Project 2 : TEST A PERCEPTUAL PHENOMENA

1.) What are the independent and dependent variables in the experiment?

Independent variable:

The colour of font or word are independent variables here.

Dependent variable:

Time taken to indicate the colour here is a dependent variable.

2.) Which set of hypothesis is suitable for the task and what kind of statistical test is expected to be performed ?

In this scenario, our hypothesis would be, that giving incongruent words is statistically significant or not . There are no information given about the samples other than their congruent and incongruent scores. So we would assume that these samples are randomly chosen which means that the participants are of different age, both male and female and of different education level.

Hypothesis testing:

Null hypothesis and alternative hypothesis are suitable for this task.

μ_1 = Mean or average of time spent by participant of congruent test.

μ_2 = Mean or average of time spent by participant of incongruent test.

The null hypothesis (μ1- μ2=0) is that there is no difference on average in the time taken to interpret in case of both congruent and incongruent conditions. This means that average time taken to say words in both cases is same.

The alternative hypothesis (μ1- μ2 ≠ 0) is that there is a difference (on average) in the time taken to interpret in case of both congruent and incongruent conditions. This means that the average time taken to say words in both cases is different.

The test we want to perform **one tailed dependent t-test** on the given sample.

- We have two groups of data without having knowledge of population parameters. We have no information about the gender , age , etc of the population. So t-test is used to address uncertainty of the population.
- Since the sample size is 24 which is small so, t-test is preferred here. But we assume that normal distribution approximately followed here.
- Each of the total sample of 24 participants recorded the time for each congruent and incongruent tests. Thus , same participants get different treatment .So, they are dependent on each other. Which means they are paired variables . So, this test is used in this case because we have to analyse data in each case .

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:

Congruent :   incongruent:

μ1(mean)=14.05   μ2(mean)=22.015

median= 14.233   median= 20.878

  Here the mean and median are similar in both the cases but not the same. Thus , this is not a case of perfectly normal distribution.

Measures of variability:

 Congruent: Incongruent:

v1(variance)= 12.141   v2(variance)=22.053

 σ1(standard =3.559   σ2(standard =4.79

   deviation)   deviation)

Google spreadsheet screenshot:

Congruent	Incongruent	deviation(cong)	deviation(incong)	squared deviation(cong)	squared deviation(incong)			
8.63	15.687	-5.421125	-6.328916667	29.38859627	40.05518617			
8.987	17.394	-5.064125	-4.621916667	25.64536202	21.36211367		congruent	incongurent
9.401	17.425	-4.650125	-4.590916667	21.62366252	21.07651584	sum=	337.227	528.382
9.564	17.51	-4.487125	-4.505916667	20.13429077	20.30328501	mean =	14.051125	22.01591667
10.639	17.96	-3.412125	-4.055916667	11.64259702	16.45046001	variance=	12.14115286	22.05293383
11.344	18.644	-2.707125	-3.371916667	7.328525766	11.36982201	standard deviation=	3.484415713	4.696055135
12.079	18.741	-1.972125	-3.274916667	3.889277016	10.72507917	median=		14.233	20.878
12.13	19.278	-1.921125	-2.737916667	3.690721266	7.496187674		Between cong and incong	
12.238	20.33	-1.813125	-1.685916667	3.287422266	2.842315007	Meandiff =	-7.964791667	
12.369	20.429	-1.682125	-1.586916667	2.829544516	2.518304507			
12.944	20.762	-1.107125	-1.253916667	1.225725766	1.572307007	significance level=	0.005	
14.233	20.878	0.181875	-1.137916667	0.03307851563	1.29485434	Standard deviation=	4.865	
14.48	21.157	0.428875	-0.8589166667	0.1839337656	0.7377378403	sample size=	24	
14.669	21.214	0.617875	-0.8019166667	0.3817695156	0.6430703403	df=	23	
14.692	22.058	0.640875	0.04208333333	0.4107207656	0.001771006944	confidence value=	2.847518564	
15.073	22.158	1.021875	0.1420833333	1.044228516	0.02018767361			
15.298	22.803	1.246875	0.7870833333	1.554697266	0.6195001736			
16.004	23.894	1.952875	1.878083333	3.813720766	3.527197007			
16.791	24.524	2.739875	2.508083333	7.506915016	6.290482007			
16.929	24.572	2.877875	2.556083333	8.282164516	6.533562007			
18.2	25.139	4.148875	3.123083333	17.21316377	9.753649507			
18.495	26.282	4.443875	4.266083333	19.74802502	18.19946701			
19.71	34.288	5.658875	12.27208333	32.02286627	150.6040293			
22.328	35.255	8.276875	13.23908333	68.50665977	175.2733275			
			sum=	291.3876686	529.2704118			

Google spreadsheet link:

https://docs.google.com/spreadsheets/d/1qfyslLmRHjc_ym4O20DtB2vHCrYIC9vEZ3rYmjVeVcw/edit?usp=sharing

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?
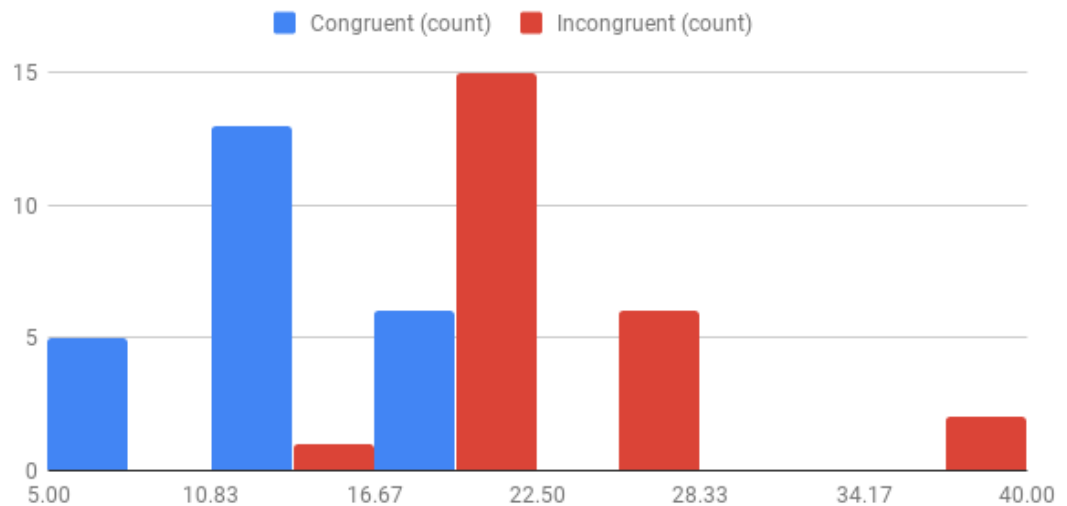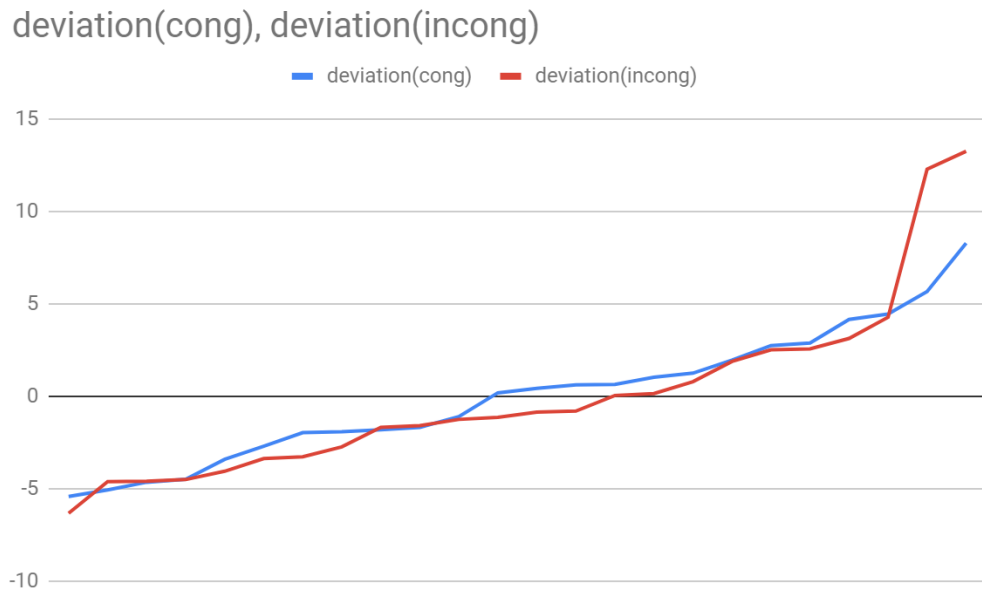
From the above graph we can see there is a significant difference between the mean median and mode of given data.

Congurent incongurent
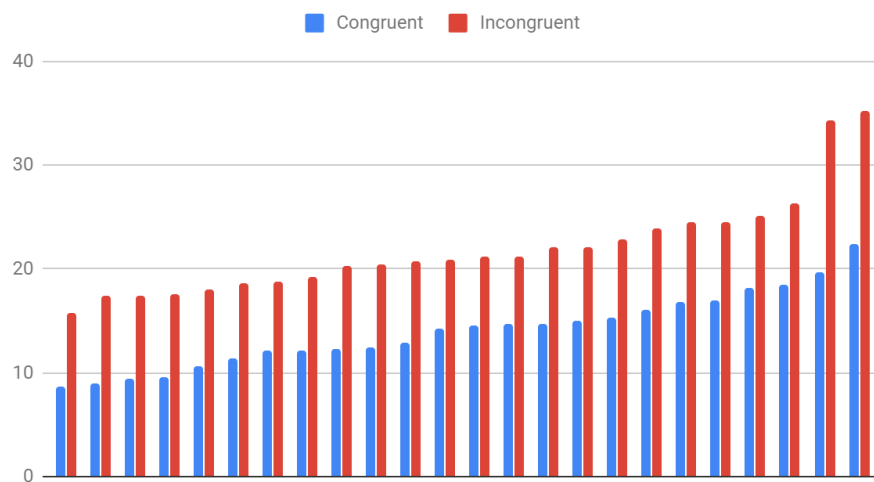
Also, we can clearly see here that the time to read words in case of incongruent is always greater than in case of congruent.

deviation(cong), deviation(incong)

Here, is a comparison in between the deviation of the two

Conditions ,incongruent and congruent .

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?

The means for each type of data:

μ_1(congruent)=14.05

μ_2(incongruent)=22.015

The Difference in the means of this data= μ_1- μ_2

(mean difference)=14.05-22.015

= -7.964

(Difference of Congruent and Incongruent – Average of differences)^2

Square of Sums of difference of sample means = 544.3304

Variance of difference = 23.667

SD of Differences = 4.865

T-statistic = $\dfrac{\text{mean difference}}{s/\sqrt{n}}$

= -8.026

Knowing n=24, the degrees of freedom for this t-test = n-1 = 23. Since we are aiming to find with 99% Confidence level for a one tail our α = 0.005

So,

Given df = 23 and α = 0.005

For 99% Confidence Level: need to be between +- 2.47

Since our t statistics fall in to the critical region, the result is statistical significant at α level 0.05 (P<.05) so we reject the null hypothesis. This happens due to T-Statistic being in the critical area of tested at 99% Confidence Level.
The t-test confirms what was expected that incongruent tests would normally take longer than congruent tests as congruent test linked both visual colours with the correct printed name of the colour while incongruent required to try to separate the visual colour and the name of the colour which required a bit more time to do.

References:

- https://www.youtube.com/watch?v=_x6j-rH33Og
- https://en.wikipedia.org/wiki/Stroop_effect
- http://blog.minitab.com/blog/adventures-in-statistics-2/understanding-

hypothesis-tests-confidence-intervals-and-confidence-levels

- http://www.chem.utoronto.ca/coursenotes/analsci/stats/12tailed.html