Q1) Identify the Data type for the Following:

Activity	Data Type
Number of beatings from Wife	DISCRETE
Results of rolling some 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	CONTINUOUS
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	INTERVAL
Religious Preference	NOMINAL
Barometer Pressure	RATIO
SAT Scores	RATIO
Years of Education	RATIO

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

Ans: HHH, HHT, HTH, THH, TTH, TTT, HTT, THT

3/8 = 0.375

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

Possible outcomes:

1,1	2, 1	3, 1	4, 1	5, 1	6, 1
1,2	2, 2	3, 2	4, 2	5, 2	6, 2
1,3	2, 3	3, 3	4, 3	5, 3	6, 3
1,4	2, 4	3, 4	4, 4	5, 4	6, 4
1,5	2, 5	3, 5	4, 5	5, 5	6, 5
1,6	2, 6	3, 6	4, 6	5, 6	6, 6

Summation of the values:

SUM	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

a) Equal to 1
   Ans: 0
b) Less than or equal to 4

   Ans: (1,1) (1,2) (1,3) (2, 1) (2, 2) (3,1)
   6/36 = 0.167
c) Sum is divisible by 2 and 3.
   Ans: (1,5) (2,4) (3,3) (4,2) (5,1) (6,6)
   6/36 = 0.167

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: $5C_2 / 7C_2 = 10/21$

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

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

Child A – the probability of having 1 candy = 0.015.

Child B – the probability of having 4 candies = 0.20

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

Ans: Expected number of candies for a randomly selected child is the weighted average of the data.

CHILD	Candies count	Probability	X*P(X)
A	1	0.015	0.015
B	4	0.2	0.06
C	3	0.65	0.045
D	5	0.005	0.075
E	6	0.01	0.09
F	2	0.12	0.03
		Weighted average	0.315

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 Comment about the values/ Draw some inferences.

Use Q7.csv file

Ans:

- The mean median and mode of the data are not equal.
- Hence, we can conclude that they are not forming a normal distribution for all three data.
- The standard deviation of these data shows it is more scattered.

	Points	Score	Weigh
Mean	3.596563	3.21725	17.84875
Median	3.695	3.325	17.71
Mode	3.92	3.44	17.02
Variance	0.276948	0.927461	0.927461
Standard Deviation	0.526258	0.963048	1.758801
Range	2.17	3.911	8.4

Q8) Calculate the 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: (108+110+123+134+135+145+167+187+199)/9 = 145.3

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

Cars speed and distance

Use Q9_a.csv.

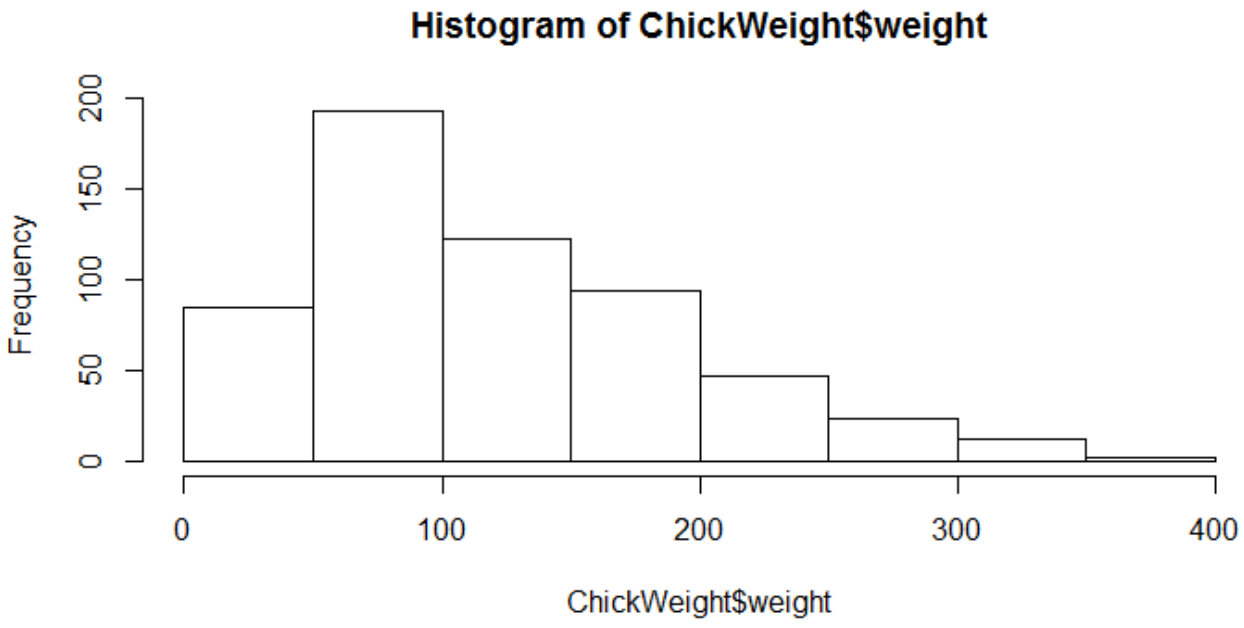
	Index	speed	dist
Skewness	-3.77627E-17	-0.11751	0.806895
Kurtosis	-1.2	-0.50899	0.405053

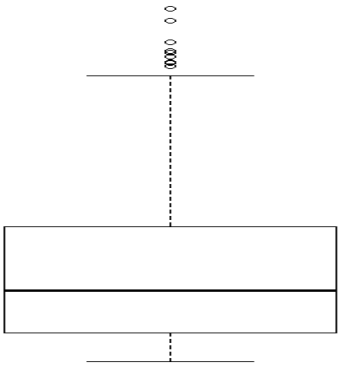
SP and Weight (WT)

Use Q9_b.csv.

	SP	WT
Skewness	1.61E+00	-0.61475
Kurtosis	2.977329	0.950291

Q10) Draw inferences about the following boxplot & histogram





Ans: Histogram:

- The mean is btw 50 to 100.
- The data is positively skewed.
- The kurtosis is positive.

Box plot:

- There are few outliers in the data.
- The outliers are above the upper fence.

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:

```
from scipy import stats
import pandas as pd
import numpy as np
```

```
Ci_94 = stats.norm.interval(0.94,200,30/(np.sqrt(2000)))
np.round(Ci_94,2)
```

```
array([198.74, 201.26])
```

```
Ci_98 = stats.norm.interval(0.98,200,30/(np.sqrt(2000)))
np.round(Ci_98,2)
```

```
array([198.44, 201.56])
```

```
Ci_96 = stats.norm.interval(0.96,200,30/(np.sqrt(2000)))
np.round(Ci_96,2)
```

```
array([198.62, 201.38])
```

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.

```
mean=Q12.mean()
mean
```

```
data points    41.0
dtype: float64
```

```
median=Q12.median()
median
```

```
data points    40.5
dtype: float64
```

```
variance=Q12.var()
variance
```

```
data points    25.529412
dtype: float64
```

```
standard_deviation=Q12.std()
standard_deviation
```

```
data points    5.052664
dtype: float64
```

2) What can we say about the student marks?
    - It is not normally distributed as mean and median are not equal. However, the difference is 0.5.
    - The data points are deviated from the mean by 5 points.

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

The data is normally distributed as the mean and median are equal. Which means skewness is zero.

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

The data will be right-skewed when the mean > median.

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

The data will be left-skewed when the mean > median.

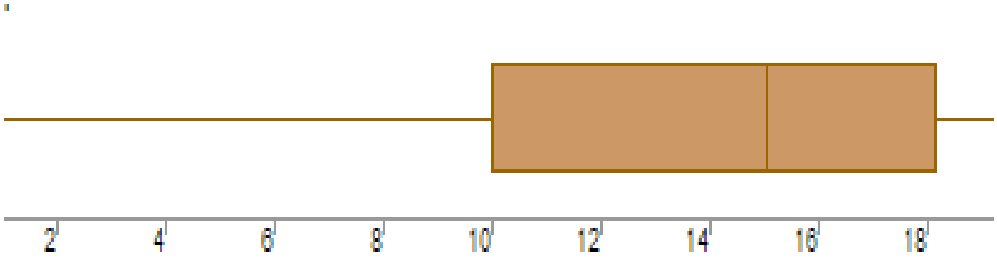
Q16) What does positive kurtosis value indicate for data?

The positive kurtosis value indicates that the data has a sharp peak.

Q17) What does the negative kurtosis value indicate for data?

The negative kurtosis value indicates that the data has a wider peak.

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



What can we say about the distribution of the data?

It is a continuous distribution. And not normally distributed.

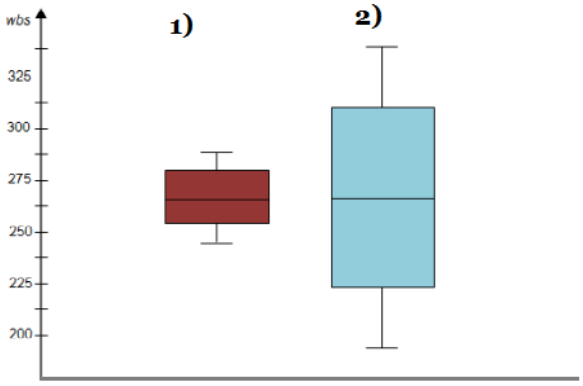
What is the nature of the skewness of the data?

The data is left-skewed or negatively skewed.

What will be the IQR of the data (approximately)?

As per the data approximately the Q3 is 18 and Q1 is 10 so, IQR=Q3-Q1=8.

Q19) Comment on the below Boxplot visualizations?



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

- The median of the data is equal, whereas the IQR differs.
- The range of the data is also less with 1 than the 2.
- The data is normally distributed.
- Data does not have any outliers.

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)

```
MPG_G38=1- stats.norm.cdf(38, loc = Q20.MPG.mean(),scale = Q20.MPG.std())
print( 'probability of MPG > 38:', np.round(MPG_G38, 4))
```

```
probability of MPG > 38: 0.3476
```

```
MPG_L40=stats.norm.cdf(40, loc = Q20.MPG.mean(),scale = Q20.MPG.std())
print( 'probability of MPG < 40:', np.round(MPG_L40, 4))
```

```
probability of MPG < 40: 0.7293
```

```
MPG_L20=stats.norm.cdf(20, loc = Q20.MPG.mean(),scale = Q20.MPG.std())
MPG_L50=stats.norm.cdf(50, loc = Q20.MPG.mean(),scale = Q20.MPG.std())
L20_MPG_L50= MPG_L50-MPG_L20
print('probability of 20 < MPG < 50:', np.round(L20_MPG_L50, 4))
```

```
probability of 20 < MPG < 50: 0.8989
```

Q 21) Check whether the data follows the normal distribution.

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

```
mean=Q21.MPG.mean()
mean
```

```
35.15272697
```

```
median=Q21.MPG.median()
median
```

```
35.15272697
```

Ans:

Yes, the data is normally distributed as the mean and median are equal.

b) Check Whether the Adipose Tissue (AT) and Waist Circumference (Waist) from wc-at data set follow Normal Distribution.
Dataset: wc-at.csv

Ans:

```
Waist_mean=Q21b.Waist.mean()
Waist_mean
```

```
91.90183486238533
```

```
AT_mean=Q21b.AT.mean()
AT_mean
```

```
101.89403669724771
```

```
Waist_median=Q21b.Waist.median()
Waist_median
```

```
90.8
```

```
AT_median=Q21b.AT.median()
AT_median
```

```
96.54
```

The Adipose Tissue (AT) and Waist Circumference (Waist) from the wc-at data set do not follow Normal Distribution as the mean and median of the data are not equal.

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

Ans:

Confidence interval	Z scores
90%	1.645
94%	1.88
60%	0.84

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

Ans:

```
from scipy import stats
```

```
t_95=stats.t.ppf(0.95,24)
t_95
```

```
1.7108820799094275
```

```
t_96=stats.t.ppf(0.96,24)
t_96
```

```
1.8280511719596342
```

```
t_99=stats.t.ppf(0.99,24)
t_99
```

```
2.4921594731575762
```

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:

```
from scipy import stats
import pandas as pd
import numpy as np
```

```
Mu=270
n=18
xbar=260
s=90
```

```
T_statistic=((Mu-xbar)/s/np.sqrt(n))
T_statistic
```

```
0.026189140043946204
```

```
stats.t.cdf(T_statistic,n-1)
```

```
0.510294274063018
```