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

   Independent Variable: Color/Word congruency
   Dependent Variable: Time it takes to name ink color of a word (Reaction time)

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

   $\mu_{congruent}$ = population mean of reaction times' for congruent words
   $\mu_{incongruent}$ = population mean of reaction times' for incongruent words

   Null Hypotheses (H_0): $\mu_{congruent}$ - $\mu_{incongruent}$ = 0

   Word's congruency does not affect test takers' reaction time (time taken to read out the ink color of a word).

   Alternate Hypotheses (H_a): $\mu_{congruent}$ - $\mu_{incongruent}$!= 0

   Word's congruency does affect test takers' reaction time (time taken to read out the ink color of a word).

   We will use two tailed dependent t-test and our confidence level is 95%.

   We are using the t-test because we want to compare the means but we don't know the population standard deviation and our sample size is small (<30). Here, we are assuming that that the population follows a Gaussian distribution.

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

   Congruent Words: Mean (x-bar) $\overline{x(congruent)}$ = 14.051 , Standard Deviation($s_{congruent}$) = 3.559

   Incongruent Words: Mean (x-bar) $\overline{x(incongruent)}$ = 22.016 , Standard Deviation($s_{incongruent}$) = 4.797

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.
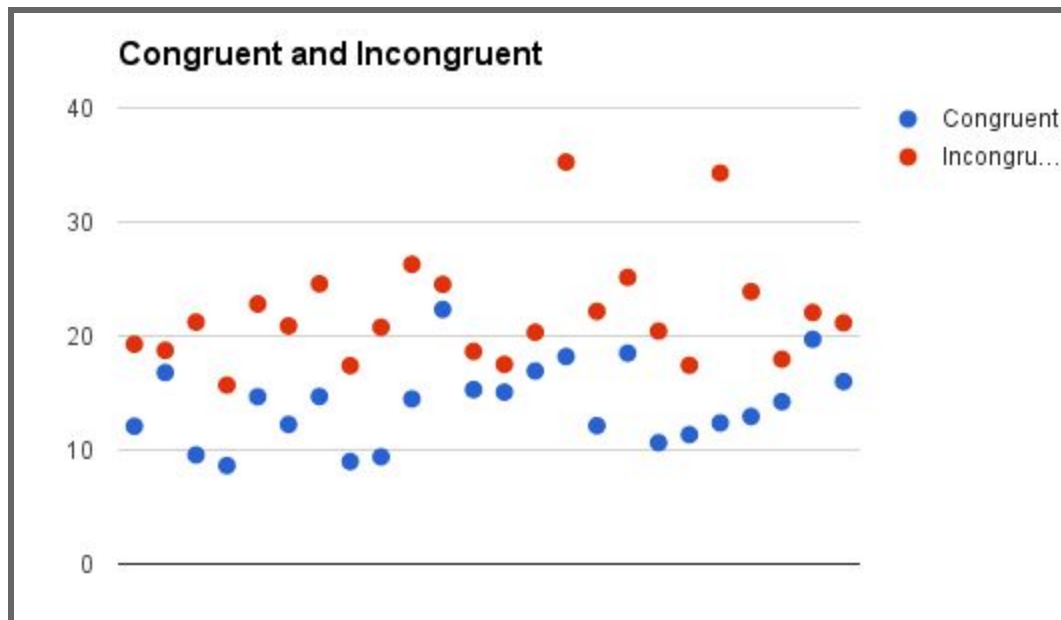
We can see from the plot that, generally, time taken for incongruent words is more than the time taken for congruent words.

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?

$\overline{D}$ = 7.965
s_d = 4.865
S.E. = 0.993
t = 8.021
For confidence level of 95% we have $\alpha = 0.05$.
Degree of Freedom = 23
$t_{critical}$ = +/- 2.069
$t > |t_{critical}|$
Based on this information we reject the null hypotheses.

So, after this analysis we can say that time taken to read out the ink color of incongruent words is more than that of congruent words.
The result does match up with our expectations from above graph.

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!

The reason behind this effect could be that our brain reacts to the word(shape) before it reacts to the color or it tries to use both the word and its color to come to a conclusion. So, in case of incongruent words we have an ambiguity and it takes a bit longer to get to the result.

References:

- http://oak.ucc.nau.edu/rh232/courses/EPS525/Handouts/Understanding%20the%20Dependent%20t%20Test.pdf
- http://www.graphpad.com/quickcalcs/statRatio2/
- http://psychclassics.yorku.ca/Stroop/
- http://www.csun.edu/~amarenco/Fcs%20682/When%20to%20use%20what%20test.pdf
- https://explorable.com/dependent-t-test-for-paired-samples
- http://stattrek.com/hypothesis-test/paired-means.aspx?Tutorial=AP
- http://www.graphpad.com/guides/prism/6/statistics/index.htm?stat_testing_if_pairs_follow_a_gaus.htm
- https://explorable.com/how-to-write-a-hypothesis
- http://support.minitab.com/en-us/minitab/17/topic-library/basic-statistics-and-graphs/hypothesis-tests/basics/null-and-alternative-hypotheses/