Statistics: The Science of Decisions Project Instructions

Background Information

In a Stroop task, participants are presented with a list of words, with each word displayed in a color of ink. The participant's task is to say out loud the color of the ink in which the word is printed. The task has two conditions: a congruent words condition, and an incongruent words condition. In the congruent words condition, the words being displayed are color words whose names match the colors in which they are printed: for example RED, BLUE. In the incongruent words condition, the words displayed are color words whose names do not match the colors in which they are printed: for example PURPLE, ORANGE. In each case, we measure the time it takes to name the ink colors in equally-sized lists. Each participant will go through and record a time from each condition.

Questions For Investigation

Questions1:
What is our independent variable? What is our dependent variable?
Answer:
The independent variable is the condition of words,whether the color and word name are the same.
The dependent variable is the amount of time it takes to name the ink colors.

Questions2:
What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform? Justify your choices.
Answer:
H_0 :There is no difference or a lower time duration between these two tests.
H_1 :There is an increase in time between these two tests.

We should use a one-tailed test to find whether incongruency can increase response times.

μ_1 =the mean time spent in congruent test
μ_2 =the mean time spent in incongruent test

$$H_0 : \mu_1 - \mu_2 \geq 0$$
$$H_A : \mu_1 - \mu_2 < 0$$

In this experiment, we should use one tailed T-test because we don't know the mean of the total population and we only have 24 sample data which is less than 30. A one tailed test is useful when we want to find that inconfruent word will not imporve recognition time.

Questions3:
Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability.

Answer:

1.Central tendency

m_1:The mean of the congruent recordings

m_2:The mean of the incongruent recordings

$$\overline{m_1} = 14.05$$
$$\overline{m_2} = 22.02$$

C_1:The median of the congruent recordings

C_2:The median of the incongruent recordings

$$C_1 = 14.36$$
$$C_2 = 21.02$$

2.Measure of variability:

The range of congruent sample:13.70

The range of incongruent sample:19.57

average deviation：

$$D_{\bar{x}} = \frac{\sum_{i=1}^{n} |x_i - \bar{x}|}{N}$$

$$Var = \frac{Square\ of\ Sums}{n-1}$$

We can get:

$$D_{con} = 2.85,\ D_{incon} = 3.40$$

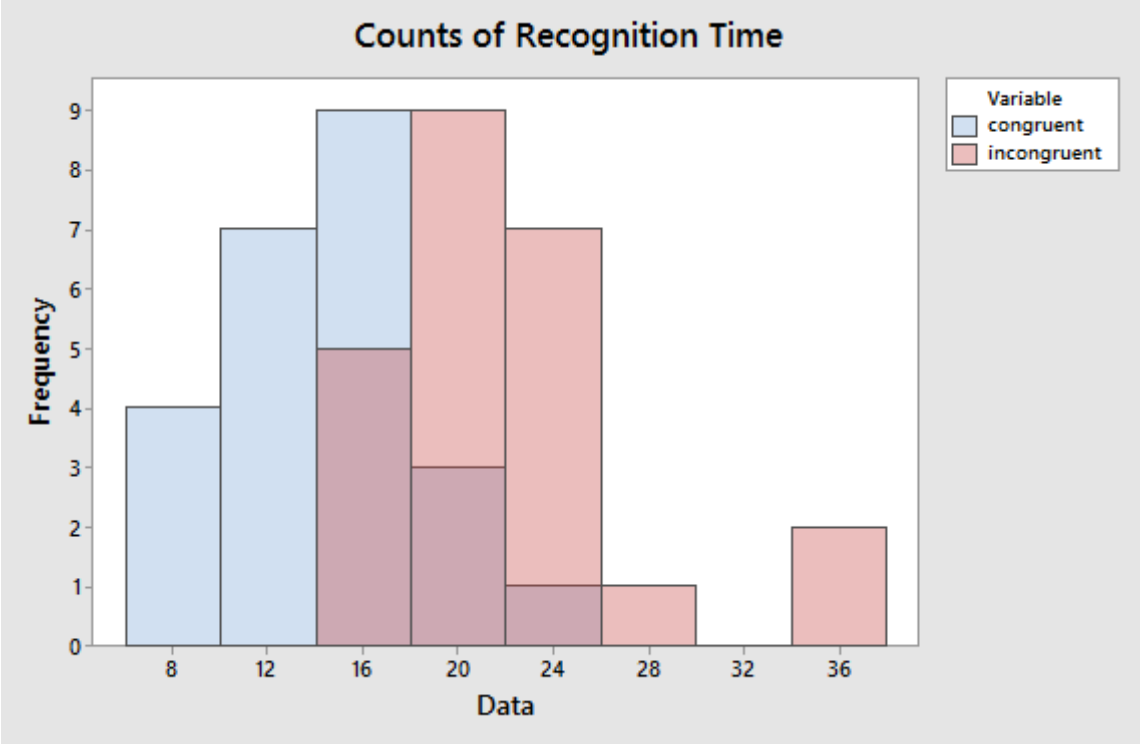
$$Var_{con} = 12.67,\ Var_{incon} = 23.012$$

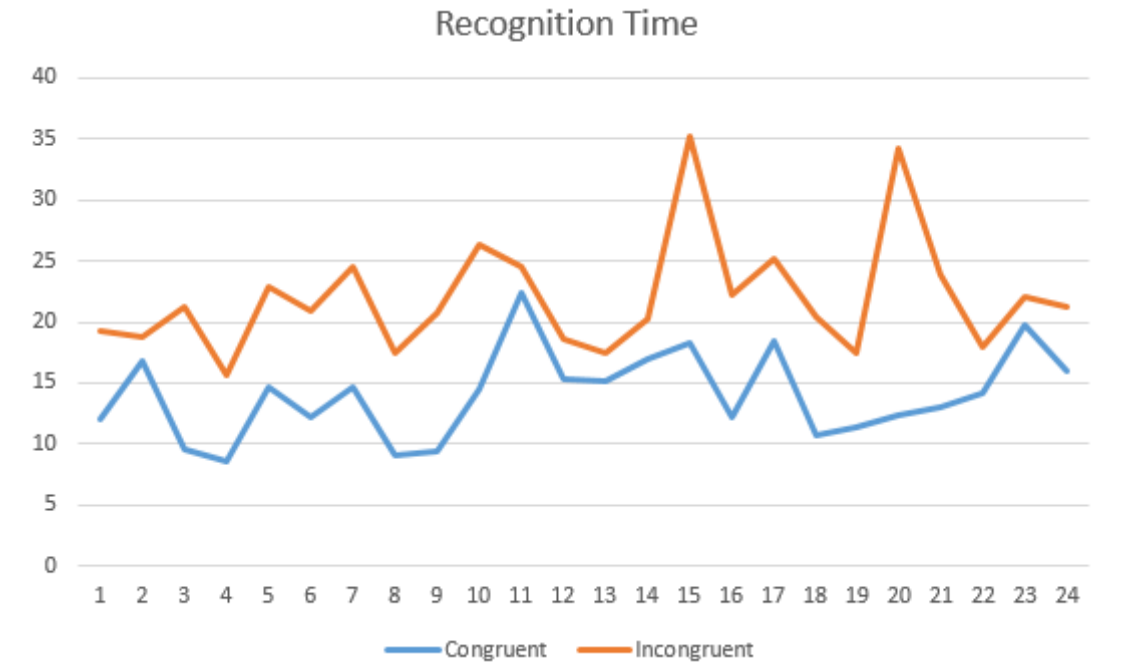
$$SD_{con} = 3.559,\ SD_{incon} = 4.797$$

Questions4:

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.

Answer:





From these two visualizations shows that the two groups have great difference in recognition times. In the histogram, we can find that the most of recognition time of congruent group lie in 14-18 but in the incongruent group it is 18-22.

Question5:

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?

Answer:

$$H_0 : \mu_1 - \mu_2 \geq 0$$
$$H_A : \mu_1 - \mu_2 < 0$$
$$df = n - 1 = 23$$

$$\alpha = .01$$
$$t(23) = -2.50,\ P < .01,\ one - tailed$$

After calculation,

Square of Sums of difference	df	S	t
544.2154258	23	4.864312927	-8.02487
mean_Con	mean_InC	average mean difference	
14.04783333	22.0159167	-7.968083333	

we can get t-statistic:

$$t - statistic = -8.02 < t(23)$$

Hense, we should reject the null hypothesis because t-statistic is in the critical area at 99% Confidence Level. From the result, we can come to the conclusion that incongruent test will take longer time than the congruent test.we can say that the sample is different from the population. So the time took is different between those two experiments and the participants took less time to say all the congruent values than to say the incongruent ones

Question6

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!

Answer:

I think that people will get distracted due to the meaning of words when people say out the color. Humans are sensitive to the meaning of words and they will read words automatically in this test.

From Wikipedia, the "warped words Stroop effect" produces the same findings similar to the original Stroop effect.The words are printed in such a way that it is more difficult to read (typically curved-shaped).

Rreference

1.Wikipedia:Stroop effect (https://en.wikipedia.org/wiki/Stroop_effect/)
2.The Stroop Effect – How it Works and Why (https://imotions.com/blog/the-stroop-effect/)