Q1) Identify the Data type for the Following:

Activity	Data Type
Number of beatings from Wife	Discrete
Results of rolling a dice	Discrete
Weight of a person	Continuous
Weight of Gold	Continuous
Distance between two places	Continuous
Length of a leaf	Continuous
Dog's weight	Continuous
Blue Color	Discrete
Number of kids	Discrete
Number of tickets in Indian railways	Discrete
Number of times married	Discrete
Gender (Male or Female)	Discrete

Q2) Identify the Data types, which were among the following

Nominal, Ordinal, Interval, Ratio.

Data	Data Type
Gender	Nominal
High School Class Ranking	Ordinal
Celsius Temperature	Interval
Weight	Ratio
Hair Color	Nominal
Socioeconomic Status	Ordinal
Fahrenheit Temperature	Interval
Height	Ratio
Type of living accommodation	Ordinal
Level of Agreement	Ordinal
IQ(Intelligence Scale)	Ratio
Sales Figures	Ratio
Blood Group	Nominal
Time Of Day	Interval
Time on a Clock with Hands	Interval
Number of Children	Nominal

Religious Preference	Nominal
Barometer Pressure	Interval
SAT Scores	Interval
Years of Education	Ratio

Q3) Three Coins are tossed, find the probability that two heads and one tail are obtained?

Ans) Total number of events= {hhh, hht, htt, ttt, tth, thh, hth, tht} =8

Interested events=3

Probability=3/8.

Q4) Two Dice are rolled, find the probability that sum is

a) Equal to 1
b) Less than or equal to 4
c) Sum is divisible by 2 and 3

Ans) Total number of outcomes when two dice are rolled=6*6=36.

(1, 1)(1, 2)(1, 3)(1, 4)(1, 5)(1, 6)
(2, 1)(2, 2)(2, 3)(2, 4)(2, 5)(2, 6)
(3, 1)(3, 2)(3, 3)(3, 4)(3, 5)(3, 6)
(4, 1)(4, 2)(4, 3)(4, 4)(4, 5)(4, 6)
(5, 1)(5, 2)(5, 3)(5, 4)(5, 5)(5, 6)
(6, 1)(6, 2)(6, 3)(6, 4)(6, 5)(6, 6)

a) Equal to 1 = **0% probability**

b) Less than or equal to 4= 6/36 = **1/6**

c) sum is divisible by 2 and 3

{	2	3	4	5	6	7
	3	4	5	6	7	8
	4	5	6	7	8	9
	5	6	7	8	9	10
	6	7	8	9	10	11
	7	8	9	10	11	12}

Probability=6/36= 1/6

Q5) A bag contains 2 red, 3 green and 2 blue balls. Two balls are drawn at random. What is the probability that none of the balls drawn is blue?

Ans) total number of events= $n \; _{r}$=7C_2=$\frac{7!}{2!*5!}$=21

Interested events=5C_2=$\frac{5!}{2!*3!}$=10

Probability that none of the balls is blue =10/21=<u>0.47</u>

Q6) Calculate the Expected number of candies for a randomly selected child

Below are the probabilities of count of candies for children (ignoring the nature of the child-Generalized view)

CHILD	Candies count	Probability
A	1	0.015
B	4	0.20
C	3	0.65
D	5	0.005
E	6	0.01
F	2	0.120

Child A – probability of having 1 candy = 0.015.

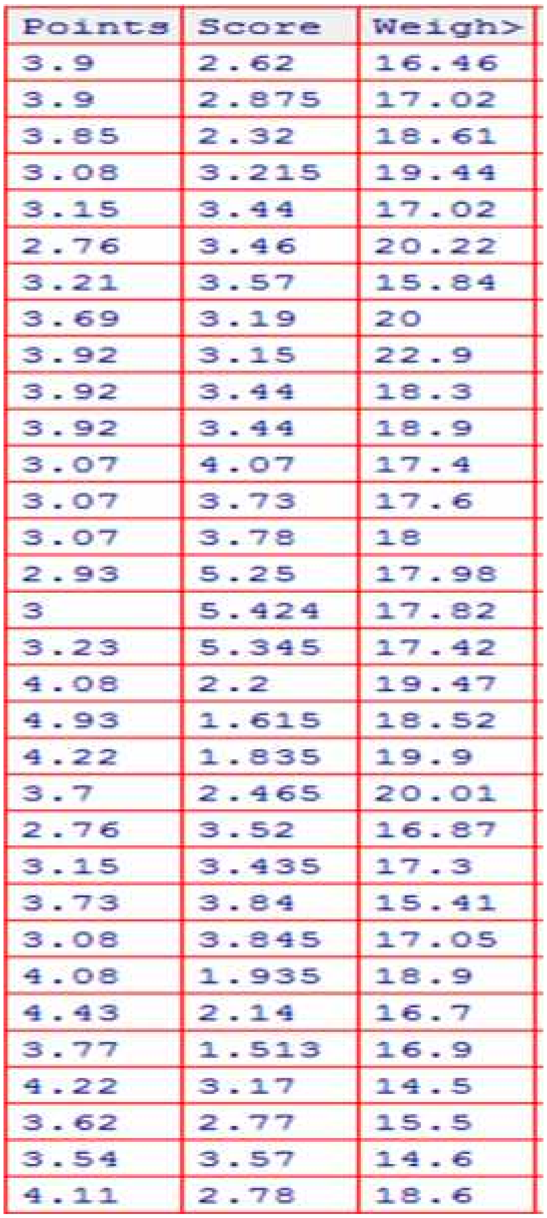
Child B – probability of having 4 candies = 0.20

Ans) Expected number = E(x)
=μ_x=1*0.015+4*0.20+3*0.65+5*0.005+6*0.01+2*0.120= **<u>3.09</u>**

Q7) Calculate Mean, Median, Mode, Variance, Standard Deviation, Range & comment about the values / draw inferences, for the given dataset

- For Points,Score,Weigh>

Find Mean, Median, Mode, Variance, Standard Deviation, and Range and also Comment about the values/ Draw some inferences.



Points	Score	Weigh>
3.9	2.62	16.46
3.9	2.875	17.02
3.85	2.32	18.61
3.08	3.215	19.44
3.15	3.44	17.02
2.76	3.46	20.22
3.21	3.57	15.84
3.69	3.19	20
3.92	3.15	22.9
3.92	3.44	18.3
3.92	3.44	18.9
3.07	4.07	17.4
3.07	3.73	17.6
3.07	3.78	18
2.93	5.25	17.98
3	5.424	17.82
3.23	5.345	17.42
4.08	2.2	19.47
4.93	1.615	18.52
4.22	1.835	19.9
3.7	2.465	20.01
2.76	3.52	16.87
3.15	3.435	17.3
3.73	3.84	15.41
3.08	3.845	17.05
4.08	1.935	18.9
4.43	2.14	16.7
3.77	1.513	16.9
4.22	3.17	14.5
3.62	2.77	15.5
3.54	3.57	14.6
4.11	2.78	18.6

Ans) df.describe()

(#will describe the data sets by providing values like mean, std, max and min, etc)

df.mode() (#will show the mode fo each column)

df.var() (#will provide the variance for given dataset for columns with numerical values)

Q8) Calculate Expected Value for the problem below

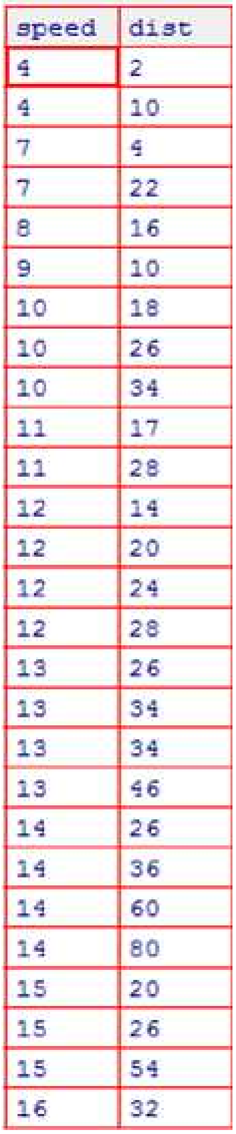
a) The weights (X) of patients at a clinic (in pounds), are
108, 110, 123, 134, 135, 145, 167, 187, 199

Assume one of the patients is chosen at random. What is the Expected Value of the Weight of that patient?

Ans: $EV=\Sigma x/n = \frac{1\ +1\ +1\ +1\ +1\ +1\ +1\ +1\ +1}{9} = \underline{145.33}$

Q9) Calculate Skewness, Kurtosis & draw inferences on the following data

Cars speed and distance



speed	dist
4	2
4	10
7	4
7	22
8	16
9	10
10	18
10	26
10	34
11	17
11	28
12	14
12	20
12	24
12	28
13	26
13	34
13	34
13	46
14	26
14	36
14	60
14	80
15	20
15	26
15	54
16	32

Ans)

```
print('skewness value for speed and distance is', np.round(df1.speed.skew(), 2),
      'and', np.round(df1.dist.skew(), 2), 'respectively')
```

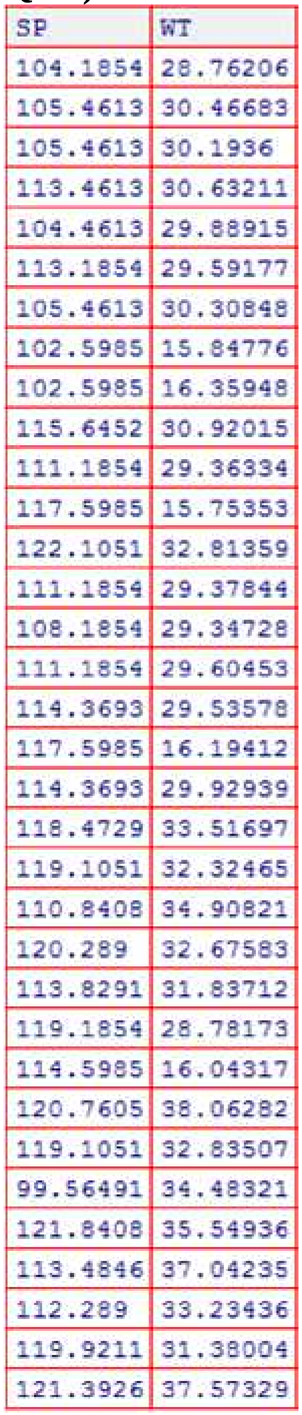
```
skewness value for speed and distance is -0.12 and 0.81 respectively
```

```
print('Kurtosis value for speed and distance is', np.round(df1.speed.kurt(), 2),
      'and', np.round(df1.dist.kurt(), 2), 'respectively')
```

```
Kurtosis value for speed and distance is -0.51 and 0.41 respectively
```

Inferences: as you can see from the above data, there is a huge difference in the kurtosis values when e1071 and moments package are compared with each other. This is due to different equations used by the packages to find kurtosis.

Q.9b)



SP	WT
104.1854	28.76206
105.4613	30.46683
105.4613	30.1936
113.4613	30.63211
104.4613	29.88915
113.1854	29.59177
105.4613	30.30848
102.5985	15.84776
102.5985	16.35948
115.6452	30.92015
111.1854	29.36334
117.5985	15.75353
122.1051	32.81359
111.1854	29.37844
108.1854	29.34728
111.1854	29.60453
114.3693	29.53578
117.5985	16.19412
114.3693	29.92939
118.4729	33.51697
119.1051	32.32465
110.8408	34.90821
120.289	32.67583
113.8291	31.83712
119.1854	28.78173
114.5985	16.04317
120.7605	38.06282
119.1051	32.83507
99.56491	34.48321
121.8408	35.54936
113.4846	37.04235
112.289	33.23436
119.9211	31.38004
121.3926	37.57329

SP and Weight(WT)

Ans)

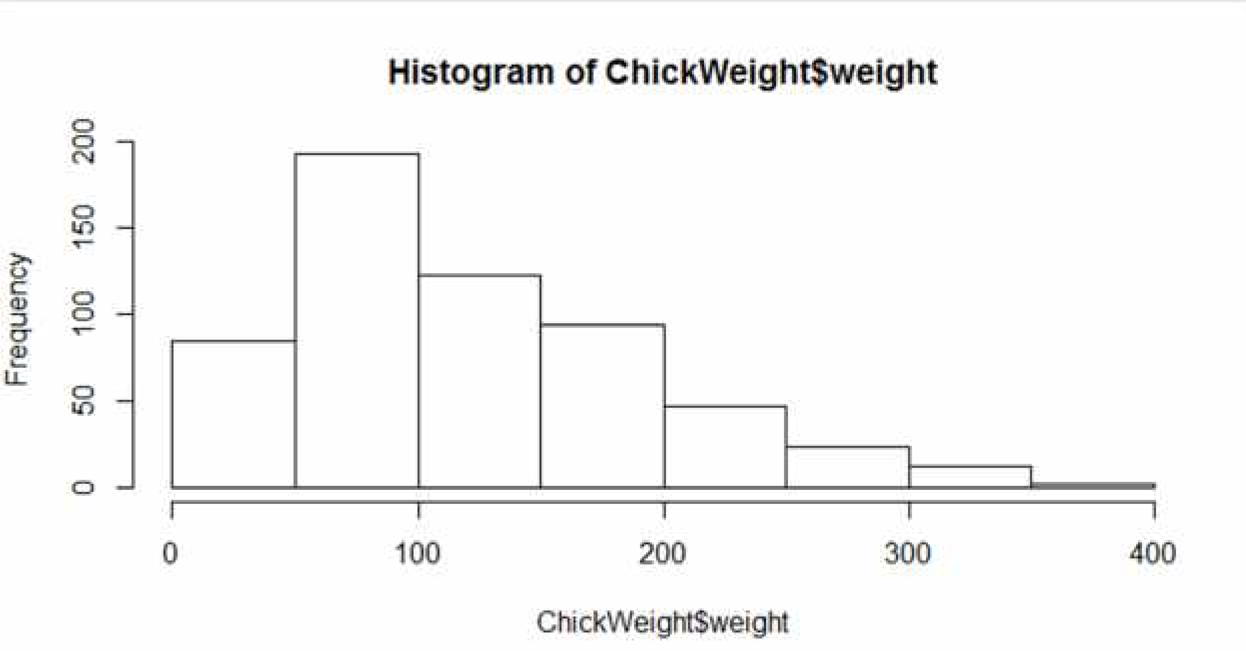
```
print('skewness value for SP and WT(weight) is', np.round(df2.SP.skew(), 2),
      'and', np.round(df2.WT.skew(), 2), 'respectively')
```

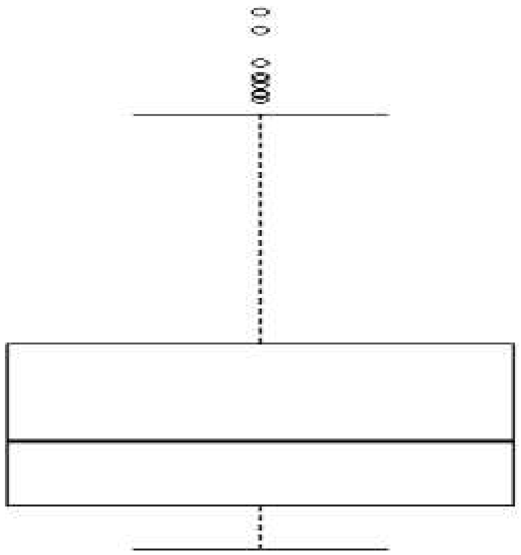
```
skewness value for SP and WT(weight) is 1.61 and -0.61 respectively
```

```
print('Kurtosis value for SP and WT(weight) is', np.round(df2.SP.kurt(), 2),
      'and', np.round(df2.WT.kurt(), 2), 'respectively')
```

```
Kurtosis value for SP and WT(weight) is 2.98 and 0.95 respectively
```

Q10) Draw inferences about the following boxplot & histogram





.

Ans: The above boxplot suggests that the distribution has lots of outliers towards upper extreme

Q11) Suppose we want to estimate the average weight of an adult male in Mexico. We draw a random sample of 2,000 men from a population of 3,000,000 men and weigh them. We find that the average person in our sample weighs 200 pounds, and the standard deviation of the sample is 30 pounds. Calculate 94%, 98%, 96% confidence interval?

Ans:

```
AVG_WGT1 = stats.norm.interval(0.97, loc = 200, scale = 30)
print('Average weight of adult in Mexico at 94% confidence interval', np.round(AVG_WGT1, 3))
```

```
Average weight of adult in Mexico at 94% confidence interval [134.897 265.103]
```

```
AVG_WGT2 = stats.norm.interval(0.99, loc = 200, scale = 30)
print('Average weight of adult in Mexico at 98% confidence interval', np.round(AVG_WGT2, 3))
```

```
Average weight of adult in Mexico at 98% confidence interval [122.725 277.275]
```

```
AVG_WGT3 = stats.norm.interval(0.98, loc = 200, scale = 30)
```

```
print('Average weight of adult in Mexico at 96% confidence interval',
np.round(AVG_WGT3, 3))
```

```
Average weight of adult in Mexico at 96% confidence interval [130.21 269.79]
```

Q12) Below are the scores obtained by a student in tests

34,36,36,38,38,39,39,40,40,41,41,41,41,42,42,45,49,56

1) Find mean, median, variance, standard deviation.
2) What can we say about the student marks?

Ans: 1)

```
df = [34,36,36,38,38,39,39,40,40,41,41,41,41,42,42,45,49,56]
df = pd.DataFrame(df)
```

```
df.mean()
```

```
0    41.0
dtype: float64
```

```
df.median()
```

```
0    40.5
dtype: float64
```

```
df.std()
```

```
0    5.052664
dtype: float64
```

```
df.var()
```

```
0    25.529412
dtype: float64
```

2) Mean > Median, This implies that the distribution is slightly skewed towards right. No outliers are present.

Q13) what is the nature of skewness when mean, median of data are equal?

Ans) no skewness, symmetric

Q14) what is the nature of skewness when mean > median ?

Ans) Right skewed(tail on the right side).

Q15) What is the nature of skewness when median > mean?

Ans) Left Skewed(tail on the left side).

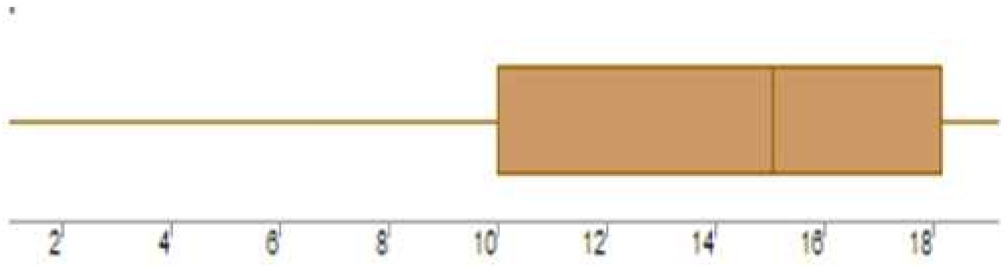
Q16) What does positive kurtosis value indicates for a data ?

Ans) peakness (sharp peak) and less variation.

Q17) What does negative kurtosis value indicates for a data?

Ans) less peakness (Broad peak) and more variation.

Q18) Answer the below questions using the below boxplot visualization.



What can we say about the distribution of the data?

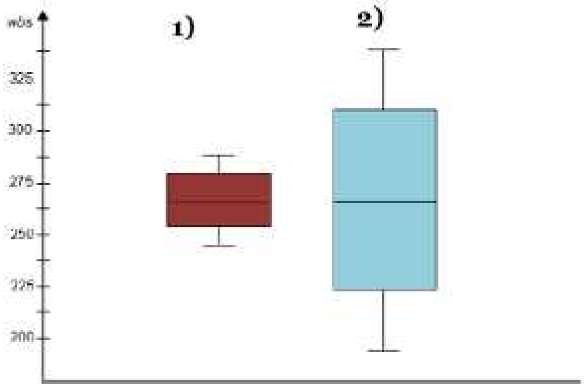
Ans) it is not a Normal Distribution

What is nature of skewness of the data?

Ans) It is left skewed.

What will be the IQR of the data (approximately)?
Ans) Inter Quartile Range =Upper Quartile- Lower Quartile => 18-10=8

Q19) Comment on the below Boxplot visualizations?



Draw an Inference from the distribution of data for Boxplot 1 with respect Boxplot 2.

Ans) 1) The median of the two boxplots are same approximately 260.

2) The boxplots are not skewed in +ve or –ve direction.

3) Outliers doesn’t exist in both of the boxplots.

Q 20) Calculate probability from the given dataset for the below cases

Data _set: Cars.csv

Calculate the probability of MPG of Cars for the below cases.

MPG <- Cars$MPG

a. P(MPG>38)
b. P(MPG<40)
c. P (20<MPG<50)

Ans)

```
print("Probabilty that 'MPG' > 38 = ", np.round(1-stats.norm.cdf(38, loc = df4.MPG.mean(), scale = df4.MPG.std()), 3))
```

```
Probabilty that 'MPG' > 38 =  0.348
```

```
print("Probabilty that 'MPG' < 40 = ", np.round(stats.norm.cdf(40, loc = df4.MPG.mean(), scale = df4.MPG.std()), 3))
```

```
Probabilty that 'MPG' < 40 =  0.729
```

```
print("Probabilty that 20 <'MPG' < 40 = ", np.round((1-stats.norm.cdf
                                              (20, loc = df4.MPG.mean(), scale = df4.MPG.std(
))) -
                                              (stats.norm.cdf(40, df4.MPG.mean(), scale = df4.
MPG.std())) , 3))
```

```
Probabilty that 20 <'MPG' < 40 =  0.214
```

```
print("Probabilty that 'MPG' < 40 = ", np.round(stats.norm.cdf(70, loc = 60, scale =
 10), 5))
```

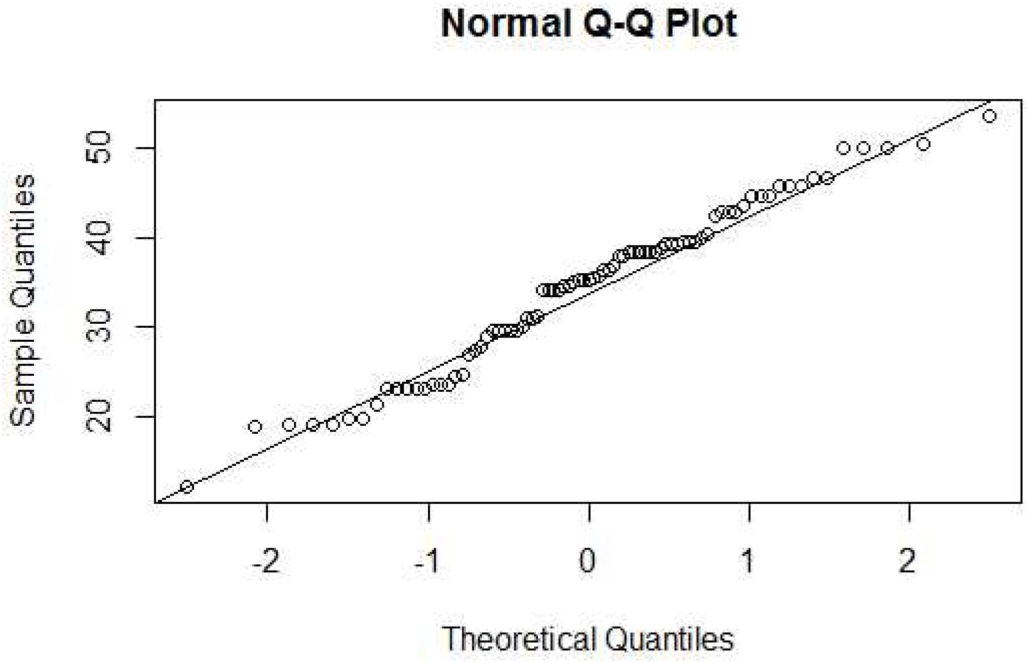
```
Probabilty that 'MPG' < 40 =  0.84134
```

Q 21) Check whether the data follows normal distribution

a) Check whether the MPG of Cars follows Normal Distribution
   Dataset: Cars.csv

Ans) Follows Normal distribution as indicated by qq-plot.

```
import statsmodels.api as smf
import pylab as py
smf.qqplot(df["MPG"],line='45')
py.show()
```

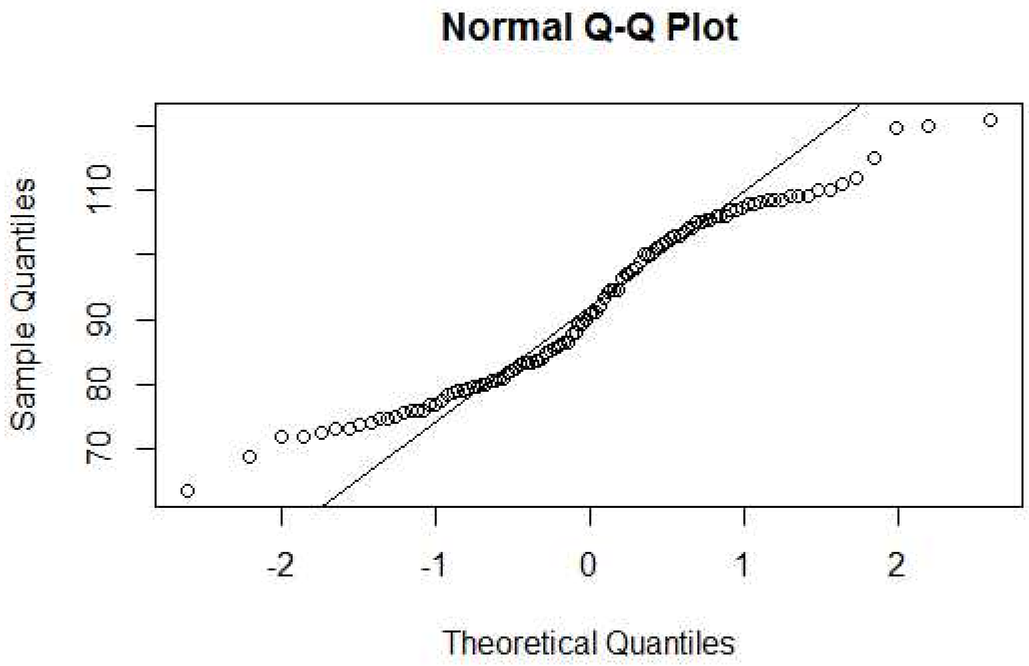


b) Check Whether the Adipose Tissue (AT) and Waist Circumference(Waist) from wc-at data set follows Normal Distribution

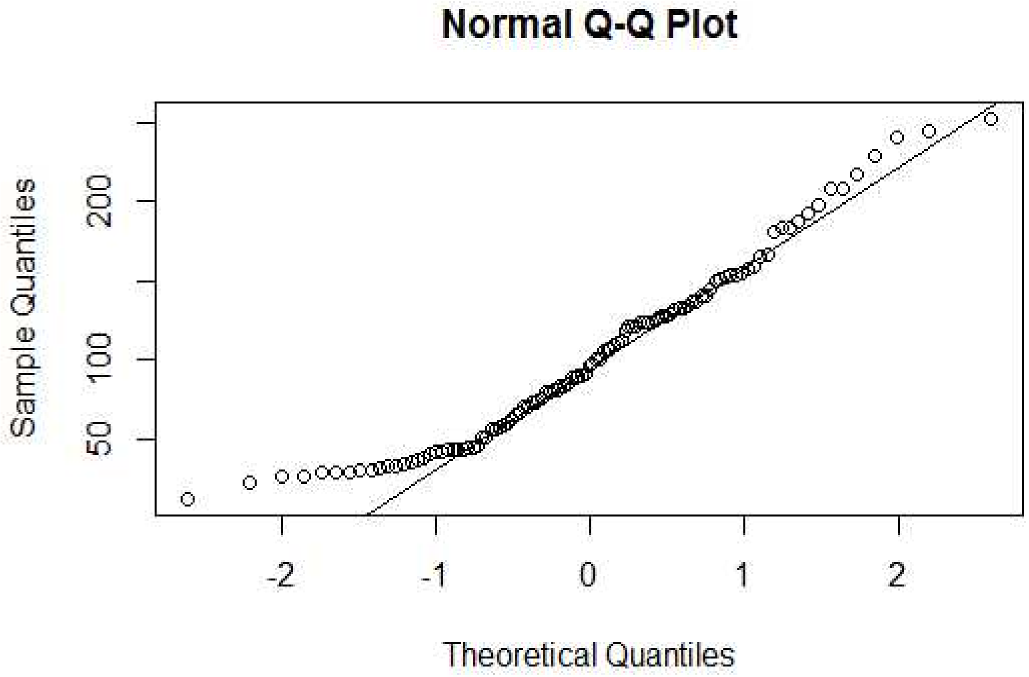
Dataset: wc-at.csv

Ans) waist follows Normal Distribution from the below QQ-plot

```
> import statsmodels.api as smf
import pylab as py
smf.qqplot(df5["Waist"],line='45')
py.show()
```



```
import statsmodels.api as smf
import pylab as py
smf.qqplot(df5["AT"],line='45')
py.show()
```



Q 22) Calculate the Z scores of 90% confidence interval,94% confidence interval, 60% confidence interval

Ans)

```
print('Z scores at 90% confidence interval is', np.round(stats.norm.ppf(.95), 2))
print('Z scores at 94% confidence interval is', np.round(stats.norm.ppf(.97), 2))
print('Z scores at 60% confidence interval is', np.round(stats.norm.ppf(.80), 2))
```

Q 23) Calculate the t scores of 95% confidence interval, 96% confidence interval, 99% confidence interval for sample size of 25

Ans)

```
print(' t scores at 95% confidence interval is', np.round(stats.t.ppf(0.975, df = 24), 2))
print(' t scores at 96% confidence interval is', np.round(stats.t.ppf(0.98, df = 24), 2))
print(' t scores at 99% confidence interval is', np.round(stats.t.ppf(0.995, df = 24), 2))
```

Q 24**)** A Government company claims that an average light bulb lasts 270 days. A researcher randomly selects 18 bulbs for testing. The sampled bulbs last an average of 260 days, with a standard deviation of 90 days. If the CEO's claim were true, what is the probability that 18 randomly selected bulbs would have an average life of no more than 260 days?

Hint:

Rcode → pt (tscore, df)

df → degrees of freedom

Ans)

```
t_value = (260 - 270)/(90/np.sqrt(18))

print('critical value = ', np.round(t_value, 2))

print('probabilty for average life of no more than 260 days is', np.round(stats.t.cdf(t_value, df=17), 2))
```

```
        critical value =  -0.47

probabilty for average life of no more than 260 days is 0.32
```