t_{cr} = \pm 2.069$
- $p<.05$

As the t-statistic is greater that t-critical value, **we reject the null**.

Conclusion: The results of the statistical test matched my expectation. By looking at the data, it was clear that the time taken to read out the incongruent list of words for each person taking the test was greater than the time taken to read out the congruent list of words. Also, when I took the test, I got similar results. The results of the dependent-sample t-test support my initial observation. As the t-statistic is way greater than the t-critical value, we can reject the null hypothesis.

6.) According to me, these results can be attributed to human psychology. Humans are used to reading out words written in default color (black) at a fast pace. But, when these words are in different inks (incongruent list of words), then it slows their pace to read out these words and makes us prone to errors because this causes some interference in the way we think.

An alternative experiment can be testing the time difference between congruent list of words and words written in black color. This experiment could tell us if adding colored ink to the words helps our brain process the words faster than plain black ink.

References:

1.) https://en.wikipedia.org/wiki/Stroop_effect#Experimental_findings

2.) http://www.sciencebuddies.org/science-fair-projects/project_variables.shtml

3.) https://rstudio-pubs-static.s3.amazonaws.com/34222_701124f9913b40c9ba318ef3b2b17e45.html