Project 1 Statistics: The Science of Decisions

Solutions

1. What is our independent variable? What is our dependent variable?
   The independent variable is the conditions, which are congruent and incongruent, in another word, whether the word name and font color were the same or different. The dependent variable is the time it takes for the participant to name the ink color 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.
   - We have limited data (samples), and from that limited data, we are trying to infer something about the population, which we don't know about. Thus, the hypotheses for this task is: trying to find out whether the sample means are different because the two populations and population means are different or just by chance, more specifically as –
     H0: $\mu C = \mu I$ (The real difference between means of the two experimental population is zero)

     HA: $\mu C \neq \mu I$ (The real difference between means of the two experimental population is not zero)

   - Based on the description of this work, it is reasonable to perform a two tailed T-test to verify if there is statistically significant difference between those two groups, as

     - We don’t know the standard deviation of the population.

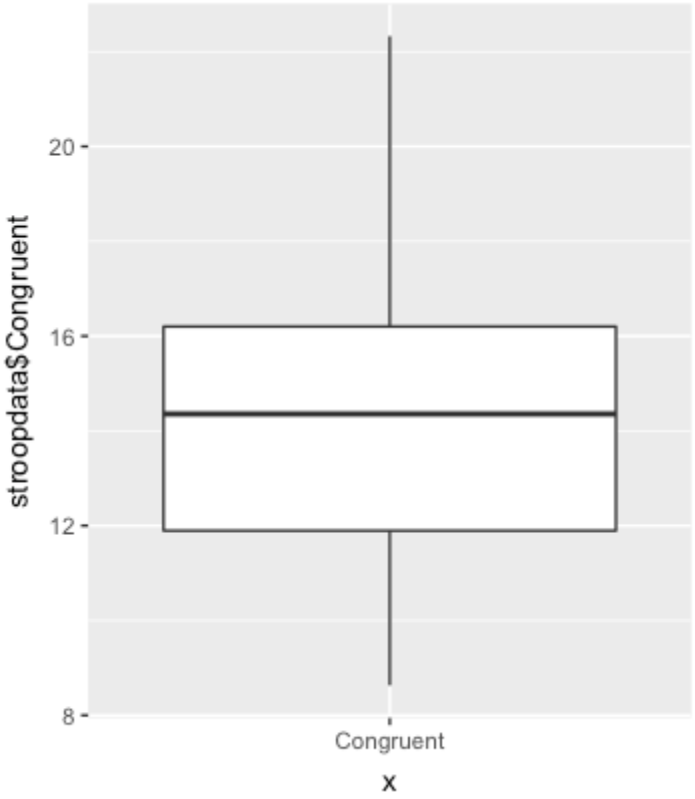
- Sample size is small.
- The means of the two groups are dependent.
- The participants attend both experiments with congruent and incongruent conditions.

3. Report some descriptive statistics regarding this dataset. Include at least onemeasure of central tendency and at least one measure of variability.
   Calculated by Excel, we have some of the descriptive statistics, including mean, median, std and variance, as:

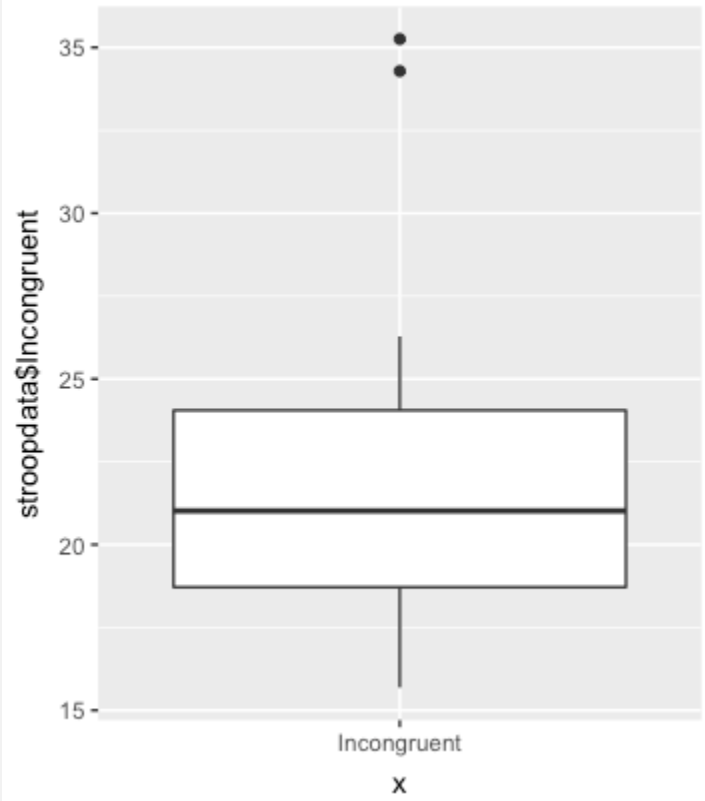
mean	
14.05113	22.01592
median	
14.3565	21.0175
std	
3.559358	4.797057
variance	
12.66903	23.01176

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.

BOX PLOT OF CONGRUENT DATA



BOX PLOT OF INCONGRUENT DATA



Clearly, the reading time in the congruent experiment and the incongruent experiment shows large difference in median and range. We can also notice that there are two outlier points in the incongruent data.

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?

   Caculated in Excel 2013, we have (95% confidence level)

   t = -8.0207, df = 23, p = 4.103e-08

   95 percent confidence interval:
   -10.019028 -5.910555

   Obviously, the p value is far less than 0.05, so that we can reject the null hypothesis and come to the conclusion that the difference between the congruent and incongruent experiments are significant. The result matches my expectations.