Stroop Effect

Q1: What is our independent variable? What is our dependent variable?

A1: Independent variable - Type of effect(congruent/Incongruent)
Dependent variable - Reaction time

Q2: What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform? Justify your choices.

A2: Null hypothesis(H0): There is no difference in population means of response time under incongruent and congruent scenarios, which can be mathematically represented as-

$$H0: \mu(c) = \mu(ic)$$

Alternative hypothesis(Ha): The population mean of the response time under incongruent sample is different than that of the congruent sample. This can be mathematically represented as-

$$Ha: \mu(c) \neq \mu(ic)$$

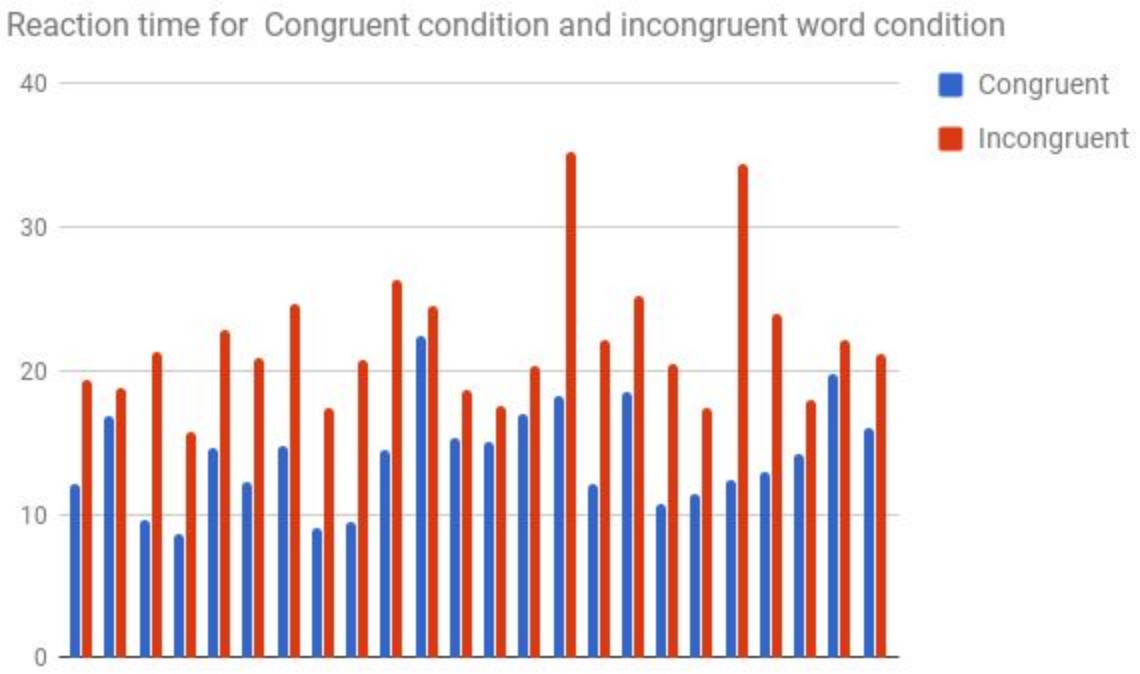
H0 = Null hypothesis.
Ha = Alternative hypothesis.
$\mu(c)$ **= Average reaction time for congruent word scenario of the population.**
$\mu(ic)$ **= Average reaction time for incongruent scenario of the population**
We do not know the population standard deviation and as same sample is undergoing two tests depending on the types of words(congruent or incongruent) and the population size is less than 30 (n = 24).
Therefore, we use a paired t-test for dependent samples.
We use the difference of the means also known as point estimate to test the hypothesis.
The alternative hypothesis is that the reaction times are not equal($\mu(c) \neq \mu(ic)$ **).**
Therefore, we use a two tailed test.

Q3: Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability.

A3: There is one sample data which undergoes two tests, a congruent words condition and an incongruent words condition. The mean and standard deviation of both the conditions are shown in the table below:

	Mean	Standard Deviation
Congruent	14.051125	3.559357958
Incongruent	22.01591667	4.797057122

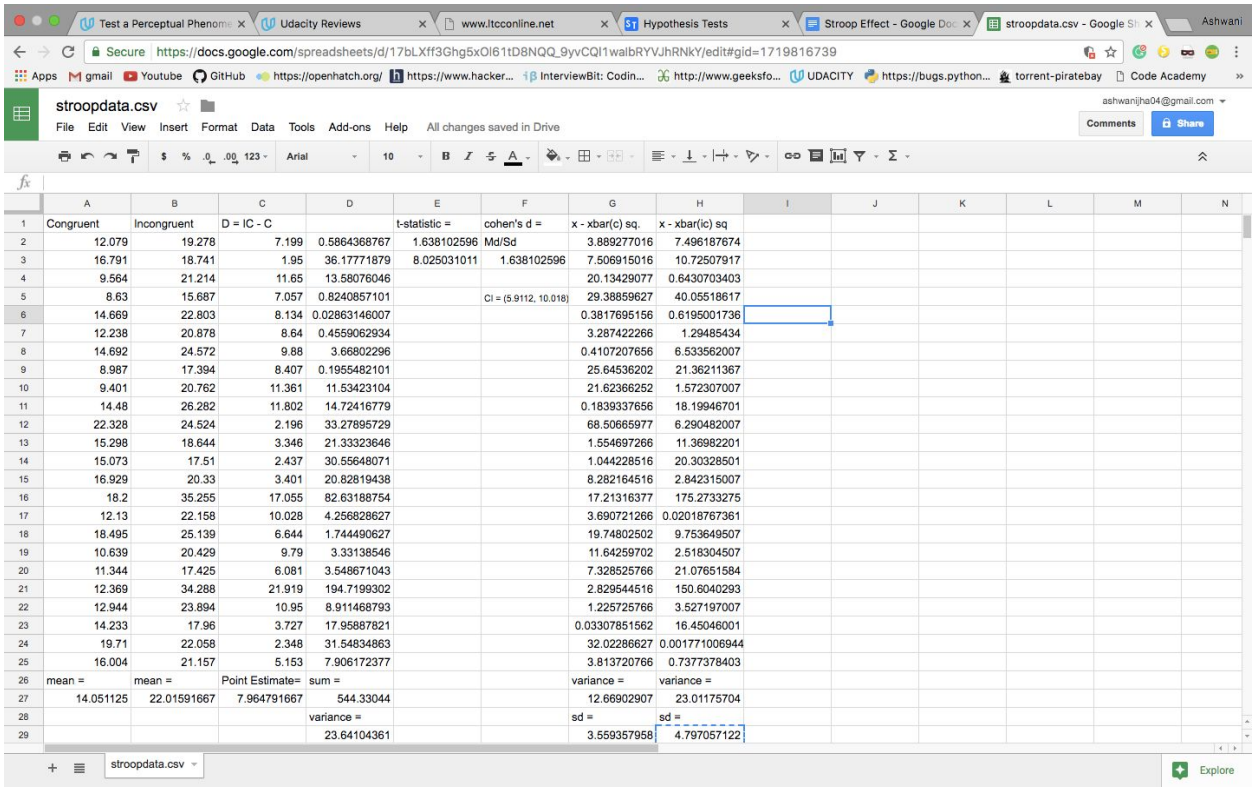
Q4: Provide one or two visualizations that show the distribution of the sample data. Write one or two sentences noting what you observe about the plot or plots.
A4:



This bar graph shows the reaction times for different conditions. We can observe that in all the cases of the sample data, the reaction time for incongruent word condition is greater than the time for congruent word condition.

Q5: 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?
A5: N = 24
Degree of freedom = 23.
Confidence Level = (5.9112, 10.018)

Critical statistic value = 2.069 for a two tailed test at α level 0.05.
t(critical) = 2.069
t(statistic) = $(\mu(ic) - \mu(c)) \div \sigma/\sqrt{n}$
t(statistic) = 8.025031011
Since t(statistic) > t(critical), this means that p < 0.05.
So, we fail to reject the null hypothesis.
The result did match up with our expectation as we saw that the reaction time for incongruent word types were more for all the sample data. Here is a screenshot of the results(please consider zooming).



stroopdata.csv

	A	B	C	D	E	F	G	H
1	Congruent	Incongruent	D = IC - C		t-statistic =	cohen's d =	x - xbar(c) sq.	x - xbar(ic) sq
2	12.079	19.278	7.199	0.5864368767	1.638102596	Md/Sd	3.889277016	7.496187674
3	16.791	18.741	1.95	36.17771879	8.025031011	1.638102596	7.506915016	10.72507917
4	9.564	21.214	11.65	13.58076046			20.13429077	0.6430703403
5	8.63	15.687	7.057	0.8240857101		CI = (5.9112, 10.018)	29.38859627	40.05518617
6	14.669	22.803	8.134	0.02863146007			0.3817695156	0.6195001736
7	12.238	20.878	8.64	0.4559062934			3.287422266	1.29485434
8	14.692	24.572	9.88	3.66802296			0.4107207656	6.533562007
9	8.987	17.394	8.407	0.1955482101			25.64536202	21.36211367
10	9.401	20.762	11.361	11.53423104			21.62366252	1.572307007
11	14.48	26.282	11.802	14.72416779			0.1839337656	18.19946701
12	22.328	24.524	2.196	33.27895729			68.50665977	6.290482007
13	15.298	18.644	3.346	21.33323646			1.554697266	11.36982201
14	15.073	17.51	2.437	30.55648071			1.044228516	20.30328501
15	16.929	20.33	3.401	20.82819438			8.282164516	2.842315007
16	18.2	35.255	17.055	82.63188754			17.21316377	175.2733275
17	12.13	22.158	10.028	4.256828627			3.690721266	0.02018767361
18	18.495	25.139	6.644	1.744490627			19.74802502	9.753649507
19	10.639	20.429	9.79	3.33138546			11.64259702	2.518304507
20	11.344	17.425	6.081	3.548671043			7.328525766	21.07651584
21	12.369	34.288	21.919	194.7199302			2.829544516	150.6040293
22	12.944	23.894	10.95	8.911468793			1.225725766	3.527197007
23	14.233	17.96	3.727	17.95887821			0.03307851562	16.45046001
24	19.71	22.058	2.348	31.54834863			32.02286627	0.001771006944
25	16.004	21.157	5.153	7.906172377			3.813720766	0.7377378403
26	mean =	mean =	Point Estimate=	sum =			variance =	variance =
27	14.051125	22.01591667	7.964791667	544.33044			12.66902907	23.01175704
28				variance =			sd =	sd =
29				23.64104361			3.559357958	4.797057122

Q6: 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?

A6: The experimental results of John Ridley Stroop showed that people are more practiced at word reading than naming colours. As learnt experiences become part of our memory, it teaches us over time that the meaning of words holds greater significance than the colours they are written in.
In other words, interference is responsible for this effect.

A similar experiment would be listening to an audio and reading a word and saying the colour we hear and not read.

List of Materials, tools, websites referred:

1. **Google.com**
2. **Wikepedia.com**
3. **Google spreadsheet**
4. **Udacity Videos**
5. **http://stattrek.com/hypothesis-test/hypothesis-testing.aspx**
6. **http://www.statisticshowto.com/when-to-use-a-t-score-vs-z-score/**
7. **http://support.minitab.com/en-us/minitab/17/topic-library/basic-statistics-and-graphs/hypothesis-tests/tests-of-means/types-of-t-tests/**