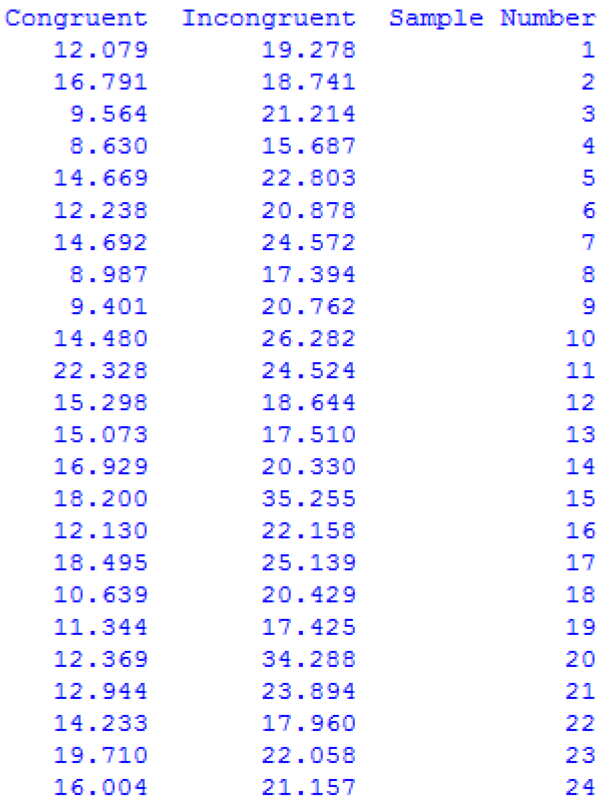
Input:

```
def filenames(filename):
    df = pandas.read_csv(filename)
    congurent = df['Congruent']
     df['Sample Number'] = df.index+1
    print df
```

Output:



```
Congruent  Incongruent  Sample Number
   12.079       19.278              1
   16.791       18.741              2
    9.564       21.214              3
    8.630       15.687              4
   14.669       22.803              5
   12.238       20.878              6
   14.692       24.572              7
    8.987       17.394              8
    9.401       20.762              9
   14.480       26.282             10
   22.328       24.524             11
   15.298       18.644             12
   15.073       17.510             13
   16.929       20.330             14
   18.200       35.255             15
   12.130       22.158             16
   18.495       25.139             17
   10.639       20.429             18
   11.344       17.425             19
   12.369       34.288             20
   12.944       23.894             21
   14.233       17.960             22
   19.710       22.058             23
   16.004       21.157             24
```

Fig 1.1: CSV data file in panda dataframe

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

Independent variables are Congruent and Incongruent. The dependent variables is Time (in sec)

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

Hypotheses Test

H_o (Null Hypothesis) : There is no significant difference in population average time of congruent word and incongruent word.

H_a (Alternative Hypothesis): There is significant difference in population average time.

Statistical Test

Input: Normal Distribution Plot (Congruent)

```
def plot_normal_distribution_congruent(filename):

    df = pandas.read_csv(filename)

    congruent = df['Congruent']

    congruent_mean = congruent.mean()

    congruent_std = congruent.std()

    range = np.arange(0, 30, 0.5)

    plot.figure().suptitle('Congruent: ', fontsize=20, fontweight='bold')

    plot.plot(range, mlab.normpdf(range,congruent_mean,congruent_std))
```

Output:

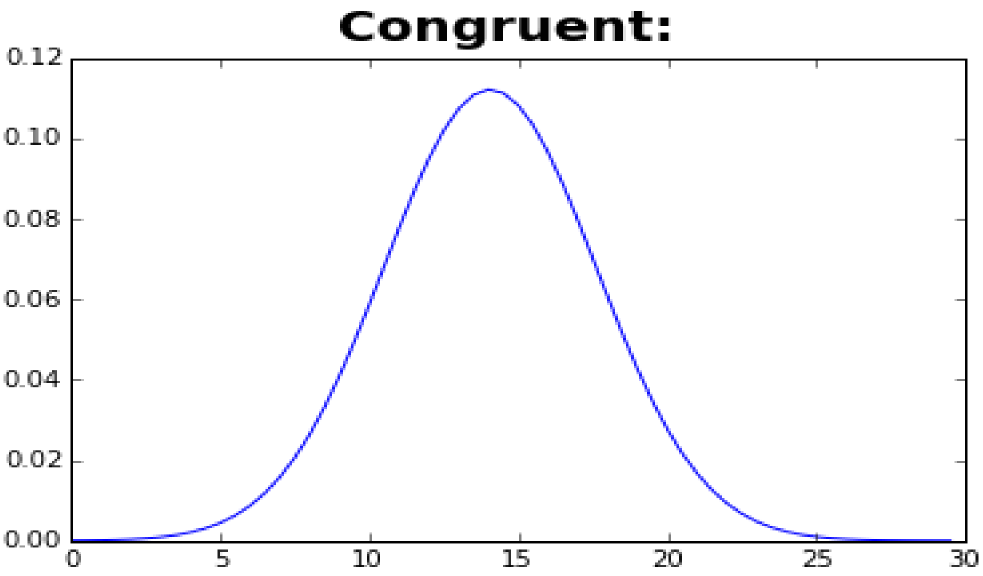


Fig 1.2: Normal Distribution curve for Congruent

Input: Normal Distribution Plot (Incongruent)

```
def plot_normal_distribution_incongurent(filename):

    df = pandas.read_csv(filename)

    incongurent = df['Incongruent']

    incongurent_mean = incongurent.mean()

    incongurent_std = incongurent.std()

    range = np.arange(0, 45, 0.5)

    plot.figure().suptitle('Incongruent: ', fontsize=20, fontweight='bold')

    plot.plot(range, mlab.normpdf(range,incongurent_mean,incongurent_std))
```

Output:

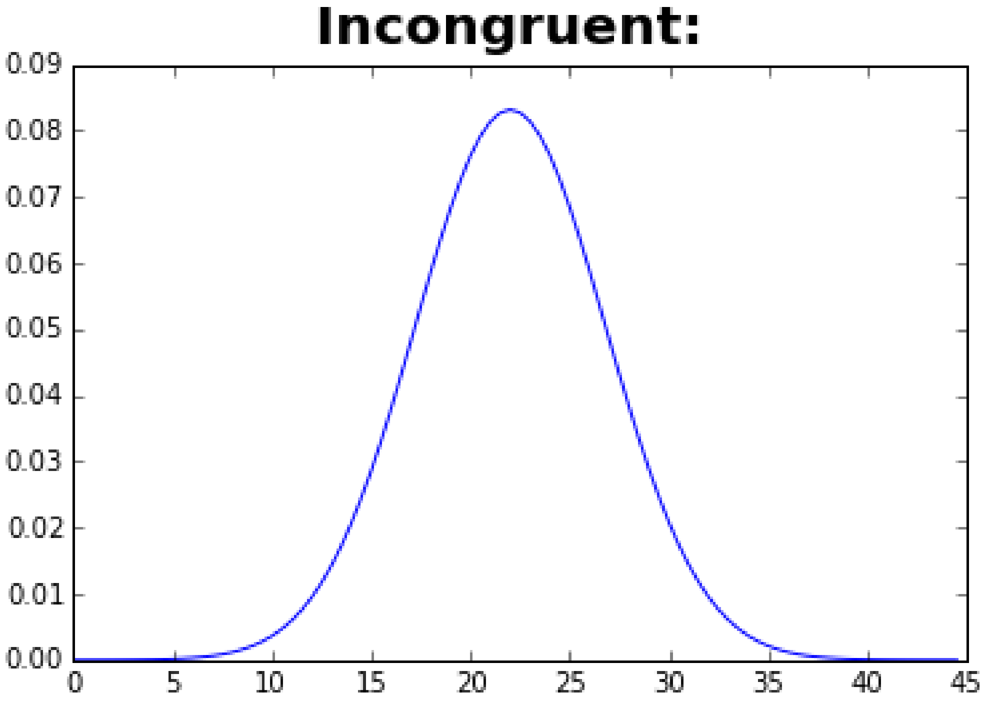


Fig 1.3: Normal Distribution curve for incongruent

As shown in the Figure 1.2 and 1.3 the data is Normally Distributed. So, I will use the two tailed dependent t-test as we comparing a two dependent dataset.

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

Congruent

Input :

```
congurent = df['Congruent']

congurent_mean = congurent.mean()

print congurent_mean
```

Output (mean): 14.051125

Input:

```
congurent = df['Congruent']

congurent_std = congurent.std()

print congurent_std
```

Output (standard deviation): 3.55935795765

Incongruent

Input:

```
 incongurent = df['Incongruent']

incongurent_mean = incongurent.mean()

print incongurent_mean
```

Output (mean): 22.0159166667

Input:

```
incongurent = df['Incongruent']

incongurent_std = incongurent.std()

print incongurent_std
```

Output (standard deviation): 4.79705712247

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.

Input:

```
def plot_congurent(filename):
    df = pandas.read_csv(filename)
    df['Sample Number'] = df.index+1
    x = df['Sample Number']
    y = df['Congruent']
    colors = 'yellow'
    area = np.pi*20
    fig = plot.figure()
    fig.suptitle('Congruent: ', fontsize=20, fontweight='bold')
    ax = fig.add_subplot(110)
    fig.subplots_adjust(top=0.85)
    ax.set_xlabel('Sample Number')
    ax.set_ylabel('Completion Time (in sec)')
    plot.xticks(np.arange(min(x), max(x)+1, 1.0))
    plot.yticks(np.arange(0, 35, 2))
    plot.scatter(x, y, s=area, c=colors, alpha=1)
    plot.ylim([0,35])
    plot.xlim([0,24])
    plot.show()
```

Output:

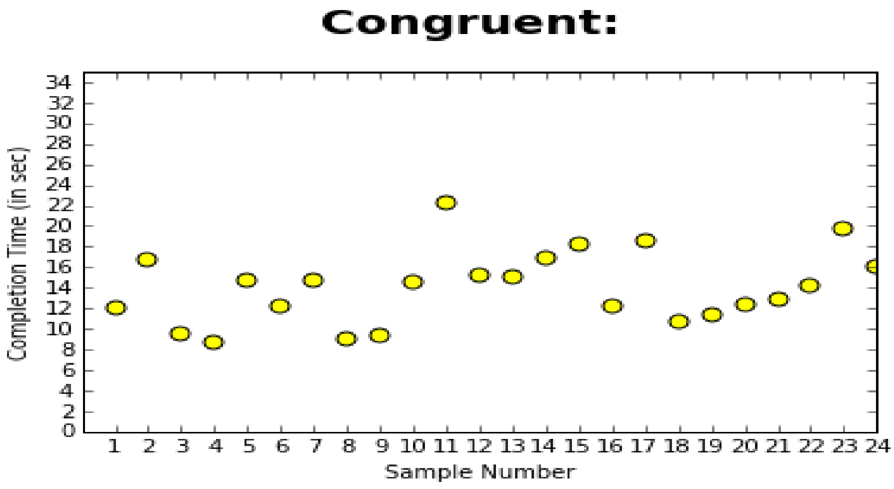


Fig 1.4: Response Time Plot of Congruent

Input:

```
def plot_incongurent(filename):
    df = pandas.read_csv(filename)
    df['Sample Number'] = df.index+1
    x = df['Sample Number']
    y = df['Incongruent']
    colors = 'green'
    area = np.pi*20
    fig = plot.figure()
    fig.suptitle('Incongruent: ', fontsize=20, fontweight='bold')
    ax = fig.add_subplot(110)
    fig.subplots_adjust(top=0.85)
    ax.set_xlabel('Sample Number')
    ax.set_ylabel('Completion Time (in sec)')
    plot.xticks(np.arange(min(x), max(x)+1, 1.0))
    plot.yticks(np.arange(0, 35, 2))
    plot.scatter(x, y, s=area, c=colors, alpha=1)
    plot.ylim([0,35])
    plot.xlim([0,24])
    plot.show()
```

Output:

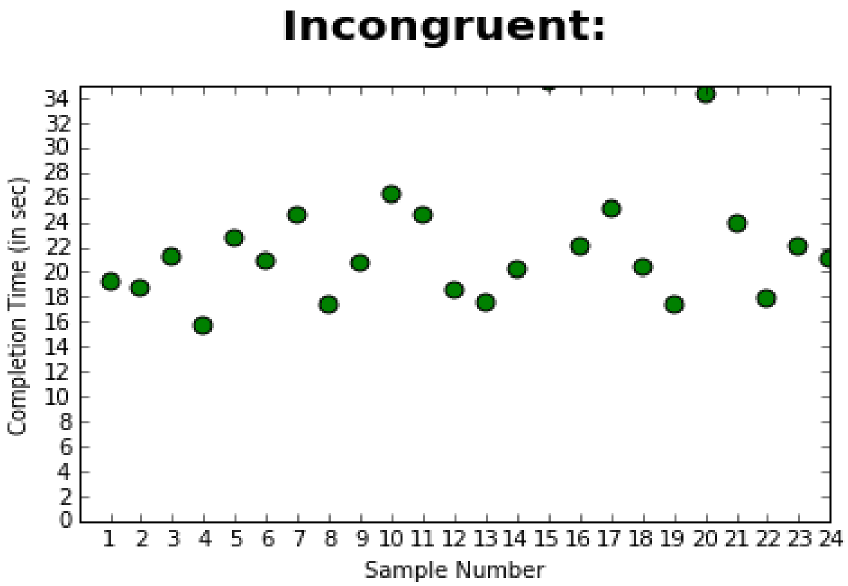


Fig 1.5: Response Time plot of Incongruent

In the Fig 1.4 the response time (in sec) is scattered from 8 to 20 sec and one sample at 22 sec. And in the Fig 1.5 the response time (in sec) is in between 15 to 22 sec and one sample at 34. As shown obviously in graph the average time of Incongruent is definitely higher than of Congruent.

5. 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?

Confidence Level = 90%

df = n -1 =24-1 =23

T-Critical Value = (+/-) 1.714

Input :

```
def ttest(filename):

    df = pandas.read_csv(filename)

    congurent = df['Congruent']

    incongurent = df['Incongruent']

    result = scipy.stats.ttest_rel(incongurent, congurent)

    print result
```

Output: (8.020706944109957, 4.1030005857111781e-08)

Observation: T-stat = 8.020706944109957

P= 4.1030005857111781e-08

T-stat > T- Critical

Null hypothesis REJECTED. The time of response in Congruent and Incongruent is different significantly. The speed is slower in Incongruent than in Congruent as previously stated in above questions.

REFRENCES

https://en.wikipedia.org/wiki/Null_hypothesis

https://en.wikipedia.org/wiki/Alternative_hypothesis

https://en.wikipedia.org/wiki/Normal_distribution

http://matplotlib.org/api/mlab_api.html

http://docs.scipy.org/doc/scipy-0.14.0/reference/generated/scipy.stats.ttest_rel.html