Statistics: The Science of Decisions

What is our independent variable? What is our dependent variable?

Independent variable is the condition in which participant is reading i.e. congruent condition and incongruent condition.

Dependant variable is the time taken by the participant (reaction time) to read and say out loud the colour of the ink.

What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform?

Through hypothesis we try to prove what Stroop effect is, which suggests that in congruent conditions we are facilitated which is not in case of incongruent conditions. So there is difference in average time taken by anyone in both conditions.
Hence, null hypothesis is there is no significant difference in time taken for reading in the two conditions.

$H_O : \mu_{\text{(time taken in incongruent condition)}} = \mu_{\text{(time taken in congruent condition)}}$

Where μ is the population mean or the average.

Alternate hypothesis is there is a significant difference in time taken for reading in the two conditions.

$H_A : \mu_{\text{(time taken in incongruent condition)}} \neq \mu_{\text{(time taken in congruent condition)}}$

A Two tailed dependent t test should be performed as we need to compare the means of two related groups (there are same participants in both groups and are measured on two different occasions) to determine the statistically significant difference between two means. Also we are comparing two dependant variables.
The assumption is that the differences are normally distributed, the difference of time taken by the participants for reading in two conditions is normally distributed.

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

Mean time taken to read the congruent set of words is 14.051125

Mean time taken to read the incongruent set of words is 22.01591667

Median of data of congruent words = 14.3565

Median of data of incongruent words = 21.059

Standard deviation for congruent words data = 3.55936

Standard deviation for incongruent words data = 4.79706

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.
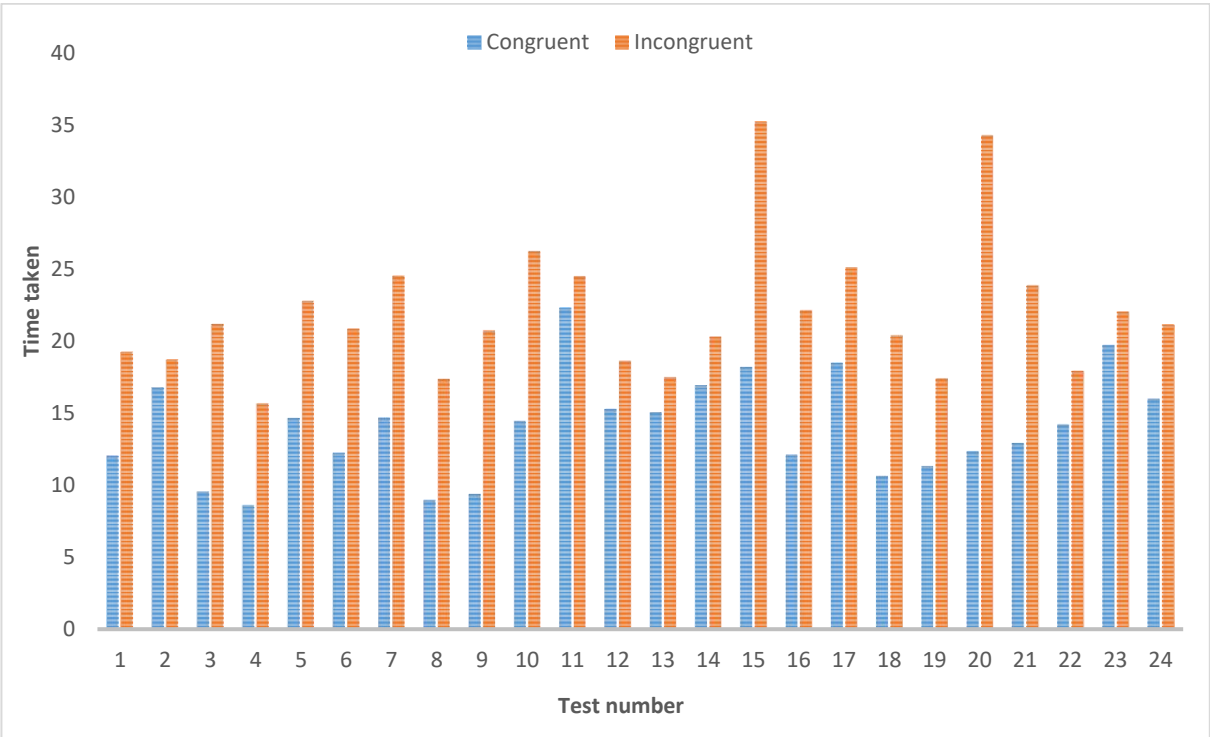
We can observe that time for reading a congruent set is less for all participants than the time for reading incongruent set of words.
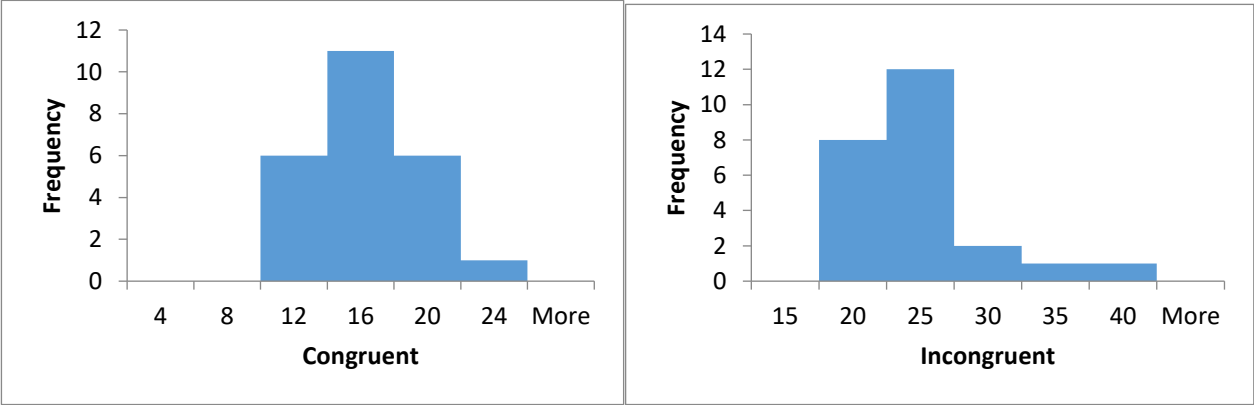
Incongruent graph is right skewed and has a range of 15 to maximum 40 seconds. Whereas congruent has range of 8 to 24.

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?

Two-tailed dependent T test using built-in data analysis tool of excel.

t-Test: Paired Two Sample for Means

	Incongruent	Congruent
Mean	22.01591667	14.051125
Variance	23.01175704	12.66902907
Observations	24	24
Pearson Correlation	0.351819527	
Hypothesized Mean Difference	0	
df	23	
t Stat	8.020706944	
P(T<=t) one-tail	2.0515E-08	
t Critical one-tail	1.713871528	
P(T<=t) two-tail	4.103E-08	
t Critical two-tail	2.06865761	

α = 0.05

p-value =0.00000041030 which can be said as p-value < 0.05

95% Confidence Interval : lower 5.910553 upper 10.01903

Standers Error of difference : 0.993029

The T-statistic (8.02) is greater than the critical value (2.06), hence we can successfully reject the null hypothesis. Also the p-value is small. We can now say that we are 95% confident that the average time taken finish reading a congruent list is shorter than the average time taken for incongruent list. Also the difference is in between 5.91 and 10.019.