Basic Statistics Level-1 Assignment

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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

Q1) Identify the Data type for the Following:

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

Nominal, Ordinal, Interval, Ratio.

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

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Time on a Clock with Hands	Interval Data Type
Number of Children	Ordinal Data Type
Religious Preference	Nominal Data Type
Barometer Pressure	Ratio Data Type
SAT Scores	Interval Data Type
Years of Education	Ordinal Data Type

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

Sol- P (Head Head Tail) + P (Head Tail Head) + P (Tail Head Head)

Probability= number of favorable outcomes/Total number of outcomes

=1/8 + 1/8 + 1/8

= 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

Sol-

a) If two dices were rolled, then total possible cases =36
Total Favorable cases (Having sum =1) = 0
As minimum sum is 2 for outcome (1,1).
Hence, probability is = 0/36

b) (1,3), (2,2), (3,1), (1,1), (2,1), (1,2) = 3 outcomes 6/36 = 1/6

c) (1,5), (2,4), (3,3), (4,2), (5,1), (6,6) = 6 outcomes 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?

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Sol: P (2Red, 3Green, 2Blue)

P (5/7)/P (5/3) =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

Sol:

$1\times0.015+4\times0.20+3\times0.65+5\times0.005+6\times0.01+2\times0.120$

$=0.015+0.80+1.95+0.025+0.06+0.24$

$=3.090$

So, the coming result is = 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

Sol:

By using 'Q7.csv' file below I got the results for above question.

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	Points	Score	Weigh
Mazda RX4	3.9	2.62	16.46
Mazda RX4 Wag	3.9	2.875	17.02
Datsun 710	3.85	2.32	18.61
Hornet 4 Drive	3.08	3.215	19.44
Hornet Sportabout	3.15	3.44	17.02
Valiant	2.76	3.46	20.22
Duster 360	3.21	3.57	15.84
Merc 240D	3.69	3.19	20
Merc 230	3.92	3.15	22.9
Merc 280	3.92	3.44	18.3
Merc 280C	3.92	3.44	18.9
Merc 450SE	3.07	4.07	17.4
Merc 450SL	3.07	3.73	17.6
Merc 450SLC	3.07	3.78	18
Cadillac Fleetwood	2.93	5.25	17.98
Lincoln Continental	3	5.424	17.82
Chrysler Imperial	3.23	5.345	17.42
Fiat 128	4.08	2.2	19.47
Honda Civic	4.93	1.615	18.52
Toyota Corolla	4.22	1.835	19.9
Toyota Corona	3.7	2.465	20.01
Dodge Challenger	2.76	3.52	16.87
AMC Javelin	3.15	3.435	17.3
Camaro Z28	3.73	3.84	15.41
Pontiac Firebird	3.08	3.845	17.05
Fiat X1-9	4.08	1.935	18.9
Porsche 914-2	4.43	2.14	16.7
Lotus Europa	3.77	1.513	16.9
Ford Pantera L	4.22	3.17	14.5
Ferrari Dino	3.62	2.77	15.5
Maserati Bora	3.54	3.57	14.6
Volvo 142E	4.11	2.78	18.6

For Points:

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- Mean = 3.596563
- Median = 3.695
- Mode = 3.07, 3.92
- Variance = 0.2858814
- Standard Deviation = 0.5346787
- Range = 2.76 4.93

For Score:

- Mean = 3.21725
- Median = 3.325
- Mode = 3.44
- Variance = 0.957379
- Standard Deviation = 0.9784574
- Range = 1.513 5.424

For Weigh:

- Mean = 17.84875
- Median = 17.71
- Mode =17.02, 18.90
- Variance = 3.193166
- Standard Deviation = 1.786943
- Range = 14.5 22.9

Comments:

1) **"Points"** and "**Score"** these two columns have mean and median close to each other but for "**Weigh"** it's slightly different.

2) **"Points"** and "**Weigh"** are Bimodal.

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?

Sol:

Probability of selecting each patient = 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)

= 145.33

So, the expected Value of the Weight of that patient is = 145.33

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

Cars speed and distance

Use Q9_a.csv

Sol:

By using the '**Q9_a.csv**' data set I got the results below for above question

Index	speed	dist
1	4	2
2	4	10
3	7	4
4	7	22
5	8	16
6	9	10
7	10	18
8	10	26
9	10	34
10	11	17
11	11	28
12	12	14

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13	12	20
14	12	24
15	12	28
16	13	26
17	13	34
18	13	34
19	13	46
20	14	26
21	14	36
22	14	60
23	14	80
24	15	20
25	15	26
26	15	54
27	16	32
28	16	40
29	17	32
30	17	40
31	17	50
32	18	42
33	18	56
34	18	76
35	18	84
36	19	36
37	19	46
38	19	68
39	20	32
40	20	48
41	20	52
42	20	56
43	20	64
44	22	66
45	23	54
46	24	70
47	24	92
48	24	93
49	24	120
50	25	85

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- Firstly, I exported this 'csv data' in 'Jupyter Notebook'.
- Later I imported required libraries to read the dataset.
- To read this data I imported the 'Pandas' library as **'import pandas as pd'**
- Before reading the 'csv data' successfully by using pandas library. First, I store the data in 'df' (you can give any name to store the data).
- df=pd.read_csv("Q9_a.csv")
- Now we have to find the Skewness & Kurtosis values for speed and distance in cars dataset by using the 'df.skew()' & 'df.kurt()'

Now the final values are:

- **Skewness** for **"speed"** = -0.11, skewness value is negative, so it is left skewed.
- **Kurtosis for "speed"** = -0.508, kurtosis value is less than Normal Kurtosis that is 3.
- **Skewness** for **"Distance"** = 0.80, skewness value is positive, so it is right skewed.
- **Kurtosis for "Distance"** = 0.405, kurtosis value is nearly equal to Normal Kurtosis that is 3.

SP and Weight (WT)

Use Q9_b.csv

Sol:

By using the '**Q9_b.csv'** data set I got the results below for above question.

	SP	WT
1	104.1854	28.76206
2	105.4613	30.46683
3	105.4613	30.1936
4	113.4613	30.63211
5	104.4613	29.88915

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6	113.1854	29.59177
7	105.4613	30.30848
8	102.5985	15.84776
9	102.5985	16.35948
10	115.6452	30.92015
11	111.1854	29.36334
12	117.5985	15.75353
13	122.1051	32.81359
14	111.1854	29.37844
15	108.1854	29.34728
16	111.1854	29.60453
17	114.3693	29.53578
18	117.5985	16.19412
19	114.3693	29.92939
20	118.4729	33.51697
21	119.1051	32.32465
22	110.8408	34.90821
23	120.289	32.67583
24	113.8291	31.83712
25	119.1854	28.78173
26	114.5985	16.04317
27	120.7605	38.06282
28	119.1051	32.83507
29	99.56491	34.48321
30	121.8408	35.54936
31	113.4846	37.04235
32	112.289	33.23436
33	119.9211	31.38004
34	121.3926	37.57329
35	111.289	32.70164
36	115.0131	31.91122
37	114.0934	28.754
38	116.9094	27.87992
39	116.9094	28.6305
40	128.4613	30.11543
41	116.3926	37.39252
42	115.7488	35.02718
43	117.4613	30.52743
44	114.0934	28.34398
45	114.381	33.07863
46	117.1051	32.62192

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47	118.2087	36.49862
48	116.4729	33.91006
49	127.9094	28.0706
50	118.289	33.45847
51	118.289	33.21395
52	118.289	33.43671
53	120.4043	40.39816
54	143.3926	37.62069
55	135.3926	37.25439
56	126.4043	40.58907
57	110.4613	30.14754
58	118.289	32.73452
59	112.6452	30.61528
60	115.5766	37.66287
61	130.2087	36.88815
62	117.6685	37.86041
63	126.0481	43.39099
64	125.3123	40.72283
65	128.1284	40.15948
66	126.5985	15.71286
67	132.4846	37.97996
68	133.6802	41.57397
69	133.3123	40.47204
70	158.3007	37.14173
71	164.5985	15.82306
72	133.416	44.01314
73	133.1401	43.35312
74	124.7152	52.99775
75	121.8642	42.6187
76	132.8642	42.77822
77	169.5985	16.13295
78	150.5766	37.92311
79	151.5985	15.76963
80	167.9445	39.4231
81	139.8408	34.94861

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- To read this data I imported the ‘Pandas’ library as **‘import pandas as pd’**

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- Before reading the 'csv data' successfully by using pandas library. First, I store the data in 'dx' (you can give any name to store the data).
- dx=pd.read_csv("Q9_b.csv")
- Now we have to find the Skewness & Kurtosis values for speed and weight by using the 'dx.skew()' & 'dx.kurt()'

Now the final values are:

- **Skewness** for **"SP"** = 1.611, skewness value is positive, so it is right skewed.
- **Kurtosis for "SP"** = 2.97, kurtosis value is close to Normal Kurtosis that is 3, so SP is normal.
- **Skewness** for **"Weight"** = -0.61, skewness value is negative, so it is left skewed.
- **Kurtosis for "Weight"** = 0.95, kurtosis value is less than Normal Kurtosis that is 3.

Q10) Draw inferences about the following boxplot & histogram

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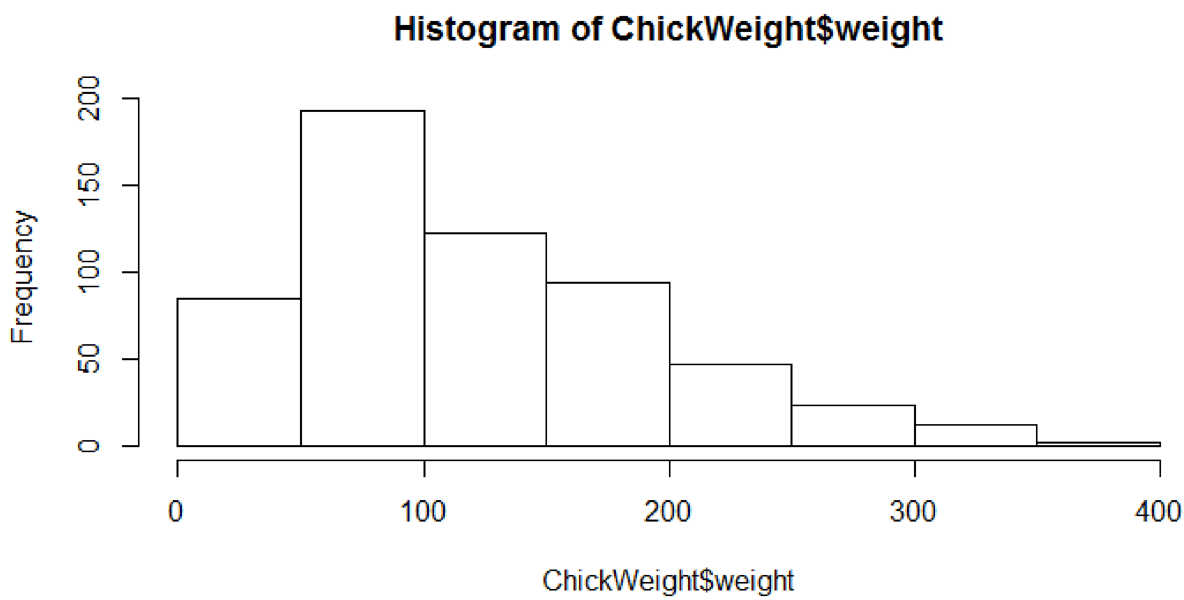
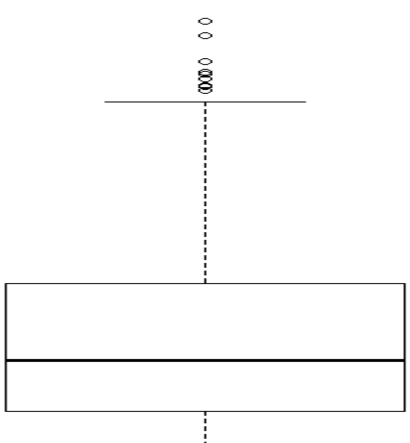


Sol:

For Histogram:

- The most of datapoints are in the range 50-100 with frequency 200.
- And least range of weight is 400 some were around 0-10.
- Skewness- we can notice a long tail towards right so it is heavily right skewed.



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Sol:

- Median is less than mean right skewed and we have outlier on the upper side of box plot and there is less data points between Q1 and bottom point.

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?

Sol:

- The **information given** is: Sample mean of X 200
- Sample standard deviation of S =30
- Sample size n = 2000
- X+/-(t1*S/sqrt(n))
- Degree of freedom = 2000-1 = 1999

➢ Considering a **94%** confidence level
T1 = 1.56
= 200+/-(1.56*30/ sqrt of 2000)
= (197.06, 202.93)

➢ Considering a **96%** confidence level
T1 = 1.75
= **200+/-(1.75*30/ sqrt of 2000)**
= (196.40, 203.60)

➢ Considering a **98%** confidence level
T1 = 2.05
= 200+/-(2.05*30/ sqrt of 2000)
= (195.22, 205.77)

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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?

Sol:

1) **Find mean, median, variance, standard deviation.**
   - Mean = 41,
   - Median = 40.5,
   - Variance = 25.52941
   - Standard Deviation = 5.052664
2) **What can we say about the student marks?**
   - we can say that mean and median are closer to each other, seems no outlier present.

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

Sol:

- symmetrical, equally oriented

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

- Mean > Median: Positively skewed (right-skewed) distribution.

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

Sol:

- Median > Mean: Negatively skewed (left-skewed) distribution.

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

Sol:

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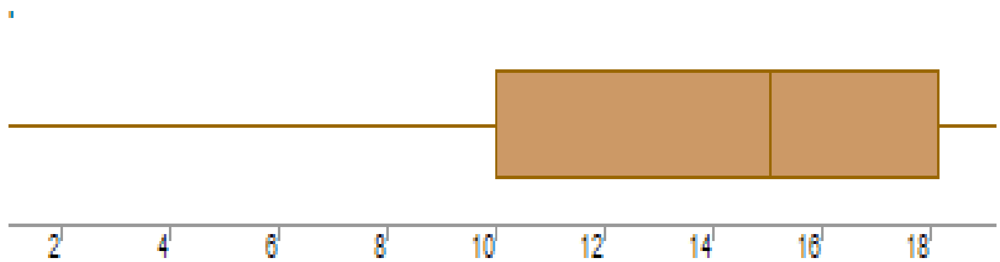
- The data is sharper and has long tails

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

Sol:

- The data is not Sharper and under the normal distribution with short tail.

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



What can we say about the distribution of the data?

What is nature of skewness of the data?

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

Sol:

What can we say about the distribution of the data?

- Most of observations are having value above 10 and observations whose value is above 15 are 40%.

What is nature of skewness of the data?

- Left skewed, median is greater than mean.

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

- Approximately= -8

Q19) Comment on the below Boxplot visualizations?

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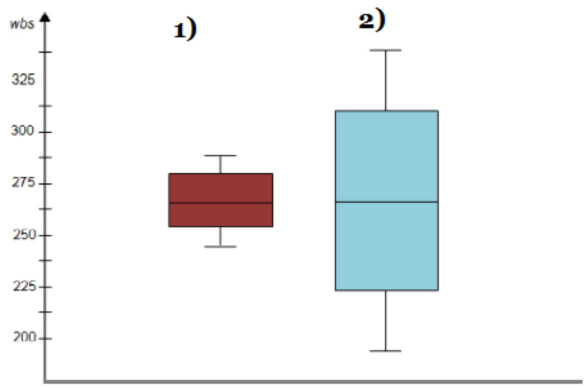

Draw an Inference from the distribution of data for Boxplot 1 with respect Boxplot 2.

Sol:

- By observing both the plots the whiskers level is same from the Q1 and Q3 to their respective upper and lower limit and again mean and median are also equal so we can say distribution is symmetrical.

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)

Sol:

From 'Cars.csv' data set we have

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HP	MPG	VOL	SP	WT
49	53.70068	89	104.1854	28.76206
55	50.0134	92	105.4613	30.46683
55	50.0134	92	105.4613	30.1936
70	45.69632	92	113.4613	30.63211
53	50.50423	92	104.4613	29.88915
70	45.69632	89	113.1854	29.59177
55	50.0134	92	105.4613	30.30848
62	46.71655	50	102.5985	15.84776
62	46.71655	50	102.5985	16.35948
80	42.29908	94	115.6452	30.92015
73	44.65283	89	111.1854	29.36334
92	39.35409	50	117.5985	15.75353
92	39.35409	99	122.1051	32.81359
73	44.65283	89	111.1854	29.37844
66	45.73489	89	108.1854	29.34728
73	44.65283	89	111.1854	29.60453
78	42.78991	91	114.3693	29.53578
92	39.35409	50	117.5985	16.19412
78	42.78991	91	114.3693	29.92939
90	38.90183	103	118.4729	33.51697
92	38.411	99	119.1051	32.32465
74	42.82848	107	110.8408	34.90821
95	38.31061	101	120.289	32.67583
81	40.47472	96	113.8291	31.83712
95	38.31061	89	119.1854	28.78173
92	38.411	50	114.5985	16.04317
92	38.411	117	120.7605	38.06282
92	38.411	99	119.1051	32.83507
52	43.46943	104	99.56491	34.48321
103	35.40419	107	121.8408	35.54936
84	39.43124	114	113.4846	37.04235
84	39.43124	101	112.289	33.23436
102	36.28546	97	119.9211	31.38004
102	36.28546	113	121.3926	37.57329
81	39.53163	101	111.289	32.70164
90	37.95874	98	115.0131	31.91122
90	37.95874	88	114.0934	28.754
102	34.07067	86	116.9094	27.87992
102	34.07067	86	116.9094	28.6305
130	31.01413	92	128.4613	30.11543
95	35.15273	113	116.3926	37.39252
95	35.15273	106	115.7488	35.02718
102	34.07067	92	117.4613	30.52743
95	35.15273	88	114.0934	28.34398
93	35.64356	102	114.381	33.07863
100	34.5615	99	117.1051	32.62192
100	34.5615	111	118.2087	36.49862
98	35.05233	103	116.4729	33.91006
130	31.01413	86	127.9094	28.0706
115	29.62994	101	118.289	33.45847
115	29.62994	101	118.289	33.21395
115	29.62994	101	118.289	33.43671
115	29.62994	124	120.4043	40.39816
180	24.48737	113	143.3926	37.62069
160	26.85228	113	135.3926	37.25439
130	27.85625	124	126.4043	40.58907
96	31.11358	92	110.4613	30.14754
115	29.62994	101	118.289	32.73452
100	30.13192	94	112.6452	30.61528
100	28.86023	115	115.5766	37.66287
145	27.35427	111	130.2087	36.88815
120	24.60913	116	117.6685	37.86041
140	23.51592	131	126.0481	43.39099
140	23.51592	123	125.3123	40.72283
150	23.60516	121	128.1284	40.15948
165	40.05	50	126.5985	15.71286
165	23.10317	114	132.4846	37.97996
165	23.10317	127	133.6802	41.57397
165	23.10317	123	133.3123	40.47204
245	21.27371	112	158.3007	37.14173
280	19.67851	50	164.5985	15.82306
162	23.20357	135	133.416	44.01314
162	23.20357	132	133.1401	43.35312
140	19.08634	160	124.7152	52.99775
140	19.08634	129	121.8642	42.6187
175	18.76284	129	132.8642	42.77822
322	36.9	50	169.5985	16.13295
238	19.19789	115	150.5766	37.92311
263	34	50	151.5985	15.76963

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MPG <- Cars$MPG

a. P(MPG>38)
   0.34

b. P(MPG<40)
   0.72

c. P (20<MPG<50)

   0.89

```
In [105]: cars.describe()
```

Out[105]:

	HP	MPG	VOL	SP	WT
count	81.000000	81.000000	81.000000	81.000000	81.000000
mean	117.469136	34.422076	98.765432	121.540272	32.412577
std	57.113502	9.131445	22.301497	14.181432	7.492813
min	49.000000	12.101263	50.000000	99.564907	15.712859
25%	84.000000	27.856252	89.000000	113.829145	29.591768
50%	100.000000	35.152727	101.000000	118.208698	32.734518
75%	140.000000	39.531633	113.000000	126.404312	37.392524
max	322.000000	53.700681	160.000000	169.598513	52.997752

```
In [106]: # P(MPG>38)
          1- stats.norm.cdf(x = 38,loc = 34.42, scale = 9.13)

Out[106]: 0.34748702501304063

In [107]: # P(MPG<40)
          stats.norm.cdf(x = 40,loc = 34.42, scale = 9.13)

Out[107]: 0.7294571279557076

In [109]: # P (20<MPG<50)
          stats.norm.cdf(x = 50,loc = 34.42, scale = 9.13) - stats.norm.cdf(x = 20,loc = 34.42, scale = 9.13)

Out[109]: 0.8989177824549222
```

Basic Statistics Level-1 Assignment

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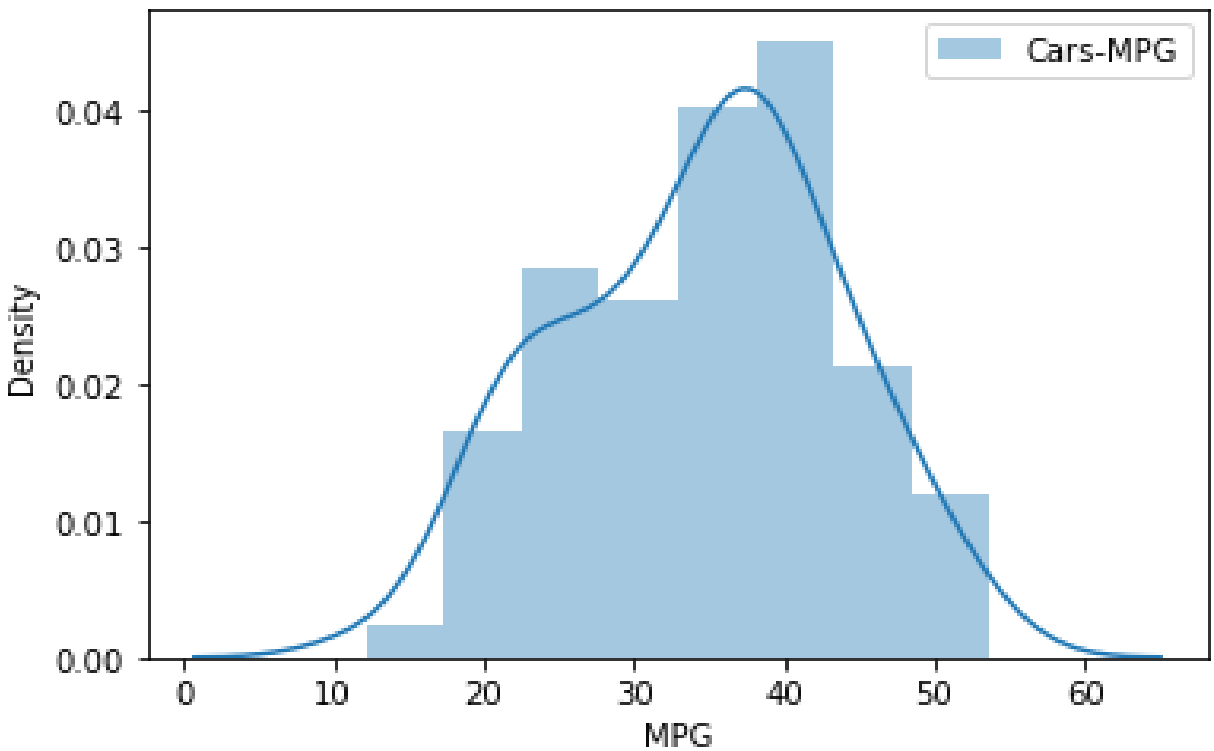
Q 21) Check whether the data follows normal distribution

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

Sol:

The MPG of cars not following Normal Distribution.

Skewness = -0.177



Basic Statistics Level-1 Assignment

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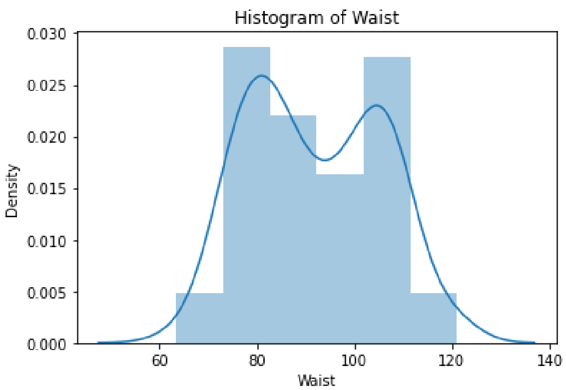
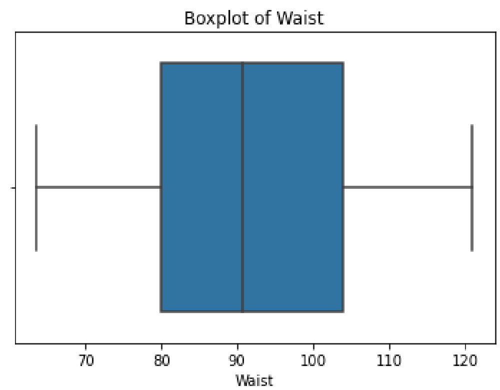
b) Check Whether the Adipose Tissue (AT) and Waist Circumference (Waist) from wc-at data set follows Normal Distribution
   Dataset: wc-at.csv

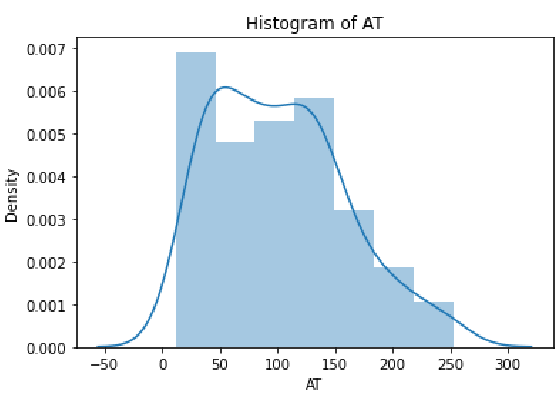
Sol:

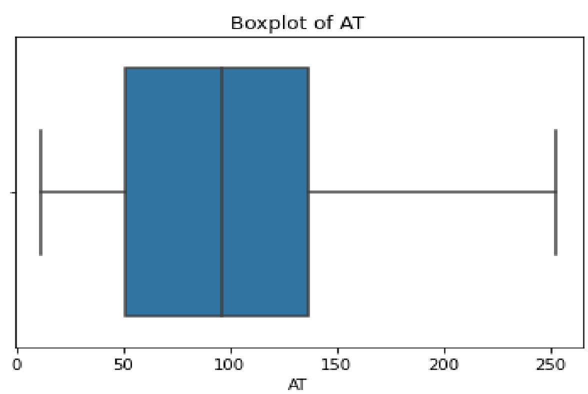
Mean greater than median, both the whisker is of same length, median is slightly shifted towards left. Data is fairly symmetric.





Mean greater than median, right whisker is larger than left whisker, data is positively skewed.





Basic Statistics Level-1 Assignment

Saikrishna Budi

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

Sol:

- **Z score of 60% Confidence Interval = 0.841**
- **Z score of 90% Confidence Interval = 1.644**
- **Z score of 94% Confidence Interval = 1.880**

```
In [133]: # Z-score of 60% confidence interval
          stats.norm.ppf(0.8)

Out[133]: 0.8416212335729143

In [134]: # Z-score of 90% confidence interval
          stats.norm.ppf(0.95)

Out[134]: 1.6448536269514722

In [135]: # Z-score of 94% confidence interval
          stats.norm.ppf(0.97)

Out[135]: 1.8807936081512509
```

Basic Statistics Level-1 Assignment

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

Sol:

Confidence Interval	T Score
95%	2.06
96%	2.17
99%	2.79

```
In [62]: # t scores of 95% confidence interval for sample size of 25
         stats.t.ppf(0.975,24)  # df = n-1 = 24

Out[62]: 2.0638985616280205

In [63]: # t scores of 96% confidence interval for sample size of 25
         stats.t.ppf(0.98,24)

Out[63]: 2.1715446760080677

In [64]: # t scores of 99% confidence interval for sample size of 25
         stats.t.ppf(0.995,24)

Out[64]: 2.796939504772804
```

Basic Statistics Level-1 Assignment

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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

Sol:

Population mean = 270 days
Sample mean = 260 days
Sample SD = 90 days
Sample n = 18 bulbs
df = n-1 = 17
t = {(260-270) / (90/√18)}
t = (-1 * √2) / 3
t = - 0.471
For probability calculations, the number of degrees of freedom is n - 1, so here you need the t-distribution with 17 degrees of freedom.

Basic Statistics Level-1 Assignment

Saikrishna Budi

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Assume Null Hypothesis is: Ho = Avg life of Bulb >= 260 days

Alternate Hypothesis is: Ha = Avg life of Bulb < 260 days

In [66]:
```
# find t-scores at x=260; t=(s_mean-P_mean)/(s_SD/sqrt(n))
t=(260-270)/(90/18**0.5)
t
```

Out[66]: -0.4714045207910317

Find P(X>=260) for null hypothesis

In [68]:
```
# 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[68]: 0.32167411684460556

In [70]:
```
#  OR p_value=stats.t.sf(abs(t_score),df=n-1)... Using sf function
p_value=stats.t.sf(abs(-0.4714),df=17)
p_value
```

Out[70]: 0.32167411684460556