PREDICTING THE ENERGY OUTPUT OF WIND

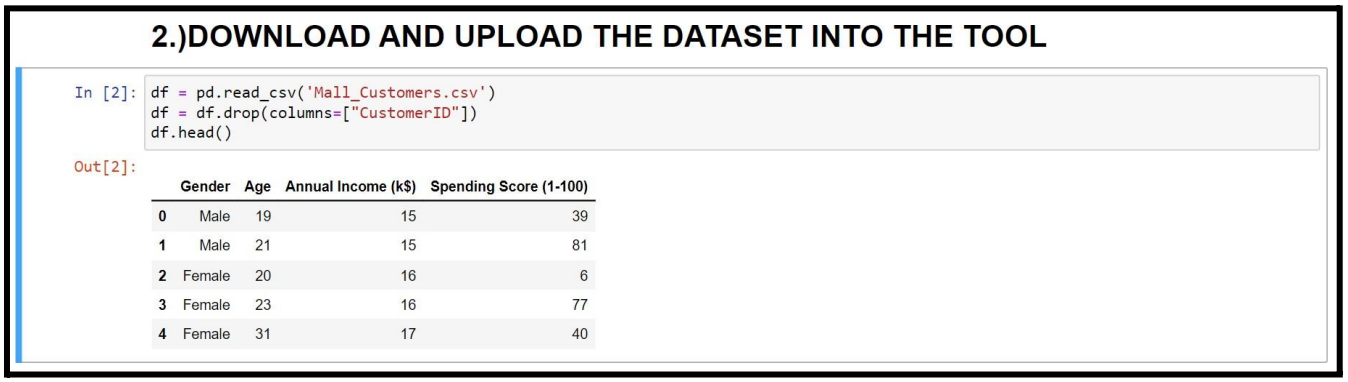
TURBINE BASED ON WEATHER CONDITION

ASSIGNMENT - 4

Date	27th October 2022
Team ID	PNT2022TMID54445
Student Name	E.Gokula Krishnan (310619106304)
Domain Name	Education
Project Name	PREDICTING THE ENERGY OUTPUT OF WIND TURBINE BASED ON WEATHER CONDITION
Maximum Marks	2 Marks

1.)IMPORT THE REQUIRED LIBRARIES

2.)DOWNLOAD AND UPLOAD THE DATASET



3.)CHECK FOR MISSING VALUES AND DEAL WITH THEM

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```
In [3]: df.isnull().sum()
```

```
Out[3]: Gender                  0
        Age                     0
        Annual Income (k$)      0
        Spending Score (1-100)  0
        dtype: int64
```

4.) PERFORM THE DESCRIPTIVE STATISTICS ON THE DATASET

4.)PERFORM DESCRIPTIVE STATISTICS ON THE DATASET

```
In [4]: df.describe()
```

Out[4]:

	Age	Annual Income (k$)	Spending Score (1-100)
count	200.000000	200.000000	200.000000
mean	38.850000	60.560000	50.200000
std	13.969007	26.264721	25.823522
min	18.000000	15.000000	1.000000
25%	28.750000	41.500000	34.750000
50%	36.000000	61.500000	50.000000
75%	49.000000	78.000000	73.000000
max	70.000000	137.000000	99.000000

```
In [5]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 4 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   Gender                  200 non-null    object
 1   Age                     200 non-null    int64
 2   Annual Income (k$)      200 non-null    int64
 3   Spending Score (1-100)  200 non-null    int64
dtypes: int64(3), object(1)
memory usage: 6.4+ KB
```

5.) PERFORM VARIOUS VISUALISATIONS
a.) UNIVARIANTEANALYSIS

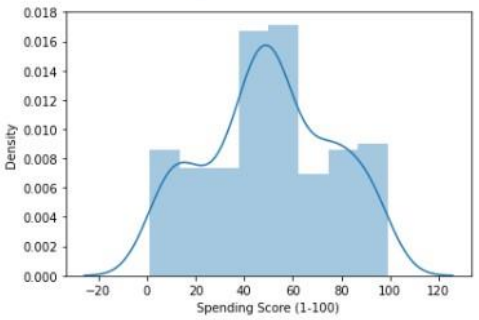
5.)PERFORM VISUALIZATIONS

a.)UNIVARIANTE ANALYSIS

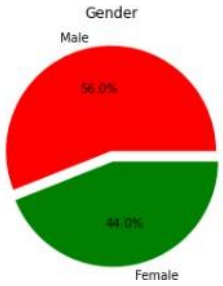
In [6]:
```
sns.distplot(df["Spending Score (1-100)"])
```

```
C:\Users\Prem\anaconda3\lib\site-packages\seaborn\distributions.py:2619: FutureWarning: `distplot` is a deprecated function and
will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexi
bility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[6]:
```
<AxesSubplot:xlabel='Spending Score (1-100)', ylabel='Density'>
```



In [7]:
```
plt.pie(df.Gender.value_counts(),[0.05,0.05],colors=['red','green'],labels=['Male','Female'],autopct="%1.1f%%")
plt.title('Gender')
plt.show()
```



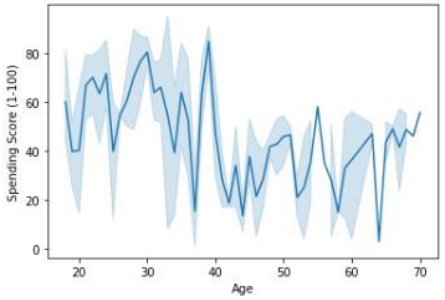
b.) BI - VARIANTEANALYSIS

b.)BI - VARIANTE ANALYSIS

In [8]:
```
sns.lineplot(df['Age'],df["Spending Score (1-100)"])
```

```
C:\Users\Prem\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variables as keyword arg
s: x, y. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit
keyword will result in an error or misinterpretation.
  warnings.warn(
```

Out[8]:
```
<AxesSubplot:xlabel='Age', ylabel='Spending Score (1-100)'>
```

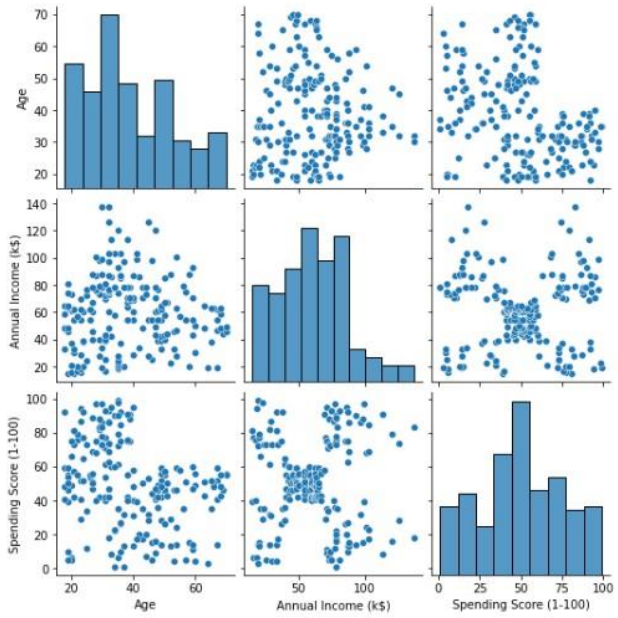


c.) MULTI - VARIANTE ANALYSIS

c.)MULTIVARIANTE ANALYSIS

```
In [9]: sns.pairplot(df)
```

```
Out[9]: <seaborn.axisgrid.PairGrid at 0x1cd269eebe0>
```




```
In [10]: df.corr()
```

Out[10]:

	Age	Annual Income (k$)	Spending Score (1-100)
Age	1.000000	-0.012398	-0.327227
Annual Income (k$)	-0.012398	1.000000	0.009903
Spending Score (1-100)	-0.327227	0.009903	1.000000

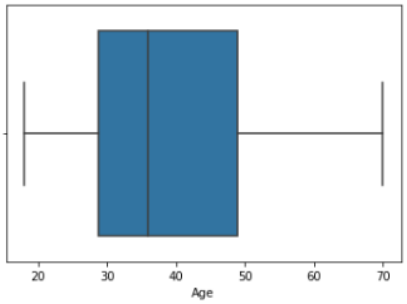
```
In [11]: sns.heatmap(df.corr(),annot=True)
         plt.show()
```

6.) FIND AND REPLACE THEOUTLIERS

6.)FIND THE OUTLIERS AND REPLACE THE OUTLIERS

In [12]:
```
for i in df.columns.drop("Gender"):
    sns.boxplot(df[i])
    plt.show()
```

```
C:\Users\Prem\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a keyword ar
g: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit key
word will result in an error or misinterpretation.
  warnings.warn(
```




```
C:\Users\Prem\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a keyword ar
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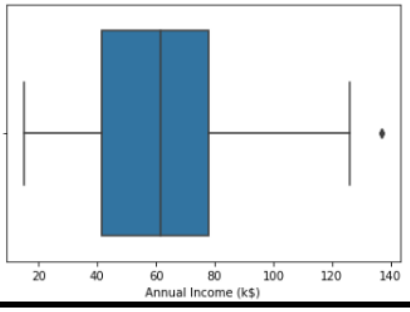


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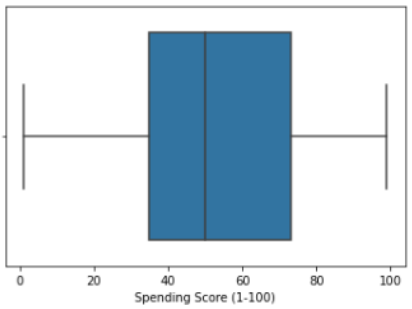

In [13]:
```
for i in df.columns.drop('Gender'):
    Q1 = df[i].quantile(0.25)
    Q3 = df[i].quantile(0.75)
    IQR = Q3-Q1
    upper_limit = Q3 + (1.5*IQR)
    lower_limit = Q1 - (1.5*IQR)
    df[i] = np.where(df[i]>=upper_limit,Q3 + (1.5*IQR),df[i])
    df[i] = np.where(df[i]<=lower_limit,Q1 - (1.5*IQR),df[i])
```

In [14]:
```
for i in  df.columns.drop('Gender'):
    sns.boxplot(df[i])
    plt.show()
```

```
C:\Users\Prem\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a keyword ar
g: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit key
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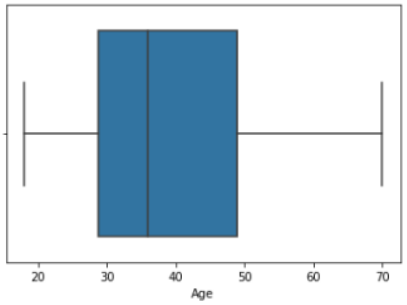
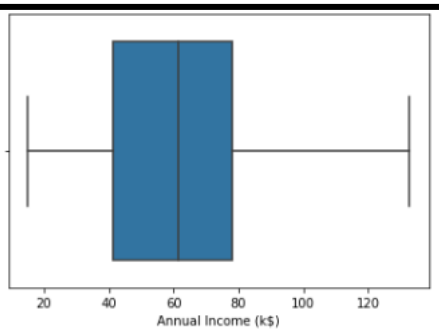
  warnings.warn(
```






```
C:\Users\Prem\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a keyword ar
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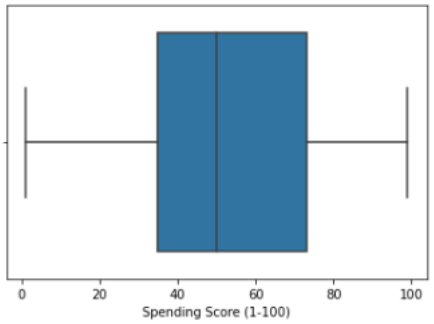
word will result in an error or misinterpretation.
  warnings.warn(
```



7.)CHECKFORCATEGORICALCOLUMNSANDENCODETHEM

7.)CHECK FOR CATEGORICAL COLUMNS AND PERFORM ENCODING

In [15]:
```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
df.Gender = le.fit_transform(df.Gender)
```

In [16]:
```
df.head()
```

Out[16]:

	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	1	19.0	15.0	39.0
1	1	21.0	15.0	81.0
2	0	20.0	16.0	6.0
3	0	23.0	16.0	77.0
4	0	31.0	17.0	40.0

8.) SCALE THE DATA

8.)SCALING THE DATA

In [17]:
```
from sklearn.preprocessing import StandardScaler
scale = StandardScaler()
df = pd.DataFrame(scale.fit_transform(df),columns=df.columns)
df.head()
```

Out[17]:

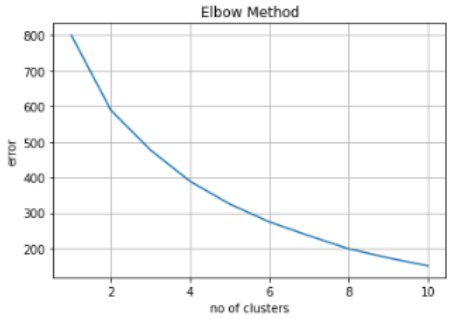
	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	1.128152	-1.424569	-1.745429	-0.434801
1	1.128152	-1.281035	-1.745429	1.195704
2	-0.886405	-1.352802	-1.707083	-1.715913
3	-0.886405	-1.137502	-1.707083	1.040418
4	-0.886405	-0.563369	-1.668737	-0.395980

9.)PERFORMANYOFTHECLUSTERINGALGORITHMS

9.)PERFORM ANY OF THE CLUSTERING ALGORITHMS

In [18]:
```
from sklearn.cluster import KMeans
error = []
for k in range(1,11):
  kmeans = KMeans(n_clusters=k,init='k-means++')
  kmeans.fit(df)
  error.append(kmeans.inertia_)
plt.plot(range(1,11),error)
plt.title('Elbow Method')
plt.xlabel('no of clusters')
plt.ylabel('error')
plt.grid()
plt.show()
```

```
C:\Users\Prem\anaconda3\lib\site-packages\sklearn\cluster\_kmeans.py:1036: UserWarning: KMeans is known to have a memory leak o
n Windows with MKL, when there are less chunks than available threads. You can avoid it by setting the environment variable OMP
_NUM_THREADS=1.
  warnings.warn(
```



In [19]:
```
km = KMeans(n_clusters=8)
Category = km.fit_predict(df)
Category
```

Out[19]:
```
array([5, 5, 7, 7, 7, 7, 0, 7, 4, 7, 4, 7, 0, 7, 5, 5, 7, 5, 4, 7, 5, 5,
       0, 5, 0, 5, 0, 5, 0, 7, 4, 7, 4, 5, 0, 7, 0, 7, 0, 7, 0, 5, 4, 7,
       0, 7, 0, 7, 7, 7, 0, 5, 7, 4, 0, 4, 0, 4, 7, 4, 4, 5, 0, 0, 4, 5,
       0, 0, 5, 7, 4, 0, 0, 0, 4, 5, 0, 5, 7, 0, 4, 5, 4, 0, 7, 4, 0, 7,
       7, 0, 0, 5, 4, 0, 7, 5, 0, 7, 4, 5, 7, 0, 4, 5, 4, 7, 0, 4, 4, 4,
       4, 7, 6, 5, 7, 7, 0, 0, 0, 0, 5, 6, 1, 2, 6, 1, 3, 2, 4, 2, 3, 2,
       6, 1, 3, 1, 6, 2, 3, 1, 6, 2, 6, 1, 3, 2, 3, 1, 6, 2, 3, 2, 6, 1,
       6, 1, 3, 1, 3, 1, 6, 1, 3, 1, 3, 1, 3, 1, 6, 2, 3, 2, 3, 2, 6, 1,
       3, 2, 3, 2, 6, 1, 3, 1, 6, 2, 6, 2, 6, 1, 6, 1, 3, 1, 6, 1, 6, 2,
       3, 2])
```

10.) ADDING THE CLUSTER WITH THE PRIMARY DATASET

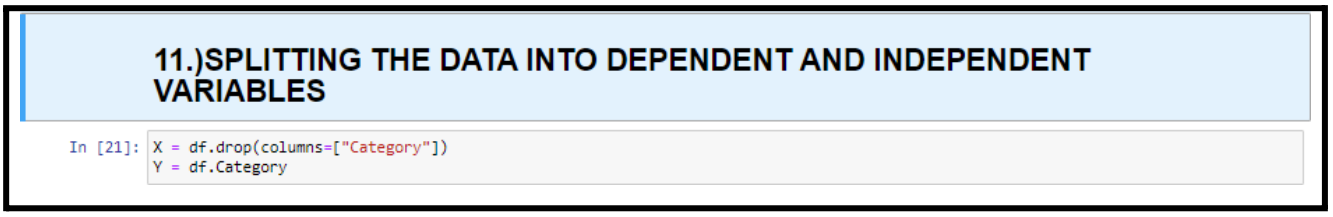
10.)ADD THE CLUSTER DATA WITH THE PRIMARY DATASET

In [20]:
```
df["Category"] = pd.Series(Category)
df.head()
```

Out[20]:

	Gender	Age	Annual Income (k$)	Spending Score (1-100)	Category
0	1.128152	-1.424569	-1.745429	-0.434801	5
1	1.128152	-1.281035	-1.745429	1.195704	5
2	-0.886405	-1.352802	-1.707083	-1.715913	7
3	-0.886405	-1.137502	-1.707083	1.040418	7
4	-0.886405	-0.563369	-1.668737	-0.395980	7

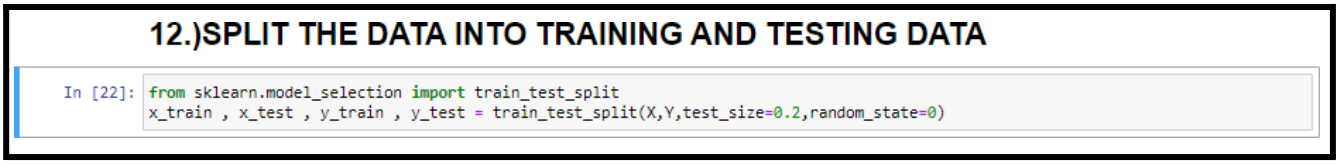
11.) SPLITTING THE DATA INTO DEPENDENT AND INDEPENDENT VARIABLES



11.)SPLITTING THE DATA INTO DEPENDENT AND INDEPENDENT VARIABLES

In [21]:
```
X = df.drop(columns=["Category"])
Y = df.Category
```

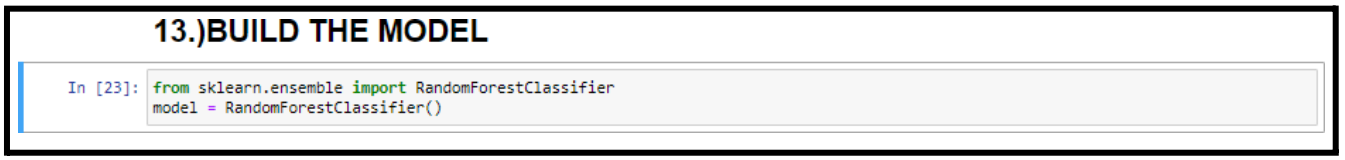
12.) SPLIT THE DATA INTO TRAININGAND TESTING DATA



12.)SPLIT THE DATA INTO TRAINING AND TESTING DATA

In [22]:
```
from sklearn.model_selection import train_test_split
x_train , x_test , y_train , y_test = train_test_split(X,Y,test_size=0.2,random_state=0)
```

13.) BUILD THEMODEL



13.)BUILD THE MODEL

In [23]:
```
from sklearn.ensemble import RandomForestClassifier
model = RandomForestClassifier()
```

14.) TRAIN THEMODEL

14.)TRAIN THE MODEL

In [24]:
```
model.fit(x_train,y_train)
```

Out[24]:
```
RandomForestClassifier()
```

15.) TEST THE MODEL

15.)TEST THE MODEL

In [25]:
```
y_predict = model.predict(x_test)
```

In [26]:
```
pd.DataFrame({"Actual":y_test,"Predicted":y_predict.round(0)})
```

Out[26]:

	Actual	Predicted
18	4	4
170	3	3
107	4	4
98	4	4
177	2	2
182	3	3
5	7	7
146	3	3
12	0	0
152	6	6
61	5	5
125	1	1
180	6	6
154	6	6
80	4	4
7	7	7
33	5	5
130	3	3
37	7	7
74	4	4
183	1	1
145	2	2
45	7	7
159	1	1
60	4	4
123	2	2
179	2	2
185	2	2
122	1	0
44	0	0
16	7	0
55	4	4
150	3	3

16.) MEASURE THE PERFORMANCE USING METRICS

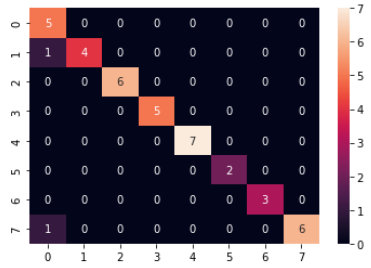
16.)MEASURE THE PERFORMANCE USING METRICS

In [27]:
```
from sklearn import metrics
metrics.accuracy_score(y_test,y_predict)
```

Out[27]: 0.95

In [28]:
```
sns.heatmap(metrics.confusion_matrix(y_test,y_predict),annot=True)
```

Out[28]: <AxesSubplot:>



In [29]:
```
print(metrics.classification_report(y_test,y_predict))
```

```
              precision    recall  f1-score   support

           0       0.71      1.00      0.83         5
           1       1.00      0.80      0.89         5
           2       1.00      1.00      1.00         6
           3       1.00      1.00      1.00         5
           4       1.00      1.00      1.00         7
           5       1.00      1.00      1.00         2
           6       1.00      1.00      1.00         3
           7       1.00      0.86      0.92         7

    accuracy                           0.95        40
   macro avg       0.96      0.96      0.96        40
weighted avg       0.96      0.95      0.95        40
```