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

1. Independent Variable : Type of stroop data (Congruent or Incongruent).
2. Dependent Variable: Time taken to finish reading the stroop words in second (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.

I will perform a t-test (T-statistic). This is two tailed paired t-test for dependent means.

If Xc is the average reading time of Congruent means,
Xi is the average reading time of incongruent means,
And Xd represents the difference (Xi - Xc) for the sample (and assuming this is equal to 0 because of paired t-test assumptions).
For the population parameter μ,

Null Hypothesis H_0: $\mu d = 0$.

Alternative hypothesis H_1: $\mu d \neq 0$ (two-tailed test).

Justification:
The intention here is to compare the central measure of time taken to read congruent words with time taken to read incongruent words.
I expect the reaction time for reading incongruent words to be greater - but since the question does not contain any assumption as to find out if this is going to be greater than the time taken to read congruent words - I am assuming it to be a two-tailed test.

If the difference is significantly different from the population data of congruent words , I can reject null hypothesis.

[If (Xi - Xc = D), then μd should be equal to D at a given level of significance].

(Assuming alpha levels of 0.05.)

- This is assuming the difference between the times are normally distributed.
- The times themselves are normally distributed - representing a population they may be from.
- All data points in the sample are picked randomly from a population.

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

Congruent words :

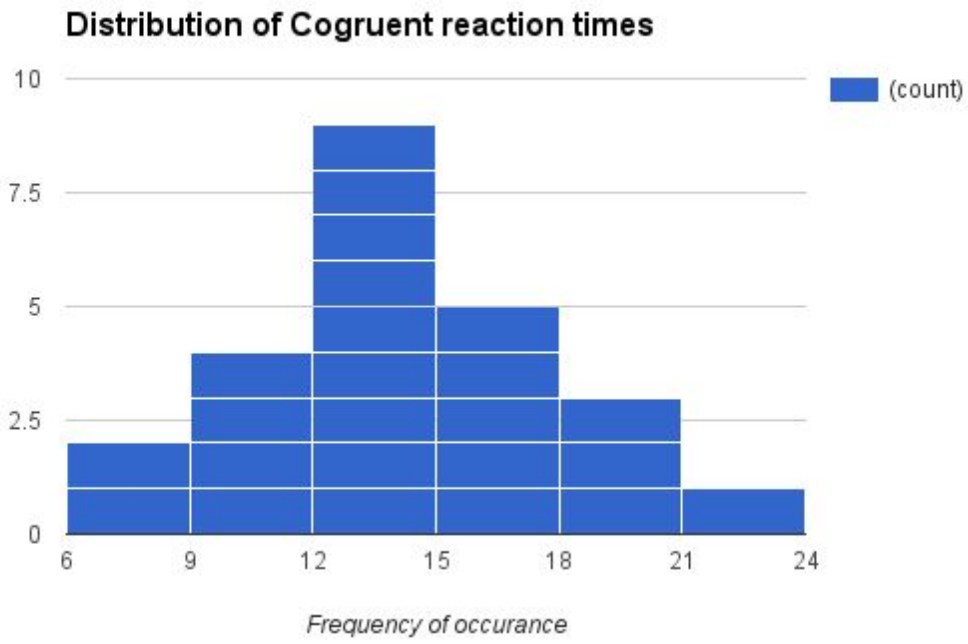
- Mean = 14.051125.
- Sum of squares : 291.3876686.
- Standard Deviation = 3.559357958.

Incongruent words :

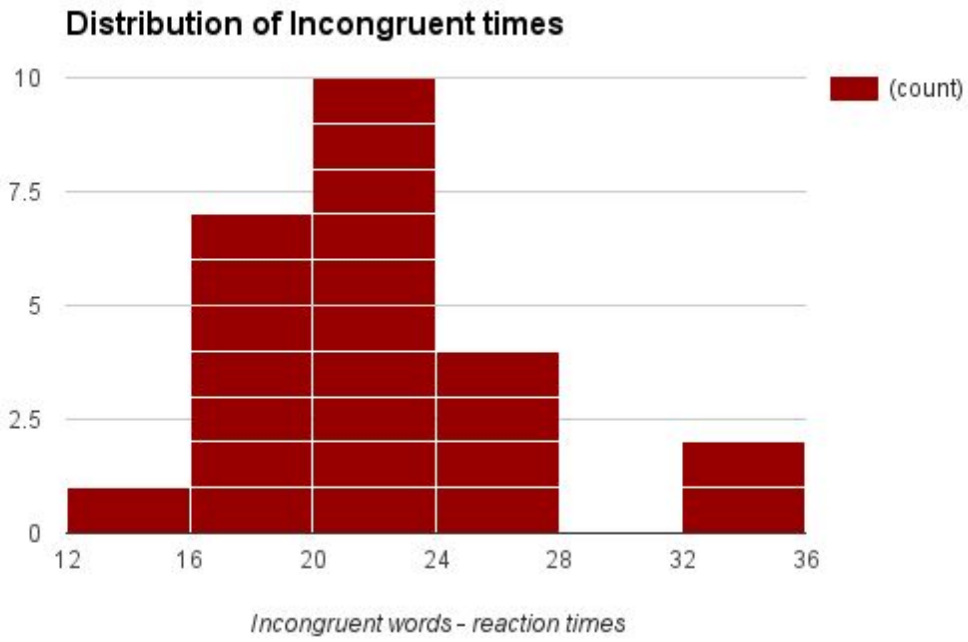
- Mean = 4.797057122.
- Sum of squares : 529.2704118.
- Standard Deviation : 4.797057122.

Pooled Variance :	17.84039305

Q4 :



Distribution of reaction times of Congruent words.



Distribution of reaction times of incongruent words.

We can see both distribution are very close to the normal bell curve.

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?**

T-Statistics :	8.020706944
T-Critical Value at alpha = 0.05 (Two-Tailed)	2.069

At a confidence level : 95%.

	Tail probability p											
df	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001	.0005
1	1.000	1.376	1.963	3.078	6.314	12.71	15.89	31.82	63.66	127.3	318.3	636.6
2	.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.09	22.33	31.60
3	.765	.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.21	12.92
4	.741	.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	.727	.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	.718	.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	.711	.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	.706	.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	.703	.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	.700	.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	.697	.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	.695	.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	.694	.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	.692	.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	.691	.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	.690	.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	.689	.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	.688	.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.611	3.922
19	.688	.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	.687	.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	.686	.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	.686	.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	.685	.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	.685	.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	.684	.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725

(I have no idea what I'm doing wrong while picking the T-critical value at 0.05).

Since T-Statistic for the sample > $T_{Critical}$ at 0.05. We reject H_0.

Therefore, it does take more time to read incoherent words compared to coherent words. (Reaction time is longer - for a variety of reasons).

This result is as predicted earlier.

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? Some research about the problem will be helpful for thinking about these two questions!

What do you think is responsible for the effects observed?

In stroop's experiment , the time taken to read a word displayed is termed as 'reaction time'.

When reading Coherent words - Stroop theorizes a process called Semantic facilitation - reaction time of reading a word is aided by the colour of the words. The

reason stroop theorizes is automation of reading, where the mind automatically determines the semantic meaning of the word.

This semantic facilitation and automation of reading are out of sync (in fact pitted against one another) when reading incoherent words. Something which Stroop describes as Semantic interference. This is the reason for the **significantly different reaction times.**

Can you think of an alternative or similar task that would result in a similar effect?

Yes. Infact, stroop had performed a test prior to recording the reaction time of coherent and incoherent words , which had reaction time of reading words all of which were in black colour , and the participants were able to have much quicker reaction time.
There are popular theories as to why this had happened. These theories each have their own merits and demerits explaining the phenomenon (Selective attention, Parallel-Processing, automaticity , Processing speed) - but none of them individually/collectively have conclusively pointed to a solution.