MAHENDRA ENGINEERING COLLEGE FOR WOMEN
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CLASS:IV YEAR-CSE
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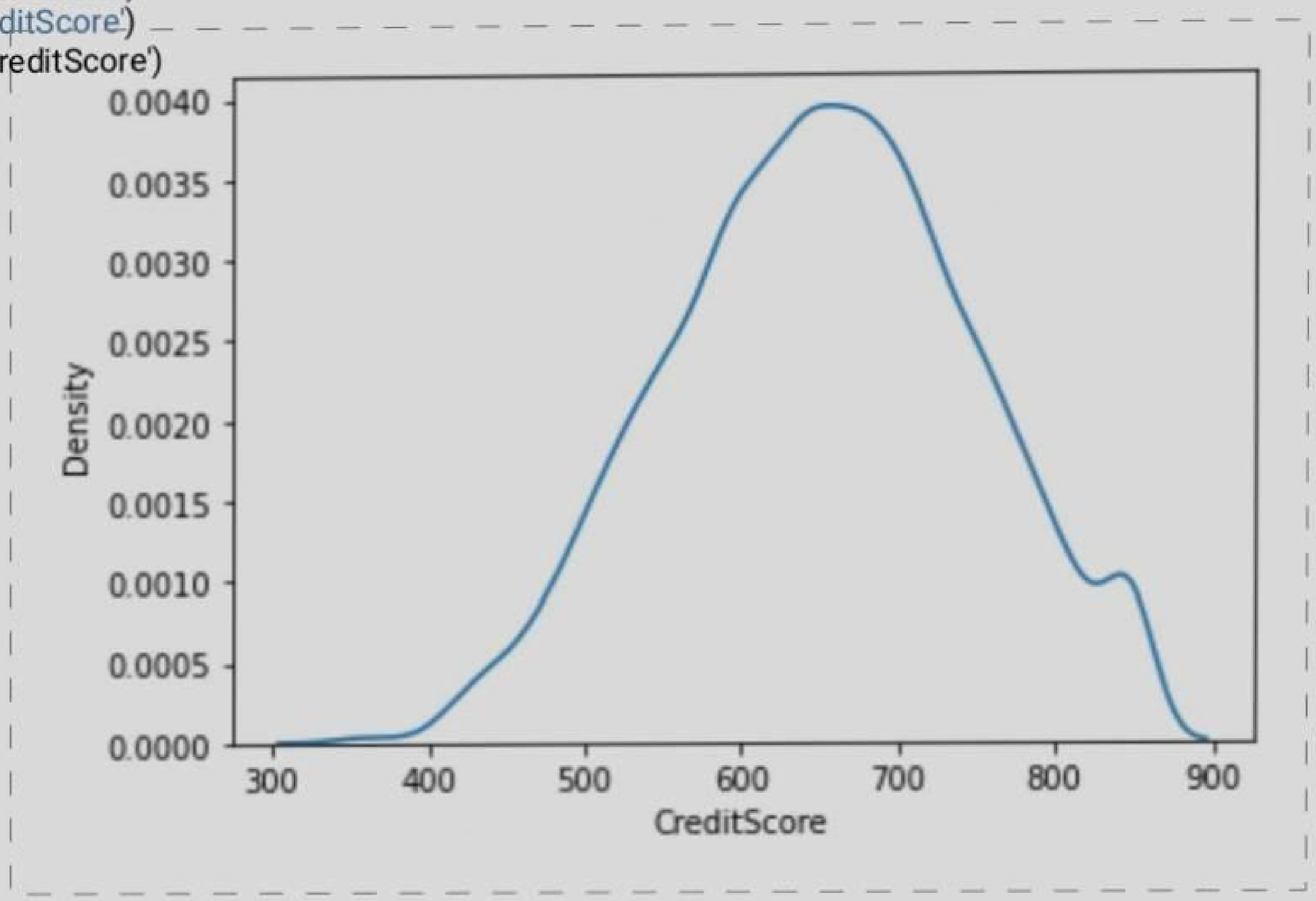
```
libraries
nport pandas as pd
nport numpy as npp
nport matplotlib.pyplot as plt
matplotlib inline
load dataset
f = pd.read_csv(r"/content/Churn_Modelling.csv")
f.head(10)
```

```
 RowNumber  CustomerId   Surname  CreditScore Geography  Gender  Age
1          1    15634602  Hargrave          619    France  Female   42
2          2    15647311      Hill          608     Spain  Female   41
3          3    15619304      Onio          502    France  Female   42
4          4    15701354      Boni          699    France  Female   39
5          5    15737888  Mitchell          850     Spain  Female   43
6          6    15574012       Chu          645     Spain    Male   44
7          7    15592531  Bartlett          822    France    Male   50
8          8    15656148   Obinna          376   Germany  Female   29
9          9    15792365        He          501    France    Male   44
          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>
```

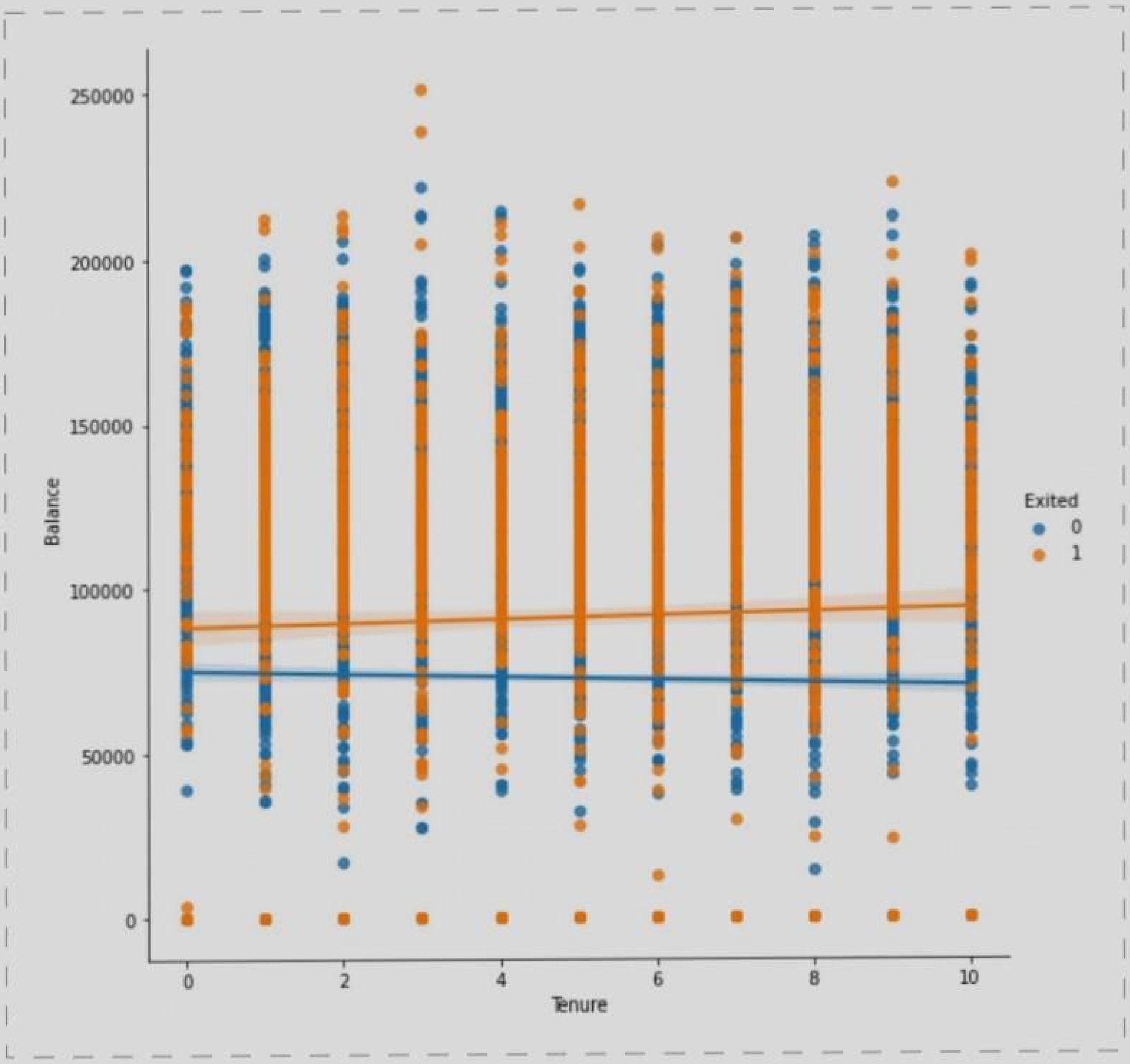
```
#Bi - Variate Analysis
plt.bar(df.CustomerId, df.CreditScore)
plt.title('CreditScore')
plt.xlabel('CustomerId')
plt.ylabel('CreditScore')
Text(0, 0.5, 'CreditScore')
```



```
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

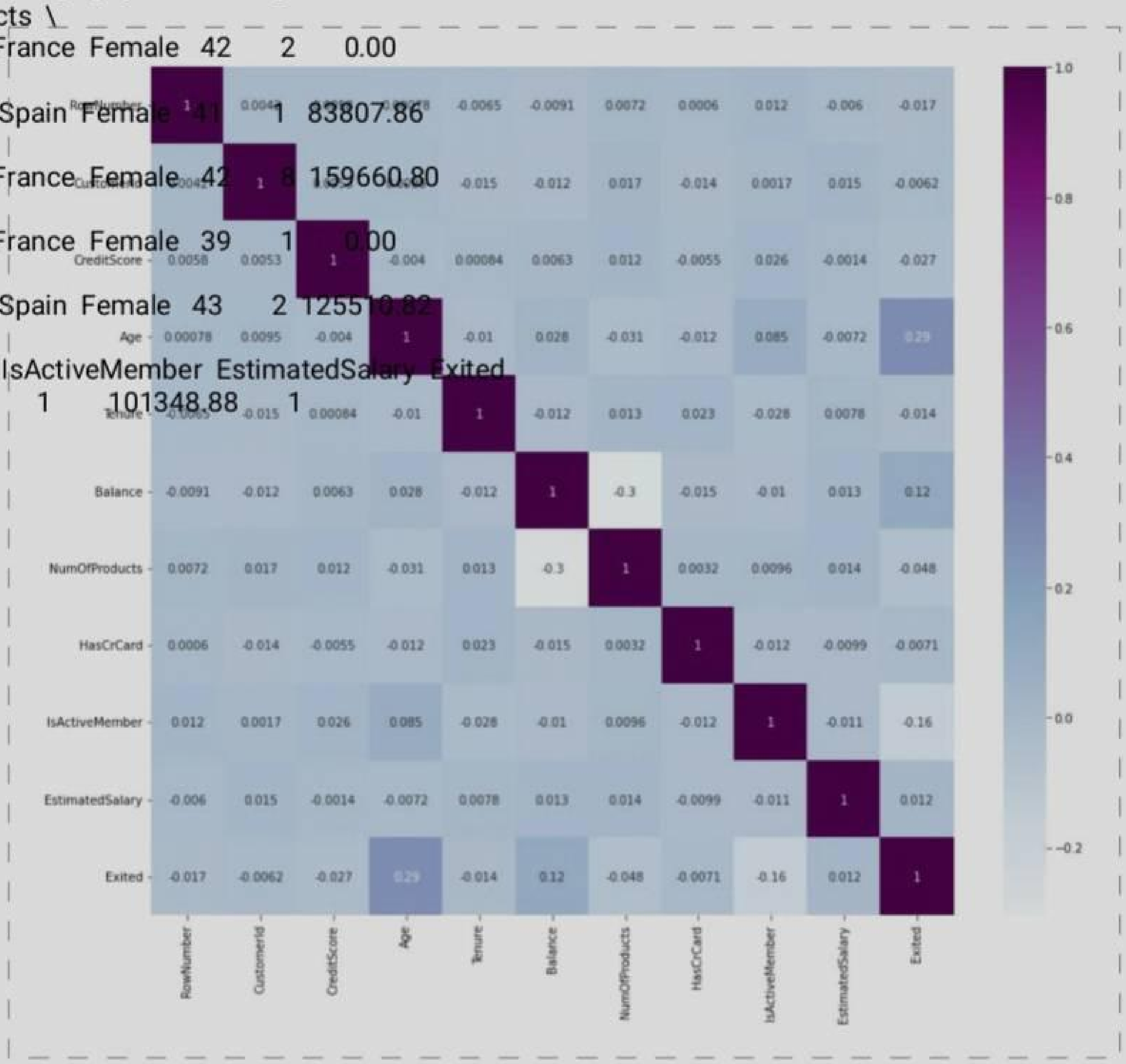
```
#Multi - Variate Analysis
ax =
df[["CreditScore","Age","Tenure","Balance"]].plot(figsize=(80,40))
ax.legend(loc='center left', bbox_to_anchor=(1, 0.5));
```



```
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]])
```