

1.

Independent Variable: Word/ink color congruency condition

Dependent Variable: Time

2.

a. **Null Hypothesis: $H_0: \mu_C = \mu_I$**

where, μ_C = mean of the population time to read the congruent set of words

μ_I = mean of the population time to read the incongruent set of words

The time remains the same to read the two sets of congruent and incongruent words.

Alternative Hypothesis: $H_a: \mu_C \neq \mu_I$

$\mu_C < \mu_I$

The time taken to read the congruent sets of words is less than the time taken to read the incongruent set of words.

b. **Type of test:**

Kind of test: Since the population parameters are unknown, therefore, a two sample dependent t-test is performed.

Direction of the test: One tailed p-value test in the negative direction.

Design of the test: Since in the stroop effect, the sample size remains same, and we check the time of the samples after a treatment(changing the color of the words), therefore, it is a pretest and posttest type of design.

Assumptions:

- a. The data is assumed to have a normal distribution
- b. The variance of each group is greater than 0.
- c. The data is dependent on each other.

3. **Descriptive Statistics:**

Mean of Congruent colors:

$\mu(\text{congruent}) = 14.05$

Median = 14.35

Measure of Variability for congruent colors:

Standard Deviation = 3.55

Mean of Incongruent colors:

$\mu(\text{Incongruent}) = 22.015$

Median = 21.01

Measure of Variability for Incongruent colors:

Standard Deviation = 4.79

Difference of the two means = -7.97

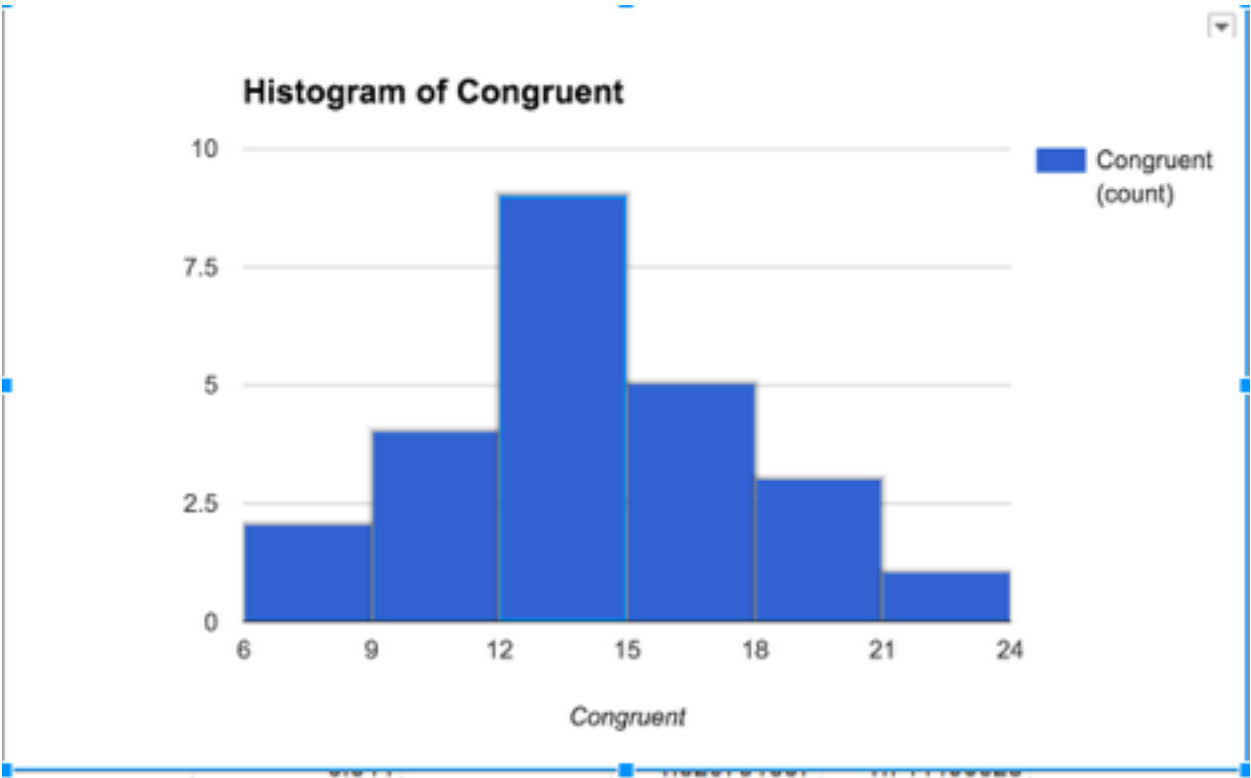
Standard deviation of the entire group = 4.87

4. **Visualizations:**

Frequency table for congruent colors:

Time	Frequency
6-9	2
9-12	4
12-15	9
15-18	5
18-21	3
21-24	1

Histogram for congruent colors:



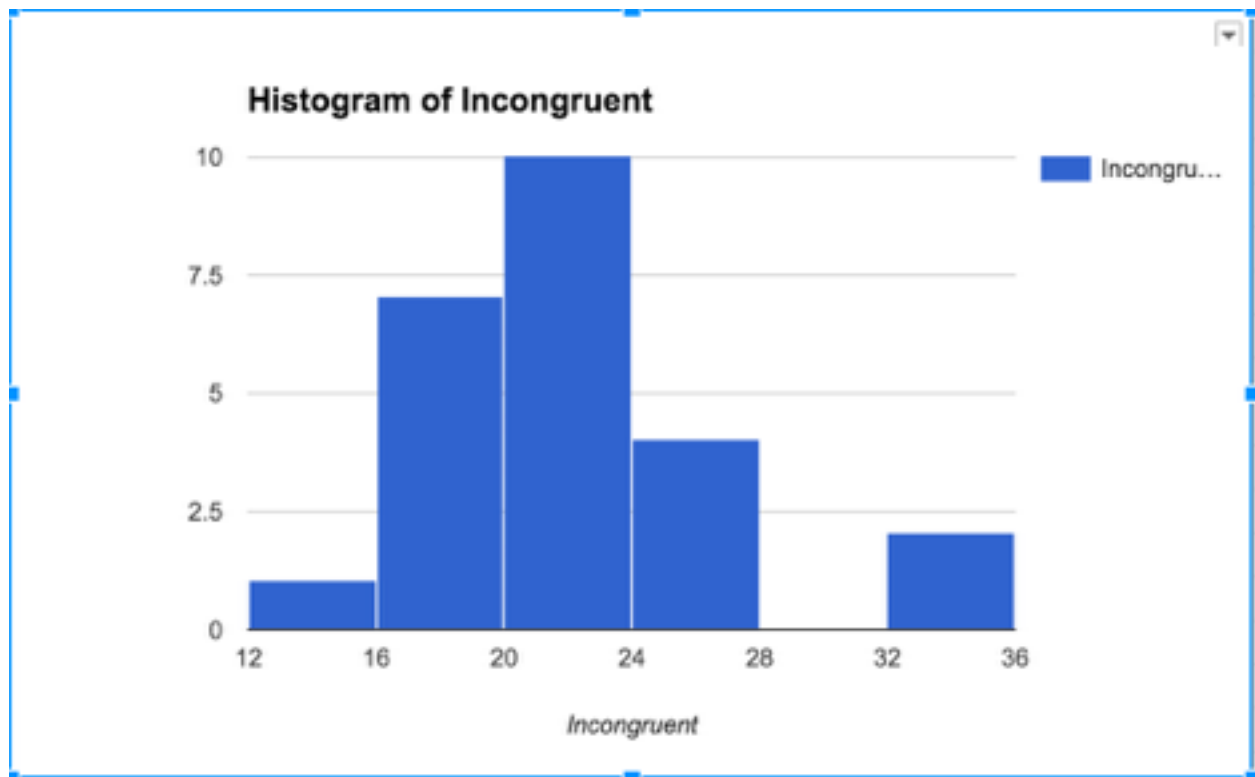
Observations:

- a. The shape of the distribution is normal.
- b. The most frequent time interval taken to read the data is 12-15 which is the **mode** of the data set.
- c. Most of the time interval is around 14
- d. There are no outliers in the data.

Frequency table for Incongruent colors:

Time	Frequency
12-16	1
16-20	7
20-24	10
24-28	4
28-32	0
32-36	2

Histogram of Incongruent colors:

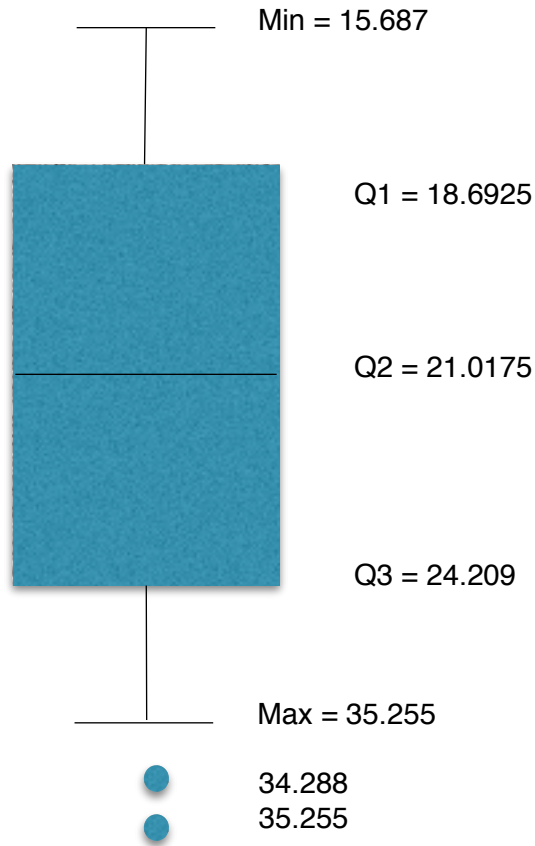


Observations:

- a. The shape of the distribution is roughly symmetrical and therefore is normal.
- b. The most frequent time interval taken to read the data is 20-24 which is the **mode** of the data set.
- c. Least of the time interval is around 14.
- d. Outliers are present in the data which can be seen as follows:
Q1 = 18.6925
Q2 = 21.0175
Q3 = 24.209
IQR = 5.5165

In the data, values 34.288 and 35.255 are outliers since those are greater than $Q3 + 1.5(IQR) = 32.56475$

The box plot visualization :



5. Inferential statistics:

Point estimate, mean difference = -7.96

Standard deviation = 4.86

Margin of error = 0.99

$t(23) = -8.02$

$p < 0.0001$, one tailed test in the negative direction

Cohen's $d = 1.63$

$r^2 = .108$

$t_{critical} = -1.714$



t-distribution

Confidence level: 95%

$\alpha = 0.05$

Lower limit = -10.01

Upper limit = -5.92

Since $p < 0.0001$ it is statistically significant and so we reject the null hypothesis,
 $\mu(\text{congruent}) = \mu(\text{incongruent})$

This means, the average time taken to read the incongruent sample is more than the time taken to read the congruent sample, $\mu(\text{congruent}) < \mu(\text{incongruent})$

6. Performing analysis on a sample of scores of 10 students, before performing a group study treatment and after the group study. Reports show students involved in group study perform better than before the group study.