Answers

Source codes used in this project

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

Independent variable is a condition of words displayed(congruent or incongruent). Dependent variable is the time to name the ink colors.

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(H_0) is that the mean time to name the ink colors has no difference between the congruent words population (μ_c) and the incongruent words population (μ_i). Alternative hypothesis(H_a) is that the time taken to name the colors between the two groups are different.

$$H_0 : \mu_c = \mu_i$$
$$H_a : \mu_c \neq \mu_i$$

(μ_c : mean time to name the ink colors of congruent words
μ_i : mean time to name the ink colors of incongruent words)

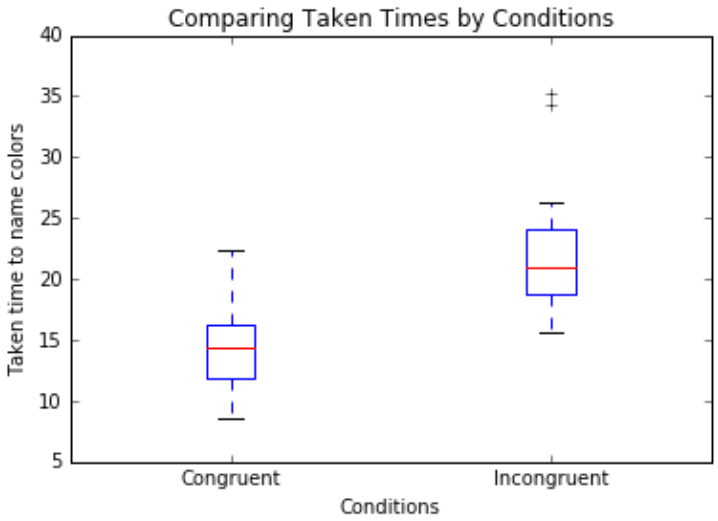
In this case, two-tailed paired t-test is appropriate method to test if the difference between the paired samples are significant or not. This is because we have less than 30 samples without information about standard deviation and mean of population. Also here we assume that population is normally distributed.

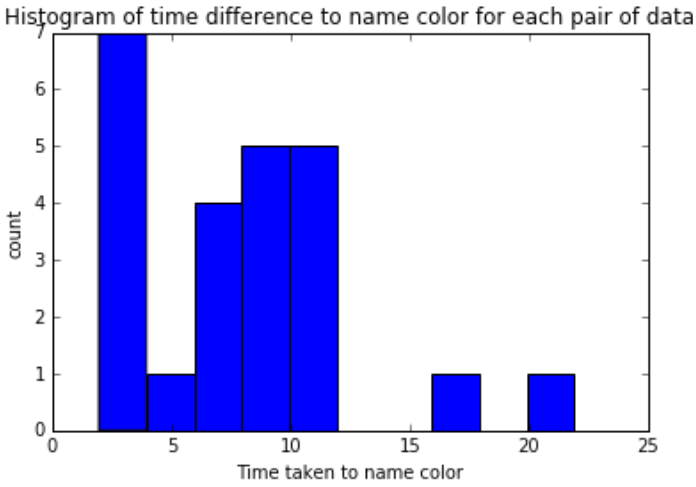
3. Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability.

There are 24 samples for each group in pair. The mean time of congruent group($\bar{X}_c$) is 14.051 and the mean time of congruent group($\bar{X}_i$) is 22.016. Sample mean and standard deviation of the differences of time for each pair is 7.965 and 4.865 respectively.

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.

Central tendency of two groups looks different between Congruent and Incongruent condition visualized on the graph left below. The right graph shows how gaps of each paired values are distributed.





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-value of this sample is 8.0207. Since the t-value is lower than the critical t-value for 95% confidence, 2.069, it is out of confidential interval. So, we can reject the null hypothesis, and can conclude that it significantly takes more time to name ink colors in Incongruent condition.
This result is consistent with my previous expectation.

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!