# PREDICTING THE ENERGY OUTPUT OF WIND TURBINE BASED ON WEATHER CONDITION

# ASSIGNMENT - 2

| | |
|---|---|
| Date | 26th September 2022 |
| Team ID | PNT2022TMID54445 |
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| 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

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

## 2.)DOWNLOAD AND UPLOAD THE DATASET

**Download and Upload the Dataset**

```
In [2]: df = pd.read_csv('Churn_Modelling.csv')
        df.head()
```

Out[2]:

| | RowNumber | CustomerId | Surname | CreditScore | Geography | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveMember | EstimatedSalary |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 15634602 | Hargrave | 619 | France | Female | 42 | 2 | 0.00 | 1 | 1 | 1 | 101348.88 |
| 1 | 2 | 15647311 | Hill | 608 | Spain | Female | 41 | 1 | 83807.86 | 1 | 0 | 1 | 112542.58 |
| 2 | 3 | 15619304 | Onio | 502 | France | Female | 42 | 8 | 159660.80 | 3 | 1 | 0 | 113931.57 |
| 3 | 4 | 15701354 | Boni | 699 | France | Female | 39 | 1 | 0.00 | 2 | 0 | 0 | 93826.63 |
| 4 | 5 | 15737888 | Mitchell | 850 | Spain | Female | 43 | 2 | 125510.82 | 1 | 1 | 1 | 79084.10 |

# 3.)HANDLE MISSING VALUES IN THE DATASET

## Handle the Missing Values in the Dataset

In [3]:
```
#Removing Unwanted Values
df = df.drop(columns=['RowNumber','CustomerId','Surname'])
```

In [4]:
```
df.isnull().sum()
```

Out[4]:
```
CreditScore        0
Geography          0
Gender             0
Age                0
Tenure             0
Balance            0
NumOfProducts      0
HasCrCard          0
IsActiveMember     0
EstimatedSalary    0
Exited             0
dtype: int64
```

In [5]:
```
df.shape
```

Out[5]:
```
(10000, 11)
```

# 4.) PERFORM THE DESCRIPTIVE STATISTICS ON THE DATASET

In [6]:
```
df.describe()
```

Out[6]:

| | CreditScore | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveMember | EstimatedSalary | Exited |
|---|---|---|---|---|---|---|---|---|---|
| **count** | 10000.000000 | 10000.000000 | 10000.000000 | 10000.000000 | 10000.000000 | 10000.00000 | 10000.000000 | 10000.000000 | 10000.000000 |
| **mean** | 650.528800 | 38.921800 | 5.012800 | 76485.889288 | 1.530200 | 0.70550 | 0.515100 | 100090.239881 | 0.203700 |
| **std** | 96.653299 | 10.487806 | 2.892174 | 62397.405202 | 0.581654 | 0.45584 | 0.499797 | 57510.492818 | 0.402769 |
| **min** | 350.000000 | 18.000000 | 0.000000 | 0.000000 | 1.000000 | 0.00000 | 0.000000 | 11.580000 | 0.000000 |
| **25%** | 584.000000 | 32.000000 | 3.000000 | 0.000000 | 1.000000 | 0.00000 | 0.000000 | 51002.110000 | 0.000000 |
| **50%** | 652.000000 | 37.000000 | 5.000000 | 97198.540000 | 1.000000 | 1.00000 | 1.000000 | 100193.915000 | 0.000000 |
| **75%** | 718.000000 | 44.000000 | 7.000000 | 127644.240000 | 2.000000 | 1.00000 | 1.000000 | 149388.247500 | 0.000000 |
| **max** | 850.000000 | 92.000000 | 10.000000 | 250898.090000 | 4.000000 | 1.00000 | 1.000000 | 199992.480000 | 1.000000 |

In [7]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 11 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   CreditScore      10000 non-null  int64
 1   Geography        10000 non-null  object
 2   Gender           10000 non-null  object
 3   Age              10000 non-null  int64
 4   Tenure           10000 non-null  int64
 5   Balance          10000 non-null  float64
 6   NumOfProducts    10000 non-null  int64
 7   HasCrCard        10000 non-null  int64
 8   IsActiveMember   10000 non-null  int64
 9   EstimatedSalary  10000 non-null  float64
 10  Exited           10000 non-null  int64
dtypes: float64(2), int64(7), object(2)
```

# 5.) PERFORM VARIOUS VISUALISATIONS
# a.) UNIVARIANTE ANALYSIS

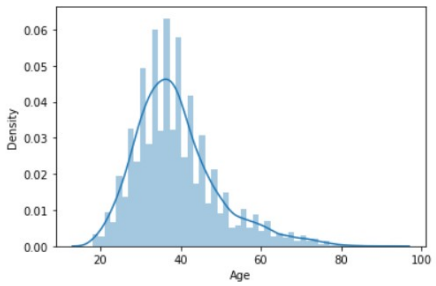
## Perform Various Visualisations

### Univariante Analysis

In [8]:
```
sns.distplot(df.Age)
```

```
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)
```

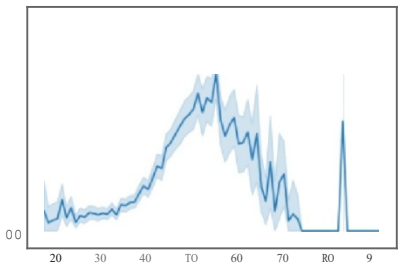
Out[8]:
```
<AxesSubplot:xlabel='Age', ylabel='Density'>
```



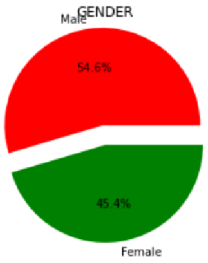
In [ ]:
```
sns.lineplot(df.Age,df.Exited)
```

```
C:\users\Prem\anaconda3\lib\site-packages\seabOru\_decOrators.Dy:36:FutureWarniug:Passthe*OllOwi"8variablesaskeywOrdarg
s:x,y.Fromversion0.12,theonlyvalidpositionalargumentwillbe'data',audpassingotherargumentswithoutanexplicit
keywordwillresultinanerrOrormisinterpretation.
```

0.J[9] <AxesSubplot:x1abel='Age', ylabel= Exited'›




In [10]:
```
plt.pie(df.Gender.value_counts(),[0.2,0],colors=['red','green'],labels=['Male','Female'],autopct='%1.1f%%')
plt.title('GENDER')
plt.show()
```




n [ ] : sn s . be cplot(df . NumofP rod u ct s . va Inc con nts ( ) . index, df . tlumO*Prod net s . va1 ue con nt s ( ) )

```
c:\Users\Prem\anaconda3\lib\siteoaclages\seaborn\decorators.py:36:FutureNarning:Passthe*ollowingvariablesaskeywordarg
s: x, y. Frow ver z I on a. 12, Ihe o nly val id pos it i ona I argument will be dad a', a nd oa s si ng of åer a rgument s i9i th out an expl i c it

  ma rnings . warn(
```

<AxesSubolot:ylabel='Num0*Produ<ts'›

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## b.) BI - VARIANTE ANALYSIS

**Bi - Variante Analysis**

In [12]:
```
def countplot_2(x,hue,title=None,figsize=(6,5)):
  plt.figure(figsize=figsize)
  sns.countplot(data=df[[x,hue]],x=x,hue=hue)
  plt.title(title)
  plt.show()
```

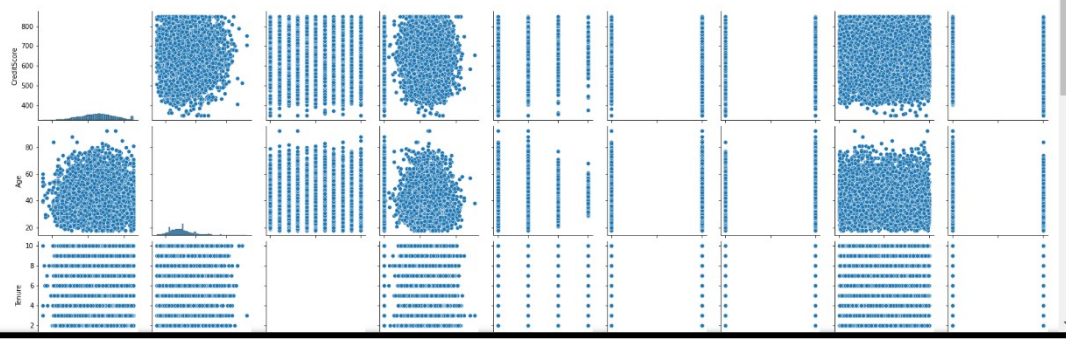
In [13]:
```
countplot_2('IsActiveMember','NumOfProducts','Credit Card Holders Product Details')
```

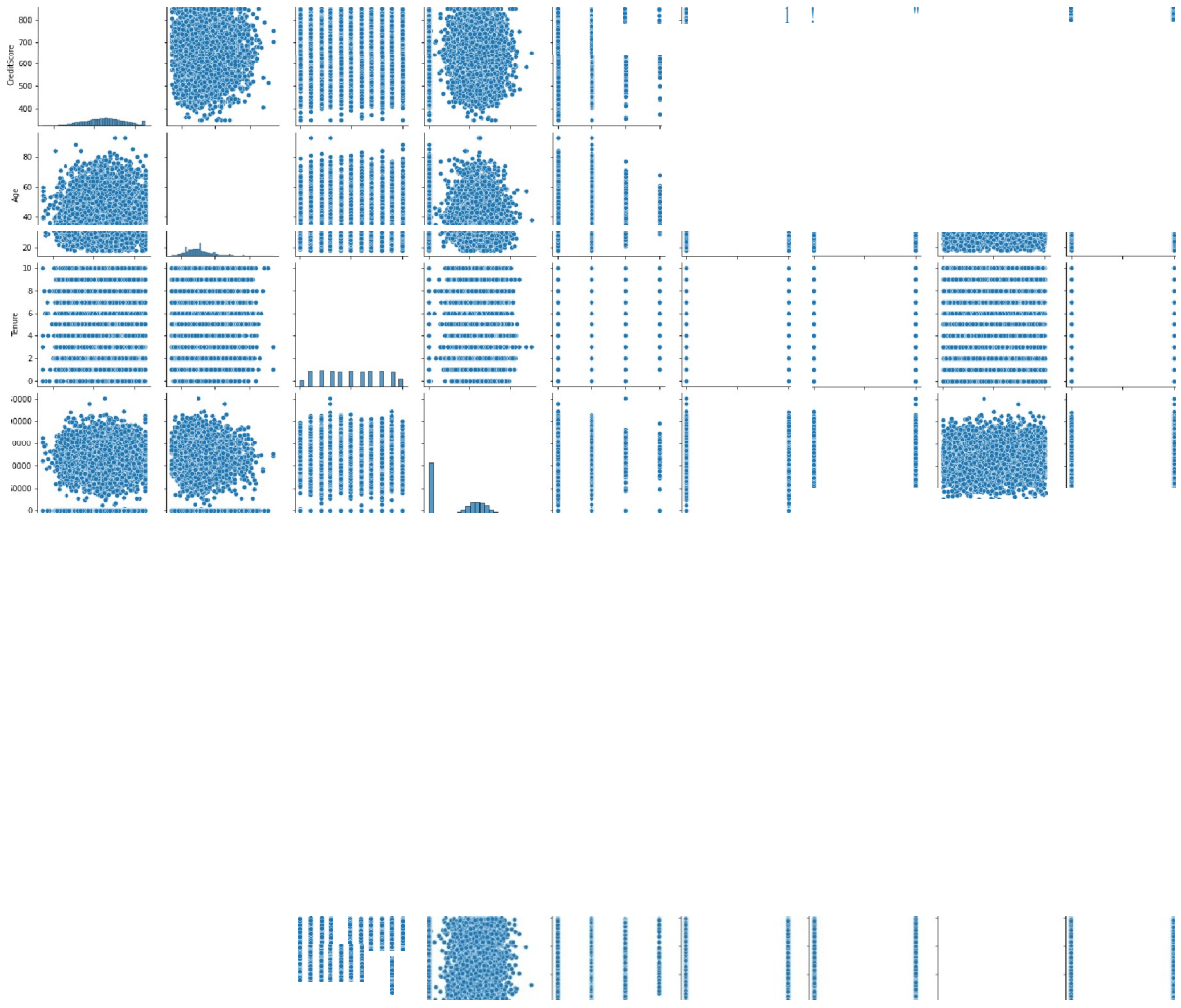

## c.) MULTI - VARIANTE ANALYSIS

**Multi - Variante Analysis**

In [14]:
```
sns.pairplot(df)
```

Out[14]:
```
<seaborn.axisgrid.PairGrid at 0x1c642d93760>
```






In [ 1sj : df. com( )

| | AQe | Teuwe | Baauce | Num‹MProduca | HasCrCard | lsAcivvMember | EsimaMdBaag | Exed |
|---|---|---|---|---|---|---|---|---|
| Credit6core | 1.000000 | -0.0089b5 | 0.00D842 | 0.006268 | 0.012238 | fi 00S45B | 0.025654 | 0.00fi 384 | -0.027094 |
| Age | -0.003966 | 4 .0000D0 | -0.00999Z | 0.028308 | -0.030680 | -0.0fi 4 724 | 0.085472 | -0.00720fi | 0.285323 |
| Tenure | 0.000842 | -0.009fi9J | fi.00D000 | -0.04 2254 | 0.013^44 | 0.022583 | -0.02B362 | 0.007Z84 | -0.0 4 40D4 |
| Balance | 0 006268 | 0 02B3D8 | -O 04 2Z54 | 4 000000 | -0 304fi BO | -0 04 485B | -O D084 | 0 012Z97 | 4 B538 |
| NuMGfProHHets | 0 012288 | —0 0306B0 | 0 04 344H | —0 304fi 80 | 1 000000 | 0 83 | 0 0098fi 2 | 0 01^204 | —0 0HT820 |
| HasCrCaN | —0 005458 | 0 OU 721 | 0 022583 | —0 04 4858 | 0 O03fi 88 | fi 00000D | —0 0fi 4 866 | 0 009983 | —0 38 |
| **lsActiveMember** | 0.025651 | 0.085472 | -0.028362 | -0.010084 | 0.009612 | -0.011866 | 1.000000 | -0.011421 | -0.156128 |
| **EstimatedSalary** | -400fi | -fi0072D10007 78H002797 | | | 001420A-i009933 | | -40fi4424 | 1000000040 20 97 | |
| **Exited** | -0.027094 | 0.285323 | -0.014001 | 0.118533 | -0.047820 | -0.007138 | -0.156128 | 0.012097 | 1.000000 |

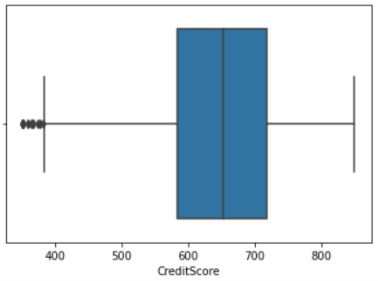
# 6.) FIND AND REPLACE THE OUTLIERS

## Find the Outliers

In [18]:
```
sns.boxplot(df.CreditScore)
```

```
Keyword will result in an error or misinterpretation.
  warnings.warn(
```

Out[18]:
```
<AxesSubplot:xlabel='CreditScore'>
```



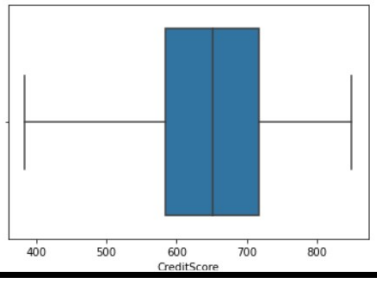

## Replace the Outliers

In [19]:
```
Q1 = df.CreditScore.quantile(0.25)
Q3 = df.CreditScore.quantile(0.75)
IQR = Q3-Q1
upper_limit = Q3 + (1.5*IQR)
lower_limit = Q1 - (1.5*IQR)
```

In [20]:
```
df['CreditScore'] = np.where(df['CreditScore']<lower_limit,650,df['CreditScore'])
sns.boxplot(df.CreditScore)
```

```
C:\Users\Prem\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a keyword arg: x. 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[20]:
```
<AxesSubplot:xlabel='CreditScore'>
```




# 7.) CHECK FOR CATEGORICAL COLUMNS AND ENCODE THEM

## Check for Categorical Columns and Perform Encoding

In [21]:
```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
df.Geography = le.fit_transform(df.Geography)
df.Gender = le.fit_transform(df.Gender)
```

In [22]:
```
df.head()
```

Out[22]:

| | CreditScore | Geography | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveMember | EstimatedSalary | Exited |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 619 | 0 | 0 | 42 | 2 | 0.00 | 1 | 1 | 1 | 101348.88 | 1 |
| **1** | 608 | 2 | 0 | 41 | 1 | 83807.86 | 1 | 0 | 1 | 112542.58 | 0 |
| **2** | 502 | 0 | 0 | 42 | 8 | 159660.80 | 3 | 1 | 0 | 113931.57 | 1 |
| **3** | 699 | 0 | 0 | 39 | 1 | 0.00 | 2 | 0 | 0 | 93826.63 | 0 |
| **4** | 850 | 2 | 0 | 43 | 2 | 125510.82 | 1 | 1 | 1 | 79084.10 | 0 |

## 8.)SPLIT DATA INTO DEPENDENT AND INDEPENDENT VARIABLES

### Split the data into Dependent and Independent Variables

In [23]:
```
X = df.drop(columns=['Exited'])
X.head()
```

Out[23]:

| | CreditScore | Geography | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveMember | EstimatedSalary |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 619 | 0 | 0 | 42 | 2 | 0.00 | 1 | 1 | 1 | 101348.88 |
| **1** | 608 | 2 | 0 | 41 | 1 | 83807.86 | 1 | 0 | 1 | 112542.58 |
| **2** | 502 | 0 | 0 | 42 | 8 | 159660.80 | 3 | 1 | 0 | 113931.57 |
| **3** | 699 | 0 | 0 | 39 | 1 | 0.00 | 2 | 0 | 0 | 93826.63 |
| **4** | 850 | 2 | 0 | 43 | 2 | 125510.82 | 1 | 1 | 1 | 79084.10 |

In [24]:
```
Y = df.Exited
Y.head()
```

Out[24]:
```
0    1
1    0
2    1
3    0
4    0
Name: Exited, dtype: int64
```

## 9.) SCALE THE INDEPENDENT VARIABLES

### Scale the Independent Variables

In [25]:
```
from sklearn.preprocessing import MinMaxScaler
scale = MinMaxScaler()
X_scaled = pd.DataFrame(scale.fit_transform(X),columns=X.columns)
```

## 10.)SPLIT THE DATA INTO TRAINING AND TESTING

### Split the data into Training and Testing

In [26]:
```
from sklearn.model_selection import train_test_split
x_train , y_train , x_test , y_test = train_test_split(X_scaled,Y,test_size=0.2,random_state=0)
```

In [27]:
```
X_scaled.shape
```

Out[27]:
```
(10000, 10)
```

In [28]:
```
x_train.shape
```

Out[28]:
```
(8000, 10)
```