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Group - A

Practical No. 1

* Title :: Data Wrangling 1

* Date of Completion ::

* Objective :: To perform data preprocessing, data transformation and data normalization.

* Problem Statement :: Perform the following operations using Python on any open source data set (eg: data.csv).

1) Import all the required Python Libraries.
2) Locate an open source data from the web. Provide a clear description of data and its source.
3) Load the dataset into pandas data frame.
4) Data preprocessing : Check for missing values in the data using pandas insult(), describe() function to get some initial statistics. Provide variable description Types of variables etc. Check the dimensions of the data frame.
5) Data Formatting and Data Normalization : Summarize types of variables by checking data types of variables in the data set. If variables are not in correct data type, apply proper type conversion.
6) Turn categorical variables into quantitative variables in Python.

Teacher's Signature _____

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★ Software and Hardware Requirements :- Python, dataset.

★ Theory :-

A) Source of data :- Kaggle
There are several data pre-processing (wrangling) techniques
1) Data Cleaning
2) Data Integration
3) Data Reduction
4) Data Transformation
5) Data Discretization.

B) Data Cleaning :- It can involve transformation to correct wrong data, such as by transforming entries for a date filled to a common format.

C) Data Wrangling :- It is the process of cleaning and unifying messy and complex data sets to make them more appropriate and valuable for a variety of downstream purpose such as analytics.

D) Data Normalization :- Converting data variable into a given range.
1) Min-Max normalization :

$$v' = \frac{v - v_{min}}{v_{max} - v_{min}} (new\_max - new\_min) + new\_min$$

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2) z - score normalization:

$$v' = \frac{v - \bar{A}}{\sigma A}$$

3) Decimal Scaling :

$$v' = \frac{v}{|n|}$$

★ Conclusion :- Perform above mentioned operations using Python.

1. Import all the required Python Libraries

In [4]:

```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
```

In [ ]:

```

```

1. Load the Dataset into pandas data frame

In [12]:

```
data = {
    "Roll_No" : [1,2,3],
    "Marks" : [50,40,45]
}

#load data into a DataFrame object:
df = pd.DataFrame(data)

df
```

Out[12]:

	Roll_No	Marks
0	**1**	**50**
1	**2**	**40**
2	**3**	**45**

In [13]:

```
print(df)
```

```
   Roll_No  Marks
0        1     50
1        2     40
2        3     45
```

In [24]:

```
print(df.to_string)
```

```
<bound method DataFrame.to_string of      Roll_No  Marks
ABC         1     50
PQR         2     40
XYZ         3     45>
```

In [23]:

```
print(df.to_string())
```

```
     Roll_No  Marks
ABC         1     50
PQR         2     40
XYZ         3     45
```

In [18]:

```
print(df.loc[2])
```

```
Roll_No     3
Marks      45
Name: 2, dtype: int64
```

In [19]:

```
print(df.loc[[0,2]])
```

```
   Roll_No  Marks
0        1     50
2        3     45
```

In [20]:

```
#load data into a DataFrame object:
df = pd.DataFrame(data,index = ["ABC","PQR","XYZ"])
print(df)
```

```
     Roll_No  Marks
ABC        1     50
PQR        2     40
XYZ        3     45
```

In [21]:

```
print(df.loc["XYZ"])
```

```
Roll_No     3
Marks      45
Name: XYZ, dtype: int64
```

In [ ]:

```

```

1. Data Preprocessing

In [25]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
df
```

Out[25]:

	Duration	Date	Pulse	Maxpulse	Calories
0	60	'2020/12/01'	110	130	409.1
1	60	'2020/12/02'	117	145	479.0
2	60	'2020/12/03'	103	135	340.0
3	45	'2020/12/04'	109	175	282.4
4	45	'2020/12/05'	117	148	406.0
5	60	'2020/12/06'	102	127	300.0
6	60	'2020/12/07'	110	136	374.0
7	450	'2020/12/08'	104	134	253.3
8	30	'2020/12/09'	109	133	195.1
9	60	'2020/12/10'	98	124	269.0
10	60	'2020/12/11'	103	147	329.3
11	60	'2020/12/12'	100	120	250.7
12	60	'2020/12/12'	100	120	250.7
13	60	'2020/12/13'	106	128	345.3
14	60	'2020/12/14'	104	132	379.3

	Duration	Date	Pulse	Maxpulse	Calories
15	60	'2020/12/15'	98	123	275.0
16	60	'2020/12/16'	98	120	215.2
17	60	'2020/12/17'	100	120	300.0
18	45	'2020/12/18'	90	112	NaN
19	60	'2020/12/19'	103	123	323.0
20	45	'2020/12/20'	97	125	243.0
21	60	'2020/12/21'	108	131	364.2
22	45	NaN	100	119	282.0
23	60	'2020/12/23'	130	101	300.0
24	45	'2020/12/24'	105	132	246.0
25	60	'2020/12/25'	102	126	334.5
26	60	20201226	100	120	250.0
27	60	'2020/12/27'	92	118	241.0
28	60	'2020/12/28'	103	132	NaN
29	60	'2020/12/29'	100	132	280.0
30	60	'2020/12/30'	102	129	380.3
31	60	'2020/12/31'	92	115	243.0

In [26]:

```
df.head()
```

Out[26]:

	Duration	Date	Pulse	Maxpulse	Calories
0	60	'2020/12/01'	110	130	409.1
1	60	'2020/12/02'	117	145	479.0
2	60	'2020/12/03'	103	135	340.0
3	45	'2020/12/04'	109	175	282.4
4	45	'2020/12/05'	117	148	406.0

In [27]:

```
df.head(10)
```

Out[27]:

	Duration	Date	Pulse	Maxpulse	Calories
0	60	'2020/12/01'	110	130	409.1
1	60	'2020/12/02'	117	145	479.0
2	60	'2020/12/03'	103	135	340.0
3	45	'2020/12/04'	109	175	282.4
4	45	'2020/12/05'	117	148	406.0
5	60	'2020/12/06'	102	127	300.0
6	60	'2020/12/07'	110	136	374.0
7	450	'2020/12/08'	104	134	253.3
8	30	'2020/12/09'	109	133	195.1
9	60	'2020/12/10'	98	124	269.0

In [28]:

```
df.tail()
```

Out[28]:

	Duration	Date	Pulse	Maxpulse	Calories
27	60	'2020/12/27'	92	118	241.0
28	60	'2020/12/28'	103	132	NaN
29	60	'2020/12/29'	100	132	280.0
30	60	'2020/12/30'	102	129	380.3
31	60	'2020/12/31'	92	115	243.0

In [29]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 32 entries, 0 to 31
Data columns (total 5 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   Duration  32 non-null     int64  
 1   Date      31 non-null     object 
 2   Pulse     32 non-null     int64  
 3   Maxpulse  32 non-null     int64  
 4   Calories  30 non-null     float64
dtypes: float64(1), int64(3), object(1)
memory usage: 1.4+ KB
```

In [30]:

```
new_df = df.dropna()
print(new_df.to_string())
```

```
    Duration           Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
7        450  '2020/12/08'    104       134     253.3
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
10        60  '2020/12/11'    103       147     329.3
11        60  '2020/12/12'    100       120     250.7
12        60  '2020/12/12'    100       120     250.7
13        60  '2020/12/13'    106       128     345.3
14        60  '2020/12/14'    104       132     379.3
15        60  '2020/12/15'     98       123     275.0
16        60  '2020/12/16'     98       120     215.2
17        60  '2020/12/17'    100       120     300.0
19        60  '2020/12/19'    103       123     323.0
20        45  '2020/12/20'     97       125     243.0
21        60  '2020/12/21'    108       131     364.2
23        60  '2020/12/23'    130       101     300.0
24        45  '2020/12/24'    105       132     246.0
25        60  '2020/12/25'    102       126     334.5
26        60      20201226    100       120     250.0
27        60  '2020/12/27'     92       118     241.0
29        60  '2020/12/29'    100       132     280.0
30        60  '2020/12/30'    102       129     380.3
31        60  '2020/12/31'     92       115     243.0
```

In [31]:

```
df
```

Out[31]:

	Duration	Date	Pulse	Maxpulse	Calories
0	60	'2020/12/01'	110	130	409.1
1	60	'2020/12/02'	117	145	479.0
2	60	'2020/12/03'	103	135	340.0
3	45	'2020/12/04'	109	175	282.4
4	45	'2020/12/05'	117	148	406.0
5	60	'2020/12/06'	102	127	300.0
6	60	'2020/12/07'	110	136	374.0
7	450	'2020/12/08'	104	134	253.3
8	30	'2020/12/09'	109	133	195.1
9	60	'2020/12/10'	98	124	269.0
10	60	'2020/12/11'	103	147	329.3
11	60	'2020/12/12'	100	120	250.7
12	60	'2020/12/12'	100	120	250.7
13	60	'2020/12/13'	106	128	345.3
14	60	'2020/12/14'	104	132	379.3
15	60	'2020/12/15'	98	123	275.0
16	60	'2020/12/16'	98	120	215.2
17	60	'2020/12/17'	100	120	300.0
18	45	'2020/12/18'	90	112	NaN
19	60	'2020/12/19'	103	123	323.0
20	45	'2020/12/20'	97	125	243.0
21	60	'2020/12/21'	108	131	364.2
22	45	NaN	100	119	282.0
23	60	'2020/12/23'	130	101	300.0
24	45	'2020/12/24'	105	132	246.0
25	60	'2020/12/25'	102	126	334.5
26	60	20201226	100	120	250.0
27	60	'2020/12/27'	92	118	241.0
28	60	'2020/12/28'	103	132	NaN
29	60	'2020/12/29'	100	132	280.0
30	60	'2020/12/30'	102	129	380.3
31	60	'2020/12/31'	92	115	243.0

In [33]:

```
df.dropna(inplace = True)
print(df.to_string())
```

```
    Duration           Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
7        450  '2020/12/08'    104       134     253.3
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
```

```
10         60   '2020/12/11'     103        147      329.3
11         60   '2020/12/12'     100        120      250.7
12         60   '2020/12/12'     100        120      250.7
13         60   '2020/12/13'     106        128      345.3
14         60   '2020/12/14'     104        132      379.3
15         60   '2020/12/15'      98        123      275.0
16         60   '2020/12/16'      98        120      215.2
17         60   '2020/12/17'     100        120      300.0
19         60   '2020/12/19'     103        123      323.0
20         45   '2020/12/20'      97        125      243.0
21         60   '2020/12/21'     108        131      364.2
23         60   '2020/12/23'     130        101      300.0
24         45   '2020/12/24'     105        132      246.0
25         60   '2020/12/25'     102        126      334.5
26         60       20201226     100        120      250.0
27         60   '2020/12/27'      92        118      241.0
29         60   '2020/12/29'     100        132      280.0
30         60   '2020/12/30'     102        129      380.3
31         60   '2020/12/31'      92        115      243.0
```

In [34]:

```
df
```

Out[34]:

	Duration	Date	Pulse	Maxpulse	Calories
0	60	'2020/12/01'	110	130	409.1
1	60	'2020/12/02'	117	145	479.0
2	60	'2020/12/03'	103	135	340.0
3	45	'2020/12/04'	109	175	282.4
4	45	'2020/12/05'	117	148	406.0
5	60	'2020/12/06'	102	127	300.0
6	60	'2020/12/07'	110	136	374.0
7	450	'2020/12/08'	104	134	253.3
8	30	'2020/12/09'	109	133	195.1
9	60	'2020/12/10'	98	124	269.0
10	60	'2020/12/11'	103	147	329.3
11	60	'2020/12/12'	100	120	250.7
12	60	'2020/12/12'	100	120	250.7
13	60	'2020/12/13'	106	128	345.3
14	60	'2020/12/14'	104	132	379.3
15	60	'2020/12/15'	98	123	275.0
16	60	'2020/12/16'	98	120	215.2
17	60	'2020/12/17'	100	120	300.0
19	60	'2020/12/19'	103	123	323.0
20	45	'2020/12/20'	97	125	243.0
21	60	'2020/12/21'	108	131	364.2
23	60	'2020/12/23'	130	101	300.0
24	45	'2020/12/24'	105	132	246.0
25	60	'2020/12/25'	102	126	334.5
26	60	20201226	100	120	250.0
27	60	'2020/12/27'	92	118	241.0
29	60	'2020/12/29'	100	132	280.0

	Duration	Date	Pulse	Maxpulse	Calories
30	60	'2020/12/30'	102	129	380.3
31	60	'2020/12/31'	92	115	243.0

In [36]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
df.fillna(130, inplace = True)
df
```

Out[36]:

	Duration	Date	Pulse	Maxpulse	Calories
0	60	'2020/12/01'	110	130	409.1
1	60	'2020/12/02'	117	145	479.0
2	60	'2020/12/03'	103	135	340.0
3	45	'2020/12/04'	109	175	282.4
4	45	'2020/12/05'	117	148	406.0
5	60	'2020/12/06'	102	127	300.0
6	60	'2020/12/07'	110	136	374.0
7	450	'2020/12/08'	104	134	253.3
8	30	'2020/12/09'	109	133	195.1
9	60	'2020/12/10'	98	124	269.0
10	60	'2020/12/11'	103	147	329.3
11	60	'2020/12/12'	100	120	250.7
12	60	'2020/12/12'	100	120	250.7
13	60	'2020/12/13'	106	128	345.3
14	60	'2020/12/14'	104	132	379.3
15	60	'2020/12/15'	98	123	275.0
16	60	'2020/12/16'	98	120	215.2
17	60	'2020/12/17'	100	120	300.0
18	45	'2020/12/18'	90	112	130.0
19	60	'2020/12/19'	103	123	323.0
20	45	'2020/12/20'	97	125	243.0
21	60	'2020/12/21'	108	131	364.2
22	45	130	100	119	282.0
23	60	'2020/12/23'	130	101	300.0
24	45	'2020/12/24'	105	132	246.0
25	60	'2020/12/25'	102	126	334.5
26	60	20201226	100	120	250.0
27	60	'2020/12/27'	92	118	241.0
28	60	'2020/12/28'	103	132	130.0
29	60	'2020/12/29'	100	132	280.0
30	60	'2020/12/30'	102	129	380.3
31	60	'2020/12/31'	92	115	243.0

In [37]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
df["Calories"].fillna(130, inplace = True)
```

```
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
7        450  '2020/12/08'    104       134     253.3
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
10        60  '2020/12/11'    103       147     329.3
11        60  '2020/12/12'    100       120     250.7
12        60  '2020/12/12'    100       120     250.7
13        60  '2020/12/13'    106       128     345.3
14        60  '2020/12/14'    104       132     379.3
15        60  '2020/12/15'     98       123     275.0
16        60  '2020/12/16'     98       120     215.2
17        60  '2020/12/17'    100       120     300.0
18        45  '2020/12/18'     90       112     130.0
19        60  '2020/12/19'    103       123     323.0
20        45  '2020/12/20'     97       125     243.0
21        60  '2020/12/21'    108       131     364.2
22        45           NaN    100       119     282.0
23        60  '2020/12/23'    130       101     300.0
24        45  '2020/12/24'    105       132     246.0
25        60  '2020/12/25'    102       126     334.5
26        60      20201226    100       120     250.0
27        60  '2020/12/27'     92       118     241.0
28        60  '2020/12/28'    103       132     130.0
29        60  '2020/12/29'    100       132     280.0
30        60  '2020/12/30'    102       129     380.3
31        60  '2020/12/31'     92       115     243.0
```

In [38]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
x = df["Calories"].mean()
df["Calories"].fillna(x, inplace = True)
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130    409.10
1         60  '2020/12/02'    117       145    479.00
2         60  '2020/12/03'    103       135    340.00
3         45  '2020/12/04'    109       175    282.40
4         45  '2020/12/05'    117       148    406.00
5         60  '2020/12/06'    102       127    300.00
6         60  '2020/12/07'    110       136    374.00
7        450  '2020/12/08'    104       134    253.30
8         30  '2020/12/09'    109       133    195.10
9         60  '2020/12/10'     98       124    269.00
10        60  '2020/12/11'    103       147    329.30
11        60  '2020/12/12'    100       120    250.70
12        60  '2020/12/12'    100       120    250.70
13        60  '2020/12/13'    106       128    345.30
14        60  '2020/12/14'    104       132    379.30
15        60  '2020/12/15'     98       123    275.00
16        60  '2020/12/16'     98       120    215.20
17        60  '2020/12/17'    100       120    300.00
18        45  '2020/12/18'     90       112    304.68
19        60  '2020/12/19'    103       123    323.00
20        45  '2020/12/20'     97       125    243.00
21        60  '2020/12/21'    108       131    364.20
22        45           NaN    100       119    282.00
23        60  '2020/12/23'    130       101    300.00
24        45  '2020/12/24'    105       132    246.00
25        60  '2020/12/25'    102       126    334.50
26        60      20201226    100       120    250.00
```

```
27         60   '2020/12/27'      92        118     241.00
28         60   '2020/12/28'     103        132     304.68
29         60   '2020/12/29'     100        132     280.00
30         60   '2020/12/30'     102        129     380.30
31         60   '2020/12/31'      92        115     243.00
```

In [39]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
x = df["Calories"].median()
df["Calories"].fillna(x, inplace = True)
df
```

Out[39]:

	Duration	Date	Pulse	Maxpulse	Calories
0	60	'2020/12/01'	110	130	409.1
1	60	'2020/12/02'	117	145	479.0
2	60	'2020/12/03'	103	135	340.0
3	45	'2020/12/04'	109	175	282.4
4	45	'2020/12/05'	117	148	406.0
5	60	'2020/12/06'	102	127	300.0
6	60	'2020/12/07'	110	136	374.0
7	450	'2020/12/08'	104	134	253.3
8	30	'2020/12/09'	109	133	195.1
9	60	'2020/12/10'	98	124	269.0
10	60	'2020/12/11'	103	147	329.3
11	60	'2020/12/12'	100	120	250.7
12	60	'2020/12/12'	100	120	250.7
13	60	'2020/12/13'	106	128	345.3
14	60	'2020/12/14'	104	132	379.3
15	60	'2020/12/15'	98	123	275.0
16	60	'2020/12/16'	98	120	215.2
17	60	'2020/12/17'	100	120	300.0
18	45	'2020/12/18'	90	112	291.2
19	60	'2020/12/19'	103	123	323.0
20	45	'2020/12/20'	97	125	243.0
21	60	'2020/12/21'	108	131	364.2
22	45	NaN	100	119	282.0
23	60	'2020/12/23'	130	101	300.0
24	45	'2020/12/24'	105	132	246.0
25	60	'2020/12/25'	102	126	334.5
26	60	20201226	100	120	250.0
27	60	'2020/12/27'	92	118	241.0
28	60	'2020/12/28'	103	132	291.2
29	60	'2020/12/29'	100	132	280.0
30	60	'2020/12/30'	102	129	380.3
31	60	'2020/12/31'	92	115	243.0

In [43]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
df["Date"] = pd.to_datetime(df["Date"])
print(df)
```

```
    Duration       Date  Pulse  Maxpulse  Calories
0         60 2020-12-01    110       130     409.1
1         60 2020-12-02    117       145     479.0
2         60 2020-12-03    103       135     340.0
3         45 2020-12-04    109       175     282.4
4         45 2020-12-05    117       148     406.0
5         60 2020-12-06    102       127     300.0
6         60 2020-12-07    110       136     374.0
7        450 2020-12-08    104       134     253.3
8         30 2020-12-09    109       133     195.1
9         60 2020-12-10     98       124     269.0
10        60 2020-12-11    103       147     329.3
11        60 2020-12-12    100       120     250.7
12        60 2020-12-12    100       120     250.7
13        60 2020-12-13    106       128     345.3
14        60 2020-12-14    104       132     379.3
15        60 2020-12-15     98       123     275.0
16        60 2020-12-16     98       120     215.2
17        60 2020-12-17    100       120     300.0
18        45 2020-12-18     90       112       NaN
19        60 2020-12-19    103       123     323.0
20        45 2020-12-20     97       125     243.0
21        60 2020-12-21    108       131     364.2
22        45        NaT    100       119     282.0
23        60 2020-12-23    130       101     300.0
24        45 2020-12-24    105       132     246.0
25        60 2020-12-25    102       126     334.5
26        60 2020-12-26    100       120     250.0
27        60 2020-12-27     92       118     241.0
28        60 2020-12-28    103       132       NaN
29        60 2020-12-29    100       132     280.0
30        60 2020-12-30    102       129     380.3
31        60 2020-12-31     92       115     243.0
```

In [46]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
df.dropna(subset = ["Date"] , inplace = True)
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
7        450  '2020/12/08'    104       134     253.3
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
10        60  '2020/12/11'    103       147     329.3
11        60  '2020/12/12'    100       120     250.7
12        60  '2020/12/12'    100       120     250.7
13        60  '2020/12/13'    106       128     345.3
14        60  '2020/12/14'    104       132     379.3
15        60  '2020/12/15'     98       123     275.0
16        60  '2020/12/16'     98       120     215.2
17        60  '2020/12/17'    100       120     300.0
18        45  '2020/12/18'     90       112       NaN
19        60  '2020/12/19'    103       123     323.0
20        45  '2020/12/20'     97       125     243.0
21        60  '2020/12/21'    108       131     364.2
23        60  '2020/12/23'    130       101     300.0
24        45  '2020/12/24'    105       132     246.0
25        60  '2020/12/25'    102       126     334.5
```

```
26         60      20201226    100        120      250.0
27         60  '2020/12/27'     92        118      241.0
28         60  '2020/12/28'    103        132        NaN
29         60  '2020/12/29'    100        132      280.0
30         60  '2020/12/30'    102        129      380.3
31         60  '2020/12/31'     92        115      243.0
```

In [49]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
df.loc[7, "Duration"] = 45
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
7         45  '2020/12/08'    104       134     253.3
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
10        60  '2020/12/11'    103       147     329.3
11        60  '2020/12/12'    100       120     250.7
12        60  '2020/12/12'    100       120     250.7
13        60  '2020/12/13'    106       128     345.3
14        60  '2020/12/14'    104       132     379.3
15        60  '2020/12/15'     98       123     275.0
16        60  '2020/12/16'     98       120     215.2
17        60  '2020/12/17'    100       120     300.0
18        45  '2020/12/18'     90       112       NaN
19        60  '2020/12/19'    103       123     323.0
20        45  '2020/12/20'     97       125     243.0
21        60  '2020/12/21'    108       131     364.2
22        45           NaN    100       119     282.0
23        60  '2020/12/23'    130       101     300.0
24        45  '2020/12/24'    105       132     246.0
25        60  '2020/12/25'    102       126     334.5
26        60      20201226    100       120     250.0
27        60  '2020/12/27'     92       118     241.0
28        60  '2020/12/28'    103       132       NaN
29        60  '2020/12/29'    100       132     280.0
30        60  '2020/12/30'    102       129     380.3
31        60  '2020/12/31'     92       115     243.0
```

In [50]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
for x in df.index :
    if df.loc[x, "Duration"] > 120 :
        df.loc[x, "Duration"] = 120
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
7        120  '2020/12/08'    104       134     253.3
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
10        60  '2020/12/11'    103       147     329.3
11        60  '2020/12/12'    100       120     250.7
12        60  '2020/12/12'    100       120     250.7
13        60  '2020/12/13'    106       128     345.3
```

```
14         60  '2020/12/14'    104        132      379.3
15         60  '2020/12/15'     98        123      275.0
16         60  '2020/12/16'     98        120      215.2
17         60  '2020/12/17'    100        120      300.0
18         45  '2020/12/18'     90        112        NaN
19         60  '2020/12/19'    103        123      323.0
20         45  '2020/12/20'     97        125      243.0
21         60  '2020/12/21'    108        131      364.2
22         45           NaN    100        119      282.0
23         60  '2020/12/23'    130        101      300.0
24         45  '2020/12/24'    105        132      246.0
25         60  '2020/12/25'    102        126      334.5
26         60      20201226    100        120      250.0
27         60  '2020/12/27'     92        118      241.0
28         60  '2020/12/28'    103        132        NaN
29         60  '2020/12/29'    100        132      280.0
30         60  '2020/12/30'    102        129      380.3
31         60  '2020/12/31'     92        115      243.0
```

In [51]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
for x in df.index :
    if df.loc[x, "Duration"] > 120 :
        df.drop(x, inplace = True)
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
10        60  '2020/12/11'    103       147     329.3
11        60  '2020/12/12'    100       120     250.7
12        60  '2020/12/12'    100       120     250.7
13        60  '2020/12/13'    106       128     345.3
14        60  '2020/12/14'    104       132     379.3
15        60  '2020/12/15'     98       123     275.0
16        60  '2020/12/16'     98       120     215.2
17        60  '2020/12/17'    100       120     300.0
18        45  '2020/12/18'     90       112       NaN
19        60  '2020/12/19'    103       123     323.0
20        45  '2020/12/20'     97       125     243.0
21        60  '2020/12/21'    108       131     364.2
22        45           NaN    100       119     282.0
23        60  '2020/12/23'    130       101     300.0
24        45  '2020/12/24'    105       132     246.0
25        60  '2020/12/25'    102       126     334.5
26        60      20201226    100       120     250.0
27        60  '2020/12/27'     92       118     241.0
28        60  '2020/12/28'    103       132       NaN
29        60  '2020/12/29'    100       132     280.0
30        60  '2020/12/30'    102       129     380.3
31        60  '2020/12/31'     92       115     243.0
```

In [52]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
print(df.duplicated())
```

```
0     False
1     False
2     False
3     False
4     False
```

```
5     False
6     False
7     False
8     False
9     False
10    False
11    False
12     True
13    False
14    False
15    False
16    False
17    False
18    False
19    False
20    False
21    False
22    False
23    False
24    False
25    False
26    False
27    False
28    False
29    False
30    False
31    False
dtype: bool
```

In [53]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
df.drop_duplicates(inplace = True)
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
7        450  '2020/12/08'    104       134     253.3
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
10        60  '2020/12/11'    103       147     329.3
11        60  '2020/12/12'    100       120     250.7
13        60  '2020/12/13'    106       128     345.3
14        60  '2020/12/14'    104       132     379.3
15        60  '2020/12/15'     98       123     275.0
16        60  '2020/12/16'     98       120     215.2
17        60  '2020/12/17'    100       120     300.0
18        45  '2020/12/18'     90       112       NaN
19        60  '2020/12/19'    103       123     323.0
20        45  '2020/12/20'     97       125     243.0
21        60  '2020/12/21'    108       131     364.2
22        45           NaN    100       119     282.0
23        60  '2020/12/23'    130       101     300.0
24        45  '2020/12/24'    105       132     246.0
25        60  '2020/12/25'    102       126     334.5
26        60      20201226    100       120     250.0
27        60  '2020/12/27'     92       118     241.0
28        60  '2020/12/28'    103       132       NaN
29        60  '2020/12/29'    100       132     280.0
30        60  '2020/12/30'    102       129     380.3
31        60  '2020/12/31'     92       115     243.0
```

In [10]:

```
data = pd.Series({'1st':1, '2nd':2, '3rd':3, '4th':4})
```

```
print(data,'\n')
print('Size = ',data.size)
```

```
1st    1
2nd    2
3rd    3
4th    4
dtype: int64

Size =  4
```

In [11]:

```
df = pd.DataFrame({'1st':[1,2], '2nd':[3,4], '3rd':[5,6], '4th':[7,8]})
print(df,'\n')
print('Size = ',df.size)
```

```
   1st  2nd  3rd  4th
0    1    3    5    7
1    2    4    6    8

Size =  8
```

In [12]:

```
df = pd.DataFrame({'1st':[1,2], '2nd':[3,4], '3rd':[5,6], '4th':[7,8]})
print(df,'\n')
print('Size = ',df.size)
print('Dimension = ',df.ndim)
print('Shape = ',df.shape)
```

```
   1st  2nd  3rd  4th
0    1    3    5    7
1    2    4    6    8

Size =  8
Dimension =  2
Shape =  (2, 4)
```

In [ ]:

```

```

1. Data Formatting and Data Normalization

In [13]:

```
df = pd.DataFrame({'Name':['Rohit', 'Raj', 'Shubh', 'Shivam'], 'Marks':[95,74,84,26], 'S
ubject':['Maths', 'Science', 'English', 'Social Science']})
column_names=df.columns
print(column_names)
```

```
Index(['Name', 'Marks', 'Subject'], dtype='object')
```

In [14]:

```
data = {'Name':['Rohit', 'Raj', 'Shubh', 'Shivam'], 'Marks':[95,74,84,26]}
df = pd.DataFrame(data)
column_names=df.columns
print(column_names)
```

```
Index(['Name', 'Marks'], dtype='object')
```

In [16]:

```
df = pd.DataFrame({'A':[21, 11, 19, None, 1],
                   'B':[7, 19, 57, 3, None],
                   'C':[10, 16, 11, 3, 8],
                   'D':[14 , 3, None, 2, 6]})
index_row = ['Row_1', 'Row_2', 'Row_3', 'Row_4', 'Row_5']
```

```
df.index = index_row
print(df)
print(df.columns)
```

```
          A     B   C     D
Row_1  21.0   7.0  10  14.0
Row_2  11.0  19.0  16   3.0
Row_3  19.0  57.0  11   NaN
Row_4   NaN   3.0   3   2.0
Row_5   1.0   NaN   8   6.0
Index(['A', 'B', 'C', 'D'], dtype='object')
```

In [17]:

```
dict = {'Phone':['Samsung S20', 'iPhone 11', 'Reliance Jio'], 'Price':[1000, 1100, 100]}
df = pd.DataFrame(dict)
print('The DataType of DataFrame is: ')
print(df.dtypes)
```

```
The DataType of DataFrame is:
Phone    object
Price     int64
dtype: object
```

In [18]:

```
dict = {'Phone':['Samsung S20', 'iPhone 11', 'Reliance Jio'], 'Price':[1000, 1100, 100],
'Discount':[np.nan, np.nan, np.nan]}
df = pd.DataFrame(dict)
print('The DataType of DataFrame is: ')
print(df.dtypes)
```

```
The DataType of DataFrame is:
Phone        object
Price         int64
Discount    float64
dtype: object
```

In [19]:

```
dict = {'Phone':['Samsung S20', 'iPhone 11', 'Reliance Jio'], 'Price':[1000, 1100, 100],
'Discount':[np.nan, np.nan, np.nan], 'ArrivalDate':[pd.Timestamp('20180310'), pd.Timesta
mp('20190310'), pd.Timestamp('20140310')]}
df = pd.DataFrame(dict)
print('The DataType of DataFrame is: ')
print(df.dtypes)
```

```
The DataType of DataFrame is:
Phone                   object
Price                    int64
Discount               float64
ArrivalDate    datetime64[ns]
dtype: object
```

In [21]:

```
dict = {'Phone':['Samsung S20', 'iPhone 11', 'Reliance Jio'], 'Price':[1000, 1100, 100],
'Discount':[np.nan, np.nan, np.nan], 'ArrivalDate':[pd.Timestamp('20180310'), pd.Timesta
mp('20190310'), pd.Timestamp('20140310')]}
df = pd.DataFrame(dict)
print('The Info of DataFrame is: ')
print(df.info())
```

```
The Info of DataFrame is:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3 entries, 0 to 2
Data columns (total 4 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   Phone        3 non-null      object
 1   Price        3 non-null      int64
 2   Discount     0 non-null      float64
```

```
 3   ArrivalDate  3 non-null      datetime64[ns]
dtypes: datetime64[ns](1), float64(1), int64(1), object(1)
memory usage: 224.0+ bytes
None
```

In [25]:

```
dataset = {'Name':['Rohit', 'Raj', 'Shubh', 'Shivam', 'Arun'],
           'Roll_No':['01', '02', '03', '04', np.nan],
           'Maths':['93', '63', np.nan, '94', '83'],
           'Science':['88', np.nan, '66', '94', np.nan],
           'English':['93', '74', '84', '92', '87']}
df = pd.DataFrame(dataset)

print('DataFrame: \n\n',df)

print('\nCount: \n')
df2 = df.count()
print(df2)
```

```
DataFrame:

      Name Roll_No Maths Science English
0   Rohit      01    93      88      93
1     Raj      02    63     NaN      74
2   Shubh      03   NaN      66      84
3  Shivam      04    94      94      92
4    Arun     NaN    83     NaN      87

Count:

Name       5
Roll_No    4
Maths      4
Science    3
English    5
dtype: int64
```

In [26]:

```
dataset = {'Name':['Rohit', 'Raj', 'Shubh', 'Shivam', 'Arun'],
           'Roll_No':['01', '02', '03', '04', np.nan],
           'Maths':['93', '63', np.nan, '94', '83'],
           'Science':['88', np.nan, '66', '94', np.nan],
           'English':['93', '74', '84', '92', '87']}
df = pd.DataFrame(dataset)

print('DataFrame: \n\n',df)

print('\nCount: \n')
df2 = df.count(axis='columns')
print(df2)
```

```
DataFrame:

      Name Roll_No Maths Science English
0   Rohit      01    93      88      93
1     Raj      02    63     NaN      74
2   Shubh      03   NaN      66      84
3  Shivam      04    94      94      92
4    Arun     NaN    83     NaN      87

Count:

0    5
1    4
2    4
3    5
4    3
dtype: int64
```

In [27]:

```
dataset = {'Name':['Rohit', 'Raj', 'Shubh', 'Shivam', 'Arun'],
           'Roll_No':['01', '02', '03', '04', np.nan],
           'Maths':['93', '63', np.nan, '94', '83'],
           'Science':['88', np.nan, '66', '94', np.nan],
           'English':['93', '74', '84', '92', '87']}
df = pd.DataFrame(dataset)

print('DataFrame: \n\n',df)

print('\nCount: \n')
df2 = df.set_index(['Maths', 'English']).count(level='Maths')
print(df2)
```

```
DataFrame:

      Name Roll_No Maths Science English
0    Rohit      01    93      88      93
1      Raj      02    63     NaN      74
2    Shubh      03   NaN      66      84
3   Shivam      04    94      94      92
4     Arun     NaN    83     NaN      87

Count:

        Name  Roll_No  Science
Maths
63         1        1        0
83         1        0        0
93         1        1        1
94         1        1        1
```

In [5]:

```
df = pd.DataFrame([
    [180000, 110, 18.9, 1400],
    [360000, 905, 23.4, 1800],
    [230000, 230, 14.0, 1300],
    [60000, 450, 13.5, 1500]],

    columns=['Col A', 'Col B', 'Col C', 'Col D'])

display(df)
```

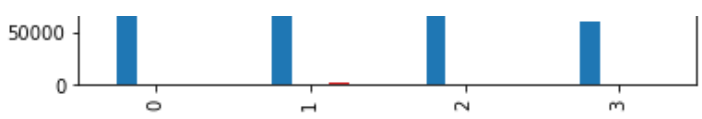
	Col A	Col B	Col C	Col D
0	**180000**	**110**	**18.9**	**1400**
1	**360000**	**905**	**23.4**	**1800**
2	**230000**	**230**	**14.0**	**1300**
3	**60000**	**450**	**13.5**	**1500**

In [31]:

```
df.plot(kind = 'bar')
```

Out[31]:

<AxesSubplot:>



In [32]:

```
df_max_scaled = df.copy()

for column in df_max_scaled.columns:
    df_max_scaled[column] = df_max_scaled[column]/df_max_scaled[column].abs().max()

display(df_max_scaled)
```

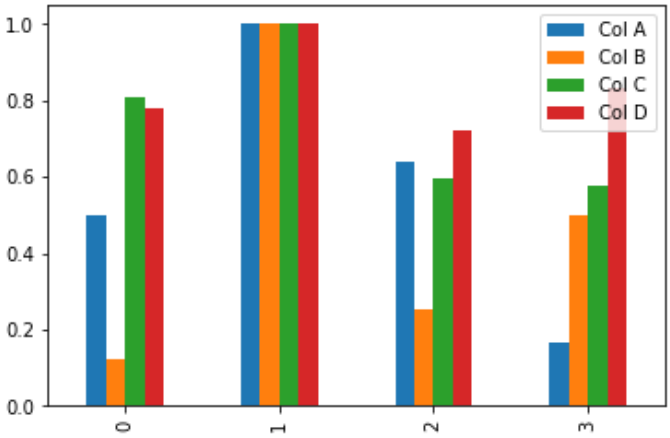
	Col A	Col B	Col C	Col D
0	**0.500000**	**0.121547**	**0.807692**	**0.777778**
1	**1.000000**	**1.000000**	**1.000000**	**1.000000**
2	**0.638889**	**0.254144**	**0.598291**	**0.722222**
3	**0.166667**	**0.497238**	**0.576923**	**0.833333**

In [33]:

```
df_max_scaled.plot(kind = 'bar')
```

Out[33]:

<AxesSubplot:>



In [6]:

```
df_min_max_scaled = df.copy()

for column in df_min_max_scaled.columns:
    df_min_max_scaled[column] = (df_min_max_scaled[column]-df_min_max_scaled[column].min
())/(df_min_max_scaled[column].max()-df_min_max_scaled[column].min())

display(df_min_max_scaled)
```

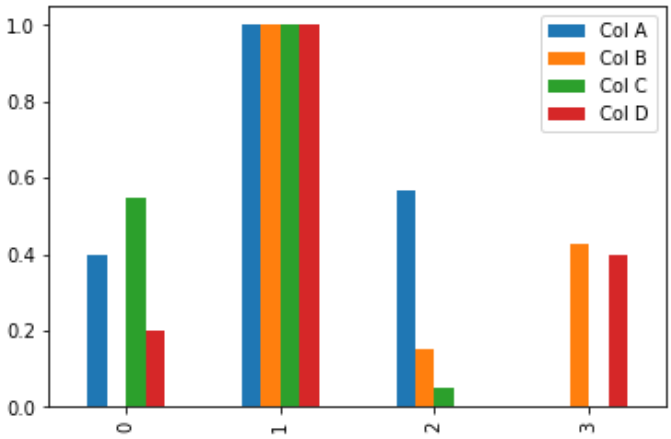
	Col A	Col B	Col C	Col D
0	**0.400000**	**0.000000**	**0.545455**	**0.2**
1	**1.000000**	**1.000000**	**1.000000**	**1.0**
2	**0.566667**	**0.150943**	**0.050505**	**0.0**
3	**0.000000**	**0.427673**	**0.000000**	**0.4**

In [7]:

```
df_min_max_scaled.plot(kind = 'bar')
```

Out[7]:

<AxesSubplot:>



In [8]:

```
df_z_scaled = df.copy()

for column in df_z_scaled.columns:
    df_z_scaled[column] = (df_z_scaled[column]-df_z_scaled[column].mean())/df_z_scaled[c
olumn].std()

display(df_z_scaled)
```

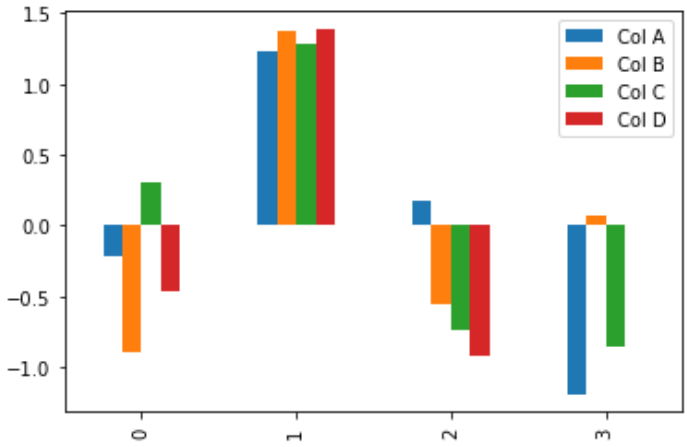
	Col A	Col B	Col C	Col D
0	-0.221422	-0.895492	0.311486	-0.46291
1	1.227884	1.373564	1.278167	1.38873
2	0.181163	-0.552993	-0.741122	-0.92582
3	-1.187625	0.074922	-0.848531	0.00000

In [12]:

```
df_z_scaled.plot(kind = 'bar')
```

Out[12]:

<AxesSubplot:>



In [ ]:

```

```

1. **Turn categorical variables into quantitative variables in Python**

In [13]:

```
d = {'col1': [1, 2], 'col2': [3, 4]}
df = pd.DataFrame(data=d)
df.dtypes
```

Out[13]:

```
col1    int64
col2    int64
dtype: object
```

In [14]:

```
df.astype('int32').dtypes
```

Out[14]:

```
col1    int32
col2    int32
dtype: object
```

In [15]:

```
df.astype({'col1': 'int32'}).dtypes
```

Out[15]:

```
col1    int32
col2    int64
dtype: object
```

In [18]:

```
ser = pd.Series([1, 2], dtype='int32')
ser
```

Out[18]:

```
0    1
1    2
dtype: int32
```

In [19]:

```
ser.astype('int64')
```

Out[19]:

```
0    1
1    2
dtype: int64
```

In [20]:

```
ser.astype('category')
```

Out[20]:

```
0    1
1    2
dtype: category
Categories (2, int64): [1, 2]
```

In [21]:

```
from pandas.api.types import CategoricalDtype
cat_dtype = CategoricalDtype(categories=[2, 1], ordered=True)
ser.astype(cat_dtype)
```

Out[21]:

```
0    1
1    2
dtype: category
Categories (2, int64): [2 < 1]
```

In [22]:

```
ser = pd.Series([1, 2])
```

```
s1 = pd.Series([1, 2])
s2 = s1.astype('int64', copy=False)
s2[0] = 10
s1
```

Out[22]:

```
0    10
1     2
dtype: int64
```

In [23]:

```
ser_date = pd.Series(pd.date_range('20200101', periods=3))
ser_date
```

Out[23]:

```
0   2020-01-01
1   2020-01-02
2   2020-01-03
dtype: datetime64[ns]
```

In [40]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\sales_data_types.csv"
df = pd.read_csv(path)
df
```

Out[40]:

	Customer Number	Customer Name	2016	2017	Percent Growth	Jan Units	Month	Day	Year	Active
0	10002.0	Quest Industries	$125,000.00	$162500.00	30.00%	500	1	10	2015	Y
1	552278.0	Smith Plumbing	$920,000.00	$101,2000.00	10.00%	700	6	15	2014	Y
2	23477.0	ACME Industrial	$50,000.00	$62500.00	25.00%	125	3	29	2016	Y
3	24900.0	Brekke LTD	$350,000.00	$490000.00	4.00%	75	10	27	2015	Y
4	651029.0	Harbor Co	$15,000.00	$12750.00	-15.00%	Closed	2	2	2014	N

In [4]:

```
df['2016']+df['2017']
```

Out[4]:

```
0      $125,000.00$162500.00
1    $920,000.00$101,2000.00
2        $50,000.00$62500.00
3      $350,000.00$490000.00
4        $15,000.00$12750.00
dtype: object
```

In [6]:

```
df.dtypes
```

Out[6]:

```
Customer Number    float64
Customer Name       object
2016                object
2017                object
Percent Growth      object
Jan Units           object
Month                int64
Day                  int64
Year                 int64
Active              object
dtype: object
```

In [7]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5 entries, 0 to 4
Data columns (total 10 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   Customer Number  5 non-null      float64
 1   Customer Name    5 non-null      object 
 2   2016             5 non-null      object 
 3   2017             5 non-null      object 
 4   Percent Growth   5 non-null      object 
 5   Jan Units        5 non-null      object 
 6   Month            5 non-null      int64  
 7   Day              5 non-null      int64  
 8   Year             5 non-null      int64  
 9   Active           5 non-null      object 
dtypes: float64(1), int64(3), object(6)
memory usage: 528.0+ bytes
```

In [8]:

```
df['Customer Number'].astype('int')
```

Out[8]:

```
0     10002
1    552278
2     23477
3     24900
4    651029
Name: Customer Number, dtype: int32
```

In [29]:

```
df['Customer Number'] = df['Customer Number'].astype('int')
df.dtypes
```

Out[29]:

```
Customer Number      int32
Customer Name       object
2016               float64
2017               float64
Percent Growth      object
Jan Units           object
Month                int64
Day                  int64
Year                 int64
Active                bool
dtype: object
```

In [13]:

```
df['2016'].astype('float')
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-13-999869d577b0> in <module>
----> 1 df['2016'].astype('float')

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\generic.py in astype(self, dtype
, copy, errors)
   5875         else:
   5876             # else, only a single dtype is given
-> 5877             new_data = self._mgr.astype(dtype=dtype, copy=copy, errors=errors)
   5878             return self._constructor(new_data).__finalize__(self, method="astype
")
   5879

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\internals\managers.py in astype(
self, dtype, copy, errors)
```

```
    629             self, dtype, copy: bool = False, errors: str = "raise"
    630         ) -> "BlockManager":
--> 631             return self.apply("astype", dtype=dtype, copy=copy, errors=errors)
    632
    633         def convert(

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\internals\managers.py in apply(s
elf, f, align_keys, ignore_failures, **kwargs)
    425                         applied = b.apply(f, **kwargs)
    426                     else:
--> 427                         applied = getattr(b, f)(**kwargs)
    428                 except (TypeError, NotImplementedError):
    429                     if not ignore_failures:

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\internals\blocks.py in astype(se
lf, dtype, copy, errors)
    671             vals1d = values.ravel()
    672             try:
--> 673                 values = astype_nansafe(vals1d, dtype, copy=True)
    674             except (ValueError, TypeError):
    675                 # e.g. astype_nansafe can fail on object-dtype of strings

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\dtypes\cast.py in astype_nansafe
(arr, dtype, copy, skipna)
   1095     if copy or is_object_dtype(arr) or is_object_dtype(dtype):
   1096         # Explicit copy, or required since NumPy can't view from / to object.
-> 1097         return arr.astype(dtype, copy=True)
   1098
   1099     return arr.view(dtype)

ValueError: could not convert string to float: '$125,000.00'
```

In [14]:

```
df['Jan Units'].astype('int')
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-14-31333711e4a4> in <module>
----> 1 df['Jan Units'].astype('int')

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\generic.py in astype(self, dtype
, copy, errors)
   5875         else:
   5876             # else, only a single dtype is given
-> 5877             new_data = self._mgr.astype(dtype=dtype, copy=copy, errors=errors)
   5878             return self._constructor(new_data).__finalize__(self, method="astype
")
   5879

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\internals\managers.py in astype(
self, dtype, copy, errors)
    629             self, dtype, copy: bool = False, errors: str = "raise"
    630         ) -> "BlockManager":
--> 631             return self.apply("astype", dtype=dtype, copy=copy, errors=errors)
    632
    633         def convert(

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\internals\managers.py in apply(s
elf, f, align_keys, ignore_failures, **kwargs)
    425                         applied = b.apply(f, **kwargs)
    426                     else:
--> 427                         applied = getattr(b, f)(**kwargs)
    428                 except (TypeError, NotImplementedError):
    429                     if not ignore_failures:

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\internals\blocks.py in astype(se
lf, dtype, copy, errors)
    671             vals1d = values.ravel()
    672             try:
--> 673                 values = astype_nansafe(vals1d, dtype, copy=True)
    674             except (ValueError, TypeError):
```

```
    675                 # e.g. astype_nansafe can fail on object-dtype of strings

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\dtypes\cast.py in astype_nansafe
(arr, dtype, copy, skipna)
   1072         # work around NumPy brokenness, #1987
   1073         if np.issubdtype(dtype.type, np.integer):
-> 1074             return lib.astype_intsafe(arr.ravel(), dtype).reshape(arr.shape)
   1075
   1076         # if we have a datetime/timedelta array of objects

pandas\_libs\lib.pyx in pandas._libs.lib.astype_intsafe()

ValueError: invalid literal for int() with base 10: 'Closed'
```

In [15]:

```
df['Active'].astype('bool')
```

Out[15]:

```
0    True
1    True
2    True
3    True
4    True
Name: Active, dtype: bool
```

In [16]:

```
df
```

Out[16]:

	Customer Number	Customer Name	2016	2017	Percent Growth	Jan Units	Month	Day	Year	Active
0	10002	Quest Industries	$125,000.00	$162500.00	30.00%	500	1	10	2015	Y
1	552278	Smith Plumbing	$920,000.00	$101,2000.00	10.00%	700	6	15	2014	Y
2	23477	ACME Industrial	$50,000.00	$62500.00	25.00%	125	3	29	2016	Y
3	24900	Brekke LTD	$350,000.00	$490000.00	4.00%	75	10	27	2015	Y
4	651029	Harbor Co	$15,000.00	$12750.00	-15.00%	Closed	2	2	2014	N

In [45]:

```
def convert_currency(val):
    new_val = val.replace(',','').replace('$','')
    return float(new_val)
```

In [18]:

```
df['2016'].apply(convert_currency)
```

Out[18]:

```
0    125000.0
1    920000.0
2     50000.0
3    350000.0
4     15000.0
Name: 2016, dtype: float64
```

In [19]:

```
df['2016'].apply(lambda x: x.replace(',','').replace('$','')).astype('float')
```

Out[19]:

```
0    125000.0
1    920000.0
2     50000.0
3    350000.0
```

```
4     15000.0
Name: 2016, dtype: float64
```

In [24]:

```
df['2016'] = df['2016'].apply(convert_currency)
df['2017'] = df['2017'].apply(convert_currency)

df.dtypes
```

Out[24]:

```
Customer Number     float64
Customer Name        object
2016                float64
2017                float64
Percent Growth       object
Jan Units            object
Month                 int64
Day                   int64
Year                  int64
Active               object
dtype: object
```

In [25]:

```
df['Percent Growth'].apply(lambda x: x.replace('%','')).astype('float')/100
```

Out[25]:

```
0    0.30
1    0.10
2    0.25
3    0.04
4   -0.15
Name: Percent Growth, dtype: float64
```

In [46]:

```
def convert_percent(val):
    new_val = val.replace('%','')
    return float(new_val)/100

df['Percent Growth'].apply(convert_percent)
```

Out[46]:

```
0    0.30
1    0.10
2    0.25
3    0.04
4   -0.15
Name: Percent Growth, dtype: float64
```

In [27]:

```
df['Active'] = np.where(df['Active'] == 'Y',True,False)
```

In [28]:

```
df
```

Out[28]:

	Customer Number	Customer Name	2016	2017	Percent Growth	Jan Units	Month	Day	Year	Active
0	10002.0	Quest Industries	125000.0	162500.0	30.00%	500	1	10	2015	True
1	552278.0	Smith Plumbing	920000.0	1012000.0	10.00%	700	6	15	2014	True
2	23477.0	ACME Industrial	50000.0	62500.0	25.00%	125	3	29	2016	True
3	24900.0	Brekke LTD	350000.0	490000.0	4.00%	75	10	27	2015	True

4	Customer Number	Customer Name	2016	2017	Percent Growth	Jan Units	Month	Day	Year	Active

In [30]:

```
df.dtypes
```

Out[30]:

```
Customer Number      int32
Customer Name       object
2016               float64
2017               float64
Percent Growth      object
Jan Units           object
Month                int64
Day                  int64
Year                 int64
Active                bool
dtype: object
```

In [31]:

```
pd.to_numeric(df['Jan Units'], errors='coerce')
```

Out[31]:

```
0    500.0
1    700.0
2    125.0
3     75.0
4      NaN
Name: Jan Units, dtype: float64
```

In [32]:

```
pd.to_numeric(df['Jan Units'], errors='coerce').fillna(0)
```

Out[32]:

```
0    500.0
1    700.0
2    125.0
3     75.0
4      0.0
Name: Jan Units, dtype: float64
```

In [33]:

```
pd.to_datetime(df[['Month','Day','Year']])
```

Out[33]:

```
0   2015-01-10
1   2014-06-15
2   2016-03-29
3   2015-10-27
4   2014-02-02
dtype: datetime64[ns]
```

In [34]:

```
df['Jan Units'] = pd.to_numeric(df['Jan Units'], errors='coerce')
df['Start Date'] = pd.to_datetime(df[['Month','Day','Year']])

df.dtypes
```

Out[34]:

```
Customer Number             int32
Customer Name              object
2016                      float64
2017                      float64
Percent Growth             object
```

```
Jan Units                 float64
Month                       int64
Day                         int64
Year                        int64
Active                       bool
Start Date         datetime64[ns]
dtype: object
```

In [64]:

```
df_2 = pd.read_csv("C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\sales_data_types.csv",
                   dtype={'Customer Number' : 'int'},
                   converters={'2016' : convert_currency,
                               '2017' : convert_currency,
                               'Percent Growth' : convert_percent,
                               'Jan Units' : lambda x: pd.to_numeric(df['Jan Units'], errors='coerce').fillna(0),
                               'Active' : lambda x: np.where(df['Active'] == 'Y',True,False)
                              }
                  )

df_2.dtypes
```

Out[64]:

```
Customer Number      int32
Customer Name       object
2016               float64
2017               float64
Percent Growth     float64
Jan Units           object
Month                int64
Day                  int64
Year                 int64
Active              object
dtype: object
```

In [5]:

```
dictionary = {'OUTLOOK' : ['Rainy', 'Rainy',
                           'Overcast', 'Sunny',
                           'Sunny', 'Sunny',
                           'Overcast', 'Rainy',
                           'Rainy', 'Sunny',
                           'Rainy', 'Overcast',
                           'Overcast', 'Sunny'],
              'TEMPERATURE' : ['Hot', 'Hot',
                               'Hot', 'Mild',
                               'Cool', 'Cool',
                               'Cool', 'Mild',
                               'Cool', 'Mild',
                               'Mild', 'Mild',
                               'Hot', 'Mild'],
              'HUMIDITY': ['High', 'High', 'High',
                           'High', 'Normal', 'Normal',
                           'Normal', 'High', 'Normal',
                           'Normal', 'Normal', 'High',
                           'Normal', 'High'],
              'WINDY': ['No', 'Yes', 'No', 'No',
                        'No','Yes', 'Yes', 'No',
                        'No', 'No', 'Yes', 'Yes',
                        'No','Yes']
             }

df = pd.DataFrame(dictionary)

df
```

Out[5]:

	OUTLOOK	TEMPERATURE	HUMIDITY	WINDY
0	Rainy	Hot	High	No
1	Rainy	Hot	High	Yes
2	Overcast	Hot	High	No
3	Sunny	Mild	High	No
4	Sunny	Cool	Normal	No
5	Sunny	Cool	Normal	Yes
6	Overcast	Cool	Normal	Yes
7	Rainy	Mild	High	No
8	Rainy	Cool	Normal	No
9	Sunny	Mild	Normal	No
10	Rainy	Mild	Normal	Yes
11	Overcast	Mild	High	Yes
12	Overcast	Hot	Normal	No
13	Sunny	Mild	High	Yes

In [66]:

```
df2 = df.copy()
df2 = pd.get_dummies(df2, columns = ['WINDY', 'OUTLOOK'])
df2
```

Out[66]:

	TEMPERATURE	HUMIDITY	WINDY_No	WINDY_Yes	OUTLOOK_Overcast	OUTLOOK_Rainy	OUTLOOK_Sunny
0	Hot	High	1	0	0	1	0
1	Hot	High	0	1	0	1	0
2	Hot	High	1	0	1	0	0
3	Mild	High	1	0	0	0	1
4	Cool	Normal	1	0	0	0	1
5	Cool	Normal	0	1	0	0	1
6	Cool	Normal	0	1	1	0	0
7	Mild	High	1	0	0	1	0
8	Cool	Normal	1	0	0	1	0
9	Mild	Normal	1	0	0	0	1
10	Mild	Normal	0	1	0	1	0
11	Mild	High	0	1	1	0	0
12	Hot	Normal	1	0	1	0	0
13	Mild	High	0	1	0	0	1

In [68]:

```
from sklearn.preprocessing import LabelBinarizer

df3 = df.copy()
label_binarizer = LabelBinarizer()
label_binarizer_output = label_binarizer.fit_transform(df3['TEMPERATURE'])
result_df = pd.DataFrame (label_binarizer_output, columns = label_binarizer.classes_)

display(result_df)
```

	Cool	Hot	Mild
0	0	1	0

	Cool	Hot	Mild
1	0	1	0
2	0	1	0
3	0	0	1
4	1	0	0
5	1	0	0
6	1	0	0
7	0	0	1
8	1	0	0
9	0	0	1
10	0	0	1
11	0	0	1
12	0	1	0
13	0	0	1

In [1]:

```
!pip install category_encoders
```

```
Collecting category_encoders
  Downloading category_encoders-2.3.0-py2.py3-none-any.whl (82 kB)
Requirement already satisfied: scikit-learn>=0.20.0 in d:\program files\anaconda3\lib\sit
e-packages (from category_encoders) (0.24.1)
Requirement already satisfied: patsy>=0.5.1 in d:\program files\anaconda3\lib\site-packag
es (from category_encoders) (0.5.1)
Requirement already satisfied: statsmodels>=0.9.0 in d:\program files\anaconda3\lib\site-
packages (from category_encoders) (0.12.2)
Requirement already satisfied: scipy>=1.0.0 in d:\program files\anaconda3\lib\site-packag
es (from category_encoders) (1.6.2)
Requirement already satisfied: pandas>=0.21.1 in d:\program files\anaconda3\lib\site-pack
ages (from category_encoders) (1.2.4)
Requirement already satisfied: numpy>=1.14.0 in d:\program files\anaconda3\lib\site-packa
ges (from category_encoders) (1.20.1)
Requirement already satisfied: pytz>=2017.3 in d:\program files\anaconda3\lib\site-packag
es (from pandas>=0.21.1->category_encoders) (2021.1)
Requirement already satisfied: python-dateutil>=2.7.3 in d:\program files\anaconda3\lib\s
ite-packages (from pandas>=0.21.1->category_encoders) (2.8.1)
Requirement already satisfied: six in d:\program files\anaconda3\lib\site-packages (from
patsy>=0.5.1->category_encoders) (1.15.0)
Requirement already satisfied: threadpoolctl>=2.0.0 in d:\program files\anaconda3\lib\sit
e-packages (from scikit-learn>=0.20.0->category_encoders) (2.1.0)
Requirement already satisfied: joblib>=0.11 in d:\program files\anaconda3\lib\site-packag
es (from scikit-learn>=0.20.0->category_encoders) (1.0.1)
Installing collected packages: category-encoders
Successfully installed category-encoders-2.3.0
```

In [6]:

```
import category_encoders as cat_encoder

df4 = df.copy()

encoder = cat_encoder.BinaryEncoder (cols = df4.columns)
df_category_encoder = encoder.fit_transform(df4)

display(df_category_encoder)
```

	OUTLOOK_0	OUTLOOK_1	TEMPERATURE_0	TEMPERATURE_1	HUMIDITY_0	HUMIDITY_1	WINDY_0	WINDY_1
0	0	1	0	1	0	1	0	1
1	0	1	0	1	0	1	1	0
2	1	0	0	1	0	1	0	1

	OUTLOOK_0	OUTLOOK_1	TEMPERATURE_0	TEMPERATURE_1	HUMIDITY_0	HUMIDITY_1	WINDY_0	WINDY_1
3	1	0	1	0	0	1	0	1
4	1	0	1	0	0	1	1	0
5	1	0	1	0	0	1	1	0
6	1	0	1	0	0	1	1	0
7	0	1	1	0	0	1	0	1
8	0	1	1	0	0	1	0	1
9	1	0	1	0	0	1	0	1
10	0	1	1	0	0	1	0	1
11	1	0	1	0	0	1	1	0
12	1	0	0	1	0	1	0	1
13	1	0	1	0	0	1	1	0

Date

Group - A

Practical No. 2

☆ Title :- Data Wrangling II

☆ Date of Completion :-

☆ Objective :- To perform operations using Python

☆ Problem Statement :- Create an "Academic performance" dataset of students and perform the following operations using Python.

1) Scan all variables for missing values and inconsistencies. If there are missing values and/or inconsistencies, use any of the suitable techniques to deal with them.
2) Scan all numeric variables for outliers. If there are outliers, use any of suitable techniques to deal with them.
3) Apply data transformations on at least one of the variables. The purpose of this transformation should be one of the following reasons : to change the scale for better understanding of variable, to convert a non linear relation into a linear one, or to decrease the skewness & convert the distribution into a normal distribution

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Date

★ Software and Hardware Requirements :- Python, dataset.

★ Theory :-

A) Data cleaning :- Process of detecting & removing the errors & inconsistencies present in the data and improve its quality.

1) Inconsistent : Data contains difference in codes or names etc.

2) Incomplete (Missing Data): How to handle such type of data ⇒ i) Ignore the tuple.
ii) Fill missing values manually.
iii) Fill it with mean or median of attribute

B) Outliers :- It is an observation in a given dataset that lies far from rest of observations. That means an outlier is vastly larger or smaller than remaining values ~~and~~ in the set.

Detecting outliers : Inter Quartile Range (IQR)

1) Sort data in ascending order.
2) Calculate 1st and 3rd quartiles (Q_1 & Q_3).
3) Compute $IQR = Q_3 - Q_1$
4) Compute lower bound = $(Q_1 - 1.5 * IQR)$,
upper bound = $(Q_3 + 1.5 * IQR)$
5) Loop through the values of dataset and check for those who below the lower bound & above the upper bound and mark them as outliers.

c) Skewness :- It is the measure of assymetry of an ideally symmetric probability distribution and is given by their standardized moment.

Two Types of skewness : 1) Positive skewness
2) Negative skewness.

Positive Skewness	Negative Skewness
a) Logarithmic	a) Square
b) Sqrt	b) Cube
c) Cubrt	
d) Reciprocal	

* Conclusion :- Performed above mentioned operations using Python.

Missing Values

In [1]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
import numpy as np
```

In [3]:

```
# dictionary of lists
dict = {'First Score':[100, 90, np.nan, 95],
        'Second Score': [30, 45, 56, np.nan],
        'Third Score':[np.nan, 40, 80, 98]}

# creating a dataframe from list
df = pd.DataFrame(dict)

print(df,"\n")
# using isnull() function
df.isnull()
```

```
   First Score  Second Score  Third Score
0        100.0          30.0          NaN
1         90.0          45.0         40.0
2          NaN          56.0         80.0
3         95.0           NaN         98.0
```

Out[3]:

	First Score	Second Score	Third Score
0	False	False	True
1	False	False	False
2	True	False	False
3	False	True	False

In [5]:

```
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\employees.csv"
df = pd.read_csv(path)
print(df)
```

```
    First Name  Gender  Start Date Last Login Time  Salary  Bonus %  \
0      Douglas    Male    8/6/1993        12:42 PM   97308    6.945
1       Thomas    Male   3/31/1996         6:53 AM   61933    4.170
2        Maria  Female   4/23/1993        11:17 AM  130590   11.858
3        Jerry    Male    3/4/2005         1:00 PM  138705    9.340
4        Larry    Male   1/24/1998         4:47 PM  101004    1.389
..         ...     ...         ...             ...     ...      ...
995      Henry     NaN  11/23/2014         6:09 AM  132483   16.655
996    Phillip    Male   1/31/1984         6:30 AM   42392   19.675
997    Russell    Male   5/20/2013        12:39 PM   96914    1.421
998      Larry    Male   4/20/2013         4:45 PM   60500   11.985
999     Albert    Male   5/15/2012         6:24 PM  129949   10.169

    Senior Management                 Team
0                True            Marketing
1                True                  NaN
2               False              Finance
3                True              Finance
4                True       Client Services
```

```
..                ...                   ...
995              False          Distribution
996              False               Finance
997              False               Product
998              False  Business Development
999               True                 Sales

[1000 rows x 8 columns]
```

In [6]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 8 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   First Name        933 non-null    object 
 1   Gender            855 non-null    object 
 2   Start Date        1000 non-null   object 
 3   Last Login Time   1000 non-null   object 
 4   Salary            1000 non-null   int64  
 5   Bonus %           1000 non-null   float64
 6   Senior Management  933 non-null    object 
 7   Team              957 non-null    object 
dtypes: float64(1), int64(1), object(6)
memory usage: 62.6+ KB
```

In [7]:

```
df.describe()
```

Out[7]:

	Salary	Bonus %
count	1000.000000	1000.000000
mean	90662.181000	10.207555
std	32923.693342	5.528481
min	35013.000000	1.015000
25%	62613.000000	5.401750
50%	90428.000000	9.838500
75%	118740.250000	14.838000
max	149908.000000	19.944000

In [8]:

```
# creating bool series True for NaN values
bool_series = pd.isnull(df["Gender"])

# filtering data
# displaying data only with Gender = NaN
df[bool_series]
```

Out[8]:

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
20	Lois	NaN	4/22/1995	7:18 PM	64714	4.934	True	Legal
22	Joshua	NaN	3/8/2012	1:58 AM	90816	18.816	True	Client Services
27	Scott	NaN	7/11/1991	6:58 PM	122367	5.218	False	Legal
31	Joyce	NaN	2/20/2005	2:40 PM	88657	12.752	False	Product
41	Christine	NaN	6/28/2015	1:08 AM	66582	11.308	True	Business Development
...	...	...	...	...	...	...	...	...

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
961	Antonio	NaN	6/18/1989	9:37 PM	103050	3.050	False	Legal
972	Victor	NaN	7/28/2006	2:49 PM	76381	11.159	True	Sales
985	Stephen	NaN	7/10/1983	8:10 PM	85668	1.909	False	Legal
989	Justin	NaN	2/10/1991	4:58 PM	38344	3.794	False	Legal
995	Henry	NaN	11/23/2014	6:09 AM	132483	16.655	False	Distribution

145 rows × 8 columns

In [11]:

```
# dictionary of lists
dict = {'First Score':[100, 90, np.nan, 95],
        'Second Score': [30, 45, 56, np.nan],
        'Third Score':[np.nan, 40, 80, 98]}

# creating a dataframe using dictionary
df = pd.DataFrame(dict)

# using notnull() function
df.notnull()
```

Out[11]:

	First Score	Second Score	Third Score
0	True	True	False
1	True	True	True
2	False	True	True
3	True	False	True

In [12]:

```
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\employees.csv"
df = pd.read_csv(path)
# creating bool series True for NaN values
bool_series = pd.notnull(df["Gender"])

# filtering data
# displayind data only with Gender = Not NaN
df[bool_series]
```

Out[12]:

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
0	Douglas	Male	8/6/1993	12:42 PM	97308	6.945	True	Marketing
1	Thomas	Male	3/31/1996	6:53 AM	61933	4.170	True	NaN
2	Maria	Female	4/23/1993	11:17 AM	130590	11.858	False	Finance
3	Jerry	Male	3/4/2005	1:00 PM	138705	9.340	True	Finance
4	Larry	Male	1/24/1998	4:47 PM	101004	1.389	True	Client Services
...	...	...	...	...	...	...	...	...
994	George	Male	6/21/2013	5:47 PM	98874	4.479	True	Marketing
996	Phillip	Male	1/31/1984	6:30 AM	42392	19.675	False	Finance
997	Russell	Male	5/20/2013	12:39 PM	96914	1.421	False	Product
998	Larry	Male	4/20/2013	4:45 PM	60500	11.985	False	Business Development
999	Albert	Male	5/15/2012	6:24 PM	129949	10.169	True	Sales

855 rows × 8 columns

In [13]:

```
# dictionary of lists
dict = {'First Score':[100, 90, np.nan, 95],
        'Second Score': [30, 45, 56, np.nan],
        'Third Score':[np.nan, 40, 80, 98]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)
print(df)
# filling missing value using fillna()
df.fillna(0)
```

```
   First Score  Second Score  Third Score
0        100.0          30.0          NaN
1         90.0          45.0         40.0
2          NaN          56.0         80.0
3         95.0           NaN         98.0
```

Out[13]:

	First Score	Second Score	Third Score
0	**100.0**	**30.0**	**0.0**
1	**90.0**	**45.0**	**40.0**
2	**0.0**	**56.0**	**80.0**
3	**95.0**	**0.0**	**98.0**

In [1]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
import numpy as np

# dictionary of lists
dict = {'First Score':[100, 90, np.nan, 95],
  'Second Score': [30, 45, 56, np.nan],
  'Third Score':[np.nan, 40, 80, 98]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)
print(df)
# filling a missing value with
# previous ones
df.fillna(method ='pad')
```

```
   First Score  Second Score  Third Score
0        100.0          30.0          NaN
1         90.0          45.0         40.0
2          NaN          56.0         80.0
3         95.0           NaN         98.0
```

Out[1]:

	First Score	Second Score	Third Score
0	**100.0**	**30.0**	**NaN**
1	**90.0**	**45.0**	**40.0**
2	**90.0**	**56.0**	**80.0**
3	**95.0**	**56.0**	**98.0**

In [2]:

```
# importing pandas as pd
import pandas as pd
```

```
# importing numpy as np
import numpy as np

# dictionary of lists
dict = {'First Score':[100, 90, np.nan, 95],
  'Second Score': [30, 45, 56, np.nan],
  'Third Score':[np.nan, 40, 80, 98]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)
print(df)
# filling null value using fillna() function
df.fillna(method ='bfill')
```

```
   First Score  Second Score  Third Score
0        100.0          30.0          NaN
1         90.0          45.0         40.0
2          NaN          56.0         80.0
3         95.0           NaN         98.0
```

Out[2]:

	First Score	Second Score	Third Score
0	100.0	30.0	40.0
1	90.0	45.0	40.0
2	95.0	56.0	80.0
3	95.0	NaN	98.0

In [3]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\employees.csv"
df = pd.read_csv(path)
# Printing the first 10 to 24 rows of
# the data frame for visualization
df[10:25]
```

Out[3]:

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
10	Louise	Female	8/12/1980	9:01 AM	63241	15.132	True	NaN
11	Julie	Female	10/26/1997	3:19 PM	102508	12.637	True	Legal
12	Brandon	Male	12/1/1980	1:08 AM	112807	17.492	True	Human Resources
13	Gary	Male	1/27/2008	11:40 PM	109831	5.831	False	Sales
14	Kimberly	Female	1/14/1999	7:13 AM	41426	14.543	True	Finance
15	Lillian	Female	6/5/2016	6:09 AM	59414	1.256	False	Product
16	Jeremy	Male	9/21/2010	5:56 AM	90370	7.369	False	Human Resources
17	Shawn	Male	12/7/1986	7:45 PM	111737	6.414	False	Product
18	Diana	Female	10/23/1981	10:27 AM	132940	19.082	False	Client Services
19	Donna	Female	7/22/2010	3:48 AM	81014	1.894	False	Product
20	Lois	NaN	4/22/1995	7:18 PM	64714	4.934	True	Legal
21	Matthew	Male	9/5/1995	2:12 AM	100612	13.645	False	Marketing
22	Joshua	NaN	3/8/2012	1:58 AM	90816	18.816	True	Client Services
23	NaN	Male	6/14/2012	4:19 PM	125792	5.042	NaN	NaN
24	John	Male	7/1/1992	10:08 PM	97950	13.873	False	Client Services

In [5]:

```
df["Gender"].fillna("No Gender", inplace = True)
```

```
df
```

Out[5]:

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
0	Douglas	Male	8/6/1993	12:42 PM	97308	6.945	True	Marketing
1	Thomas	Male	3/31/1996	6:53 AM	61933	4.170	True	NaN
2	Maria	Female	4/23/1993	11:17 AM	130590	11.858	False	Finance
3	Jerry	Male	3/4/2005	1:00 PM	138705	9.340	True	Finance
4	Larry	Male	1/24/1998	4:47 PM	101004	1.389	True	Client Services
...	...	...	...	...	...	...	...	...
995	Henry	No Gender	11/23/2014	6:09 AM	132483	16.655	False	Distribution
996	Phillip	Male	1/31/1984	6:30 AM	42392	19.675	False	Finance
997	Russell	Male	5/20/2013	12:39 PM	96914	1.421	False	Product
998	Larry	Male	4/20/2013	4:45 PM	60500	11.985	False	Business Development
999	Albert	Male	5/15/2012	6:24 PM	129949	10.169	True	Sales

1000 rows × 8 columns

In [6]:

```
df[10:25]
```

Out[6]:

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
10	Louise	Female	8/12/1980	9:01 AM	63241	15.132	True	NaN
11	Julie	Female	10/26/1997	3:19 PM	102508	12.637	True	Legal
12	Brandon	Male	12/1/1980	1:08 AM	112807	17.492	True	Human Resources
13	Gary	Male	1/27/2008	11:40 PM	109831	5.831	False	Sales
14	Kimberly	Female	1/14/1999	7:13 AM	41426	14.543	True	Finance
15	Lillian	Female	6/5/2016	6:09 AM	59414	1.256	False	Product
16	Jeremy	Male	9/21/2010	5:56 AM	90370	7.369	False	Human Resources
17	Shawn	Male	12/7/1986	7:45 PM	111737	6.414	False	Product
18	Diana	Female	10/23/1981	10:27 AM	132940	19.082	False	Client Services
19	Donna	Female	7/22/2010	3:48 AM	81014	1.894	False	Product
20	Lois	No Gender	4/22/1995	7:18 PM	64714	4.934	True	Legal
21	Matthew	Male	9/5/1995	2:12 AM	100612	13.645	False	Marketing
22	Joshua	No Gender	3/8/2012	1:58 AM	90816	18.816	True	Client Services
23	NaN	Male	6/14/2012	4:19 PM	125792	5.042	NaN	NaN
24	John	Male	7/1/1992	10:08 PM	97950	13.873	False	Client Services

In [7]:

```
df.replace(to_replace = np.nan, value = -99)
```

Out[7]:

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
0	Douglas	Male	8/6/1993	12:42 PM	97308	6.945	True	Marketing

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
1	Thomas	Male	3/31/1996	6:53 AM	61933	4.170	True	-99
2	Maria	Female	4/23/1993	11:17 AM	130590	11.858	False	Finance
3	Jerry	Male	3/4/2005	1:00 PM	138705	9.340	True	Finance
4	Larry	Male	1/24/1998	4:47 PM	101004	1.389	True	Client Services
...	...	...	...	...	...	...	...	...
995	Henry	No Gender	11/23/2014	6:09 AM	132483	16.655	False	Distribution
996	Phillip	Male	1/31/1984	6:30 AM	42392	19.675	False	Finance
997	Russell	Male	5/20/2013	12:39 PM	96914	1.421	False	Product
998	Larry	Male	4/20/2013	4:45 PM	60500	11.985	False	Business Development
999	Albert	Male	5/15/2012	6:24 PM	129949	10.169	True	Sales

1000 rows × 8 columns

In [8]:

```
import pandas as pd

# Creating the dataframe
df = pd.DataFrame({"A":[12, 4, 5, None, 1],
    "B":[None, 2, 54, 3, None],
    "C":[20, 16, None, 3, 8],
    "D":[14, 3, None, None, 6]})

# Print the dataframe
df
```

Out[8]:

	A	B	C	D
0	12.0	NaN	20.0	14.0
1	4.0	2.0	16.0	3.0
2	5.0	54.0	NaN	NaN
3	NaN	3.0	3.0	NaN
4	1.0	NaN	8.0	6.0

In [9]:

```
df.interpolate(method ='linear', limit_direction ='forward')
```

Out[9]:

	A	B	C	D
0	12.0	NaN	20.0	14.0
1	4.0	2.0	16.0	3.0
2	5.0	54.0	9.5	4.0
3	3.0	3.0	3.0	5.0
4	1.0	3.0	8.0	6.0

In [10]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
import numpy as np
```

```
# dictionary of lists
dict = {'First Score':[100, 90, np.nan, 95],
   'Second Score': [30, np.nan, 45, 56],
   'Third Score':[52, 40, 80, 98],
   'Fourth Score':[np.nan, np.nan, np.nan, 65]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)

df
```

Out[10]:

	First Score	Second Score	Third Score	Fourth Score
0	**100.0**	**30.0**	**52**	**NaN**
1	**90.0**	**NaN**	**40**	**NaN**
2	**NaN**	**45.0**	**80**	**NaN**
3	**95.0**	**56.0**	**98**	**65.0**

In [11]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
import numpy as np

# dictionary of lists
dict = {'First Score':[100, 90, np.nan, 95],
   'Second Score': [30, np.nan, 45, 56],
   'Third Score':[52, 40, 80, 98],
   'Fourth Score':[np.nan, np.nan, np.nan, 65]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)

# using dropna() function
df.dropna()
```

Out[11]:

	First Score	Second Score	Third Score	Fourth Score
3	**95.0**	**56.0**	**98**	**65.0**

In [12]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
import numpy as np

# dictionary of lists
dict = {'First Score':[100, np.nan, np.nan, 95],
   'Second Score': [30, np.nan, 45, 56],
   'Third Score':[52, np.nan, 80, 98],
   'Fourth Score':[np.nan, np.nan, np.nan, 65]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)

df
```

Out[12]:

	First Score	Second Score	Third Score	Fourth Score

	First Score	Second Score	Third Score	Fourth Score
0	100.0	30.0	52.0	NaN
1	NaN	NaN	NaN	NaN
2	NaN	45.0	80.0	NaN
3	95.0	56.0	98.0	65.0

In [14]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
import numpy as np

# dictionary of lists
dict = {'First Score':[100, np.nan, np.nan, 95],
   'Second Score': [30, np.nan, 45, 56],
   'Third Score':[52, np.nan, 80, 98],
   'Fourth Score':[np.nan, np.nan, np.nan, 65]}

df = pd.DataFrame(dict)

# using dropna() function
df.dropna(how = 'all')
```

Out[14]:

	First Score	Second Score	Third Score	Fourth Score
0	100.0	30.0	52.0	NaN
2	NaN	45.0	80.0	NaN
3	95.0	56.0	98.0	65.0

In [15]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
import numpy as np

# dictionary of lists
dict = {'First Score':[100, np.nan, np.nan, 95],
   'Second Score': [30, np.nan, 45, 56],
   'Third Score':[52, np.nan, 80, 98],
   'Fourth Score':[60, 67, 68, 65]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)

df
```

Out[15]:

	First Score	Second Score	Third Score	Fourth Score
0	100.0	30.0	52.0	60
1	NaN	NaN	NaN	67
2	NaN	45.0	80.0	68
3	95.0	56.0	98.0	65

In [16]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
```

```
import numpy as np

# dictionary of lists
dict = {'First Score':[100, np.nan, np.nan, 95],
   'Second Score': [30, np.nan, 45, 56],
   'Third Score':[52, np.nan, 80, 98],
   'Fourth Score':[60, 67, 68, 65]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)

# using dropna() function
df.dropna(axis = 1)
```

Out[16]:

	Fourth Score
0	60
1	67
2	68
3	65

In [17]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\employees.csv"
data = pd.read_csv(path)

# making new data frame with dropped NA values
new_data = data.dropna(axis = 0, how ='any')

new_data
```

Out[17]:

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
0	Douglas	Male	8/6/1993	12:42 PM	97308	6.945	True	Marketing
2	Maria	Female	4/23/1993	11:17 AM	130590	11.858	False	Finance
3	Jerry	Male	3/4/2005	1:00 PM	138705	9.340	True	Finance
4	Larry	Male	1/24/1998	4:47 PM	101004	1.389	True	Client Services
5	Dennis	Male	4/18/1987	1:35 AM	115163	10.125	False	Legal
...	...	...	...	...	...	...	...	...
994	George	Male	6/21/2013	5:47 PM	98874	4.479	True	Marketing
996	Phillip	Male	1/31/1984	6:30 AM	42392	19.675	False	Finance
997	Russell	Male	5/20/2013	12:39 PM	96914	1.421	False	Product
998	Larry	Male	4/20/2013	4:45 PM	60500	11.985	False	Business Development
999	Albert	Male	5/15/2012	6:24 PM	129949	10.169	True	Sales

764 rows × 8 columns

In [18]:

```
print("Old data frame length:", len(data))
print("New data frame length:", len(new_data))
print("Number of rows with at least 1 NA value: ", (len(data)-len(new_data)))
```

```
Old data frame length: 1000
New data frame length: 764
Number of rows with at least 1 NA value:  236
```

In [19]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\AcademicPerformance.csv"
df = pd.read_csv(path)
print(df)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0   NaN  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
96      97  152.0       1  56.0  Yes
97      98    1.8       1  28.0   No
98      99   35.0       0  44.0  NaN
99     100    4.0       0  24.0   No

[100 rows x 5 columns]
```

In [20]:

```
df.shape
```

Out[20]:

```
(100, 5)
```

In [21]:

```
print(df.isnull().sum())
```

```
Rollno     0
Marks      0
Gender     0
Age       16
PhD       13
dtype: int64
```

In [22]:

```
df.dropna(inplace=True)
print(df.isnull().sum())
```

```
Rollno    0
Marks     0
Gender    0
Age       0
PhD       0
dtype: int64
```

In [24]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\AcademicPerformance.csv"
df = pd.read_csv(path)
print(df)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0   NaN  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
96      97  152.0       1  56.0  Yes
97      98    1.8       1  28.0   No
98      99   35.0       0  44.0  NaN
99     100    4.0       0  24.0   No

[100 rows x 5 columns]
```

In [25]:

```
df["Age"] = df["Age"].replace(np.NaN,df["Age"].mean())
print(df["Age"][:10])
```

```
0    47.000000
1    65.000000
2    56.000000
3    23.000000
4    47.821429
5    27.000000
6    53.000000
7    47.821429
8    44.000000
9    63.000000
Name: Age, dtype: float64
```

In [26]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\AcademicPerformance.csv"
df = pd.read_csv(path)
print(df)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0   NaN  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
96      97  152.0       1  56.0  Yes
97      98    1.8       1  28.0   No
98      99   35.0       0  44.0  NaN
99     100    4.0       0  24.0   No

[100 rows x 5 columns]
```

In [28]:

```
df["Age"] = df["Age"].replace(np.NaN,df["Age"].median())
print(df["Age"][:10])
```

```
0    47.0
1    65.0
2    56.0
3    23.0
4    50.0
5    27.0
6    53.0
7    50.0
8    44.0
9    63.0
Name: Age, dtype: float64
```

In [29]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\AcademicPerformance.csv"
df = pd.read_csv(path)
print(df)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0   NaN  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
```

```
96      97  152.0        1  56.0  Yes
97      98    1.8        1  28.0   No
98      99   35.0        0  44.0  NaN
99     100    4.0        0  24.0   No

[100 rows x 5 columns]
```

In [30]:

```
import statistics
df["Age"] = df["Age"].replace(np.NaN, statistics.mode(df["Age"]))
print(df["Age"][:10])
```

```
0    47.0
1    65.0
2    56.0
3    23.0
4    65.0
5    27.0
6    53.0
7    65.0
8    44.0
9    63.0
Name: Age, dtype: float64
```

In [31]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\AcademicPerformance.csv"
df = pd.read_csv(path)
print(df)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0   NaN  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
96      97  152.0       1  56.0  Yes
97      98    1.8       1  28.0   No
98      99   35.0       0  44.0  NaN
99     100    4.0       0  24.0   No

[100 rows x 5 columns]
```

In [32]:

```
df.isnull().sum()
```

Out[32]:

```
Rollno     0
Marks      0
Gender     0
Age       16
PhD       13
dtype: int64
```

In [33]:

```
df["PhD"] = df["PhD"].fillna('U')
df.isnull().sum()
```

Out[33]:

```
Rollno     0
Marks      0
Gender     0
Age       16
PhD        0
dtype: int64
```

dtype: int64

In [34]:

```
print(df)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0   NaN  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
96      97  152.0       1  56.0  Yes
97      98    1.8       1  28.0   No
98      99   35.0       0  44.0    U
99     100    4.0       0  24.0   No

[100 rows x 5 columns]
```

In [35]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\AcademicPerformance.csv"
dataset = pd.read_csv(path)

#LOCF - last observation carried forward

dataset["Age"] = dataset["Age"].fillna(method ='ffill')

dataset.isnull().sum()

print(dataset)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0  23.0  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
96      97  152.0       1  56.0  Yes
97      98    1.8       1  28.0   No
98      99   35.0       0  44.0  NaN
99     100    4.0       0  24.0   No

[100 rows x 5 columns]
```

In [36]:

```
import pandas as pd
import numpy as np

path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\AcademicPerformance.csv"
dataset = pd.read_csv(path)

#interpolation - linear

dataset["Age"] = dataset["Age"].interpolate(method='linear', limit_direction='forward',
axis=0)

print(dataset)

dataset.isnull().sum()
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0  25.0  Yes
```

```
4        5    80.0        0  25.0   Yes
..     ...     ...      ...   ...   ...
95      96    18.6        1  26.0    No
96      97   152.0        1  56.0   Yes
97      98     1.8        1  28.0    No
98      99    35.0        0  44.0   NaN
99     100     4.0        0  24.0    No

[100 rows x 5 columns]
```

Out[36]:

```
Rollno     0
Marks      0
Gender     0
Age        0
PhD       13
dtype: int64
```

In [37]:

```
#for knn imputation - we need to remove normalize the data and categorical data we need t
o convert
cat_variables = dataset[['PhD']]
cat_dummies = pd.get_dummies(cat_variables, drop_first=True)
cat_dummies.head()
dataset = dataset.drop(['PhD'], axis=1)
dataset = pd.concat([dataset, cat_dummies], axis=1)
dataset.head()

#removing unwanted features
dataset = dataset.drop(['Gender'], axis=1)
dataset.head()

#scaling mandatory before knn
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()
dataset = pd.DataFrame(scaler.fit_transform(dataset), columns = dataset.columns)
dataset.head()

#knn imputer
from sklearn.impute import KNNImputer
imputer = KNNImputer(n_neighbors=3)
dataset = pd.DataFrame(imputer.fit_transform(dataset),columns = dataset.columns)

#checking for missing
dataset.isnull().sum()
```

Out[37]:

```
Rollno     0
Marks      0
Age        0
PhD_Yes    0
dtype: int64
```

In [2]:

```
import pandas as pd
import numpy as np

path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\AcademicPerformance.csv"
dataset = pd.read_csv(path)
print(dataset)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0   NaN  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
```

```
96      97  152.0        1  56.0  Yes
97      98    1.8        1  28.0   No
98      99   35.0        0  44.0  NaN
99     100    4.0        0  24.0   No

[100 rows x 5 columns]
```

In [39]:

```
dataset["PhD"].isnull()
```

Out[39]:

```
0     False
1     False
2     False
3     False
4     False
      ...
95    False
96    False
97    False
98     True
99    False
Name: PhD, Length: 100, dtype: bool
```

In [40]:

```
# Detecting numbers
cnt=0
for row in dataset['PhD']:
    try:
        int(row)
        dataset.loc[cnt, 'PhD']=np.nan
    except ValueError:
        pass
    cnt+=1
```

In [41]:

```
dataset["PhD"].isnull()
print(dataset)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0   NaN  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
96      97  152.0       1  56.0  Yes
97      98    1.8       1  28.0   No
98      99   35.0       0  44.0  NaN
99     100    4.0       0  24.0   No

[100 rows x 5 columns]
```

In [4]:

```
dataset.skew(axis=0)
```

Out[4]:

```
Rollno    0.000000
Marks     1.077026
Gender    0.000000
Age      -0.236916
dtype: float64
```

In [5]:

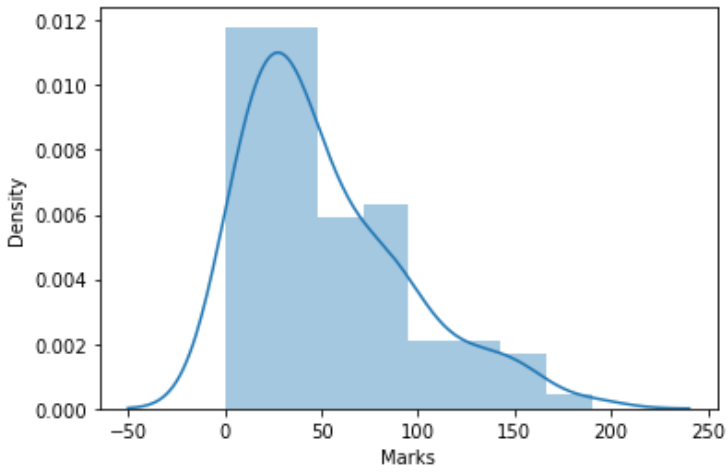
```
import seaborn as sn
```

```
sn.distplot(dataset["Marks"])
```

```
D:\Program Files\Anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning
: `distplot` is a deprecated function and will be removed in a future version. Please ada
pt your code to use either `displot` (a figure-level function with similar flexibility) o
r `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[5]:

```
<AxesSubplot:xlabel='Marks', ylabel='Density'>
```



In [6]:

```
np.log(1.077026)
```

Out[6]:

```
0.07420353901563533
```

In [7]:

```
log_Marks=np.log(dataset["Marks"])
```

In [8]:

```
log_Marks.head()
```

Out[8]:

```
0    4.941642
1    3.401197
2    3.558201
3    3.401197
4    4.382027
Name: Marks, dtype: float64
```

In [9]:

```
log_Marks.skew()
```

Out[9]:

```
-1.3980101345258154
```

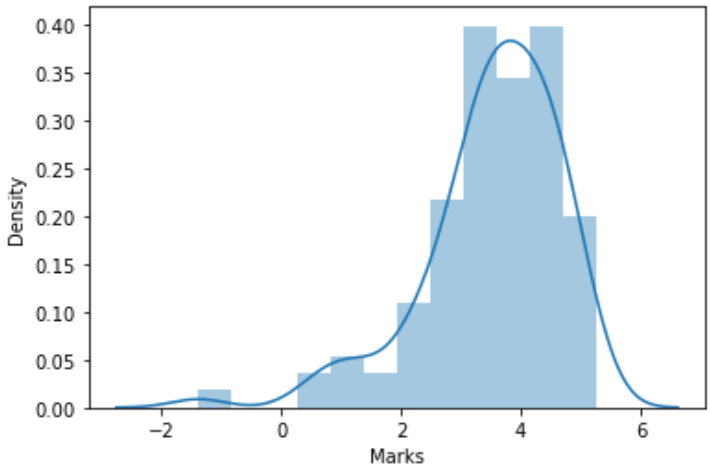
In [10]:

```
import seaborn as sn
sn.distplot(log_Marks)
```

```
D:\Program Files\Anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning
: `distplot` is a deprecated function and will be removed in a future version. Please ada
pt your code to use either `displot` (a figure-level function with similar flexibility) o
r `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[10]:

```
<AxesSubplot:xlabel='Marks', ylabel='Density'>
```



In [11]:

```
log_Marks_sq=np.sqrt(dataset["Marks"])
```

In [12]:

```
log_Marks_sq.head()
```

Out[12]:

```
0    11.832160
1     5.477226
2     5.924525
3     5.477226
4     8.944272
Name: Marks, dtype: float64
```

In [13]:

```
log_Marks_sq.skew()
```

Out[13]:

```
0.21202620353224017
```

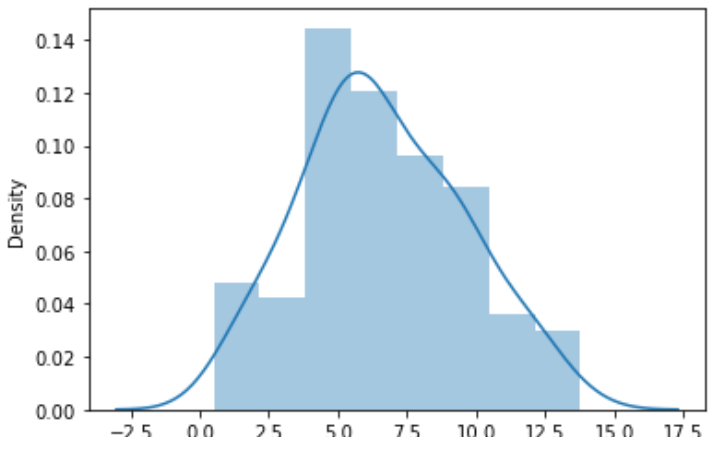
In [14]:

```
import seaborn as sn
sn.distplot(log_Marks_sq)
```

```
D:\Program Files\Anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning
: `distplot` is a deprecated function and will be removed in a future version. Please ada
pt your code to use either `displot` (a figure-level function with similar flexibility) o
r `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[14]:

```
<AxesSubplot:xlabel='Marks', ylabel='Density'>
```



In [15]:

```
log_Marks_cb=np.cbrt(dataset["Marks"])
```

In [16]:

```
log_Marks_cb.head()
```

Out[16]:

```
0    5.192494
1    3.107233
2    3.274179
3    3.107233
4    4.308869
Name: Marks, dtype: float64
```

In [17]:

```
log_Marks_cb.head()
```

Out[17]:

```
0    5.192494
1    3.107233
2    3.274179
3    3.107233
4    4.308869
Name: Marks, dtype: float64
```

In [18]:

```
log_Marks_cb.skew()
```

Out[18]:

```
-0.18525230594632391
```

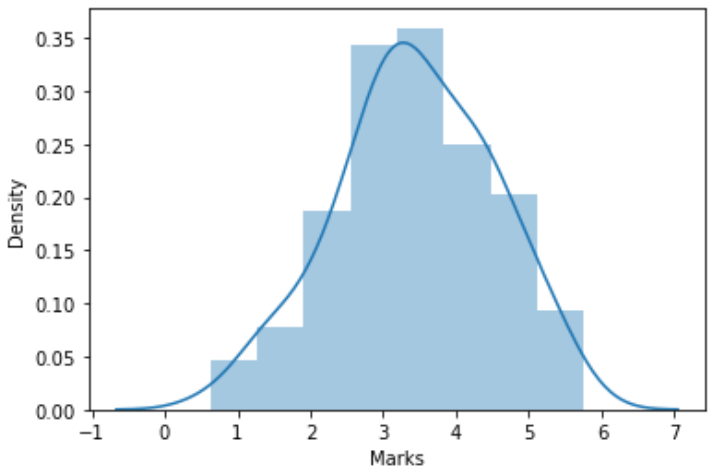
In [19]:

```
import seaborn as sn
sn.distplot(log_Marks_cb)
```

```
D:\Program Files\Anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning
: `distplot` is a deprecated function and will be removed in a future version. Please ada
pt your code to use either `displot` (a figure-level function with similar flexibility) o
r `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[19]:

```
<AxesSubplot:xlabel='Marks', ylabel='Density'>
```



In [21]:

```
Marks_reci=np.reciprocal(dataset["Marks"])
```

In [22]:

```
Marks_reci.head()
```

Out[22]:

```
0    0.007143
1    0.033333
2    0.028490
3    0.033333
4    0.012500
Name: Marks, dtype: float64
```

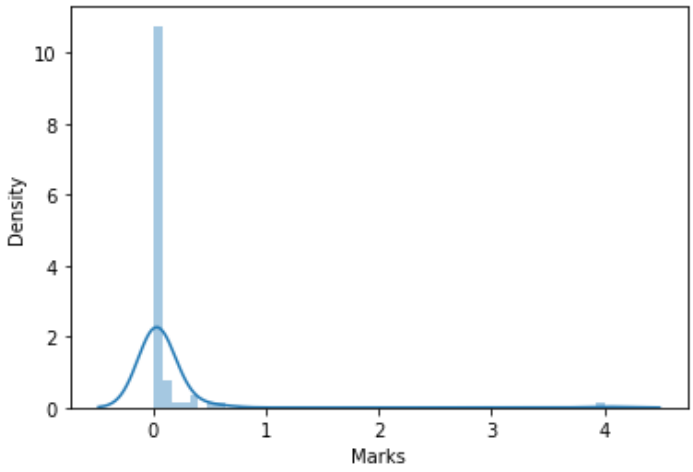
In [23]:

```
import seaborn as sn
sn.distplot(Marks_reci)
```

```
D:\Program Files\Anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning
: `distplot` is a deprecated function and will be removed in a future version. Please ada
pt your code to use either `displot` (a figure-level function with similar flexibility) o
r `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[23]:

```
<AxesSubplot:xlabel='Marks', ylabel='Density'>
```



In [24]:

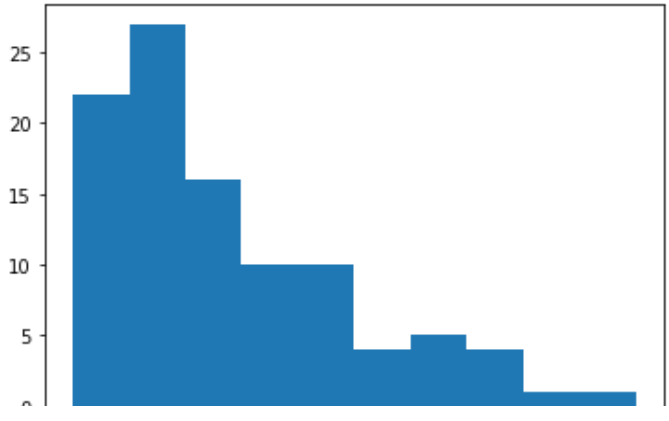
```
Marks_reci.skew()
```

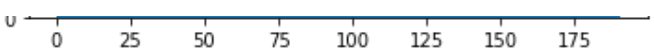
Out[24]:

```
9.14246062263327
```

In [25]:

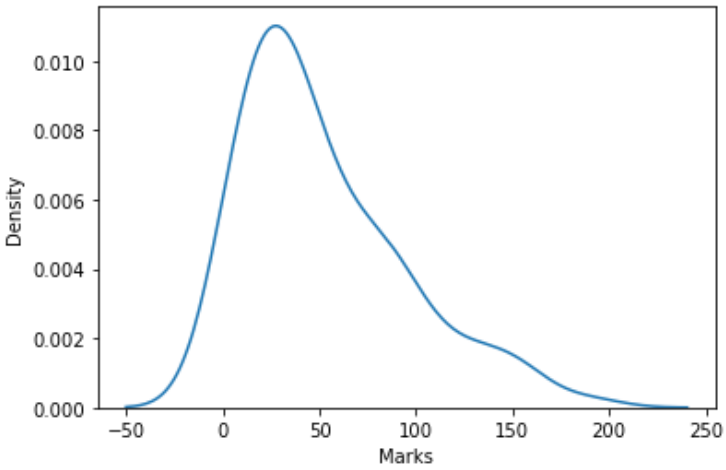
```
import matplotlib.pyplot as plt
his_Marks_cplt=plt.hist(dataset["Marks"])
```





In [26]:

```
plot_marks=sn.kdeplot(dataset["Marks"])
```



In [27]:

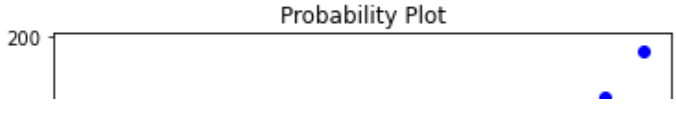
```
import scipy.stats as stats
import pylab
```

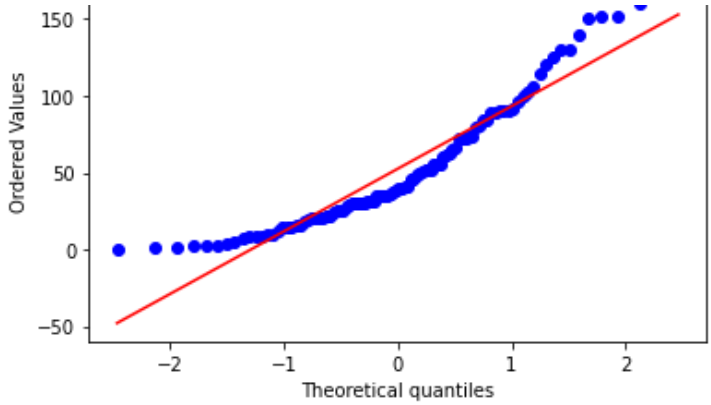
In [28]:

```
stats.probplot(dataset["Marks"],plot=pylab)
```

Out[28]:

```
((array([-2.46203784, -2.12570747, -1.93122778, -1.79044653, -1.67819304,
         -1.58381122, -1.50174123, -1.42869743, -1.36256869, -1.30191411,
         -1.24570419, -1.19317644, -1.14374949, -1.09696931, -1.05247413,
         -1.00997067, -0.96921765, -0.93001393, -0.89218993, -0.85560121,
         -0.82012357, -0.78564937, -0.75208458, -0.71934648, -0.68736185,
         -0.65606548, -0.62539893, -0.59530962, -0.56574992, -0.53667655,
         -0.50804994, -0.47983378, -0.45199463, -0.42450149, -0.39732558,
         -0.37044003, -0.34381966, -0.31744076, -0.29128096, -0.26531902,
         -0.23953472, -0.21390872, -0.18842244, -0.16305799, -0.13779803,
         -0.1126257 , -0.08752455, -0.06247843, -0.03747145, -0.01248789,
          0.01248789,  0.03747145,  0.06247843,  0.08752455,  0.1126257 ,
          0.13779803,  0.16305799,  0.18842244,  0.21390872,  0.23953472,
          0.26531902,  0.29128096,  0.31744076,  0.34381966,  0.37044003,
          0.39732558,  0.42450149,  0.45199463,  0.47983378,  0.50804994,
          0.53667655,  0.56574992,  0.59530962,  0.62539893,  0.65606548,
          0.68736185,  0.71934648,  0.75208458,  0.78564937,  0.82012357,
          0.85560121,  0.89218993,  0.93001393,  0.96921765,  1.00997067,
          1.05247413,  1.09696931,  1.14374949,  1.19317644,  1.24570419,
          1.30191411,  1.36256869,  1.42869743,  1.50174123,  1.58381122,
          1.67819304,  1.79044653,  1.93122778,  2.12570747,  2.46203784]),
  array([  0.25,   1.7 ,   1.8 ,   2.5 ,   3.  ,   3.  ,   4.  ,   4.6 ,
           7.  ,   9.  ,   9.  ,   9.  ,   9.5 ,  10.  ,  12.  ,  14.7 ,
          15.  ,  15.  ,  15.2 ,  16.  ,  18.6 ,  19.  ,  20.  ,  20.  ,
          20.  ,  20.  ,  22.  ,  22.3 ,  24.  ,  25.  ,  25.  ,  25.8 ,
          28.  ,  28.6 ,  30.  ,  30.  ,  30.  ,  30.  ,  30.  ,  31.1 ,
          32.  ,  32.  ,  34.8 ,  35.  ,  35.  ,  35.  ,  35.1 ,  36.  ,
          38.  ,  38.8 ,  39.8 ,  40.  ,  40.7 ,  41.  ,  45.6 ,  46.  ,
          48.  ,  50.  ,  51.  ,  52.  ,  52.  ,  52.  ,  55.  ,  55.  ,
          55.  ,  60.  ,  62.  ,  63.  ,  65.  ,  66.  ,  72.  ,  72.  ,
          72.  ,  73.  ,  74.  ,  80.  ,  81.  ,  84.  ,  84.  ,  89.  ,
          89.  ,  90.  ,  90.  ,  90.  ,  92.  ,  96.  , 100.  , 102.  ,
         106.  , 115.  , 120.  , 125.  , 130.  , 130.  , 140.  , 150.  ,
         152.  , 152.  , 160.  , 190.  ])),
 (40.79054296233955, 52.52449999999999, 0.9515395328716016))
```





In [29]:

```
stats.probplot(log_Marks_cb,plot=pylab)
```

Out[29]:

```
((array([-2.46203784, -2.12570747, -1.93122778, -1.79044653, -1.67819304,
         -1.58381122, -1.50174123, -1.42869743, -1.36256869, -1.30191411,
         -1.24570419, -1.19317644, -1.14374949, -1.09696931, -1.05247413,
         -1.00997067, -0.96921765, -0.93001393, -0.89218993, -0.85560121,
         -0.82012357, -0.78564937, -0.75208458, -0.71934648, -0.68736185,
         -0.65606548, -0.62539893, -0.59530962, -0.56574992, -0.53667655,
         -0.50804994, -0.47983378, -0.45199463, -0.42450149, -0.39732558,
         -0.37044003, -0.34381966, -0.31744076, -0.29128096, -0.26531902,
         -0.23953472, -0.21390872, -0.18842244, -0.16305799, -0.13779803,
         -0.1126257 , -0.08752455, -0.06247843, -0.03747145, -0.01248789,
          0.01248789,  0.03747145,  0.06247843,  0.08752455,  0.1126257 ,
          0.13779803,  0.16305799,  0.18842244,  0.21390872,  0.23953472,
          0.26531902,  0.29128096,  0.31744076,  0.34381966,  0.37044003,
          0.39732558,  0.42450149,  0.45199463,  0.47983378,  0.50804994,
          0.53667655,  0.56574992,  0.59530962,  0.62539893,  0.65606548,
          0.68736185,  0.71934648,  0.75208458,  0.78564937,  0.82012357,
          0.85560121,  0.89218993,  0.93001393,  0.96921765,  1.00997067,
          1.05247413,  1.09696931,  1.14374949,  1.19317644,  1.24570419,
          1.30191411,  1.36256869,  1.42869743,  1.50174123,  1.58381122,
          1.67819304,  1.79044653,  1.93122778,  2.12570747,  2.46203784]),
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         2.08008382, 2.08008382, 2.11791179, 2.15443469, 2.28942849,
         2.44965982, 2.46621207, 2.46621207, 2.47712466, 2.5198421 ,
         2.64954306, 2.66840165, 2.71441762, 2.71441762, 2.71441762,
         2.71441762, 2.80203933, 2.81471841, 2.88449914, 2.92401774,
         2.92401774, 2.95488036, 3.03658897, 3.05812578, 3.10723251,
         3.10723251, 3.10723251, 3.10723251, 3.10723251, 3.14475486,
         3.1748021 , 3.1748021 , 3.2648238 , 3.27106631, 3.27106631,
         3.27106631, 3.27417865, 3.30192725, 3.36197541, 3.38540456,
         3.41424245, 3.41995189, 3.43978636, 3.44821724, 3.57263198,
         3.58304787, 3.63424119, 3.6840315 , 3.70842977, 3.73251116,
         3.73251116, 3.73251116, 3.80295246, 3.80295246, 3.80295246,
         3.91486764, 3.95789161, 3.97905721, 4.02072576, 4.04124002,
         4.16016765, 4.16016765, 4.16016765, 4.1793392 , 4.19833645,
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         4.4647451 , 4.48140475, 4.48140475, 4.48140475, 4.51435744,
         4.57885697, 4.64158883, 4.67232873, 4.73262349, 4.86294413,
         4.93242415, 5.        , 5.06579702, 5.06579702, 5.1924941 ,
         5.31329285, 5.3368033 , 5.3368033 , 5.42883523, 5.74889708])),
 (1.0964930316814503, 3.441077741563151, 0.9963217176950497))
```

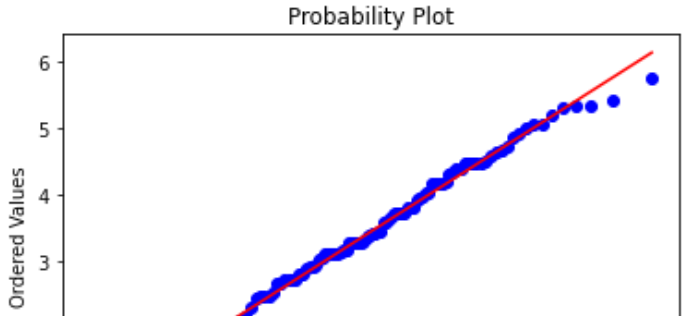

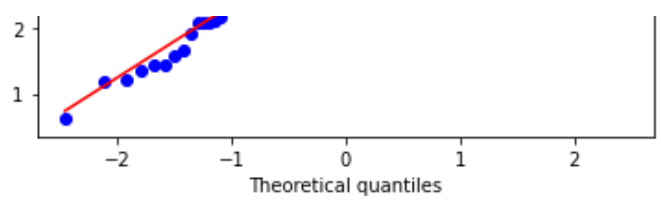

In [30]:

```
stats.probplot(log_Marks_sq,plot=pylab)
```

Out[30]:

```
((array([-2.46203784, -2.12570747, -1.93122778, -1.79044653, -1.67819304,
         -1.58381122, -1.50174123, -1.42869743, -1.36256869, -1.30191411,
         -1.24570419, -1.19317644, -1.14374949, -1.09696931, -1.05247413,
         -1.00997067, -0.96921765, -0.93001393, -0.89218993, -0.85560121,
         -0.82012357, -0.78564937, -0.75208458, -0.71934648, -0.68736185,
         -0.65606548, -0.62539893, -0.59530962, -0.56574992, -0.53667655,
         -0.50804994, -0.47983378, -0.45199463, -0.42450149, -0.39732558,
         -0.37044003, -0.34381966, -0.31744076, -0.29128096, -0.26531902,
         -0.23953472, -0.21390872, -0.18842244, -0.16305799, -0.13779803,
         -0.1126257 , -0.08752455, -0.06247843, -0.03747145, -0.01248789,
          0.01248789,  0.03747145,  0.06247843,  0.08752455,  0.1126257 ,
          0.13779803,  0.16305799,  0.18842244,  0.21390872,  0.23953472,
          0.26531902,  0.29128096,  0.31744076,  0.34381966,  0.37044003,
          0.39732558,  0.42450149,  0.45199463,  0.47983378,  0.50804994,
          0.53667655,  0.56574992,  0.59530962,  0.62539893,  0.65606548,
          0.68736185,  0.71934648,  0.75208458,  0.78564937,  0.82012357,
          0.85560121,  0.89218993,  0.93001393,  0.96921765,  1.00997067,
          1.05247413,  1.09696931,  1.14374949,  1.19317644,  1.24570419,
          1.30191411,  1.36256869,  1.42869743,  1.50174123,  1.58381122,
          1.67819304,  1.79044653,  1.93122778,  2.12570747,  2.46203784]),
  array([ 0.5       ,  1.30384048,  1.34164079,  1.58113883,  1.73205081,
          1.73205081,  2.        ,  2.14476106,  2.64575131,  3.        ,
          3.        ,  3.        ,  3.082207  ,  3.16227766,  3.46410162,
          3.8340579 ,  3.87298335,  3.87298335,  3.89871774,  4.        ,
          4.31277173,  4.35889894,  4.47213595,  4.47213595,  4.47213595,
          4.47213595,  4.69041576,  4.72228758,  4.89897949,  5.        ,
          5.        ,  5.07937004,  5.29150262,  5.34789678,  5.47722558,
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          5.91607978,  5.9245253 ,  6.        ,  6.164414  ,  6.2289646 ,
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          6.78232998,  6.92820323,  7.07106781,  7.14142843,  7.21110255,
          7.21110255,  7.21110255,  7.41619849,  7.41619849,  7.41619849,
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         10.95445115, 11.18033989, 11.40175425, 11.40175425, 11.83215957,
         12.24744871, 12.32882801, 12.32882801, 12.64911064, 13.78404875])),
 (2.983044720739973, 6.6254088687442305, 0.9951899042212309))
```

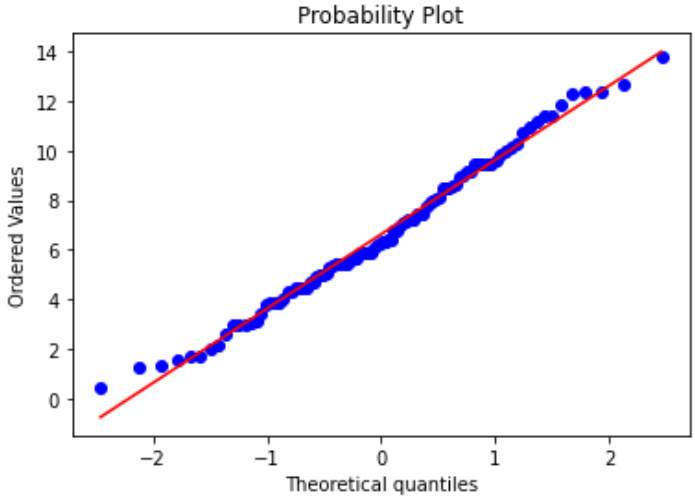

In [31]:

```
stats.probplot(Marks_reci,plot=pylab)
```

Out[31]:

```
((array([-2.46203784, -2.12570747, -1.93122778, -1.79044653, -1.67819304,
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         -1.24570419, -1.19317644, -1.14374949, -1.09696931, -1.05247413,
         -1.00997067, -0.96921765, -0.93001393, -0.89218993, -0.85560121,
         -0.82012357, -0.78564937, -0.75208458, -0.71934648, -0.68736185,
         -0.65606548, -0.62539893, -0.59530962, -0.56574992, -0.53667655,
         -0.50804994, -0.47983378, -0.45199463, -0.42450149, -0.39732558,
         -0.37044003, -0.34381966, -0.31744076, -0.29128096, -0.26531902,
         -0.23953472, -0.21390872, -0.18842244, -0.16305799, -0.13779803,
         -0.1126257 , -0.08752455, -0.06247843, -0.03747145, -0.01248789,
          0.01248789,  0.03747145,  0.06247843,  0.08752455,  0.1126257 ,
          0.13779803,  0.16305799,  0.18842244,  0.21390872,  0.23953472,
          0.26531902,  0.29128096,  0.31744076,  0.34381966,  0.37044003,
          0.39732558,  0.42450149,  0.45199463,  0.47983378,  0.50804994,
          0.53667655,  0.56574992,  0.59530962,  0.62539893,  0.65606548,
          0.68736185,  0.71934648,  0.75208458,  0.78564937,  0.82012357,
          0.85560121,  0.89218993,  0.93001393,  0.96921765,  1.00997067,
          1.05247413,  1.09696931,  1.14374949,  1.19317644,  1.24570419,
          1.30191411,  1.36256869,  1.42869743,  1.50174123,  1.58381122,
          1.67819304,  1.79044653,  1.93122778,  2.12570747,  2.46203784]),
  array([0.00526316, 0.00625   , 0.00657895, 0.00657895, 0.00666667,
         0.00714286, 0.00769231, 0.00769231, 0.008     , 0.00833333,
         0.00869565, 0.00943396, 0.00980392, 0.01      , 0.01041667,
         0.01086957, 0.01111111, 0.01111111, 0.01111111, 0.01123596,
         0.01123596, 0.01190476, 0.01190476, 0.01234568, 0.0125    ,
         0.01351351, 0.01369863, 0.01388889, 0.01388889, 0.01388889,
         0.01515152, 0.01538462, 0.01587302, 0.01612903, 0.01666667,
         0.01818182, 0.01818182, 0.01818182, 0.01923077, 0.01923077,
         0.01923077, 0.01960784, 0.02      , 0.02083333, 0.02173913,
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         0.02857143, 0.02857143, 0.02873563, 0.03125   , 0.03125   ,
         0.03215434, 0.03333333, 0.03333333, 0.03333333, 0.03333333,
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         0.04      , 0.04166667, 0.04484305, 0.04545455, 0.05      ,
         0.05      , 0.05      , 0.05      , 0.05263158, 0.05376344,
         0.0625    , 0.06578947, 0.06666667, 0.06666667, 0.06802721,
         0.08333333, 0.1       , 0.10526316, 0.11111111, 0.11111111,
         0.11111111, 0.14285714, 0.2173913 , 0.25      , 0.33333333,
         0.33333333, 0.4       , 0.55555556, 0.58823529, 4.        ])),
 (0.16654238388625658, 0.0958160800017085, 0.4031270817229625))
```

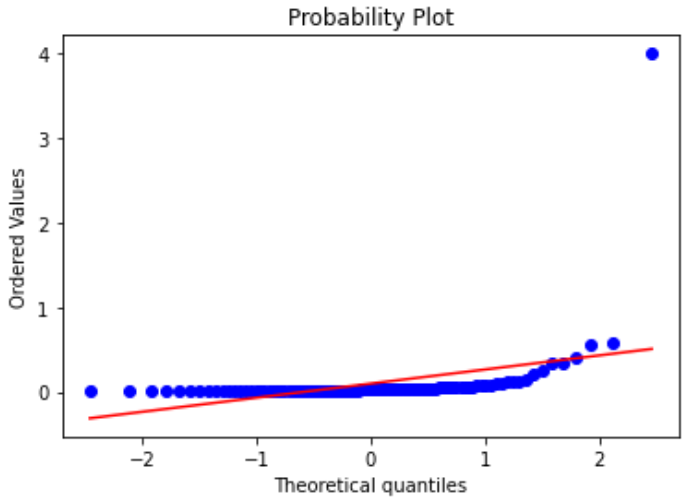

In [32]:

```
stats.probplot(log_Marks,plot=pylab)
```

Out[32]:

```
((array([-2.46203784, -2.12570747, -1.93122778, -1.79044653, -1.67819304,
```

```
          -1.58381122, -1.50174123, -1.42869743, -1.36256869, -1.30191411,
          -1.24570419, -1.19317644, -1.14374949, -1.09696931, -1.05247413,
          -1.00997067, -0.96921765, -0.93001393, -0.89218993, -0.85560121,
          -0.82012357, -0.78564937, -0.75208458, -0.71934648, -0.68736185,
          -0.65606548, -0.62539893, -0.59530962, -0.56574992, -0.53667655,
          -0.50804994, -0.47983378, -0.45199463, -0.42450149, -0.39732558,
          -0.37044003, -0.34381966, -0.31744076, -0.29128096, -0.26531902,
          -0.23953472, -0.21390872, -0.18842244, -0.16305799, -0.13779803,
          -0.1126257 , -0.08752455, -0.06247843, -0.03747145, -0.01248789,
           0.01248789,  0.03747145,  0.06247843,  0.08752455,  0.1126257 ,
           0.13779803,  0.16305799,  0.18842244,  0.21390872,  0.23953472,
           0.26531902,  0.29128096,  0.31744076,  0.34381966,  0.37044003,
           0.39732558,  0.42450149,  0.45199463,  0.47983378,  0.50804994,
           0.53667655,  0.56574992,  0.59530962,  0.62539893,  0.65606548,
           0.68736185,  0.71934648,  0.75208458,  0.78564937,  0.82012357,
           0.85560121,  0.89218993,  0.93001393,  0.96921765,  1.00997067,
           1.05247413,  1.09696931,  1.14374949,  1.19317644,  1.24570419,
           1.30191411,  1.36256869,  1.42869743,  1.50174123,  1.58381122,
           1.67819304,  1.79044653,  1.93122778,  2.12570747,  2.46203784]),
 array([-1.38629436,  0.53062825,  0.58778666,  0.91629073,  1.09861229,
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          2.19722458,  2.19722458,  2.2512918 ,  2.30258509,  2.48490665,
          2.68784749,  2.7080502 ,  2.7080502 ,  2.72129543,  2.77258872,
          2.92316158,  2.94443898,  2.99573227,  2.99573227,  2.99573227,
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          3.8286414 ,  3.87120101,  3.91202301,  3.93182563,  3.95124372,
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          4.27666612,  4.27666612,  4.27666612,  4.29045944,  4.30406509,
          4.38202663,  4.39444915,  4.4308168 ,  4.4308168 ,  4.48863637,
          4.48863637,  4.49980967,  4.49980967,  4.49980967,  4.52178858,
          4.56434819,  4.60517019,  4.62497281,  4.66343909,  4.74493213,
          4.78749174,  4.82831374,  4.86753445,  4.86753445,  4.94164242,
          5.01063529,  5.02388052,  5.02388052,  5.07517382,  5.24702407])),
(1.1033972747040552, 3.522558182933606, 0.9494491339528739))
```

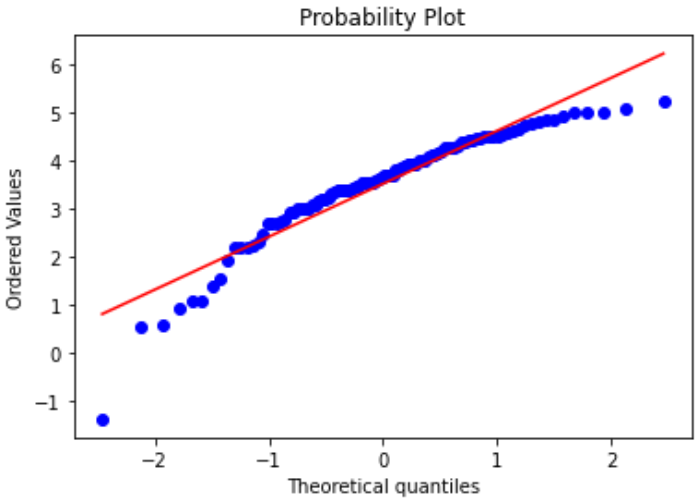

Page No.
Date

Group - A

Practical No. 3

☆ Title :: Descriptive Statistics - Measures of Central Tendency and variability.

☆ Date of Completion ::

☆ Objective :: To display some basic statistical details and provide summary of statistics.

☆ Problem Statement :: Perform the following operations on any open source dataset (eg : data.csv).

1) Provide summary statistics (mean, median, minimum, maximum, standard deviation) for a dataset (age, income, etc.) with numeric value grouped by one of qualitative (categorical) variable. For example, if your categorical variable is age groups and quantitative variable is income, then provide summary statistics of income grouped by age groups. Create a list that contains a numeric value for each response to the categorical variable.
2) Write a python program to display some basic statistical details like percentile, mean, standard deviation etc. of the species of 'Iris-setosa', 'Iris-versicolor' and 'Iris-versicolor' of iris.csv dataset.

Page No.
Date

★ Software and Hardware Requirements :- Python, dataset.

★ Theory :-
Measures of central tendency :-
1) Mean
2) Median
3) Mode.

A) Mean :- It is average of sample values in a given dataset.

$\bar{x} = \sum_{i=1}^{n} \frac{x_i}{n}$, $\bar{x}$ ⇒ Mean of sample.

B) Median :- It is the value separating higher half from lower half of data sample, population or a probability distribution.

C) Mode :- It is the value that occurs most frequently in the set. It is possible for greatest frequency to correspond to several different values which routes in more than one mode.

D) Standard Deviation :- It is the measure of how spread out the data is. The way to calculate, it is to compute the squares of distance from each data point to mean of set. Add them all up, divide by n-1, and then take square root.

$$s = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}}$$

Teacher's Signature _____

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Date

★ Conclusion :: We have provided summary statistics and displayed statistical details.