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P1: Testing a Perceptual Phenomenon

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

Our independent variable is the type of test that is conducted (congruent vs. incongruent). The dependent variable is the time difference (in seconds) to complete the two tests.

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

My hypotheses would be the following:

H_0: $\mu C = \mu I$ (There is no mean time difference between the results of the two tests.)
H_A: $\mu C < \mu I$ (There is a mean time difference between the results of the two tests.)

"μC" is the mean time it takes to complete the congruent test and "μI" is the mean time it takes to complete the incongruent test.

I would expect to perform a t-Test here so I could compare the means of the two sample datasets and find out if there is a significant difference between the results of the congruent and incongruent tests. There are a couple of reasons why I would select a t-Test:

a) We do not know the population standard deviation.
b) We have a small sample size.
c) We have two sets of data from the same sample (Incongruent test scores vs congruent test scores).

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

Congruent Test Stats:

X = 14.051125
Variance = 12.14115286
$\mathbf{S_X}$ = 3.484415713
SE(X) = 3.559357958

Incongruent Test Stats:

Y = 22.01591667
Variance = 22.05293383
$\mathbf{S_Y}$ = 4.696055135

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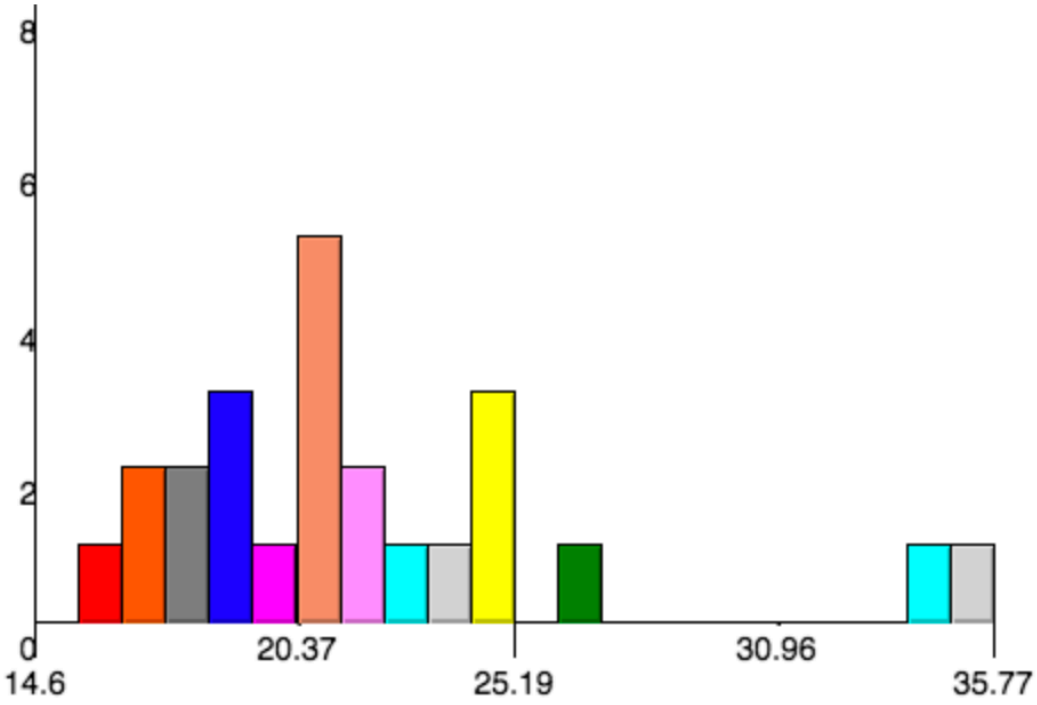
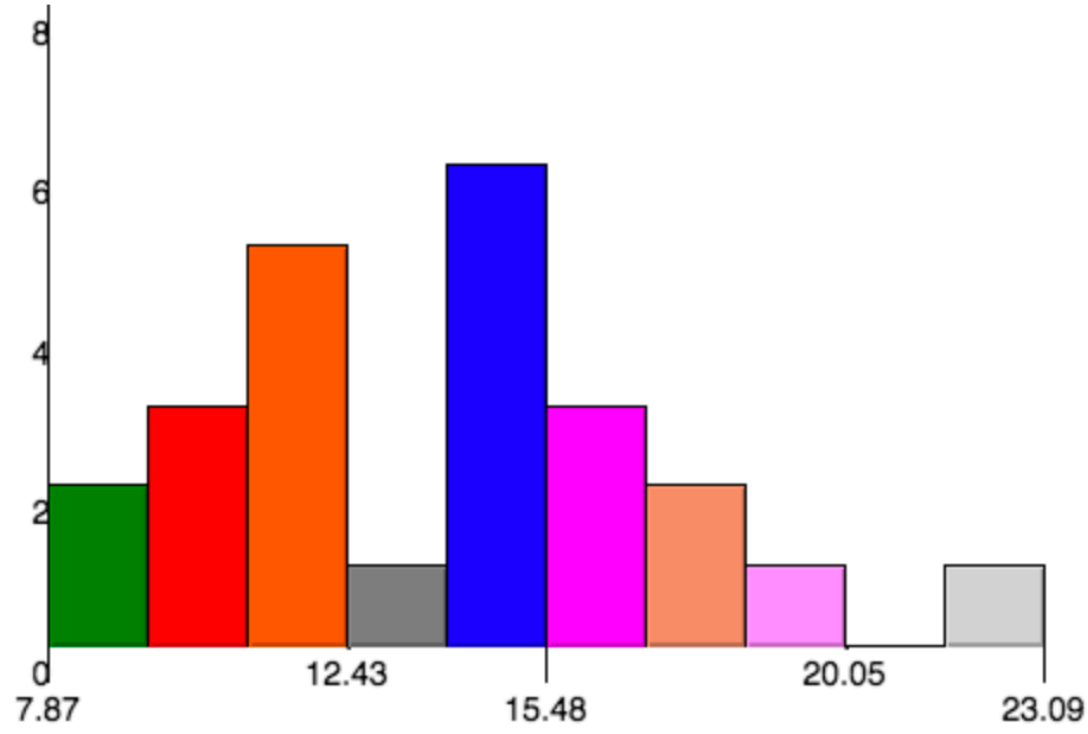
SE(Y) = 4.797057122

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.





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Histogram 1 is the incongruent data sample, and histogram 2 is for the congruent data sample. As you can see they are both relatively normally distributed. With a couple of outliers.

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?

I performed a paired t-test with a confidence level of 95% ($\alpha = 0.05$). My t-critical value = 1.714 and my t-statistic = 6.435. We would certainly reject the null hypothesis here because this statistic falls well under our t-critical value. We can conclude that it will take people much longer to complete the incongruent test than that congruent test. This did match up with my expectations because just by looking at the sample data itself it was obvious that the incongruent test took much longer. Having more info about the entire population would probably make this experiment and its findings more useful.

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!