MAHENDRA ENGINEERING COLLEGE FOR WOMEN
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CLASS :IV YEAR-CSE
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```
#libraries
import pandas as pd
import numpy as npp
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	EstimatedSalary	Exited
0	2	0.00	1	1	1	101348.88	1
1	1	83807.86	1	0	1	112542.58	0
2	8	159660.80	3	1	0	113931.57	1
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		

```
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
```

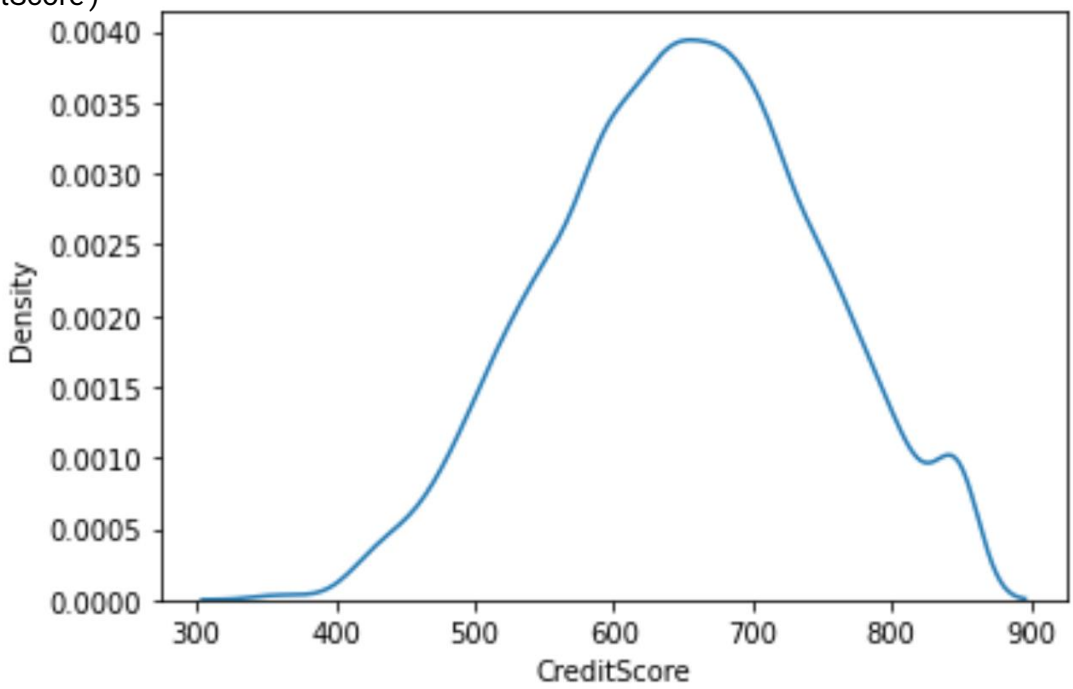
```
df.info()
```

```
<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'])
```

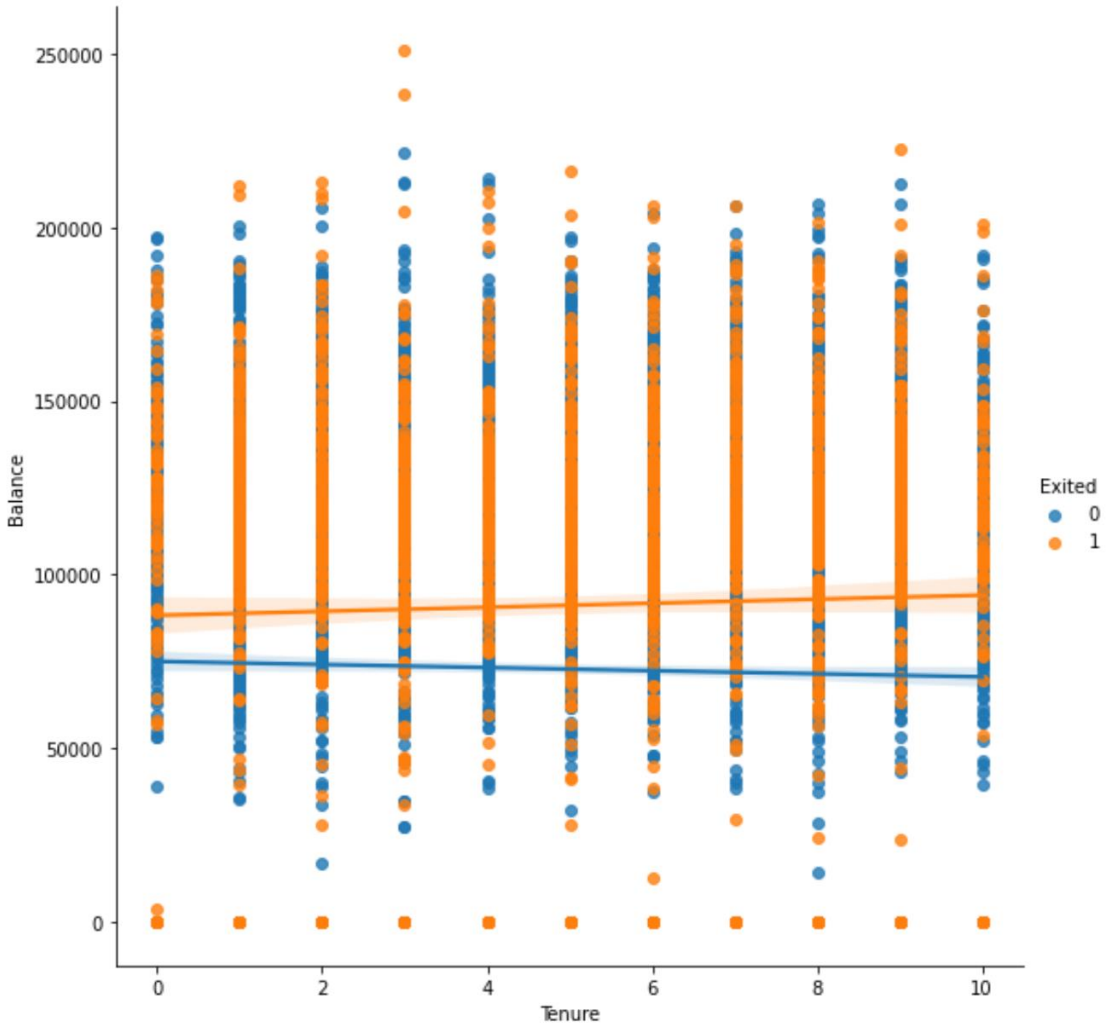
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fc4a0cd2790>
```

```
#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>
```

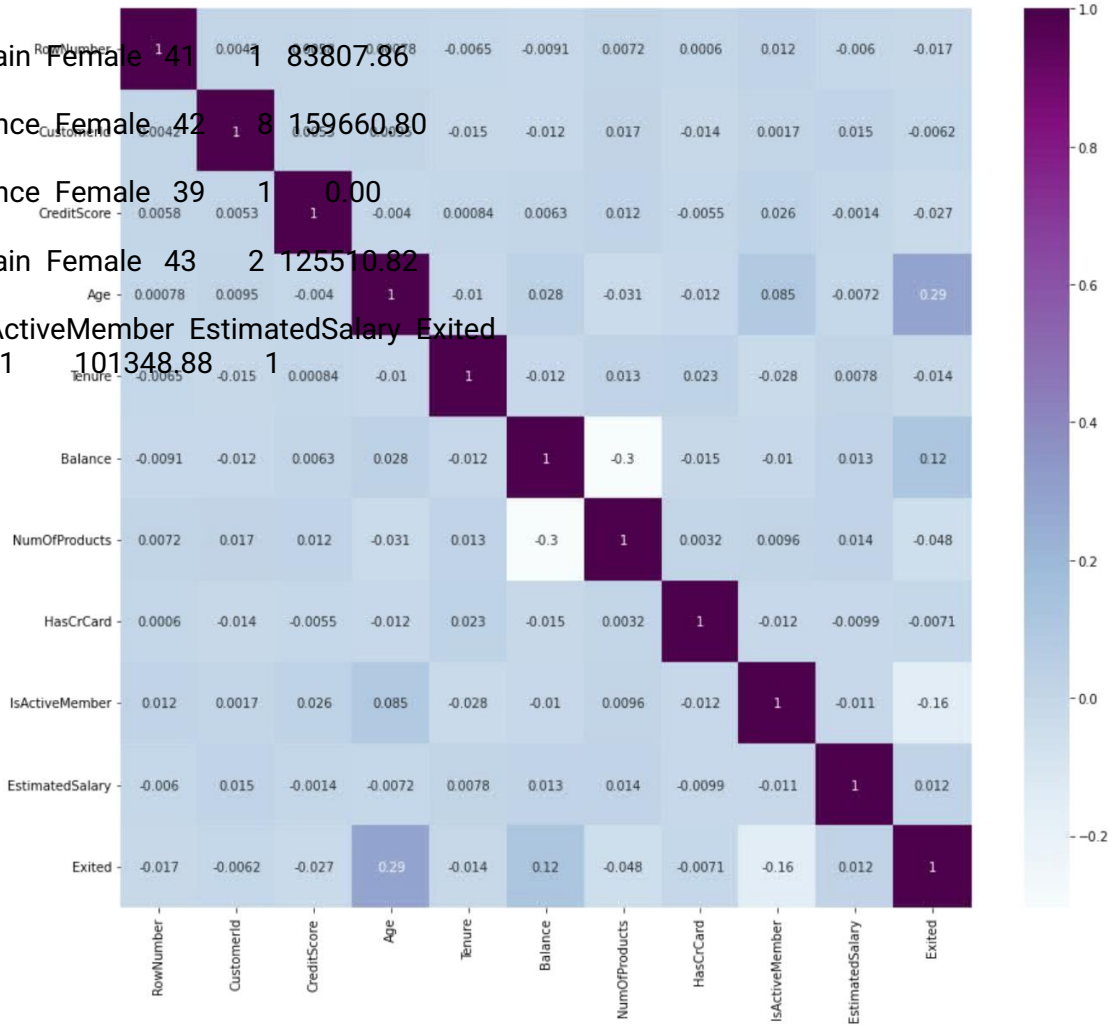
```
#Multi - Variate Analysis
ax =
df[["CreditScore","Age","Tenure","Balance"]].plot(figsize=(80,40))
ax.legend(loc='center left', bbox_to_anchor=(1, 0.5));
```



```
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]])
```