Statistics: The Science of Decisions Project Instructions

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

The independent variable is the different word display conditions: congruent words condition and incongruent words condition. The dependent variable is the time taken for the participant to go through each condition.

2. What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform? Justify your choices.

Null hypothesis: participants take the same time to go through a congruent words condition and an incongruent words condition. That is to say, the difference between congruent population mean and incongruent population mean equals to 0. $\mu C - \mu I = 0$.

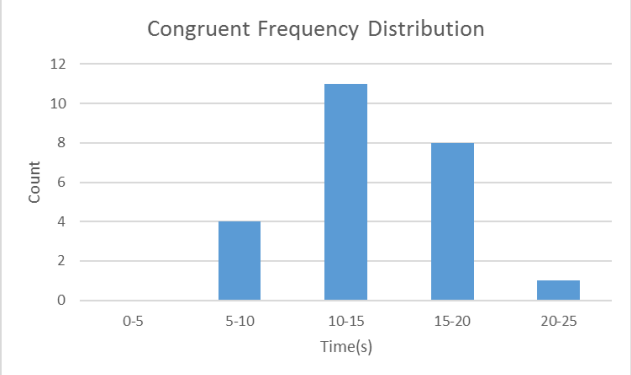
Alternative hypothesis: participants on average take less time to go through a congruent words condition than an incongruent words condition. That is to say, the difference between congruent population means and incongruent population mean is less than 0. $\mu C - \mu I < 0$.

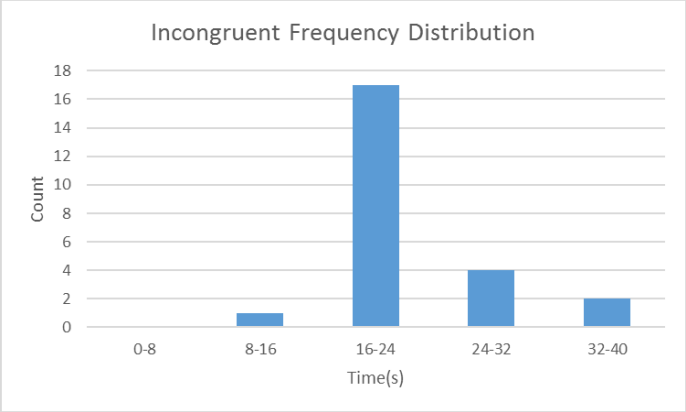
T-test is to perform. There are 24 (less than 30) samples in the example and we don't know the population's standard deviation. So we cannot use the z-score. Here, paired t-test should be conducted. Because the time taken for congruent and incongruent conditions are paired observation, it was tested twice under different test conditions. It is a directional hypothesis. Because from the sample data, we can see that all of the participants in the sample take less time to go through a congruent condition than an incongruent condition. So one tailed test is chosen.

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

	Congruent	Incongruent
Median	14.36	21.02
Average	14.06	21.98
Range	(8.63, 22.328)	(15.687, 35.255)
Standard Deviation	3.56	4.80

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.





For congruent condition, most candidate finished the test in 10-20s. For incongruent condition, most candidate finished in 16-24s, significantly concentrated than other time range.

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?

T-Score

The population means of the difference is **μC – μI = 0. The sample mean of the difference is Xc-XI = -7.96. the STDEV of (Xc-XI) is 4.86. There are 24 samples in this case.**

By the equation, $t = \frac{\bar{x}-\mu_0}{s/\sqrt{n}}$

The t score is -8.02

Assume that the condifence level is 1%, by using the t score calculator, the critical t score is -2.5, based on 24 samples. As the calculated t score equals -8.02 < -2.5. We can reject the null hypothesis.

Conclusion: participants on average take less time to go through a congruent words condition than an incongruent words condition. That is to say, the difference between congruent population means and incongruent population mean is less than 0. **μC – μI < 0.**

This match up with my expectations. Since all the records indicate that people take more time to finish the incongruent condition.

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!

Reference:

[1] https://en.wikipedia.org/wiki/Statistical_hypothesis_testing
[2] http://www.statisticshowto.com/when-to-use-a-t-score-vs-z-score/

[3] http://support.minitab.com/en-us/minitab/17/topic-library/basic-statistics-and-graphs/hypothesis-tests/tests-of-means/types-of-t-tests/
[4] https://en.wikipedia.org/wiki/Student%27s_t-test#Unpaired_and_paired_two-sample_t-tests
[5] http://stattrek.com/online-calculator/t-distribution.aspx