Mahendra Engineering College For Women

Assingnment-2
Name of the Student- R. Ranjani
Subject -IBM
Register No- 611419106048
Department- ECE

```
#libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt%
matplotlib inline
#load dataset
df = pd.read_csv(r"/content/Churn_Modelling.csv")
df.head(10)
```

```
   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
5          6    15574012       Chu          645     Spain    Male   44
6          7    15592531  Bartlett          822    France    Male   50
7          8    15656148    Obinna          376   Germany  Female   29
8          9    15792365        He          501    France    Male   44
9         10    15592389        H?          684    France    Male   27

   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   5
        8  113755.78              2          1               0   6
        7       0.00              2          1               1   7
        4  115046.74              4          1               0   8     4
           142051.07              2          0               1   9     2
           134603.88              1          1               1

   EstimatedSalary  Exited
0        101348.88       1
1        112542.58       0
2        113931.57       1
```

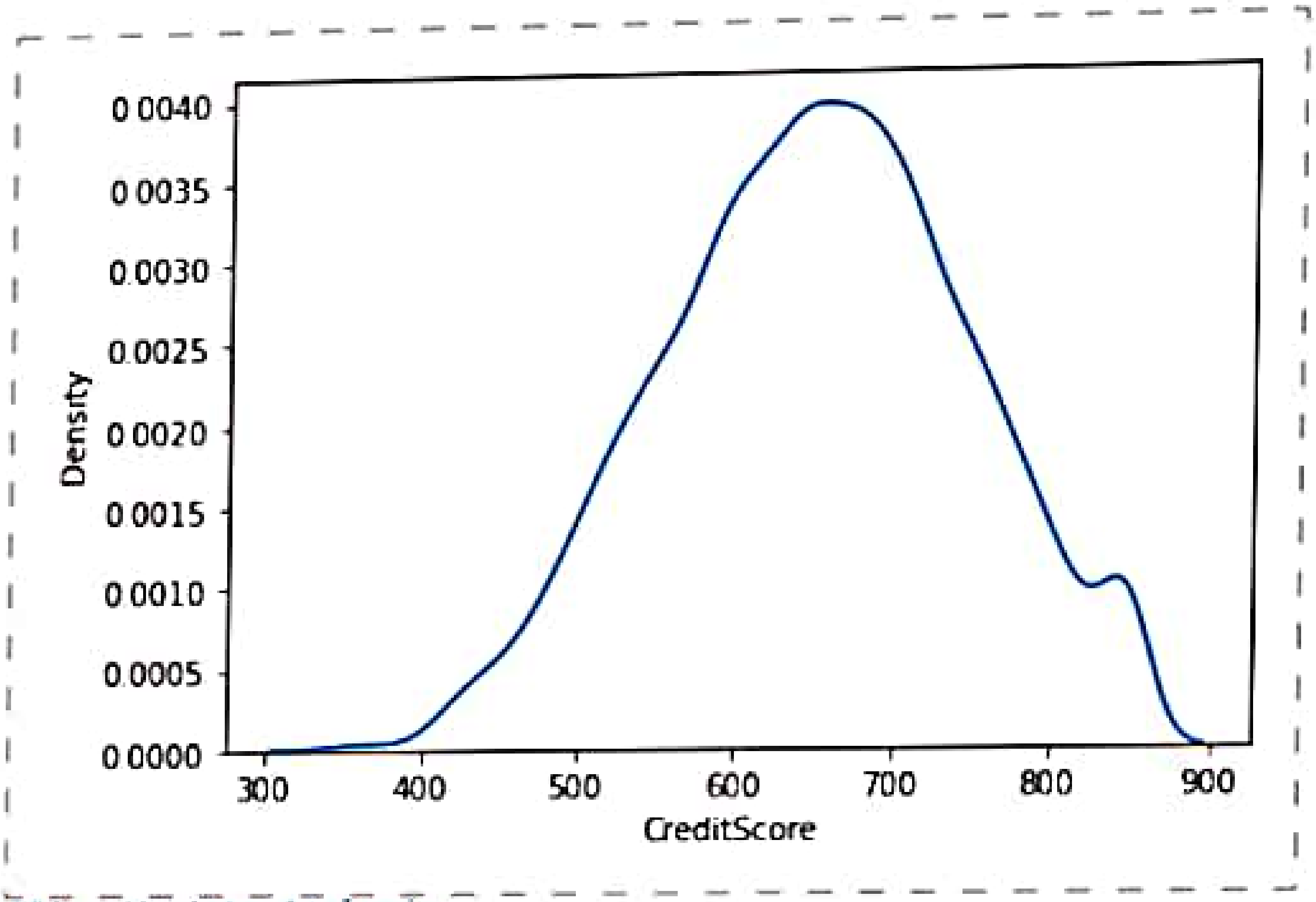
```
3         93826.63       0  4
         79084.10       0  5
       149756.71       1  6
        10062.80       0  7
      119346.88       1  8
      74940.50       0  9
     71725.73       0
```

```
df.info()
```

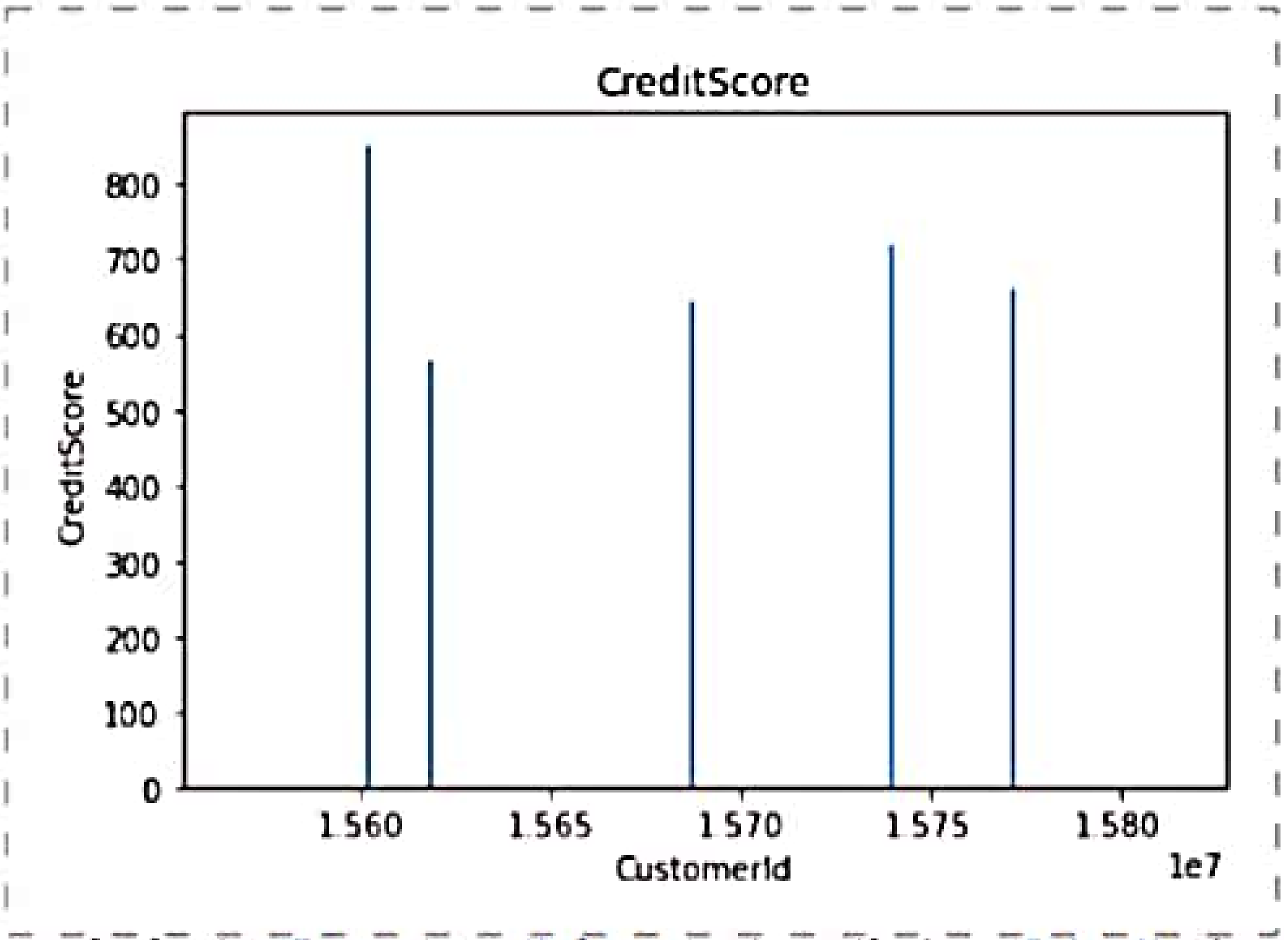
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 14 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   RowNumber        10000 non-null  int64
 1   CustomerId       10000 non-null  int64
 2   Surname          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
```

```
#Visualizations
#Univariate Analysis
import seaborn as sns

sns.kdeplot(df['CreditScore'])
```

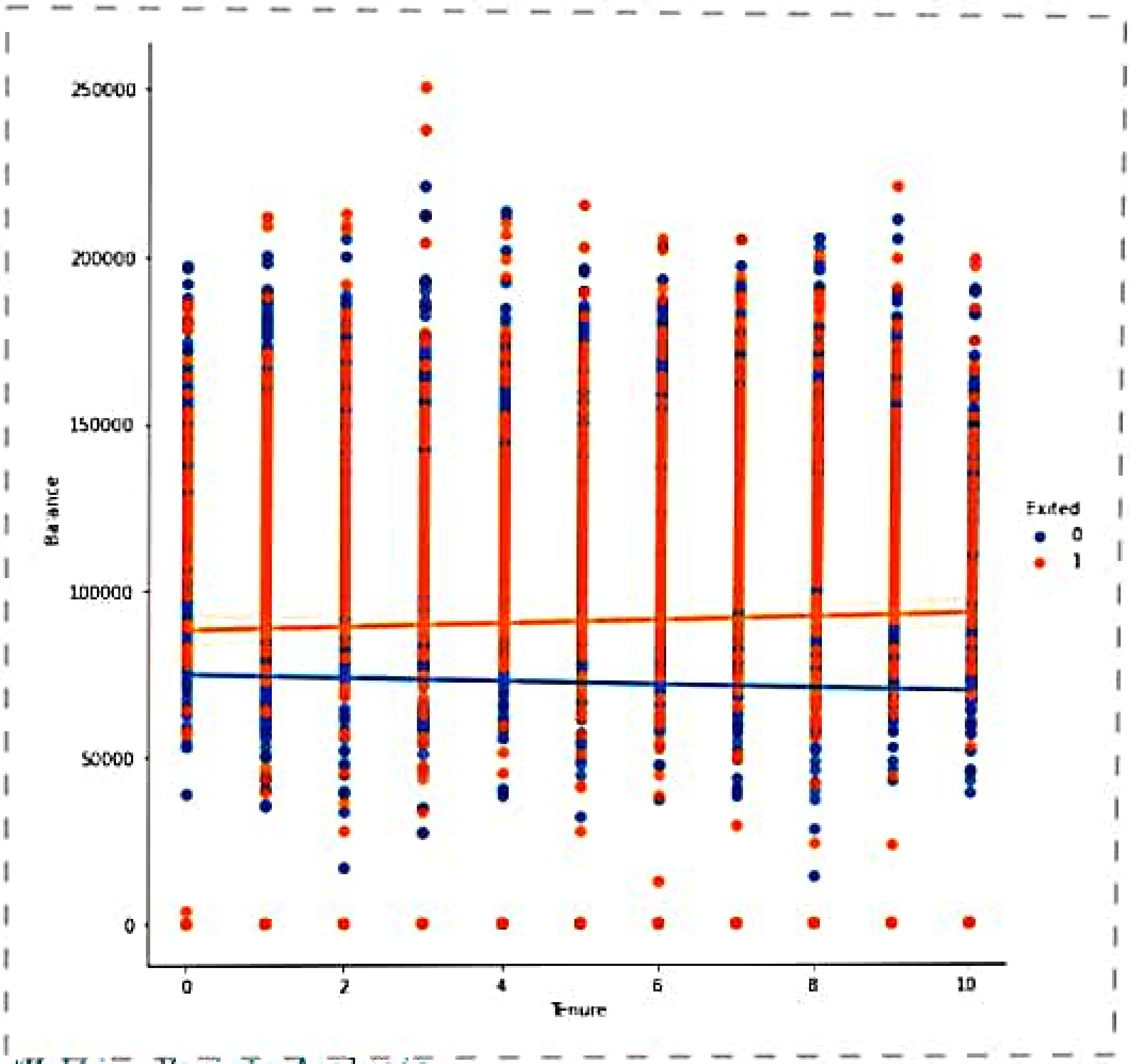
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fc4a0cd2790>
```



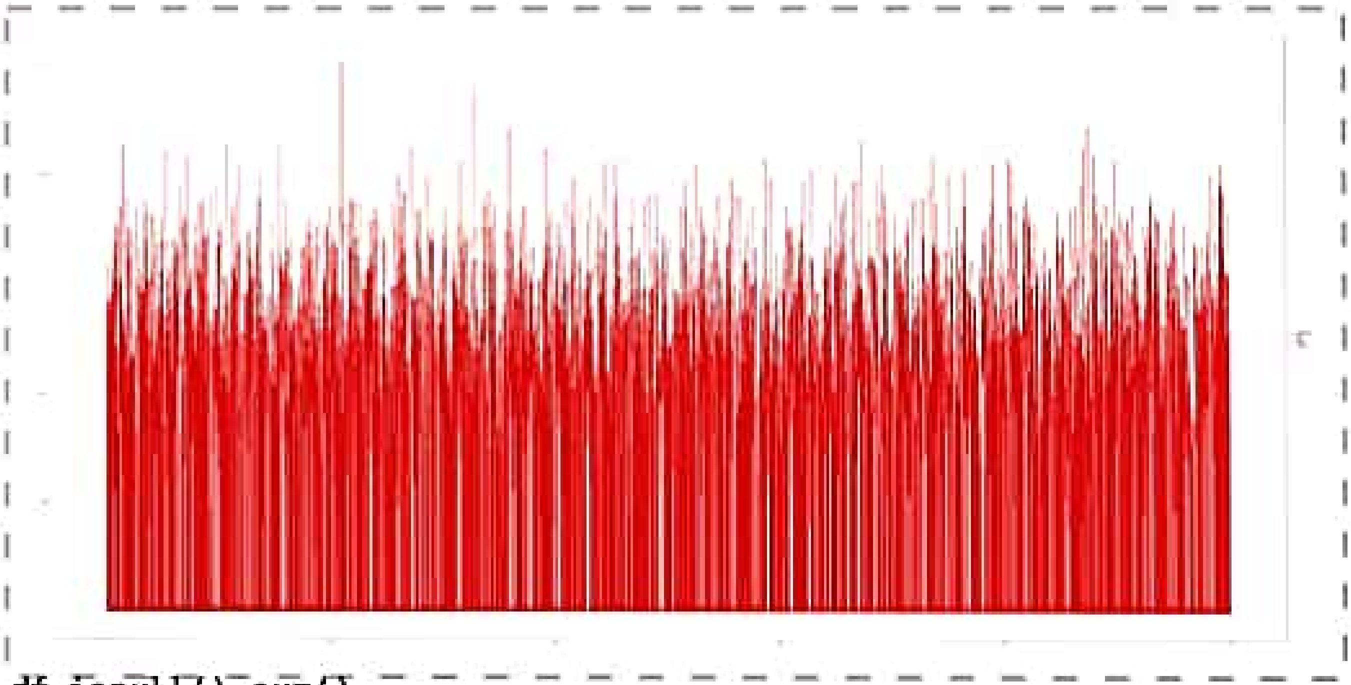
```
#Bi - Variate Analysis

plt.bar(df.CustomerId, df.CreditScore)
plt.title('CreditScore')
plt.xlabel('CustomerId')
plt.ylabel('CreditScore')

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



```
sns.lmplot(x='Tenure', y='Balance', data=df ,hue='Exited',size=8)

/usr/local/lib/python3.7/dist-packages/seaborn/regression.py:581:
UserWarning: The `size` parameter has been renamed to `height`; please
update your code.
  warnings.warn(msg, UserWarning)

<seaborn.axisgrid.FacetGrid at 0x7fc4a149e2d0>
```



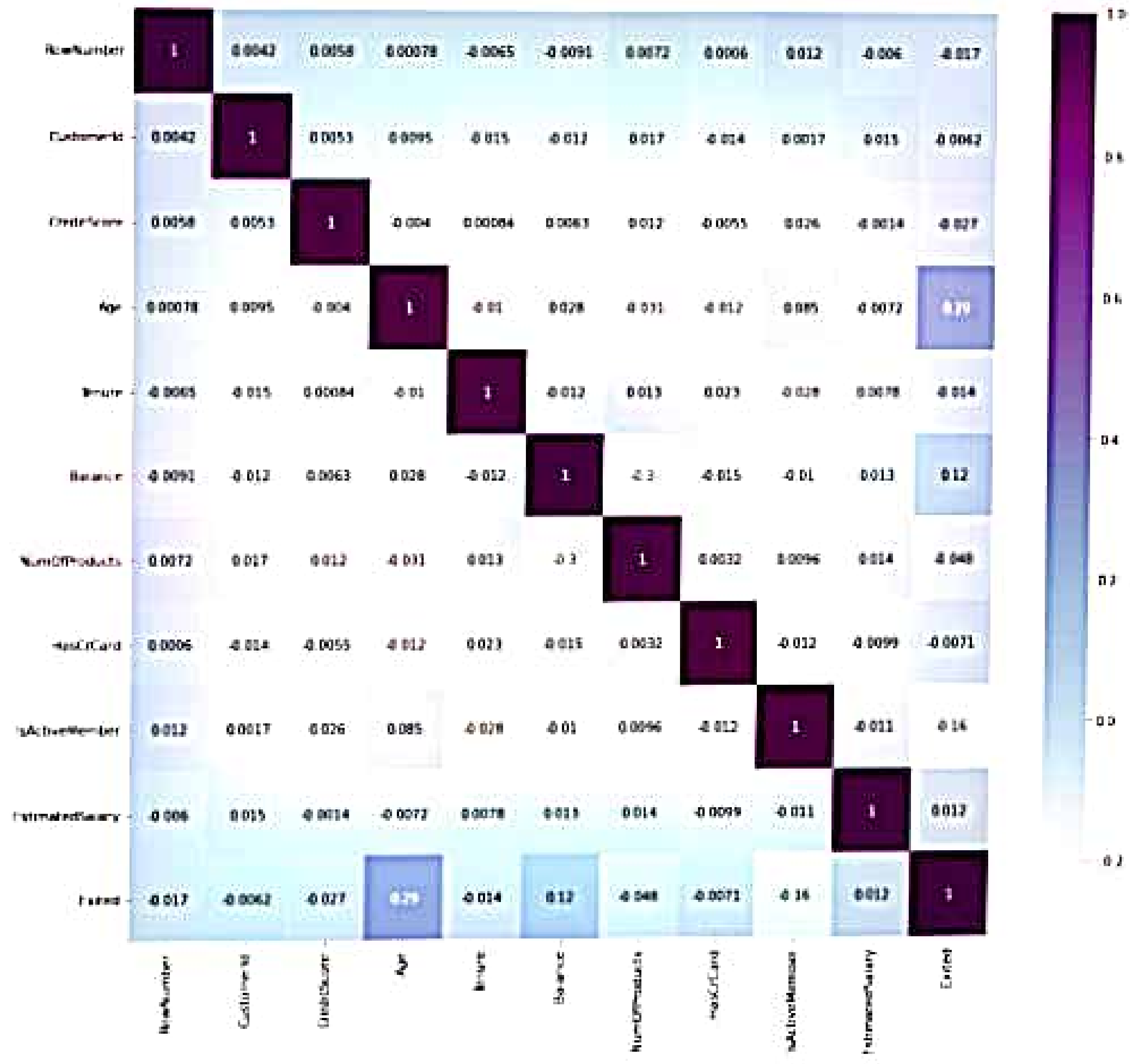
```
#Multi - Variate Analysis
ax =
df[["CreditScore","Age","Tenure","Balance"]].plot(figsize=(80,40))
ax.legend(loc='center left', bbox_to_anchor=(1, 0.5));
```



```
df.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
```

```
plt.figure(figsize=(15,13))
sns.heatmap(df.corr(),annot=True,cmap='BuPu')
plt.show()
```



```
df.drop(['RowNumber', 'CustomerId','Surname'],axis=1,inplace=True)

df.head()

   CreditScore Geography  Gender  Age  Tenure    Balance
NumOfProducts  \
0          619    France  Female   42       2       0.00
1
1          608     Spain  Female   41       1   83807.86
1
2          502    France  Female   42       8  159660.80
3
3          699    France  Female   39       1       0.00
2
4          850     Spain  Female   43       2  125510.82
1

   HasCrCard  IsActiveMember  EstimatedSalary  Exited
0          1               1        101348.88       1
```

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

```
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)
memory usage: 859.5+ KB
```

```
df["Geography"].unique()
```

```
array(['France', 'Spain', 'Germany'], dtype=object)
```

```
df["Gender"].unique()
```

```
array(['Female', 'Male'], dtype=object)
```

```
geo=pd.get_dummies(df["Geography"],drop_first=False)
```

```
geo.head()
```

```
   France  Germany  Spain
0       1        0      0
1       0        0      1
2       1        0      0
3       1        0      0
4       0        0      1
```

```
gen=pd.get_dummies(df["Gender"],drop_first=False)
```

```
df=pd.concat([df, geo,gen], axis=1)
```

```
df
```

```
      CreditScore Geography  Gender  Age  Tenure    Balance  
NumOfProducts  \
0             619    France  Female   42       2       0.00
1
1             608     Spain  Female   41       1   83807.86
1
2             502    France  Female   42       8  159660.80
3
3             699    France  Female   39       1       0.00
2
4             850     Spain  Female   43       2  125510.82
1
...           ...       ...     ...  ...     ...        ...
...
9995          771    France    Male   39       5       0.00
2
9996          516    France    Male   35      10   57369.61
1
9997          709    France  Female   36       7       0.00
1
9998          772   Germany    Male   42       3   75075.31
2
9999          792    France  Female   28       4  130142.79
1

      HasCrCard  IsActiveMember  EstimatedSalary  Exited  France
Germany  \
0             1               1        101348.88       1       1
0
1             0               1        112542.58       0       0
0
2             1               0        113931.57       1       1
0
3             0               0         93826.63       0       1
0
4             1               1         79084.10       0       0
0
...         ...             ...              ...     ...     ...
...
9995          1               0         96270.64       0       1
0
9996          1               1        101699.77       0       1
0
9997          0               1         42085.58       1       1
0
9998          1               0         92888.52       1       0
1
9999          1               0         38190.78       0       1
0

      Spain  Female  Male
0         0       1     0
```

```
1          1       1     0
2          0       1     0
3          0       1     0
4          1       1     0
...      ...     ...   ...
9995       0       0     1
9996       0       0     1
9997       0       1     0
9998       0       0     1
9999       0       1     0

[10000 rows x 16 columns]
```

```
df.drop(["Geography","Gender"], axis=1, inplace=True)
```

```
df.head()
```

```
   CreditScore  Age  Tenure    Balance  NumOfProducts  HasCrCard  \
0          619   42       2       0.00              1          1
1          608   41       1   83807.86              1          0
2          502   42       8  159660.80              3          1
3          699   39       1       0.00              2          0
4          850   43       2  125510.82              1          1

   IsActiveMember  EstimatedSalary  Exited  France  Germany  Spain
Female  \
0               1        101348.88       1       1        0      0
1
1               1        112542.58       0       0        0      1
1
2               0        113931.57       1       1        0      0
1
3               0         93826.63       0       1        0      0
1
4               1         79084.10       0       0        0      1
1

   Male
0     0
1     0
2     0
3     0
4     0
```

```
x=df.drop('Exited',axis=1)
```

```
x
```

```
      CreditScore  Age  Tenure    Balance  NumOfProducts  HasCrCard  \
0             619   42       2       0.00              1          1
1             608   41       1   83807.86              1          0
```

```
2             502   42      8  159660.80           3         1
3             699   39      1       0.00           2         0
4             850   43      2  125510.82           1         1
...           ...  ...    ...        ...         ...       ...
9995          771   39      5       0.00           2         1
9996          516   35     10   57369.61           1         1
9997          709   36      7       0.00           1         0
9998          772   42      3   75075.31           2         1
9999          792   28      4  130142.79           1         1

      IsActiveMember  EstimatedSalary  France  Germany  Spain  Female
Male
0                  1        101348.88       1        0      0       1
0
1                  1        112542.58       0        0      1       1
0
2                  0        113931.57       1        0      0       1
0
3                  0         93826.63       1        0      0       1
0
4                  1         79084.10       0        0      1       1
0
...              ...              ...     ...      ...    ...     ...
...
9995               0         96270.64       1        0      0       0
1
9996               1        101699.77       1        0      0       0
1
9997               1         42085.58       1        0      0       1
0
9998               0         92888.52       0        1      0       0
1
9999               0         38190.78       1        0      0       1
0

[10000 rows x 13 columns]
```

```
y=df['Exited']
```

```
y
```

```
0       1
1       0
2       1
3       0
4       0
       ..
9995    0
9996    0
9997    1
9998    1
```

```
9999    0
Name: Exited, Length: 10000, dtype: int64
```

```
df.shape
```

```
(10000, 14)
```

```
x.shape
```

```
(10000, 13)
```

```
y.shape
```

```
(10000,)
```

```
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)
```

```
x_train.shape
```

```
(8000, 13)
```

```
x_test.shape
```

```
(2000, 13)
```

```
y_test.shape
```

```
(2000,)
```

```
from sklearn.preprocessing import StandardScaler
```

```
sc = StandardScaler()
```

```
x_train = sc.fit_transform(x_train)
```

```
x_train
```

```
array([[ 0.16958176, -0.46460796,  0.00666099, ...,  1.74309049,
         1.09168714, -1.09168714],
       [-2.30455945,  0.30102557, -1.37744033, ..., -0.57369368,
        -0.91601335,  0.91601335],
       [-1.19119591, -0.94312892, -1.031415  , ..., -0.57369368,
         1.09168714, -1.09168714],
       ...,
       [ 0.9015152 , -0.36890377,  0.00666099, ..., -0.57369368,
        -0.91601335,  0.91601335],
       [-0.62420521, -0.08179119,  1.39076231, ...,  1.74309049,
         1.09168714, -1.09168714],
       [-0.28401079,  0.87525072, -1.37744033, ..., -0.57369368,
         1.09168714, -1.09168714]])
```

```
x_test = sc.transform(x_test)
```

```
x_test
```

```
array([[-0.55204276, -0.36890377,  1.04473698, ..., -0.57369368,
         1.09168714, -1.09168714],
       [-1.31490297,  0.10961719, -1.031415  , ..., -0.57369368,
         1.09168714, -1.09168714],
       [ 0.57162971,  0.30102557,  1.04473698, ...,  1.74309049,
         1.09168714, -1.09168714],
       ...,
       [-0.74791227, -0.27319958, -1.37744033, ...,  1.74309049,
        -0.91601335,  0.91601335],
       [-0.00566991, -0.46460796, -0.33936434, ..., -0.57369368,
        -0.91601335,  0.91601335],
       [-0.79945688, -0.84742473,  1.04473698, ..., -0.57369368,
        -0.91601335,  0.91601335]])
```