1. a. What is our independent variable? b. What is our dependent variable?

1.a. independent variable: whether the word color is congruent with the word

1.b. dependent variable: the time it takes to name the ink colors in equally sized lists

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

2.a. An appropriate null hypothesis should be: incongruent words (in which the meaning of the words is inconsistent with ink color) have no negative effects or even positive effects on response time of participants. *Or mathematically expressed, H0:* $u1_{(congruent)}$-$u2_{(incongruent)} >= 0$

Corresponding alternative hypothesis should be: incongruent words do have negative effect on response time of participants. *Or mathematically expressed, H1:* $u1_{(congruent)}$-$u2_{(incongruent)} < 0$

2.b. A single-tail t test should be performed since: 1. sample size is small (only 25); 2.the standard deviation of population of interest, which is human beings with cognitive ability, is unknown.

The t test is paired since: 1. Data are collected from subjects just on 2 time points (dependent samples);2. Sample size is the same. (Assuming equal sample variance)

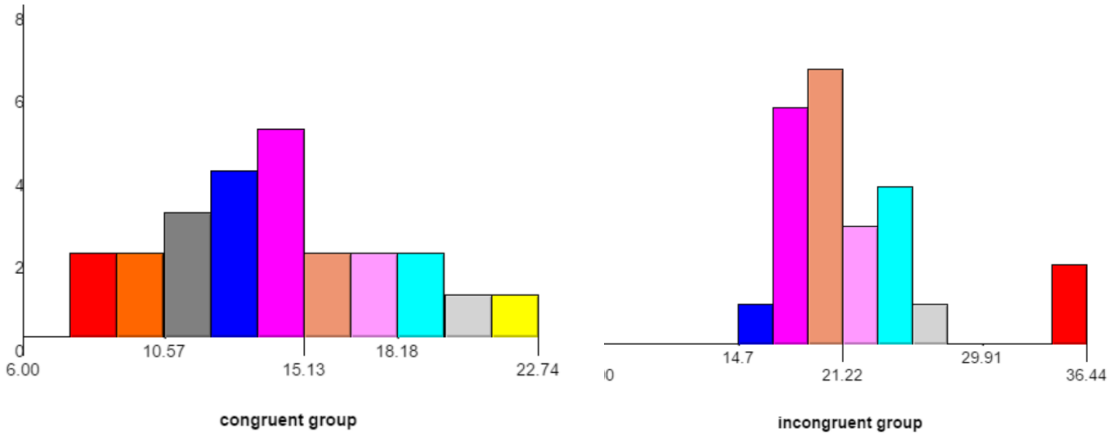
3.Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability.

Central Tendency measure: The sample mean for each congruent and incongruent group is 14.051125 and 22.01591667 respectively.

Variability measure: The corresponding SD is 3.559357958 and 4.797057122.

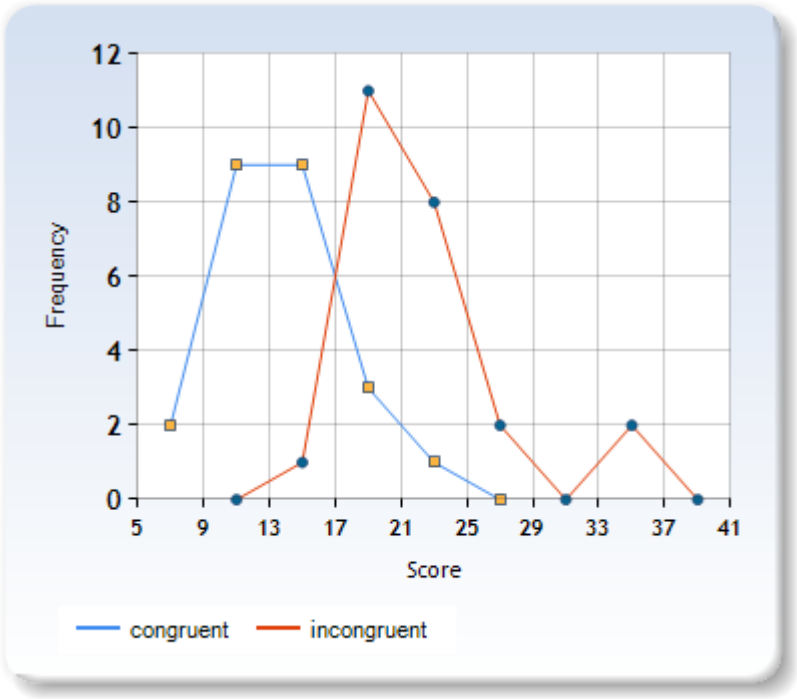
4.Provide one or two visualizations that show the distribution of the sample data. Write one or two sentences noting what you observe about the plot or plots.

Visualization I



Histograms of two data sets: for congruent group, the distribution is much more uniform, indicating SD is bigger and the mode is almost the mean which is 14; for the incongruent group, the distribution is much narrowed and right shifted comparing with the other.

Visualization II



Polygon line chart: again, it confirms the central tendency measures right shift dramatically in the second group.

5. Now, perform the statistical test and report your results. a. What is your confidence level and your critical statistic value? b. Do you reject the null hypothesis or fail to reject it? c. Come to a conclusion in terms of the experiment task. Did the results match up with your expectations?

5.a. Choose 95% as confidence level, the calculated confidence interval is -7.9648(Mean.a—Mean.b)+/- 2.0556 (i.e., -10.3546 ~ -5.575). The critical statistic value t(0.05,23) is -1.7138

5.b. The critical value t(0.05,23) is -1.7138, while the computed t(0.05,23) =-8.02, thus null hypothesis is rejected.

5.c. So the conclusion is: incongruent word group takes significant longer time than congruent word group in naming the ink colors of words in equally sized lists. It is not surprising to see this conclusion. First, when I did Stroop test myself I found strong disruption from incongruence. And the 2 visualizations experiment lends credit to the observation further.

6. Optional: a. What do you think is responsible for the effects observed? b. 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!

6.a. There are couple of theories trying to explain the interesting effect. I favor Speed of Processing Theory, in which it is claimed the interference occurs because words are read faster than colors are named.

6.b. There is a popular game in entertainment TV programmes, which takes advantage of similar effect: once after the emcee gives the command, such as 'lie down', 'turn right' ,'Walk right', in response the players should do 'stand up' , 'turn left', 'walk left' immediately, which is exact opposite to command.