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

The independent variable is the test conditions, in this case, a congruent words condition, and an incongruent words condition. The dependent variable is the time that participants take 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.

H_0: mean time spent on an incongruent word (μ_i) is the same as on a congruent word (μ): $\mu=\mu_i$.
H_A: mean time spent on an incongruent word (μ_i) is greater than on a congruent word (μ): $\mu<\mu_i$.

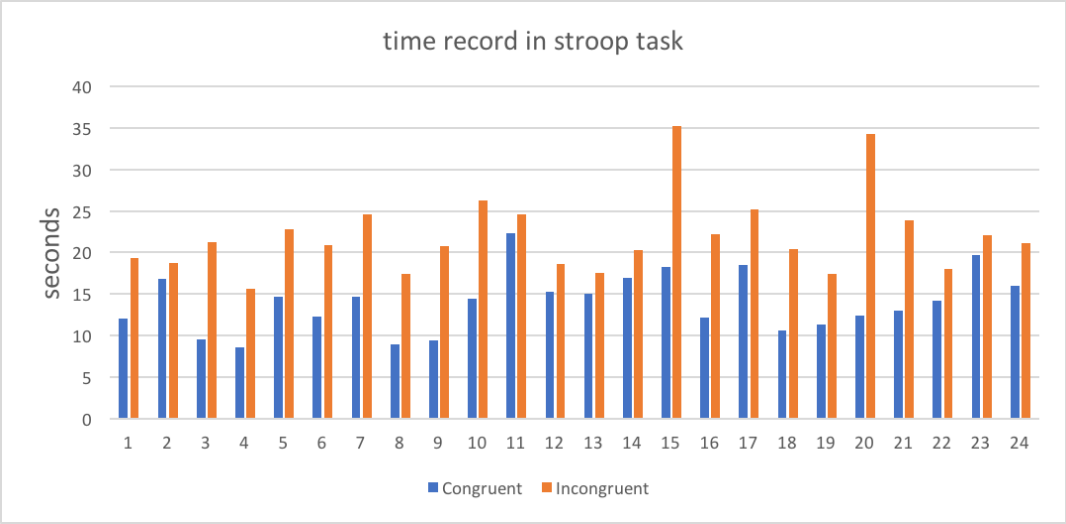
(this is the revised part)
In this Stroop task, randomly selected participants(n) of this study are the sample from population. Sample means ($\overline{x}$ and $\overline{x}_i$) can be calculated, so that we can further calculate the standard deviation(S) and t-statistic from the sample data. Additionally, because of the samples are randomly selected and nearly normal distributed, we can infer general population from sample statistic.

An appropriate statistical test would be dependent t-test for paired samples because this is an experiment on the same sample but with different conditions.

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

In congruent condition, the range of result is from 8.63 to 22.328 seconds, of which the median is 14.3565, mean is 14.051125, Standard deviation is 3.559357958. In congruent condition, the range of result is from 19.278 to 35.255 seconds, of which the median is 21.0175, mean is 22.01591667, Standard deviation is 4.797057122.

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.



This plot indicates that all 24 participants spend more time recognizing the color when in incongruent condition.

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?

H_0: time spent on an incongruent word (μ_i) is the same as on a congruent word (μ): $\mu=\mu_i$.
H_A: time spent on an incongruent word (μ_i) is greater than on a congruent word (μ): $\mu<\mu_i$.

Dependent t test for paired samples, df=23

If we set α=0.05, and this is a one-tailed test, then t-critical is -1.714.
S= 4.76239803
Standard error= 0.993028635
t-statistic=-8.020706944
p<0.00001
cohen's d=-1.64
95% CI of mean difference: (-9.66, -6.26)

based on the result, we reject the null hypothesis.

Conclusion: time spent on an incongruent word (μ_i) is greater than on a congruent word (μ): $\mu<\mu_i$.
This result matches my 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!

In my opinion, Stroop effect is caused by the amount of information processed in our central nervous system and the extra effort of judgement when we face conflicts. An alternative task would be: participants are presented with a dozen of pictures of their friends that they are familiar with. The participant's task is to say out loud the name of each friend. The task has two conditions: interruptive pictures and normal pictures. In the interruptive pictures, someone else's name was written on picture of each friend while in conditions of normal pictures nothing was written. In this task, we measure the time it takes to speak out the friend's name. Each participant will go through and record a time from each condition.

Reference:

1. t-table: https://s3.amazonaws.com/udacity-hosted-downloads/t-table.jpg
2. Calculation of p value: http://www.socscistatistics.com/pvalues/tdistribution.aspx
3. Stroop effect Wikipedia: https://en.wikipedia.org/wiki/Stroop_effect