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

As a general note, be sure to keep a record of any resources that you use or refer to in the creation of your project. You will need to report your sources as part of the project submission.

1. What is our independent variable? What is our dependent variable?
    - Independent variable: Two different task conditions: a congruent words condition, and incongruent words condition
    - Dependent variable: The time it takes to name the ink colors in equally-sized lists.
2. What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform? Justify your choices.

    2.1Appropriate set of hypotheses:
    - $H_o : U_a = U_b$
    - $H_A : U_a \neq U_b$

    * H_0 : There is no significant difference in time for the population to state the colors of the words in a congruent or incongruent condition
    H_A : There is difference in time for the population to state the colors of the words in a congruent or incongruent condition
    U_a : The population of the mean in a congruent words condition
    U_b : The population of the mean in an incongruent words condition

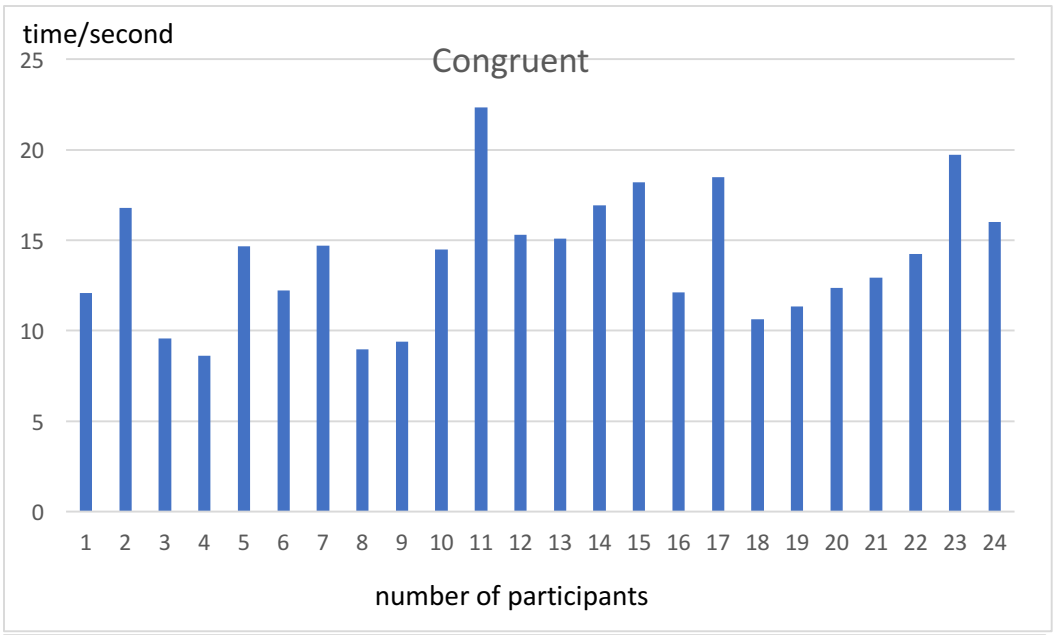
Now it's your chance to try out the Stroop task for yourself. Go to this link, which has a Java-based applet for performing the Stroop task. Record the times that you received on the task (you do not need to submit your times to the site.) Now, download this dataset which contains results from a number of participants in the task. Each row of the dataset contains the performance for one participant, with the first number their results on the congruent task and the second number their performance on the incongruent task.
Dataset:

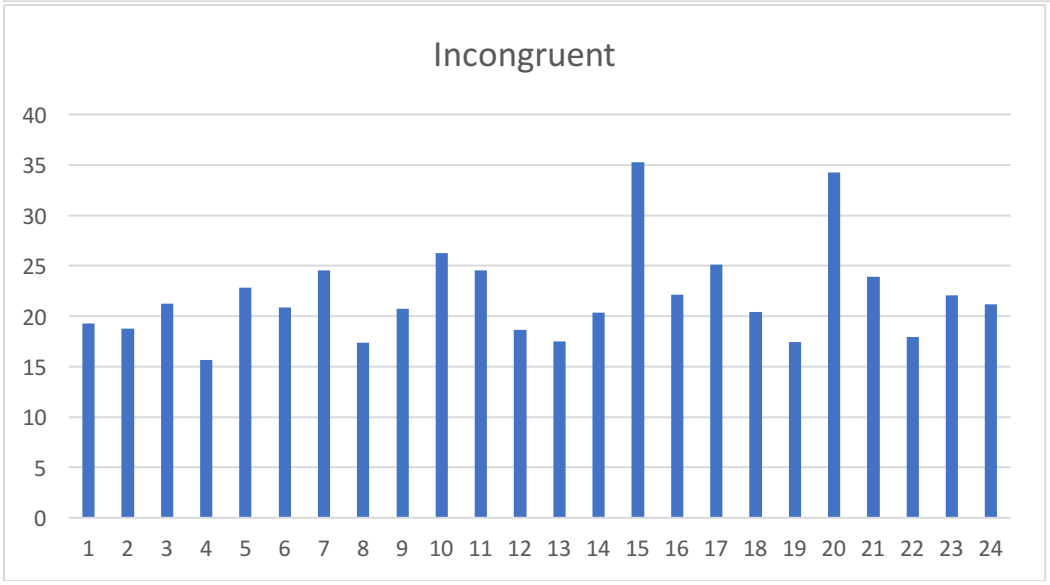
Congruent	Incongruent
12.079	19.278

16.791	18.741
9.564	21.214
8.63	15.687
14.669	22.803
12.238	20.878
14.692	24.572
8.987	17.394
9.401	20.762
14.48	26.282
22.328	24.524
15.298	18.644
15.073	17.51
16.929	20.33
18.2	35.255
12.13	22.158
18.495	25.139
10.639	20.429
11.344	17.425
12.369	34.288
12.944	23.894
14.233	17.96
19.71	22.058
16.004	21.157

2.2 statistical test perform:

1. This two groups of test result was take same participants in different conditions, so the total number of data is 24(<30).
2. In other words,the total number of data is 24 cannot consider Z test,so t-Test is better for this statistical test perform.
3. T-test condition:
   1> The test sample is random,because all the participants was random selected and all the participants haven't restricted condition.
   2> Two sample group showing in graphs is normal distribution.





In sum, all the sample data distribution accord with normal distribution and two groups of test are independent. So two tailed T-test for statistical test(α=0.05) confirm to test

Reference:

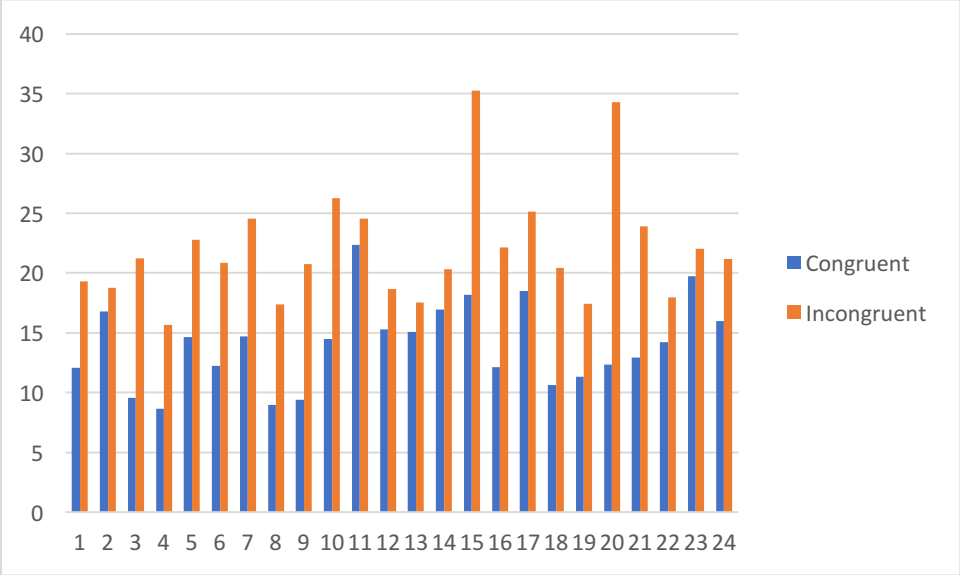
OpenIntro Statistics, 3rd, Chapter 5 Inference for numerical data,introduce t test distribution.

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

Description	Symbol	Value
Congruent sample mean	Ua	14.05
Incongruent sample mean	Ub	22.02

sample mean difference	Ud	7.97
The number of sample	n	24
freedom	df	23
standard deviation of sample difference	σ_D	4.86
Standard error of sample difference	SE	0.99

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.



all the incongruent condition used time is greater than congruent condition.

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?

Two tailed T-test for statistical test(α=0.05)

1. Df = 23,Tcritical = ±2.069
2. T statistical:
   $t = \frac{UD-0}{\sigma D/\sqrt{n}} = 8.02$
3. P value :0.0001 <0.05
4. 95%CI (5.91,10.02)
5. $r^2 = \frac{t^2}{t^2} + df = 0.7366$ (73.66%)

In sum: T statistical is greater than t critical and P value is lower than 0.05,which means it can reject H_0.In other words,there have difference time use in two conditions and incongruent condtion used time is great than congruent condition.there have 73.66% difference because of incongruent words and print color, but the result is same with expected.

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!