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

# 2.Loading the dataset
data=pd.read_csv("Churn_Modelling.csv")

data.head()
```

```
   RowNumber  CustomerId   Surname  CreditScore Geography  Gender  Age
\
0          1    15634602  Hargrave          619    France  Female   42

1          2    15647311      Hill          608     Spain  Female   41

2          3    15619304      Onio          502    France  Female   42

3          4    15701354      Boni          699    France  Female   39

4          5    15737888  Mitchell          850     Spain  Female   43


   Tenure    Balance  NumOfProducts  HasCrCard  IsActiveMember  \
0       2       0.00              1          1               1
1       1   83807.86              1          0               1
2       8  159660.80              3          1               0
3       1       0.00              2          0               0
4       2  125510.82              1          1               1

   EstimatedSalary  Exited
0        101348.88       1
1        112542.58       0
2        113931.57       1
3         93826.63       0
4         79084.10       0
```

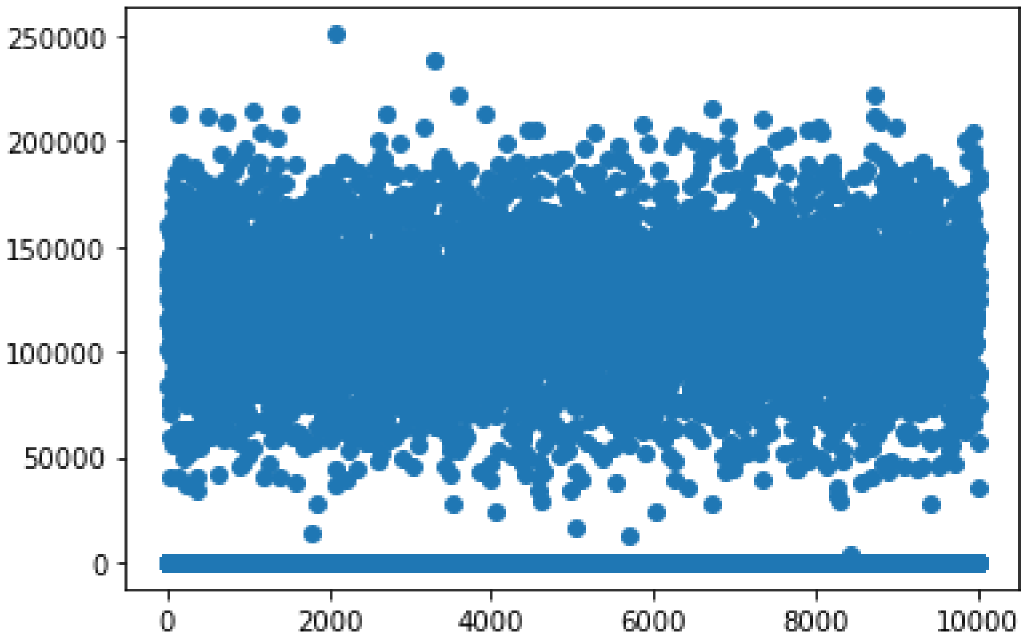
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 14 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   RowNumber        10000 non-null  int64
 1   CustomerId       10000 non-null  int64
 2   Surname          10000 non-null  object
 3   CreditScore      10000 non-null  int64
 4   Geography        10000 non-null  object
 5   Gender           10000 non-null  object
 6   Age              10000 non-null  int64
 7   Tenure           10000 non-null  int64  
 8   Balance          10000 non-null  float64
 9   NumOfProducts    10000 non-null  int64  
 10  HasCrCard        10000 non-null  int64  
 11  IsActiveMember   10000 non-null  int64  
 12  EstimatedSalary  10000 non-null  float64
 13  Exited           10000 non-null  int64  
dtypes: float64(2), int64(9), object(3)
memory usage: 1.1+ MB
```

```
data.tail()
```

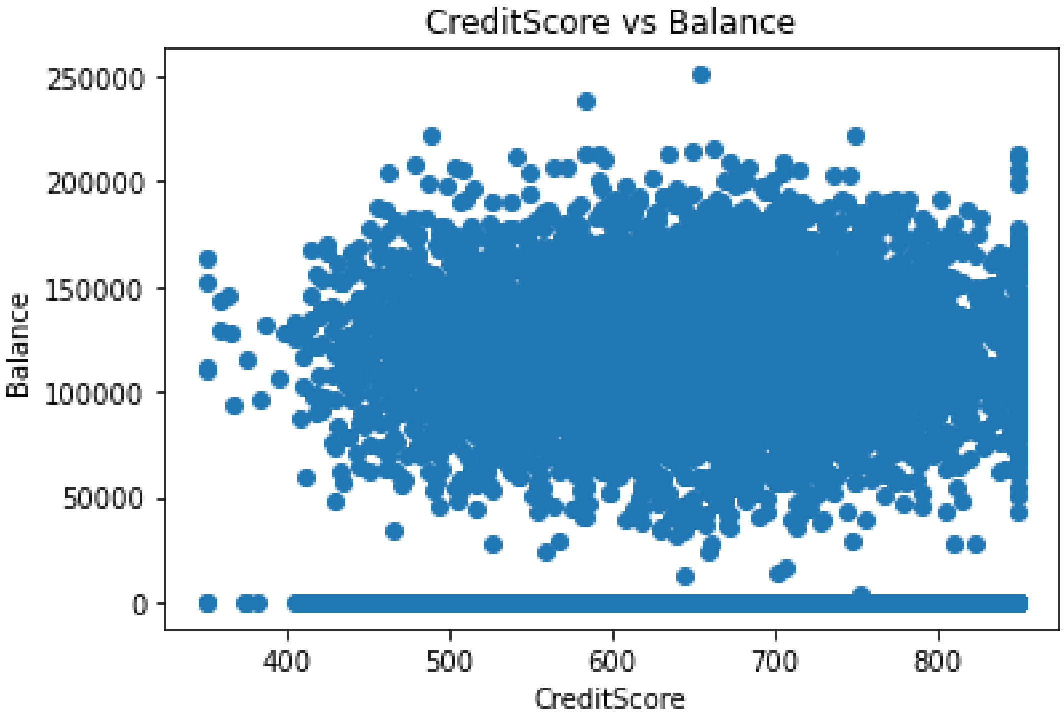
```
      RowNumber  CustomerId    Surname  CreditScore Geography  Gender  
Age  \
9995       9996    15606229   Obijiaku          771    France    Male   
39   
9996       9997    15569892  Johnstone          516    France    Male   
35   
9997       9998    15584532        Liu          709    France  Female   
36   
9998       9999    15682355  Sabbatini          772   Germany    Male   
42   
9999      10000    15628319     Walker          792    France  Female   
28   

      Tenure    Balance  NumOfProducts  HasCrCard  IsActiveMember  \
9995       5       0.00              2          1               0   
9996      10   57369.61              1          1               1   
9997       7       0.00              1          0               1   
9998       3   75075.31              2          1               0   
9999       4  130142.79              1          1               0   

      EstimatedSalary  Exited  
9995         96270.64       0  
9996        101699.77       0  
9997         42085.58       1  
9998         92888.52       1  
9999         38190.78       0  
```

```
#3.Data Visualization
#Univariate Analysis
plt.scatter(data.index,data['Balance'])
plt.show()
```



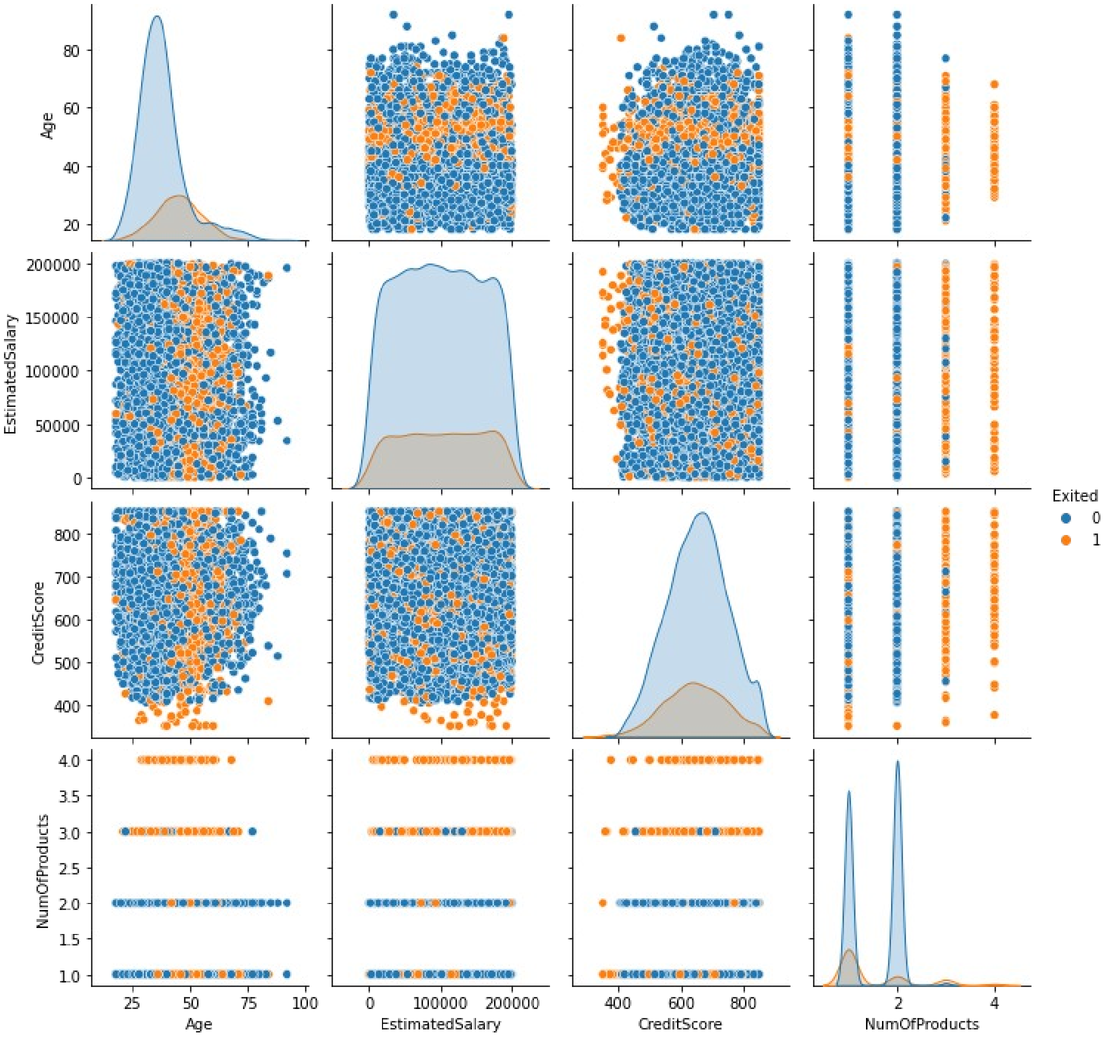
```
#BIVARIATE ANALYSIS
plt.scatter(data.CreditScore,data.Balance)
plt.title('CreditScore vs Balance')
plt.xlabel('CreditScore')
plt.ylabel('Balance')
```

```
Text(0, 0.5, 'Balance')
```



```
#Multivariate Analysis
sns.pairplot(data[['Age','EstimatedSalary','CreditScore','NumOfProduct
s','Exited']],hue='Exited')
```

```
<seaborn.axisgrid.PairGrid at 0x1de827c9e50>
```



```
#4.Descriptive Statisrics
data.describe()
```

```
         RowNumber    CustomerId   CreditScore           Age
Tenure  \
count  10000.00000  1.000000e+04  10000.000000  10000.000000
10000.000000
mean    5000.50000  1.569094e+07    650.528800     38.921800
5.012800
std     2886.89568  7.193619e+04     96.653299     10.487806
2.892174
min        1.00000  1.556570e+07    350.000000     18.000000
0.000000
```

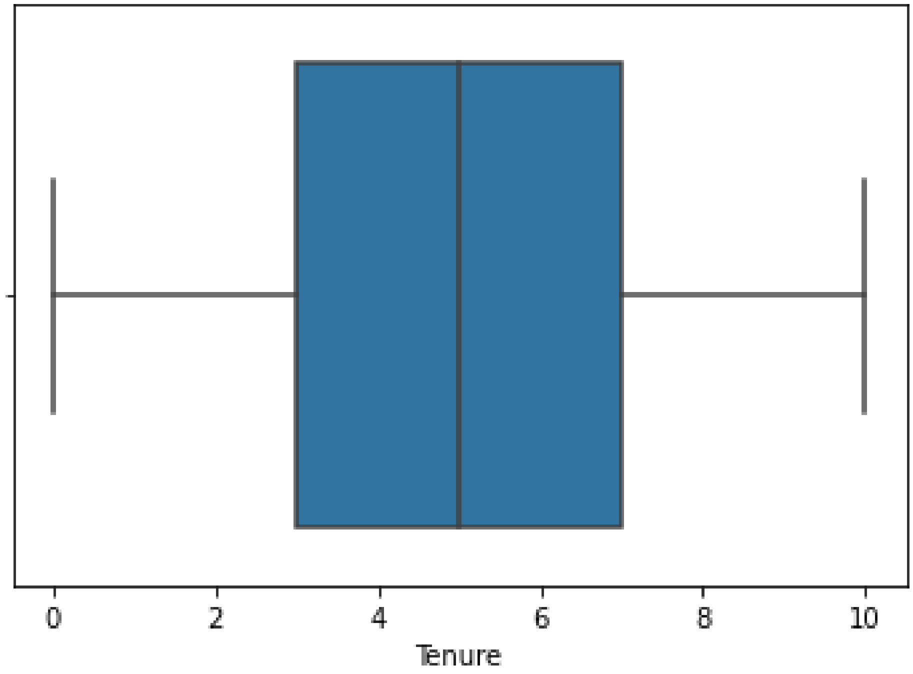
```
25%     2500.75000  1.562853e+07    584.000000     32.000000
3.000000
50%     5000.50000  1.569074e+07    652.000000     37.000000
5.000000
75%     7500.25000  1.575323e+07    718.000000     44.000000
7.000000
max    10000.00000  1.581569e+07    850.000000     92.000000
10.000000

             Balance  NumOfProducts    HasCrCard  IsActiveMember  \
count   10000.000000   10000.000000  10000.00000    10000.000000
mean    76485.889288       1.530200      0.70550        0.515100
std     62397.405202       0.581654      0.45584        0.499797
min         0.000000       1.000000      0.00000        0.000000
25%         0.000000       1.000000      0.00000        0.000000
50%     97198.540000       1.000000      1.00000        1.000000
75%    127644.240000       2.000000      1.00000        1.000000
max    250898.090000       4.000000      1.00000        1.000000

       EstimatedSalary        Exited
count     10000.000000  10000.000000
mean     100090.239881      0.203700
std       57510.492818      0.402769
min          11.580000      0.000000
25%       51002.110000      0.000000
50%      100193.915000      0.000000
75%      149388.247500      0.000000
max      199992.480000      1.000000
```

```
# 5.Missing Value Handling
data.isnull().sum()
```

```
RowNumber          0
CustomerId         0
Surname            0
CreditScore        0
Geography          0
Gender             0
Age                0
Tenure             0
Balance            0
NumOfProducts      0
HasCrCard          0
IsActiveMember     0
EstimatedSalary    0
Exited             0
dtype: int64
```

```
#6.Outliers
sns.boxplot(data['Tenure'],data=data)
```

```
C:\Program Files\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(

<AxesSubplot:xlabel='Tenure'>
```



```
#Replacing Outliers
Q1=data['Tenure'].quantile(0.10)
Q3=data['Tenure'].quantile(0.90)
IQR=Q3 - Q1
whisker_width = 1.5
lower_whisker = Q1 - (whisker_width*IQR)
upper_whisker = Q3 + (whisker_width*IQR)
index=data['Tenure'][(data['Tenure']>upper_whisker)|
(data['Tenure']<lower_whisker)].index
data.drop(index,inplace=True)
```

```
#7-Categorical Columns
df_numeric=data[['RowNumber','CustomerId','CreditScore','Age','Tenure'
,'Balance','NumOfProducts','EstimatedSalary']]
df_categorical=data[['Geography','Gender','HasCrCard','IsActiveMember'
,'Exited']]
df_numeric.head()
```

```
   RowNumber  CustomerId  CreditScore  Age  Tenure    Balance  
NumOfProducts  \
0          1    15634602          619   42       2       0.00
```

```
1
1          2    15647311          608   41       1   83807.86
1
2          3    15619304          502   42       8  159660.80
3
3          4    15701354          699   39       1       0.00
2
4          5    15737888          850   43       2  125510.82
1

   EstimatedSalary
0        101348.88
1        112542.58
2        113931.57
3         93826.63
4         79084.10
```

```
df_categorical.head()
```

```
  Geography  Gender  HasCrCard  IsActiveMember  Exited
0    France  Female          1               1       1
1     Spain  Female          0               1       0
2    France  Female          1               0       1
3    France  Female          0               0       0
4     Spain  Female          1               1       0
```

```
data.columns
```

```
Index(['RowNumber', 'CustomerId', 'Surname', 'CreditScore',
'Geography',
       'Gender', 'Age', 'Tenure', 'Balance', 'NumOfProducts',
'HasCrCard',
       'IsActiveMember', 'EstimatedSalary', 'Exited'],
      dtype='object')
```

```
#Perform Encoding
print(data['Geography'].unique())
print(data['Gender'].unique())
```

```
['France' 'Spain' 'Germany']
['Female' 'Male']
```

```
from sklearn.preprocessing import LabelEncoder
Gender_encoder=LabelEncoder()
Gender_encoder.fit(df_categorical['Gender'])
Gender_values = Gender_encoder.transform(df_categorical['Gender'])
print("Before Encoding:",list(df_categorical['Gender'][-10:]))
print("After Encoding:",Gender_values[-10:])
print("The inverse from the encoding
result:",Gender_encoder.inverse_transform(Gender_values[-10:]))
```

```
Before Encoding: ['Male', 'Female', 'Male', 'Male', 'Female', 'Male',
'Male', 'Female', 'Male', 'Female']
After Encoding: [1 0 1 1 0 1 1 0 1 0]
The inverse from the encoding result: ['Male' 'Female' 'Male' 'Male'
'Female' 'Male' 'Male' 'Female' 'Male'
 'Female']
```

```
#8-Split Dependent And Independent Variables
X=data[['RowNumber','CustomerId','Surname','CreditScore','Geography','
Gender','Age','Tenure','Balance','NumOfProducts','HasCrCard','IsActive
Member','EstimatedSalary']]
Y=data['Exited']

X=data.iloc[:, :-1].values
print(X)
```

```
[[1 15634602 'Hargrave' ... 1 1 101348.88]
 [2 15647311 'Hill' ... 0 1 112542.58]
 [3 15619304 'Onio' ... 1 0 113931.57]
 ...
 [9998 15584532 'Liu' ... 0 1 42085.58]
 [9999 15682355 'Sabbatini' ... 1 0 92888.52]
 [10000 15628319 'Walker' ... 1 0 38190.78]]
```

```
y=data.iloc[:, -1].values
print(y)
```

```
[1 0 1 ... 1 1 0]
```

```
#9-Scale the independent Variables
from sklearn.preprocessing import scale

y=scale(y)
y
```

```
array([ 1.97716468, -0.50577476,  1.97716468, ...,  1.97716468,
        1.97716468, -0.50577476])
```

```
#10-Split training and testing dataset
response = data["Exited"]
dataset = data.drop(columns="Exited")
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(dataset,
response,stratify=response, test_size = 0.2)
print("Number transactions X_train dataset: ", X_train.shape)
print("Number transactions y_train dataset: ", y_train.shape)
print("Number transactions X_test dataset: ", X_test.shape)
print("Number transactions y_test dataset: ", y_test.shape)
```

```
Number transactions X_train dataset:  (8000, 13)
Number transactions y_train dataset:  (8000,)
Number transactions X_test dataset:  (2000, 13)
Number transactions y_test dataset:  (2000,)
```