Q1. What are our independent and dependent variable?

Dependent variable: - Time taken to name ink colours
Independent variable:- The condition of ink colours (congruent/incongruent)

Q2. What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform?

Let μ_i and μ_c denote the mean time taken in incongruent and congruent tasks respectively.

H_0 = There is no significant difference between the mean time taken for congruent and incongruent tasks.

$$H_0 : \mu_i = \mu_c$$

H_a = There is a significant difference between the mean time taken for congruent and incongruent tasks.

$$H_a : \mu_i \neq \mu_c$$

Statistical Test:-

I will use **dependent variable two tailed t-test** because:-

1. We do not know anything about the population parameters, only the sample's.
2. The participant taking both the tasks is same, therefore, it will be dependent.
3. The sample size is less than 30.
4. Also, here the distributions are not highly skewed.

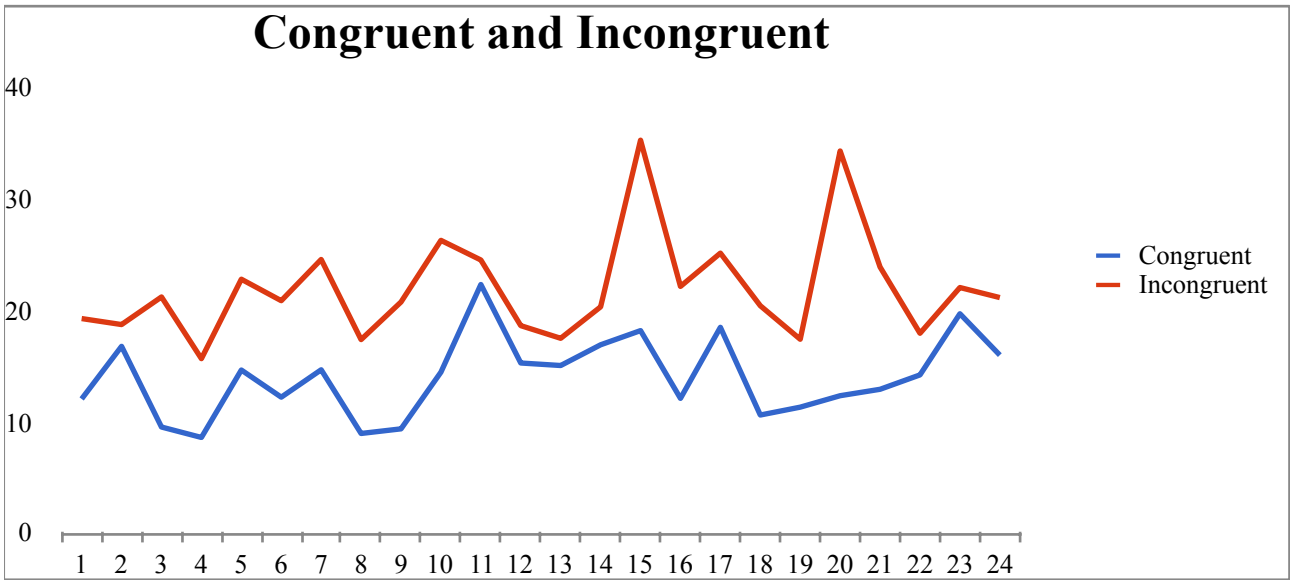
Assumptions:

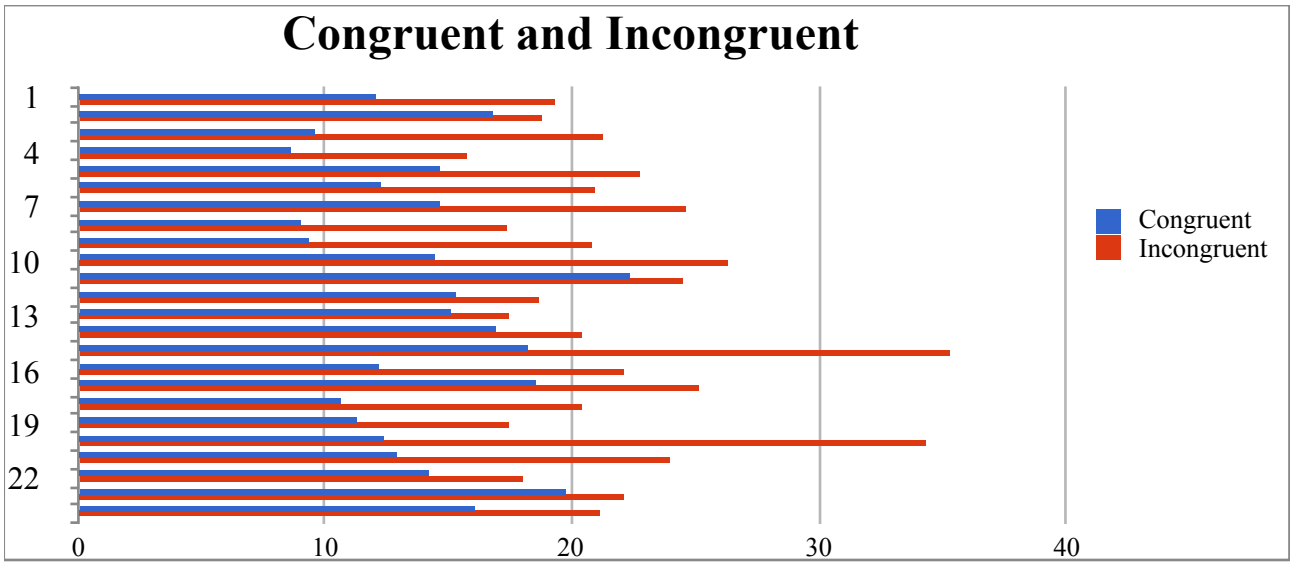
1. The assumption for a t-test is that the scale of measurement applied to the data collected follows a continuous or ordinal scale.
2. The second assumption made is that of a **simple random sample**, that the data is collected from a representative, randomly selected portion of the total population.
3. The third assumption is that the data, when plotted, results in a normal distribution, bell-shaped distribution curve.
4. The fourth assumption is that a reasonably large sample size is used. A larger sample size means that the distribution of results should approach a normal bell-shaped curve.

Q3. Report Descriptive Statistics.

Property Name	Congruent	Incongruent
Mean	14.02	22.01
Standard Deviation	3.56	4.80
Number of samples	25	25

Q4. Provide one or two visualisations that show the distribution of the sample data. Write one or two sentences noting what you observe about the plot or plots.





Congruent tasks appear to be consistently completed faster than incongruent tasks.

Q5. 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?

$$d = X_i - X_c$$

$$t = (\mu_i - \mu_c) / SEM$$

$$SEM = S / \sqrt{n-1} \text{ where } n = 25$$

After calculating 'd' :

Paramter	Value
Mean	-7.9648
S	4.8648
Calculated t	-8.0207
t-critical at α=0.05	-2.06865761, 2.06865761
95% confidence interval	-25.3527231, 9.42314
P-value	4.103E-08

Since t-calculated < t-critical, it lies in the critical region. The result is statistically significant. Hence, we **reject the null**. Therefore, At α=0.05, the **time to name colours is significantly different between congruent and incongruent tasks**. People do not name colours at the same speed when the word's meaning and its colour match, as when they do not match. The result confirms my expectations.

Q6. 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?

The brain has an image association between the shape of the word and the colour. When there is a mismatch, additional time is necessary for the prefrontal cortex to process the information and decide on its meaning.
A similar effect would likely be observed if the participants were shown words of the correct colour but the wrong text. My hunch, however, is that the difference would be less pronounced as I'd expect the visual colour representation to be more ingrained in the brain that word shape associations.