

1. Independent Variable=Congruence vs Incongruence, Dependent Variable="Time it takes to name the color in equally sized list"
2. Work is below
  - a. We are given a sample of the data and we are trying to make inferences about the population. Therefore, I will use t-test with the following null and alternative hypothesis. See below for setup.

$$H_0 = \mu_0 = \mu_1$$

$$H_A = \mu_0 \neq \mu_1$$

$H_0$  = Null Hypothesis  
 $H_A$  = Alternative Hypothesis

$\mu_0$  = Incongruent Population Mean  
 $\mu_1$  = Congruent Population Mean

In natural language:

Null Hypothesis says that there is no significant time difference when naming ink color between the congruent and incongruent population.

Alt. Hypothesis: There is a significant time difference when naming the ink color between the congruent and incongruent population.

We are making an inference about the population mean since we only have samples. Here we are making the inference from our that the population mean is not the same. Hence, we are trying to disprove the null hypothesis with out t-test.

b. Since the each participant goes through both incongruent/congruent treatment we have a dependent-sample t-test. And since in our alternative hypothesis we are trying to infer has non directional, we will choose two-tail test.

### 3. Descriptive Statistic

Congruence	
Avg_C	14.05
STDEV_C	3.56

Incongruence	
AVG_IC	22.02
STDEV_IC	4.80

4. One visualization that show distribution of sample data.



5.

We can make a point estimate:  $\text{Avg\_C} - \text{Avg\_I} = -7.97$  (This is our estimate based on the sample)

We take the difference of both samples and then calculate the Standard Deviation = S. In this case  $S = 4.86$

$$t\text{-stat} = (\text{mean}(a) - \text{mean}(b)) / (\text{standard\_deviation}(a-b) / \text{square\_root}(N))$$

where "a" and "b" are the measurements for each condition and "N" is the sample size.

Using the formula above, we calculate the numerator to be -7.97. Our standard Deviation is 4.86. And our sample size is  $N=24$ , plugging in the values we get -8.02

We know that our degree of freedom is 23 ( $N-1$ ), and since this is two tail test we want to set the threshold at 2.5 – which is equivalent to 2.069 (found using the t-table). At alpha level 0.05 I would use  $\pm 2.069$  as my threshold.

Knowing our t-critical value and t-statistic, we can reject the null hypothesis. And since this is an experimental design we can also make causal statement and say that congruent/incongruent had a causal effect on the speed.