

Statistics: The Science of Decisions Project Instructions

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

Our dependent variable is time because it is the variable measured in the experiment.
Our independent variable is the condition (whether it is congruent or incongruent).

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

$\mu_D = \mu_X - \mu_Y$ where μ_X = incongruent condition population mean and μ_Y = congruent condition population mean. μ_D is the difference between the two population means.

$H_0: \mu_D = 0$

$H_A: \mu_D \neq 0$ (two-tailed test)

The null hypothesis states that there is no significant difference between the two population means. The alternative hypothesis suggests that the two population means are actually different.

I expect to perform a paired dependent t-test because this is a repeated measures design and we are looking to see if there is a difference between the two tests. Additionally, since our sample data is very small (24) then a t-test is more appropriate since our population cannot be approximated as being a normal distribution (a z-test with a large population size typically approximates a normal distribution).

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

14.05 seconds = Congruent Mean

22.02 seconds = Incongruent Mean

7.96 seconds = Difference Mean

14.36 seconds = Congruent Median

21.02 seconds = Incongruent Median

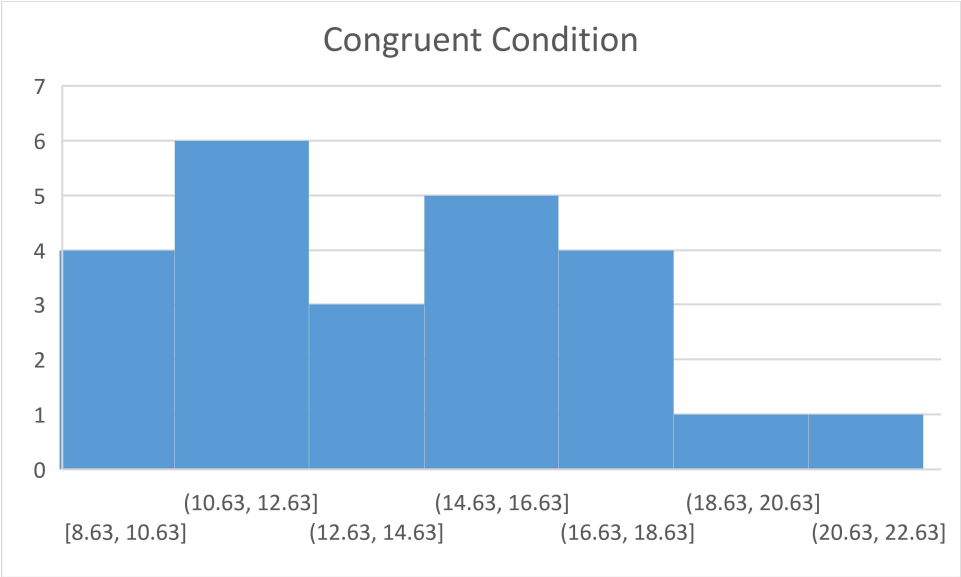
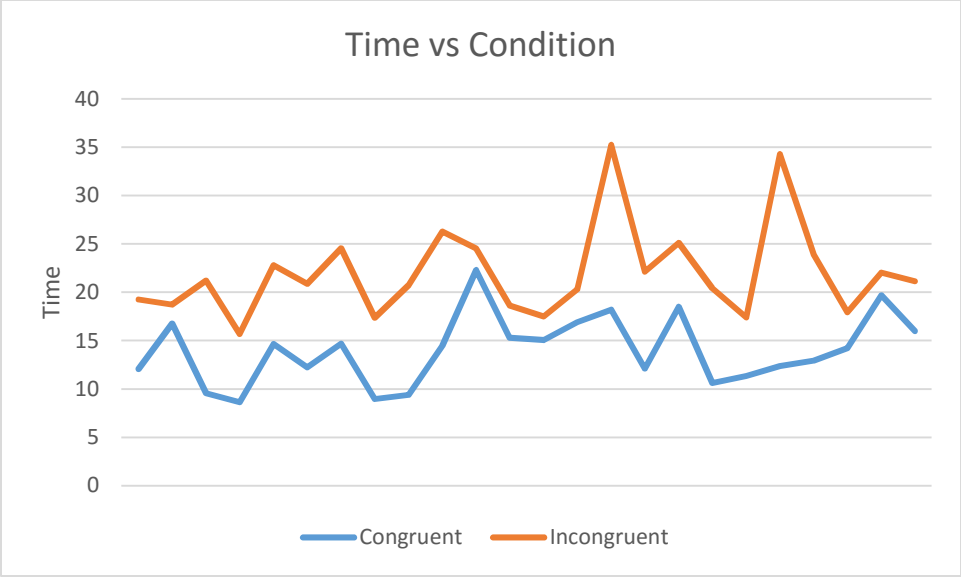
7.66 seconds = Difference Median

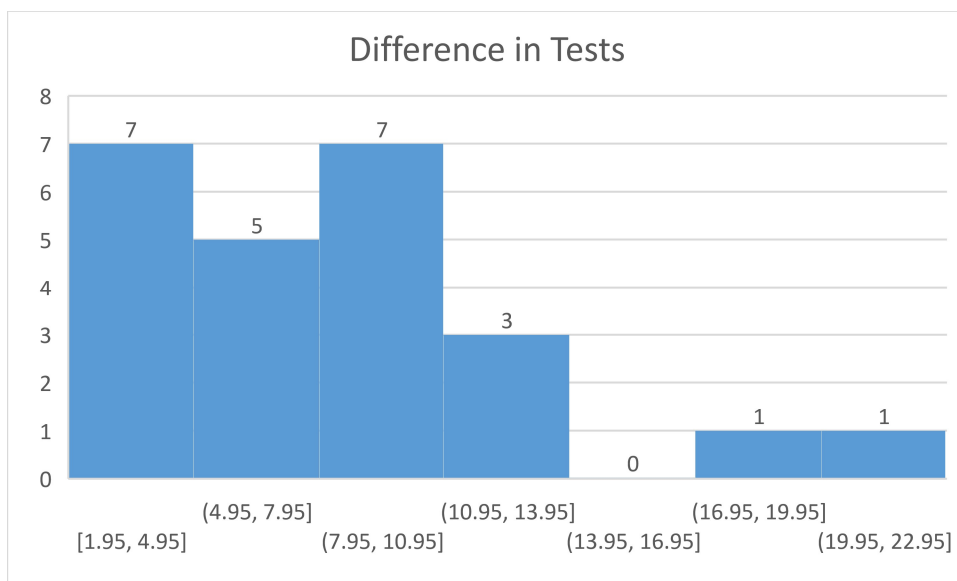
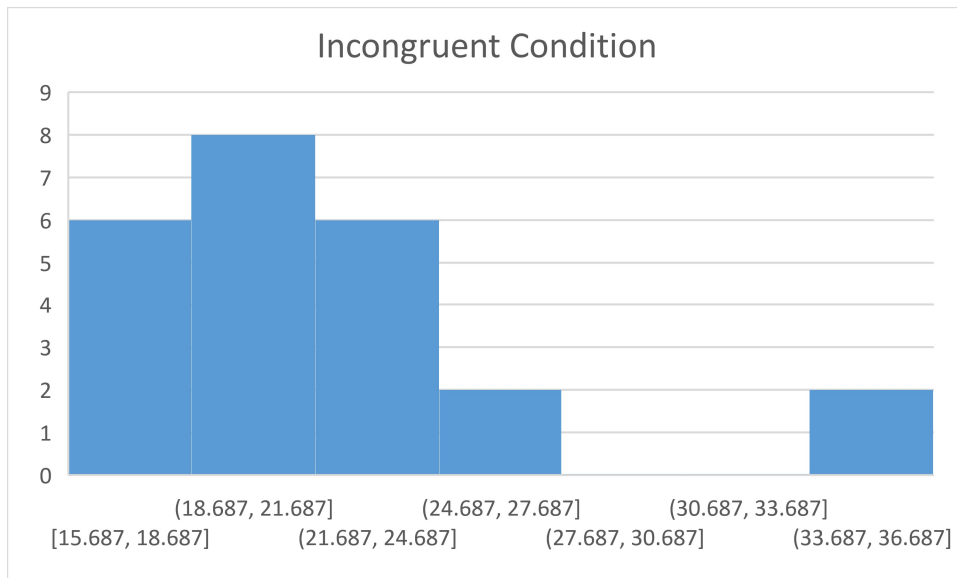
Congruent variance = 12.67 seconds, standard deviation = 3.56 seconds

Incongruent variance = 23.01 seconds, standard deviation = 4.80 seconds

Difference variance = 23.67 seconds, standard deviation = 4.86 seconds

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.





Both the congruent and incongruent conditions appear to be right skewed. Not surprisingly, the difference between them follows suit. Majority of the differences in the times appear to be between 1.95 and 10.95 seconds, with none of them below or at zero seconds. This strengthens the alternative hypothesis in that there is a significant difference between them. But before coming to any conclusions, we need to conduct statistical tests.

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?

$\alpha = 0.05$ = confidence level

The critical statistic value is t – we will be using a t-distribution.

$$t = \frac{\bar{x}_D}{s/\sqrt{n}} = \frac{7.96}{4.86/\sqrt{24}} = 8.024$$

Using $(24-1) = 23$ degrees of freedom on the t distribution table, we see that that tail probability is less than 0.05, which indicates that our value is in the critical region. We also know that the cutoff points are ± 2.069 and 8.024 is far greater than 2.069.

Therefore, we reject our null hypothesis that there is no significant difference between the two tests. There is in fact statistical evidence that the two tests differ in completion time. The incongruent test condition causes participants to take longer to complete the Stroop test relative to the congruent condition. The results were as expected.

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!

Before doing any research, the first thing that came to mind was that we tend to process words faster than colours. Furthermore, if we're trying to state the colour of the word, then the word is probably interfering with our attention as we try to dismiss it and focus on the colour. This is definitely a mentally exhausting task. The site below calls this the "speed of processing model".

An alternative task would be to have two separate tests like so:

LEFT	UPPER
left	lower
right	LOWER
RIGHT	upper

First, do each test by saying whether each word is lower/upper case. Then say whether each word is printed to the left/right.

<https://www.rit.edu/cla/gssp400/sbackground.html>