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Branch - Andheri

Assignment No.1

(Basic statistics level I)

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	Ratio
Weight	Interval
Hair Color	Nominal
Socioeconomic Status	Nominal
Fahrenheit Temperature	Ratio
Height	Interval
Type of living accommodation	Ordinal
Level of Agreement	Nominal
IQ(Intelligence Scale)	Interval
Sales Figures	Interval
Blood Group	Nominal
Time Of Day	Ordinal
Time on a Clock with Hands	Nominal
Number of Children	Nominal
Religious Preference	Ordinal
Barometer Pressure	Ratio
SAT Scores	Interval
Years of Education	Interval

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

Ans.

S = { HHH , HHT , HTH , THH , TTT , TTH , THT , HTT }

n(S) = 8

P = { HHT , HTH , THH }

n(P) = 3

Probaility of two heads and one tail is = n(P) / n(S)

= 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.

S = {
(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)
}

n(S) = 36

a) Sum equal to 1 = { 0}
= 0/36

b) Sum less than or equal to 4 = { (1,1) , (1,2) , (1,3) , (2,1) , (2,2) , (3,1) }
=6/36 = 1 / 6

c) Sum divisible by 2 and 3 = 29/36.

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 balls
= (2 + 3 + 2)
= 7

Let S be the sample space
Then, n(S) = Number of ways of drawing 2 balls out of 7

n(S)=7C2

n(S)=(7×6)/(2×1)

n(S)=21
Let E = Event of 2 balls, none of which is blue
Therefore , n(E) = Number of ways of drawing 2 balls out of (2 + 3) balls

n(E)=5C2

n(E)=(5×4)/(2×1)

n(E)=10

∴P(E)=n(E)/n(S)

=10/21

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 of candies for a randomly selected child

= 1 * 0.015 + 4*0.20 + 3 *0.65 + 5*0.005 + 6 *0.01 + 2 * 0.12

= 0.015 + 0.8 + 1.95 + 0.025 + 0.06 + 0.24

= 3.090

= 3.09

Expected number of candies for a randomly selected child = 3.09

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.

Use Q7.csv file

Q7

In [24]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [4]:
```
cars=pd.read_csv("C:/Users/Computer/Desktop/csv files/Q7.csv")
```

In [5]:
```
cars
```

Out[5]:

	Unnamed: 0	Points	Score	Weigh
0	Mazda RX4	3.90	2.620	16.46
1	Mazda RX4 Wag	3.90	2.875	17.02
2	Datsun 710	3.85	2.320	18.61
3	Hornet 4 Drive	3.08	3.215	19.44
4	Hornet Sportabout	3.15	3.440	17.02
5	Valiant	2.76	3.460	20.22
6	Duster 360	3.21	3.570	15.84
7	Merc 240D	3.69	3.190	20.00
8	Merc 230	3.92	3.150	22.90
9	Merc 280	3.92	3.440	18.30

In [8]:
```
#mean
cars.mean()
```
Out[8]:
```
Points     3.596563
Score      3.217250
Weigh     17.848750
dtype: float64
```
In [9]:
```
#median
cars.median()
```
Out[9]:
```
Points     3.695
Score      3.325
Weigh     17.710
dtype: float64
```
In [10]:
```
#mode for points
cars.Points.mode()
```
Out[10]:
```
0    3.07
1    3.92
dtype: float64
```
In [12]:
```
#mode for Score
cars.Score.mode()
```
Out[12]:
```
0    3.44
dtype: float64
```
In [13]:
```
#mode for Weigh
cars.Weigh.mode()
```
Out[13]:
```
0    17.02
1    18.90
dtype: float64
```
In [14]:
```
#Variance
cars.var()
```
Out[14]:
```
Points    0.285881
Score     0.957379
Weigh     3.193166
dtype: float64
```
In [16]:
```
#Standard Deviation
cars.std()
```
Out[16]:
```
Points    0.534679
Score     0.978457
Weigh     1.786943
dtype: float64
```

In [17]:
```
#Summary
cars.describe()
```

Out[17]:

	Points	Score	Weigh
count	32.000000	32.000000	32.000000
mean	3.596563	3.217250	17.848750
std	0.534679	0.978457	1.786943
min	2.760000	1.513000	14.500000
25%	3.080000	2.581250	16.892500
50%	3.695000	3.325000	17.710000
75%	3.920000	3.610000	18.900000
max	4.930000	5.424000	22.900000

In [18]:
```
#range = max -min
Points_Range=cars.Points.max()-cars.Points.min()
Points_Range
```

Out[18]: 2.17

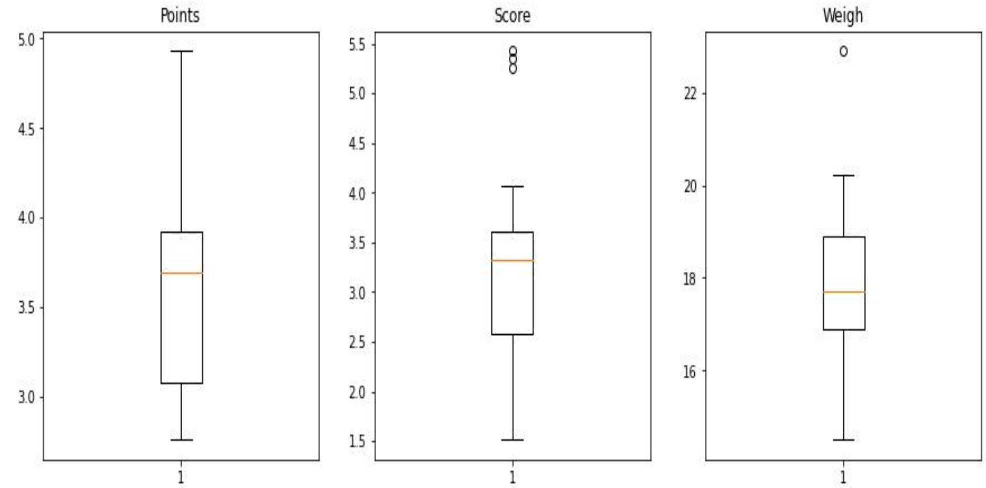
In [21]:
```
Score_Range=cars.Score.max()-cars.Score.min()
Score_Range
```

Out[21]: 3.9110000000000005

In [20]:
```
Weigh_Range=cars.Weigh.max()-cars.Weigh.min()
Weigh_Range
```

Out[20]: 8.399999999999999

In [22]:
```
f,ax=plt.subplots(figsize=(15,5))
plt.subplot(1,3,1)
plt.boxplot(cars.Points)
plt.title('Points')
plt.subplot(1,3,2)
plt.boxplot(cars.Score)
plt.title('Score')
plt.subplot(1,3,3)
plt.boxplot(cars.Weigh)
plt.title('Weigh')
plt.show()
```




```
In [ ]: #Inferences:
        a) For Points dataset:
            1) we see that data is concentrated aroound Median
            2) There are no outliars
            3) The distribution is Right skewed

            b) For Score dataset:
                1) The data is concentrated around Median
                2) There are 3 Outliars:
                    3) The distribution is Left skewed

                    c) For Weigh dataset:
                        1) The data is concentrated around Median
                        2) There is 1 Outliar:
                            3) The distribution is Left skewed
```

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.

We have :

Expected Value = (probability * Value)

P(x).E(x)

By the given data there are 9 patients , So the probability of selecting each patient is 1/9

Ex 108, 110, 123, 134, 135, 145, 167, 187, 199

P(x) 1/9 1/9 1/9 1/9 1/9 1/9 1/9 1/9 1/9

Expected Value = (1/9)(108) + (1/9)110 + (1/9)123 + (1/9)134 + (1/9)135 + (1/9)145+ (1/9(167) + (1/9)187 + (1/9)199

= (1/9) (108 + 110 + 123 + 134 + 135 + 145 + 167 + 187 + 199)

= (1/9) (1308)

= 145.

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

Cars speed and distance

Use Q9_a.csv

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Q9_a

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [48]:
```
dataQ9a=pd.read_csv("C:/Users/Computer/Desktop/csv files/Q9_a.csv")
```

In [3]:
```
dataQ9a
```

Out[3]:

	Index	speed	dist
0	1	4	2
1	2	4	10
2	3	7	4
3	4	7	22
4	5	8	16
5	6	9	10
6	7	10	18
7	8	10	26
8	9	10	34
9	10	11	17

In [7]:
```
#Skewness
dataQ9a.skew()
```

Out[7]:
```
Index    0.000000
speed   -0.117510
dist     0.806895
dtype: float64
```

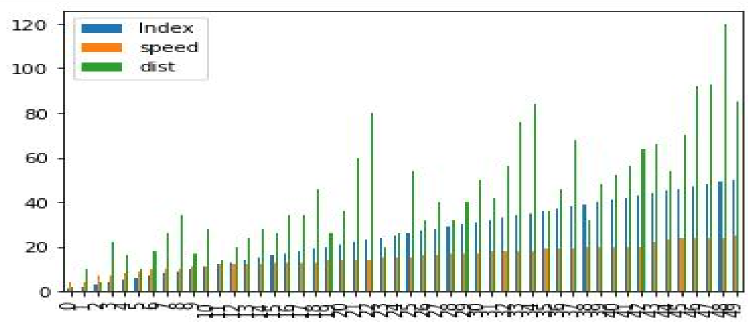
In [ ]:
```
#Inference:
    1.As we see Speed distribution is left skewed (negative skewness)
    2.As we see Distance distribution is right skewed (positive skewness)
```

In [8]:
```
#Kurtosis
dataQ9a.kurt()
```

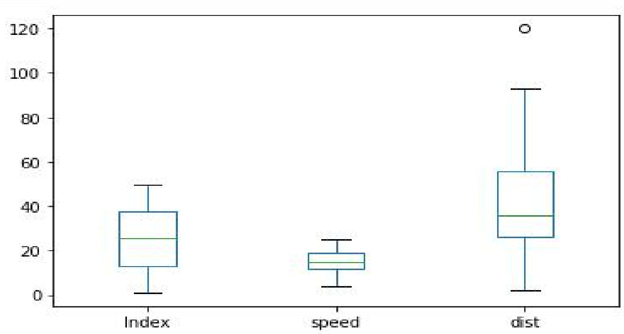
Out[8]:
```
Index   -1.200000
speed   -0.508994
dist     0.405053
dtype: float64
```

In [ ]:
```
# Inference:
    1. Speed distribution is flatter than normal distribution which is negative kurtosis.
    2. Distance distributin is peaked than normal distribution which is positive kurtosis.
```

In [4]:
```
#Bar plot
dataQ9a.plot.bar()
plt.show()
```



In [5]:
```
#Box Plot
dataQ9a.plot.box()
plt.show()
```



SP and Weight(WT)

Use Q9_b.csv

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Q9_b

In [19]:
```
dataQ9b=pd.read_csv("C:/Users/Computer/Desktop/csv files/Q9_b.csv")
```

In [20]:
```
dataQ9b
```

Out[20]:

	Unnamed: 0	SP	WT
0	1	104.185353	28.762059
1	2	105.461264	30.466833
2	3	105.461264	30.193597
3	4	113.461264	30.632114
4	5	104.461264	29.889149
...	...	...	...
76	77	169.598513	16.132947
77	78	150.576579	37.923113
78	79	151.598513	15.769625
79	80	167.944460	39.423099
80	81	139.840817	34.948615

81 rows × 3 columns

In [22]:
```
#Skewness
dataQ9b.skew()
```

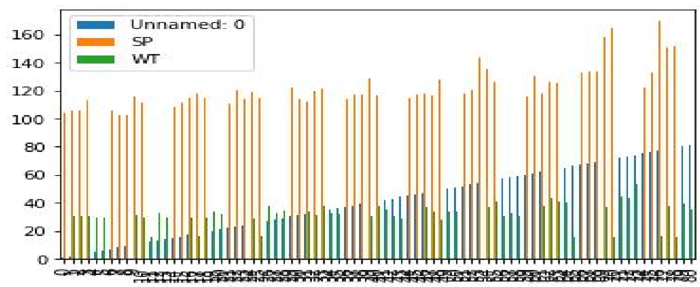
Out[22]:
```
Unnamed: 0    0.000000
SP            1.611450
WT           -0.614753
dtype: float64
```

In [23]:
```
#Kurtosis
dataQ9b.kurt()
```

Out[23]:
```
Unnamed: 0   -1.200000
SP            2.977329
WT            0.950291
dtype: float64
```

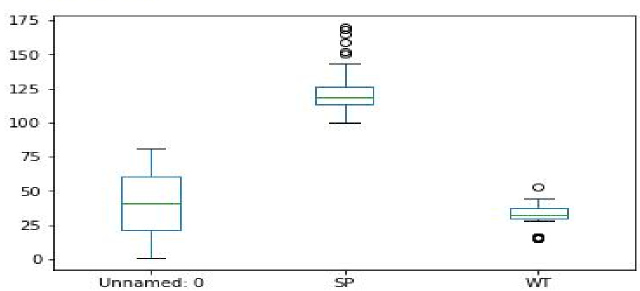
In [45]:
```
#Bar Plot
dataQ9b.plot.bar()
```

Out[45]: <AxesSubplot:>

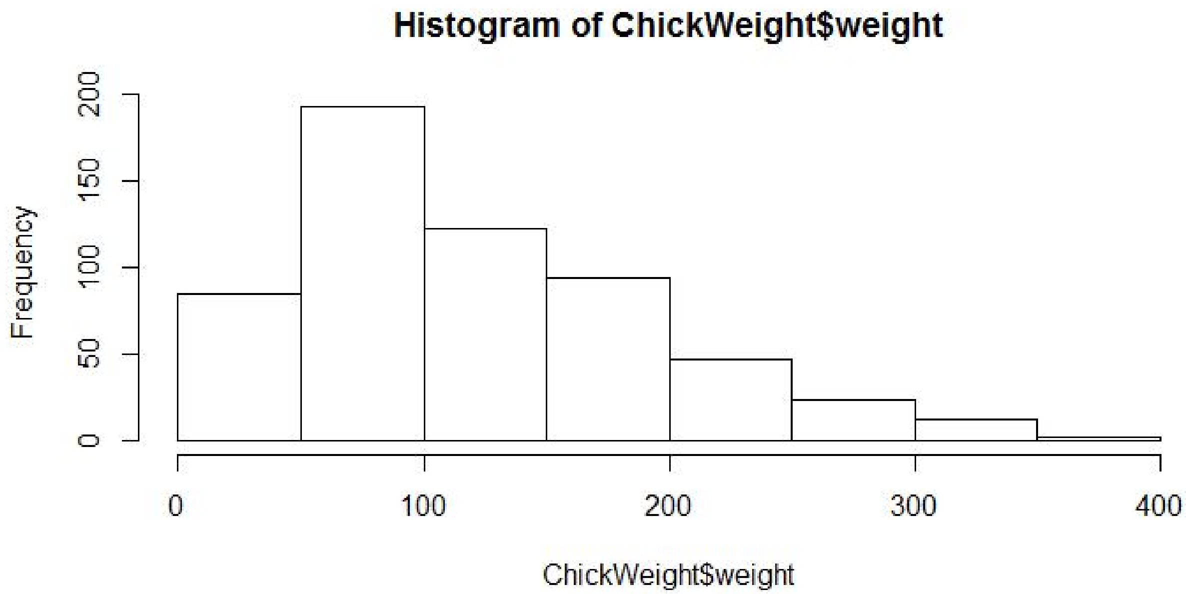


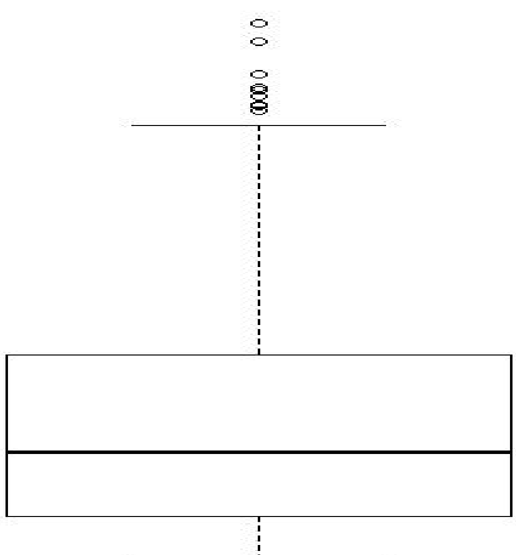
In [46]:
```
#Box Plot
dataQ9b.plot.box()
```

Out[46]: <AxesSubplot:>



Q10) Draw inferences about the following boxplot & histogram





Ans. It shows that the interface of the box is right side skewed or positively skewed.

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.

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Q11

In [37]:
```
import numpy as np
import pandas as pd
from scipy import stats
from scipy.stats import norm
```

In [43]:
```
# for 94% Confidence interval
stats.norm.interval(0.94,200,30/(2000**0.5))
```

Out[43]:
```
(198.738325292158, 201.261674707842)
```

In [41]:
```
# for 98% Confidence interval
stats.norm.interval(0.98,200,30/(2000**0.5))
```

Out[41]:
```
(198.43943840429978, 201.56056159570022)
```

In [56]:
```
# for 96% Confidence interval
stats.norm.interval(0.96,200,30/(2000**0.5))
```

Out[56]:
```
(198.62230334813333, 201.37769665186667)
```

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.

The marks of the students are in uniformly distribution data in ascending order.

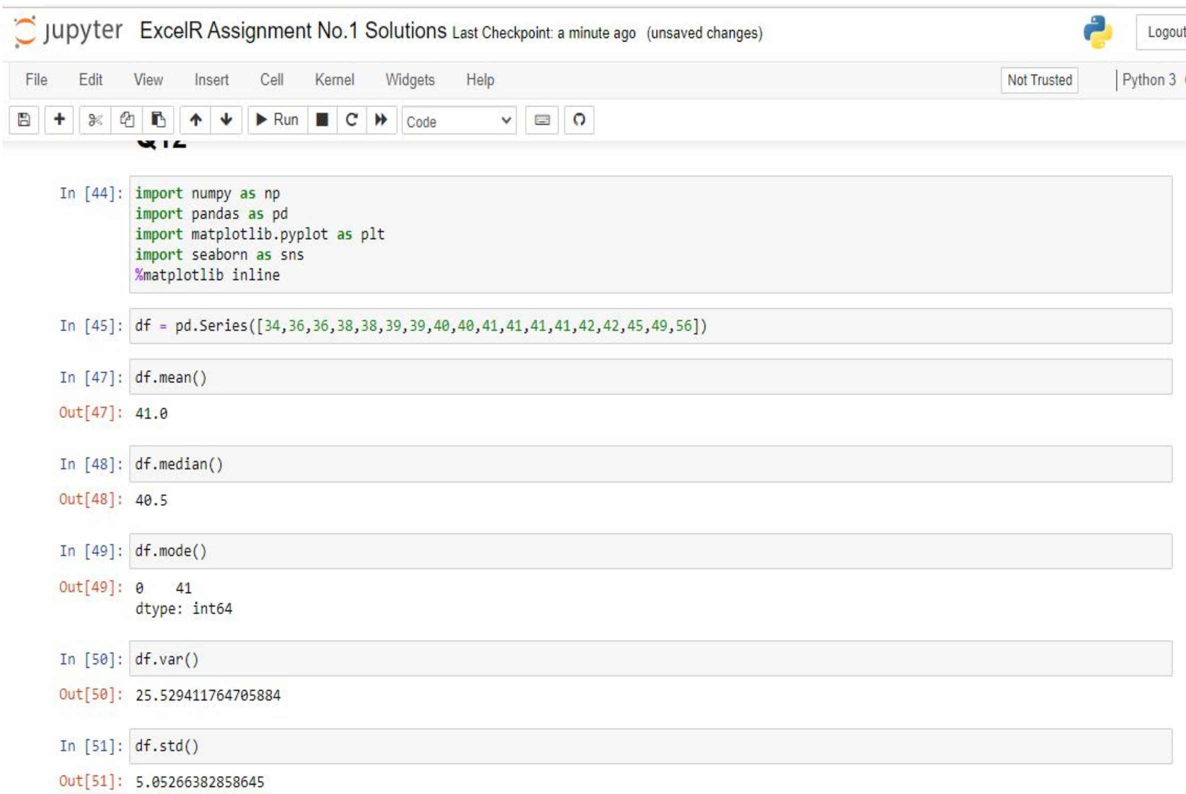
So the mean , median , variance and standard deviation will be :

Mean = 41

Median = 40.5

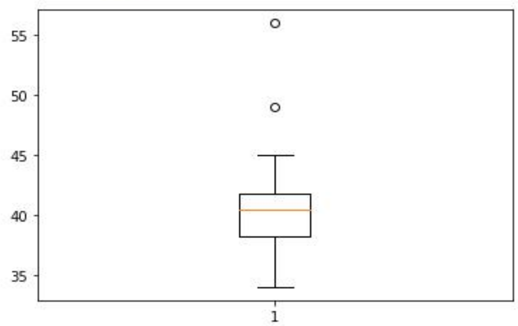
Variance = 25.52

Standard Deviation = 5.05




```
In [44]: import numpy as np
         import pandas as pd
         import matplotlib.pyplot as plt
         import seaborn as sns
         %matplotlib inline

In [45]: df = pd.Series([34,36,36,38,38,39,39,40,40,41,41,41,41,42,42,45,49,56])

In [47]: df.mean()
Out[47]: 41.0

In [48]: df.median()
Out[48]: 40.5

In [49]: df.mode()
Out[49]: 0    41
         dtype: int64

In [50]: df.var()
Out[50]: 25.529411764705884

In [51]: df.std()
Out[51]: 5.05266382858645
```

```
In [55]: #boxplot
         plt.boxplot(df)

Out[55]: {'whiskers': [<matplotlib.lines.Line2D at 0x230ffd498e0>,
           <matplotlib.lines.Line2D at 0x230ffd49c40>],
          'caps': [<matplotlib.lines.Line2D at 0x230ffd49fa0>,
           <matplotlib.lines.Line2D at 0x230ffd54340>],
          'boxes': [<matplotlib.lines.Line2D at 0x230ffd49580>],
          'medians': [<matplotlib.lines.Line2D at 0x230ffd546a0>],
          'fliers': [<matplotlib.lines.Line2D at 0x230ffd54a00>],
          'means': []}
```




```
In [ ]: #As we there are two outliers in following students marks between 45 and 60.
```

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

Ans. It shows the nature is Normalized Skewness

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

Ans. It shows the nature is Right Skewed

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

Ans. It shows the nature is left skewed.

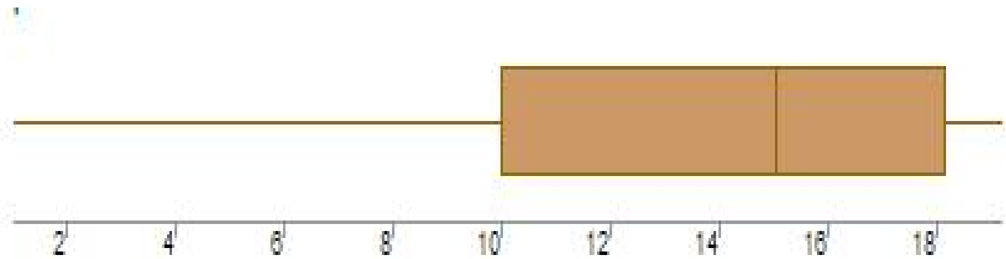
Q16) What does positive kurtosis value indicates for a data ?

Ans. It indicates the peak is narrow in the plot and has less gap between tails towards x-axis.

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

Ans. It indicates border peak under the curve and and there is more gap between tails and x-axis.

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



What can we say about the distribution of the data?

Ans. The data is distributed in skewed format.

What is nature of skewness of the data?

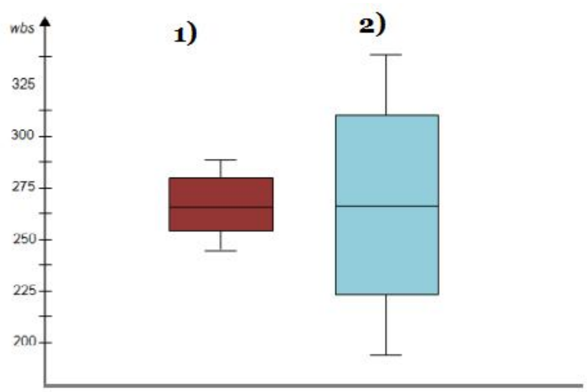
Ans. The nature of the skewness of data is Left side skewed

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

Ans. Q3-Q1 = 18-10

= 8 is IQR

Q19) Comment on the below Boxplot visualizations?



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

Ans. The box plot 1 designed with range = 3

The second one range is = 1.5

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 :

A. **P(MPG>38)-**
1-pnorm(38,34.422,9.13144) = 0.3475908

. B. **P(MPG<40)-**
pnorm(40,34.422,9.13144) = 0.7293527

C.. **P (20<MPG<50)-**
pnorm(50,34.422,9.13144)-(1-pnorm(20,34.422,9.13144)) = 0.01311818

Q 21) Check whether the data follows normal distribution

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

Ans :

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Run Code

Q21_a

In [33]:
```
cars=pd.read_csv("C:/Users/Computer/Desktop/csv files/Cars.csv")
```

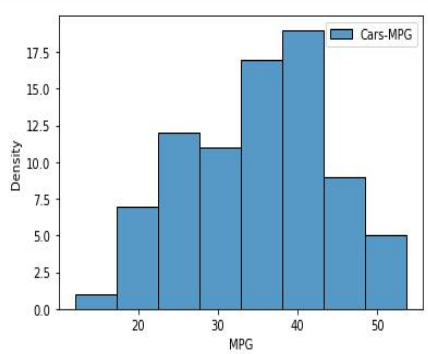
In [53]:
```
cars
```

Out[53]:

	HP	MPG	VOL	SP	WT
0	49	53.700681	89	104.185353	28.762059
1	55	50.013401	92	105.461264	30.466833
2	55	50.013401	92	105.461264	30.193597
3	70	45.696322	92	113.461264	30.632114
4	53	50.504232	92	104.461264	29.889149
...	...	...	...	...	...
76	322	36.900000	50	169.598513	16.132947
77	238	19.197888	115	150.576579	37.923113
78	263	34.000000	50	151.598513	15.769625
79	295	19.833733	119	167.944460	39.423099
80	236	12.101263	107	139.840817	34.948615

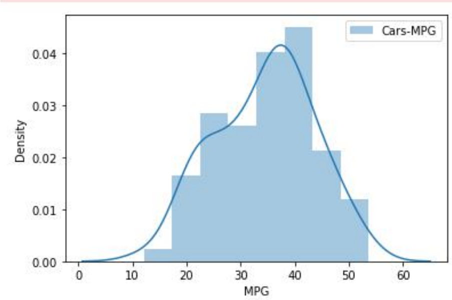
81 rows × 5 columns

In [60]:
```
sns.histplot(cars.MPG, label='Cars-MPG')
plt.xlabel('MPG')
plt.ylabel('Density')
plt.legend();
```



In [61]:
```
sns.distplot(cars.MPG, label='Cars-MPG')
plt.xlabel('MPG')
plt.ylabel('Density')
plt.legend();
```

```
C:\Users\Computer\anaconda3\lib\site-packages\seaborn\
and will be removed in a future version. Please adapt 
lexibility) or `histplot` (an axes-level function for 
  warnings.warn(msg, FutureWarning)
```



In [22]:
```
cars.MPG.mean()
```
Out[22]: 34.422075728024666

In [59]:
```
cars.MPG.median()
```
Out[59]: 35.15272697

In [ ]:
```
#Inference:
    MPG of Cars does follow normal distribution approximately (as mean and median are approx. same)
```

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

Ans :

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Run | Code

Q21_b

In [35]:
```
df=pd.read_csv("C:/Users/Computer/Desktop/csv files/wc-at.csv")
```

In [63]:
```
df
```

Out[63]:

	Waist	AT
0	74.75	25.72
1	72.60	25.89
2	81.80	42.60
3	83.95	42.80
4	74.65	29.84
...	...	...
104	100.10	124.00
105	93.30	62.20
106	101.80	133.00
107	107.90	208.00
108	108.50	208.00

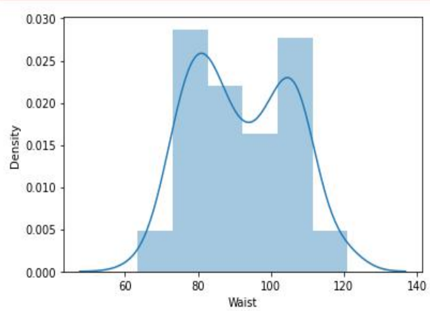
109 rows × 2 columns

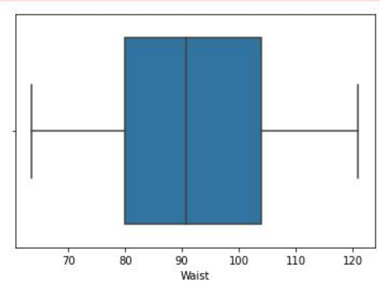
In [68]:
```
df.mean()
```
Out[68]:
```
Waist     91.901835
AT       101.894037
dtype: float64
```

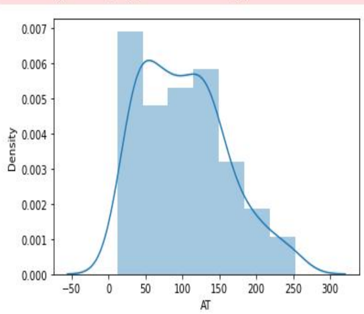
In [69]:
```
df.median()
```
Out[69]:
```
Waist    90.80
AT       96.54
dtype: float64
```

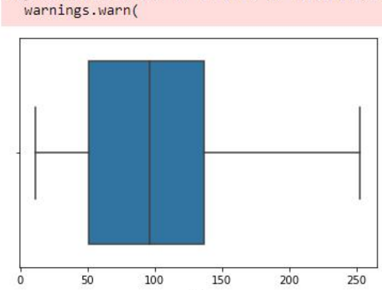
In [73]:
```
df.mode()
```
Out[73]:

	Waist	AT
0	94.5	121.0
1	106.0	123.0
2	108.5	NaN

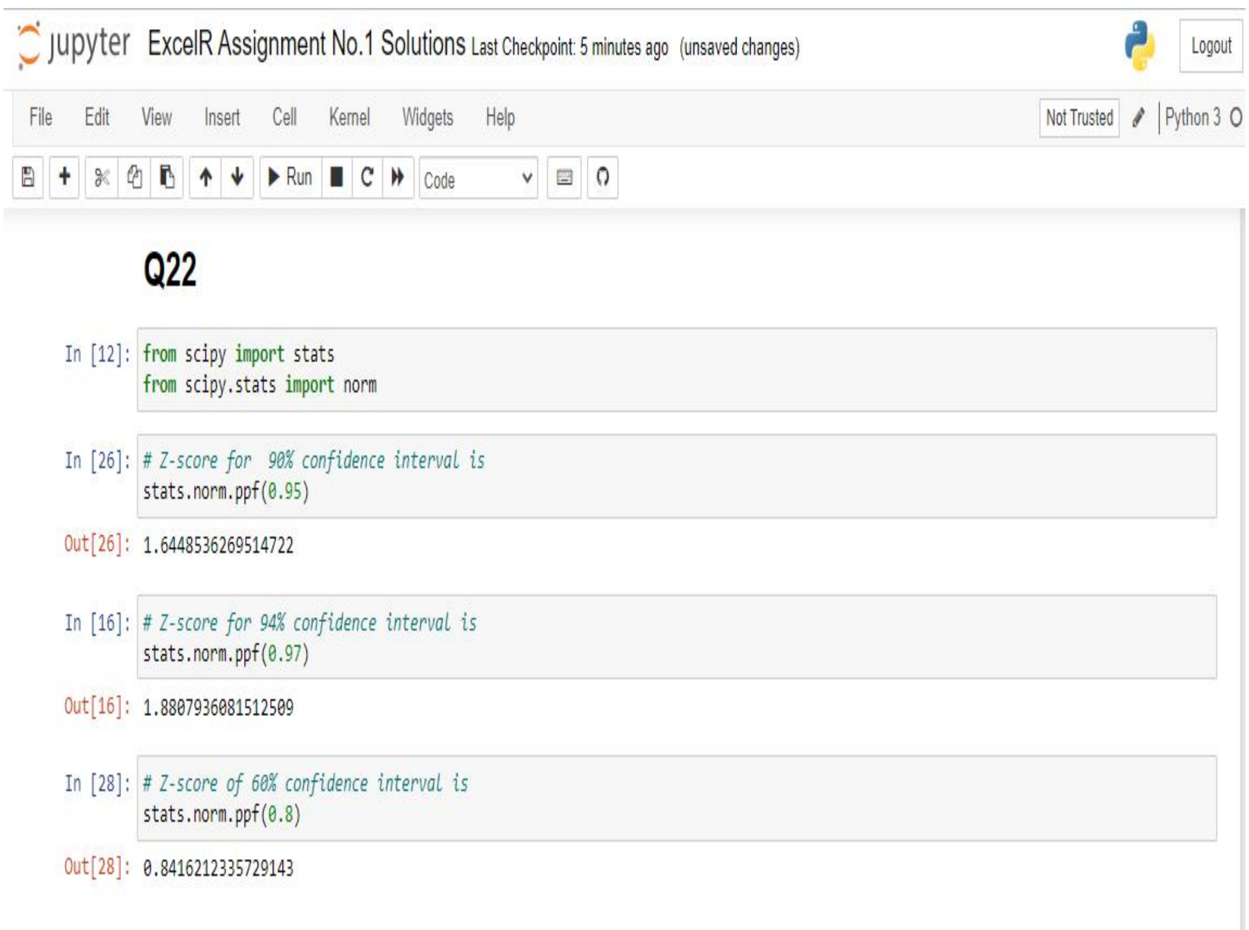
In [36]:
```
sns.distplot(df['Waist'])
plt.show()
```
```
C:\Users\Computer\anaconda3\lib\site-packages\seaborn\dist
and will be removed in a future version. Please adapt your
lexibility) or `histplot` (an axes-level function for hist
  warnings.warn(msg, FutureWarning)
```


In [77]:
```
sns.boxplot(df['Waist'])
plt.show()

# mean> median, both the whisker are of same lenght, medi
```
```
C:\Users\Computer\anaconda3\lib\site-packages\seaborn\_de
d arg: x. From version 0.12, the only valid positional ar
keyword will result in an error or misinterpretation.
  warnings.warn(
```


In [75]:
```
sns.distplot(df['AT'])
plt.show()
```
```
C:\Users\Computer\anaconda3\lib\site-packages\seaborn\distributions.
and will be removed in a future version. Please adapt your code to u
lexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```


In [76]:
```
sns.boxplot(df['AT'])
plt.show()

# mean> median, right whisker is larger than left w
```
```
C:\Users\Computer\anaconda3\lib\site-packages\seabo
d arg: x. From version 0.12, the only valid positio
keyword will result in an error or misinterpretatio
  warnings.warn(
```


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



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Q22

In [12]:
```python
from scipy import stats
from scipy.stats import norm
```

In [26]:
```python
# Z-score for  90% confidence interval is
stats.norm.ppf(0.95)
```

Out[26]: 1.6448536269514722

In [16]:
```python
# Z-score for 94% confidence interval is
stats.norm.ppf(0.97)
```

Out[16]: 1.8807936081512509

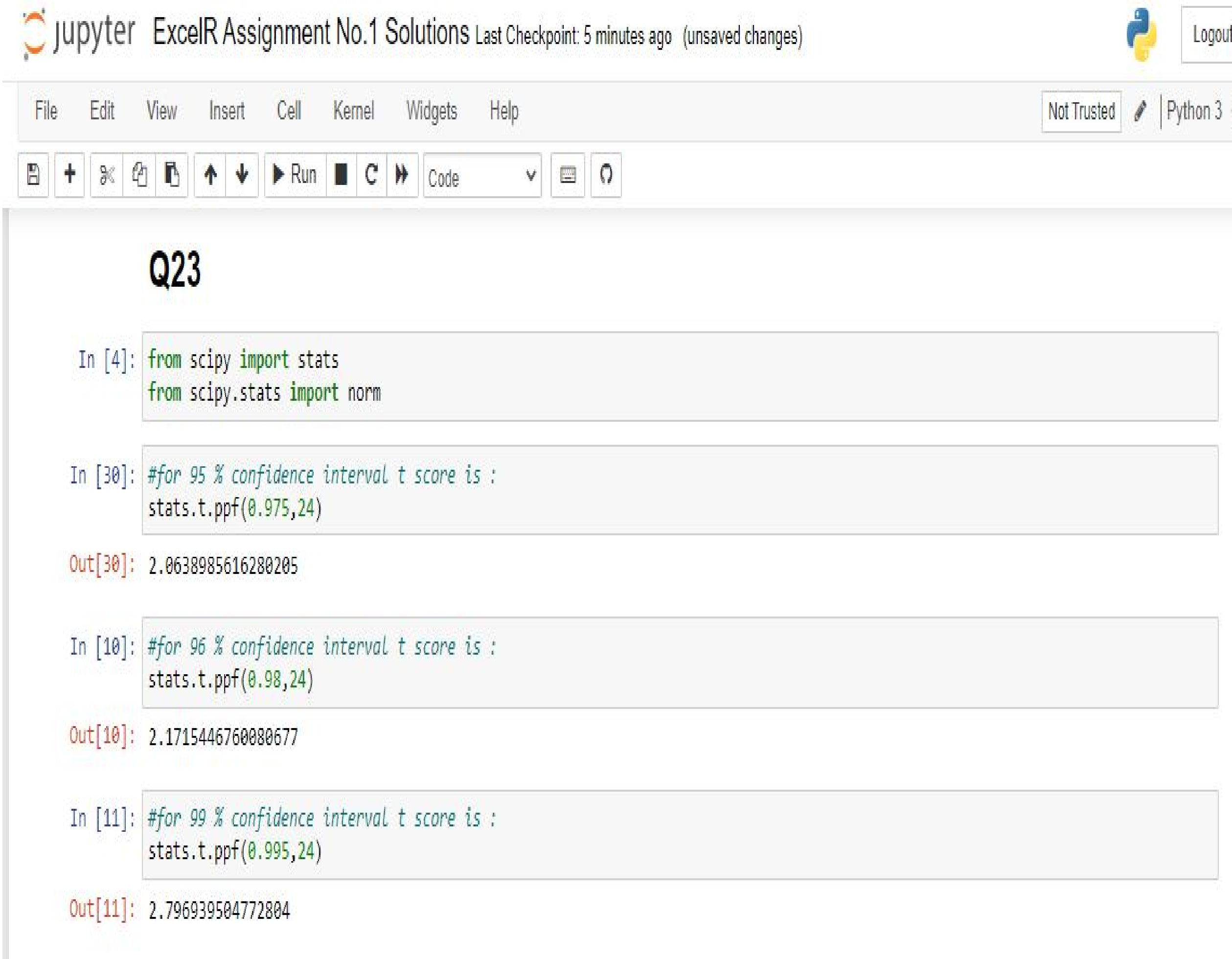
In [28]:
```python
# Z-score of 60% confidence interval is
stats.norm.ppf(0.8)
```

Out[28]: 0.8416212335729143

Confidence Interval	Z-score
60%	0.8416212
90%	1.644854
94%	1.880794

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

Ans :



Q23

In [4]:
```
from scipy import stats
from scipy.stats import norm
```

In [30]:
```
#for 95 % confidence interval t score is :
stats.t.ppf(0.975,24)
```

Out[30]: 2.0638985616280205

In [10]:
```
#for 96 % confidence interval t score is :
stats.t.ppf(0.98,24)
```

Out[10]: 2.1715446760080677

In [11]:
```
#for 99 % confidence interval t score is :
stats.t.ppf(0.995,24)
```

Out[11]: 2.796939504772804

Confidence Interval	T-score
95%	2.063899
96%	2.171545
99%	2.79694

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.

We have the foolowing data :

x = mean of the sample of bulbs = 260

μ = population mean = 270

s = standard deviation of the sample = 90

n = number of items in the sample = 18

t = [260-270 | 90/sqrt of 18]

We get , t = - 0.471

We have formula for , degrees of freedom is n - 1, so we will get 18-1 =17

We want , t-distribution with 17 degrees of freedom.

So the probability of **t < - 0.471 with 17 degrees of freedom** assuming the population mean is true, the t-value is less than the t-value obtained With 17 degrees of freedom and a t score of - 0.471.

So the probability of the bulbs lasting less than 260 days on average of **0.3218** assuming the mean life of the bulbs is 300 days.

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Run | Code

Q24

In [18]:
```
from scipy import stats
from scipy.stats import norm
```

In [32]:
```
# find t-scores at x=260; t=(s_mean-P_mean)/(s_SD/sqrt(n))
t=(260-270)/(90/18**0.5)
t
```

Out[32]: -0.4714045207910317

In [20]:
```
# p_value=1-stats.t.cdf(abs(t_scores),df=n-1)... Using cdf function
p_value=1-stats.t.cdf(abs(-0.4714),df=17)
p_value
```

Out[20]: 0.32167411684460556

In [ ]: