PROJECT - Statistics: The Science of Decisions

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1. **What is our independent variable? What is our dependent variable?**
   - The independent variable is the type of test condition: either congruent or incongruent
   - The dependent variable is the time taken to perform the test, in seconds

2. **What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform? Justify your choices.**
   - The question we would like to answer is whether or not there is a difference in times taken to perform either condition (congruent or incongruent).
   - To answer this question, we should set the null-hypothesis to assume the mean testing times for the two conditions are equal, and an alternative hypothesis stating that they are unequal.

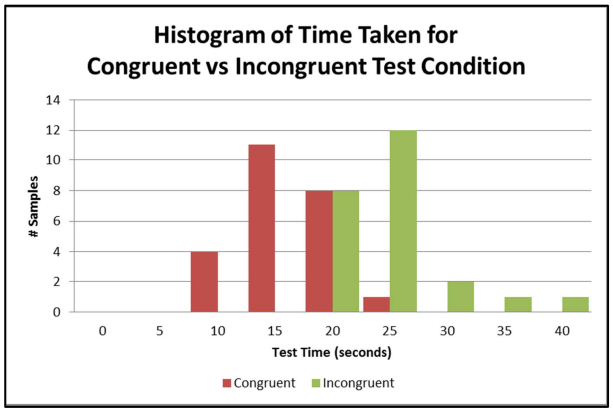
     $H_o: \mu_c = \mu_i$ or $\mu_c - \mu_i = 0$

     $H_a: \mu_c \neq \mu_i$ or $\mu_c - \mu_i \neq 0$

     Where μ_c is the population mean for the congruent condition,
     and μ_i is that for the incongruent condition.
   - Our hypotheses are based on the difference between paired means, and the population data are only slightly skewed, unimodal, and without outliers, with a sample size less than 40
   - For this null and alternate hypothesis, and for the data given, we should use a two-tailed, matched-pairs t-test

3. **Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability.**
   - The average time taken for the congruent condition was 14.05 seconds (SD = 3.56)
   - The average time taken for the incongruent condition was higher with greater variability, at 22.02 seconds (SD = 4.80)

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(s).**



   - The difference in means observed in the previous question is easily identified in the histogram plot. The mean test time for congruent conditions appears to be around 15

seconds, while the mean test time for incongruent conditions is between 20 and 25 seconds (agrees with previously calculated sample means).

- The congruent test times appear to be fairly normally distributed, while the incongruent test samples have some positive skewness, resulting in a wider distribution

5. 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?

- Performing a two-tailed t-test with $\alpha = 0.05$, we can reject the null hypothesis with 95% confidence, with congruent condition test times being lower than incongruent condition test times:

$$t^*(23) = \pm 2.069 \text{ for 95\% confidence } (\alpha = 0.05)$$

$$t(23) = -8.02,\ p < .001, \text{ two-tailed matched-pairs t-test}$$

- This result agrees with the expectations based on the plotted histogram shown in the previous question (sample mean value for congruent condition is significantly lower than that observed for incongruent condition).