ASSIGNMENT 2

MAHENDRA ENGINEERING COLLEGE

FOR WOMEN

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CLASS :4 year ece

SUBJECT:IBM

REGISTER NO:611419106066

```
#libraries
 importpandasas
 pdimportnumpyas np
 importmatplotlib.pyplotasplt
 %matplotlib inline

 #loaddataset
 df=pd.read_csv(r"/content/Churn_Modelling.csv")df.hea

 d(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
```

```
3         93826.63       0
4         79084.10       0
5         149756.7       1
                 1
6         10062.80       0
7         119346.8       1
                 8
8         74940.50       0
9         71725.73       0
```

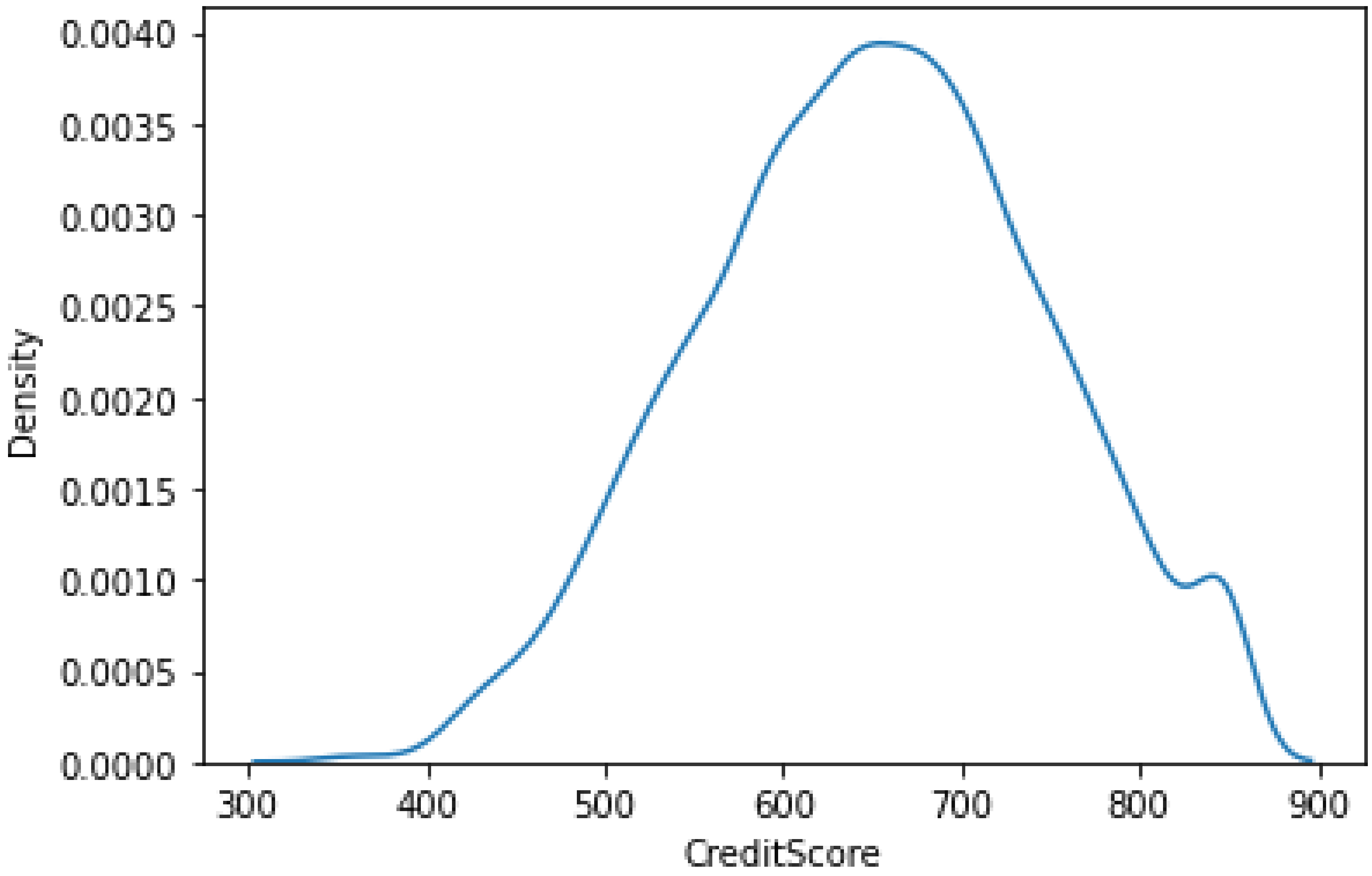
```
df.info(
)
```

```
<class
'pandas.core.frame.DataFrame'>RangeIn
dex:10000entries,0to9999Datacolumns(t
otal 14 columns):
 #   Column          Non-NullCountDtype
---  -----           ---------- -----
 0  RowNumber        10000non-nullint64
 1  CustomerId       10000non-nullint64
 2  Surname          10000non-null  object
 3  CreditScore      10000non-nullint64
 4  Geography        10000non-nullobject
 5  Gender           10000non-nullobject
 6  Age              10000non-nullint64
 7  Tenure           10000non-nullint64
 8  Balance          10000non-nullfloat64
 9  NumOfProducts    10000non-nullint64
 10 HasCrCard        10000non-nullint64
 11 IsActiveMember   10000non-nullint64
 12 EstimatedSalary10000non-null  float64
 13 Exited           10000
non-nullint64dtypes: float64(2),
int64(9),object(3)memoryusage:1.1+MB
```

```
#Visualizations#Univa
riate Analysisimport
seabornassns
```

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

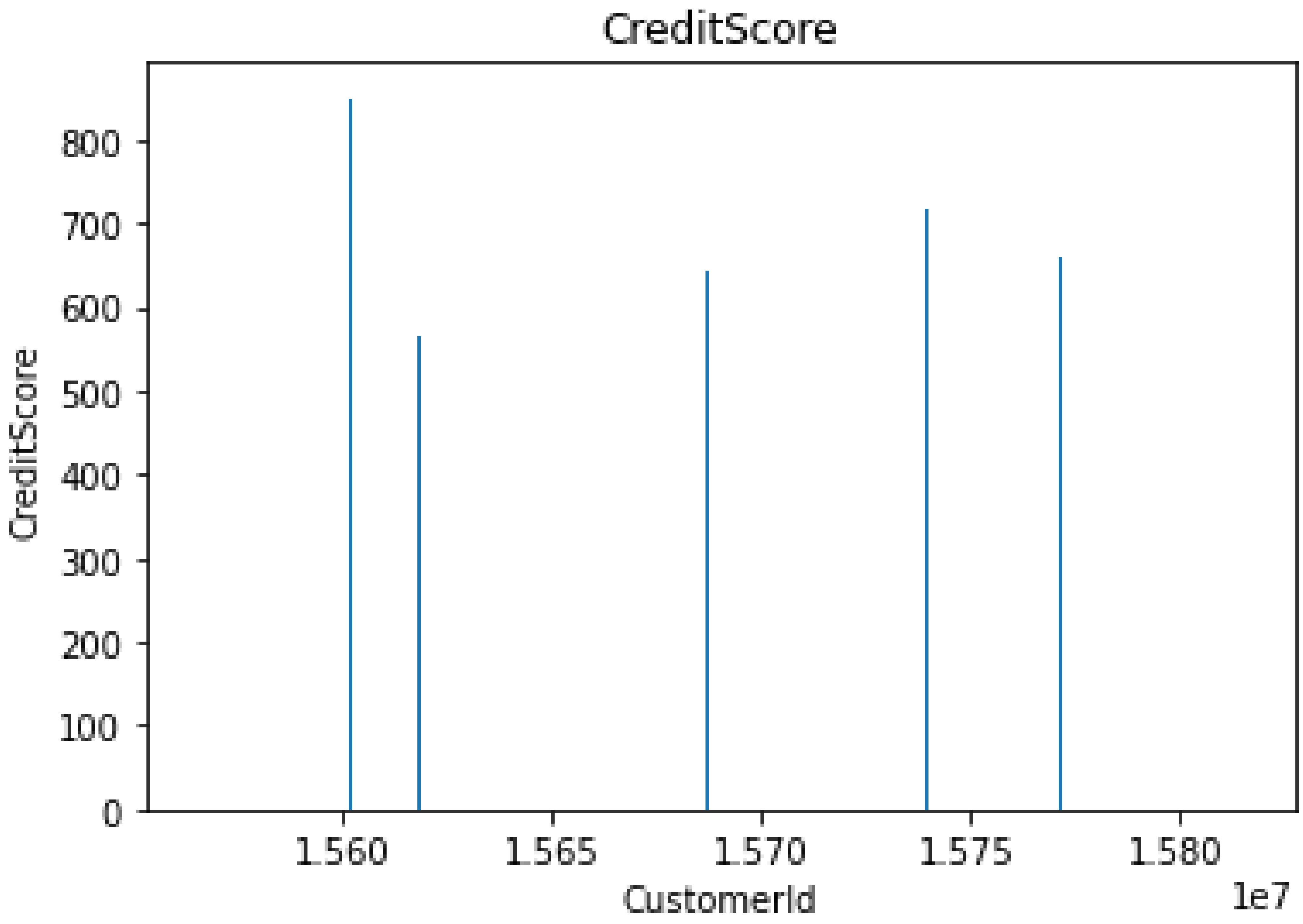
```
<matplotlib.axes._subplots.AxesSubplotat0x7fc4a0cd2790>
```



```
#Bi-VariateAnalysis

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

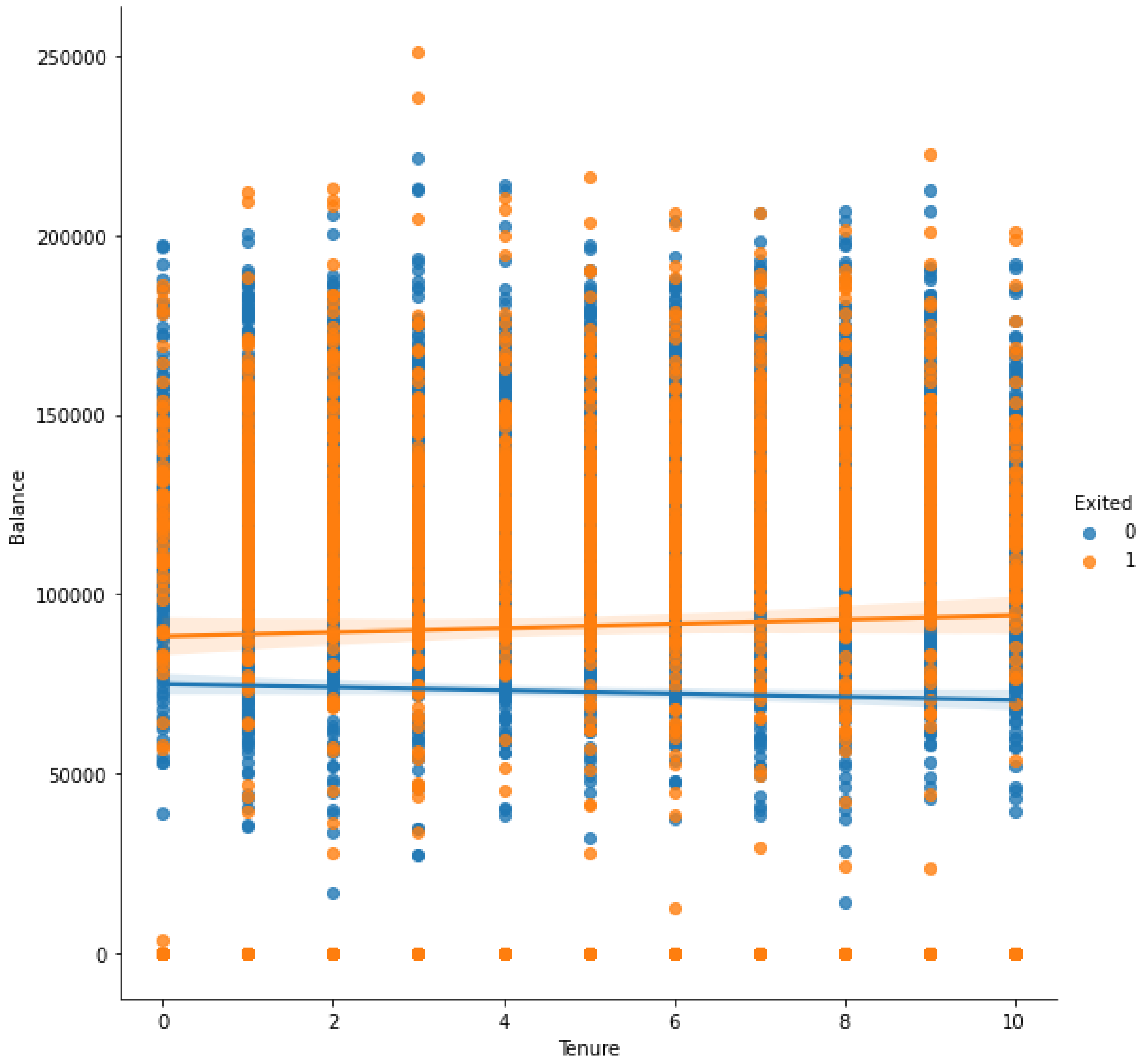
```
Text(0,0.5,'CreditScore')
```



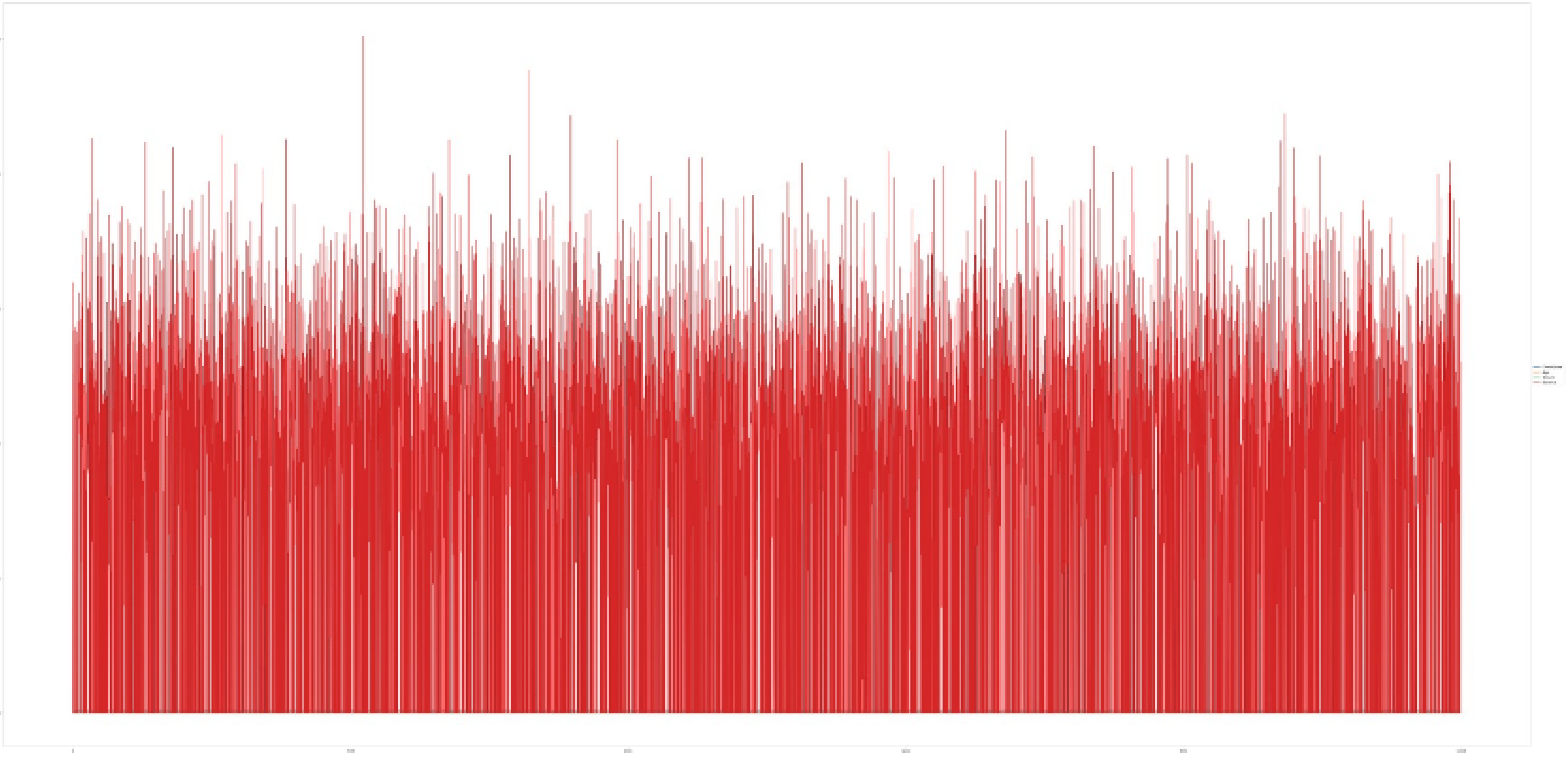
```
sns.lmplot(x='Tenure', y='Balance',data=df,hue='Exited',size=8)
```

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

```
<seaborn.axisgrid.FacetGridat0x7fc4a149e2d0>
```



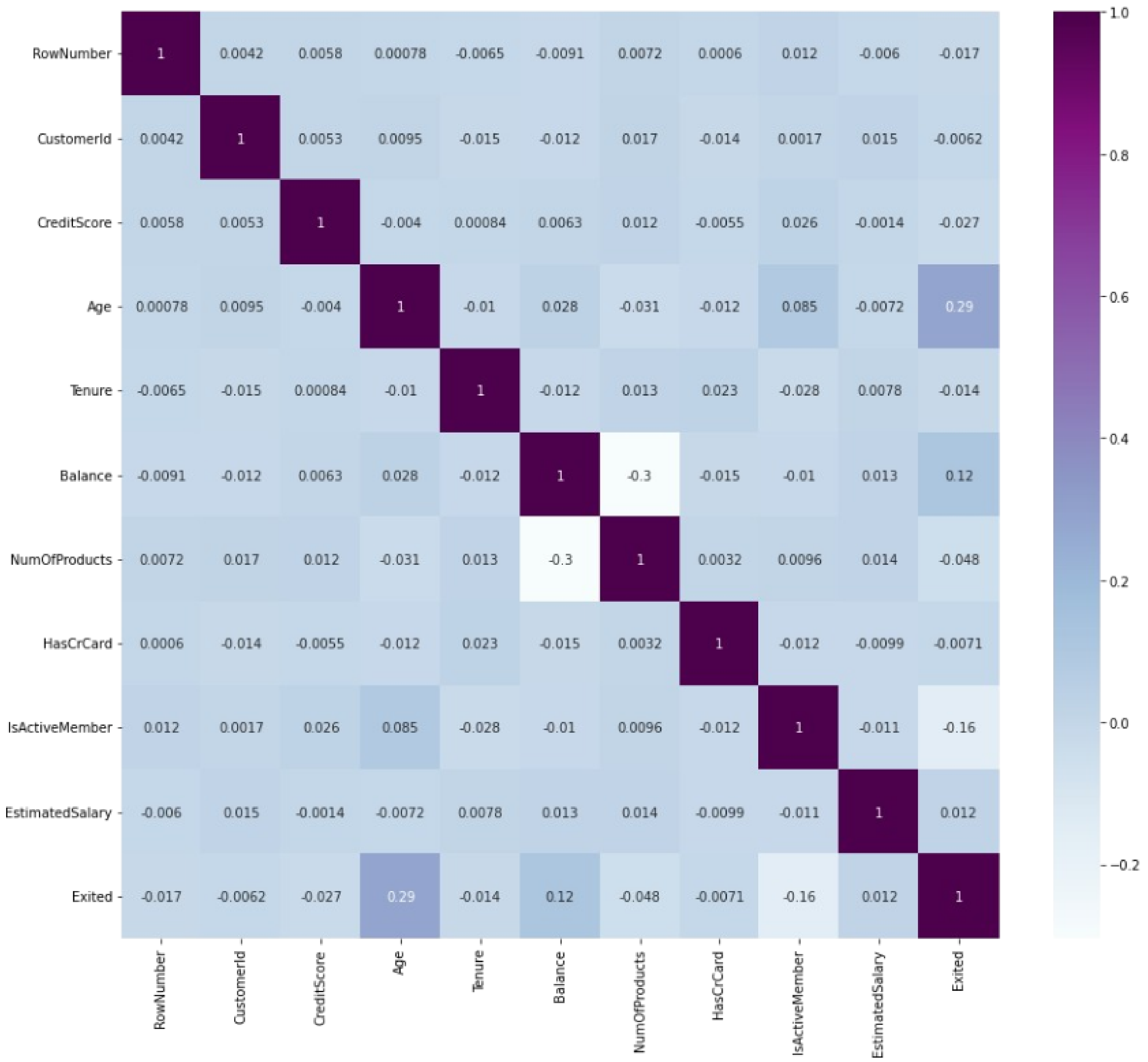
```
#Multi -Variate Analysis
ax=df[["CreditScore","Age","Tenure","Balance"]].plot(figsize=(80,4
0))ax.legend(loc='centerleft',bbox_to_anchor=(1,0.5));
```



```
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(),anno
t=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

   HasCrCardIsActiveMemberEstimatedSalaryExited0     1
           1                101348.881
```

```
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'>RangeIn
dex:10000entries,0to9999Datacolumns(t
otal 11 columns):
 #   Column           Non-NullCountDtype
---  -----            -----------  -----

 0  CreditScore       10000non-nullint64
 1  Geography         10000non-nullobject
 2  Gender            10000non-nullobject
 3  Age               10000non-nullint64
 4  Tenure            10000non-nullint64
 5  Balance           10000non-nullfloat64
 6  NumOfProducts     10000non-nullint64
 7  HasCrCard         10000non-nullint64
 8  IsActiveMember    10000non-nullint64
 9  EstimatedSalary10000non-null  float64
 10 Exited            10000
non-nullint64dtypes: float64(2),
int64(7),object(2)memoryusage:859.5+KB

df["Geography"].unique()

array(['France', 'Spain', 'Germany'],

dtype=object)df["Gender"].unique()

array(['Female','Male'],dtype=object)geo=pd.get_dummi

es(df["Geography"],drop_first=False)geo.head()

   FranceGermanySpain0  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=p

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

df

      CreditScoreGeographyGenderAgeTenure
                                                    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

      HasCrCardIsActiveMemberEstimatedSalaryExitedFranceGermany\

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
...         ...             ...              ...     ...     ...
...9
995           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
```

```
[10000rowsx16columns]df.drop(["Geography","Gender"],

axis=1,inplace=True)df.head()
```

```
   CreditScoreAgeTenure   BalanceNumOfProductsHasCrCard\0    61942
          2               0.00 1   1
1         608   41        1   83807.86              1          0
2         502   42        8159660.80                3          1
3         699   39        1       0.00              2          0
4         850   43        2125510.82                1          1

   IsActiveMemberEstimatedSalaryExitedFranceGermanySpainFemale\
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   Spai  Female
Male                                                        n
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
...              ...              ...     ...      ...    ...     ...
...9
995                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:

int64df.shape

(10000,14)

x.shape(10000,

13)

y.shape(

10000,)

fromsklearn.model_selectionimporttrain_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

StandardScalersc =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]])
```