MAHENDRA ENGINEERING COLLEGE FOR WOMEN
NAME: I N B A N I L A M
CLASS:IV YEAR-CSE
SUB:IBM(AI)
REG NO:611419104017

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

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

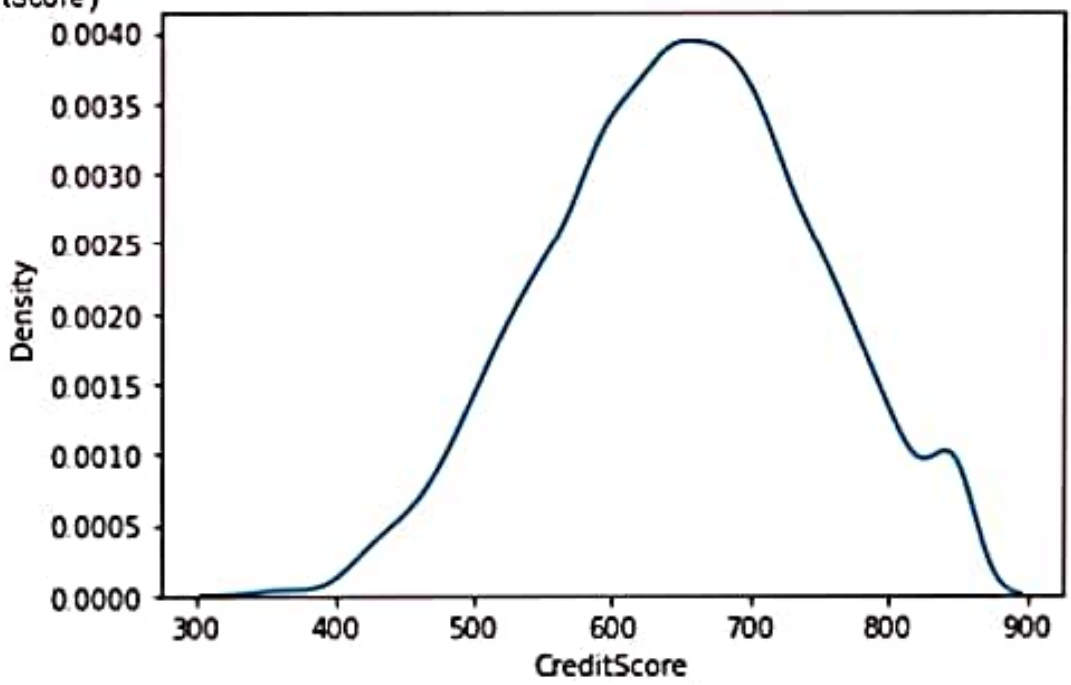
	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	\
0	2	0.00	1	1	1	
	1	83807.86	1	0	1	
2	8	159660.80	3	1	0	
3	1	0.00	2	0	0	
4	2	125510.82	1	1	1	
5	8	113755.78	2	1	0	
6	7	0.00	2	1	1	
7	4	115046.74	4	1	0	
8	4	142051.07	2	0	1	
9	2	134603.88	1	1	1	

	EstimatedSalary	Exited
0	101348.88	1
	112542.58	0
2	113931.57	1

```
      93826.63       0
      79084.10       0
     149756.71       1
      10062.80       0
     119346.88       1
      74940.50       0
      71725.73       0
lf.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
5   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
ltypes: float64(2), int64(9), object(3)
nemory usage: 1.1+ MB
#Visualizations
#Univariate Analysis
mport seaborn as sns
sns.kdeplot(df['CreditScore'])
<matplotlib.axes._subplots.AxesSubplot at 0x7fc4a0cd2790>
```

Bi - Variate Analysis

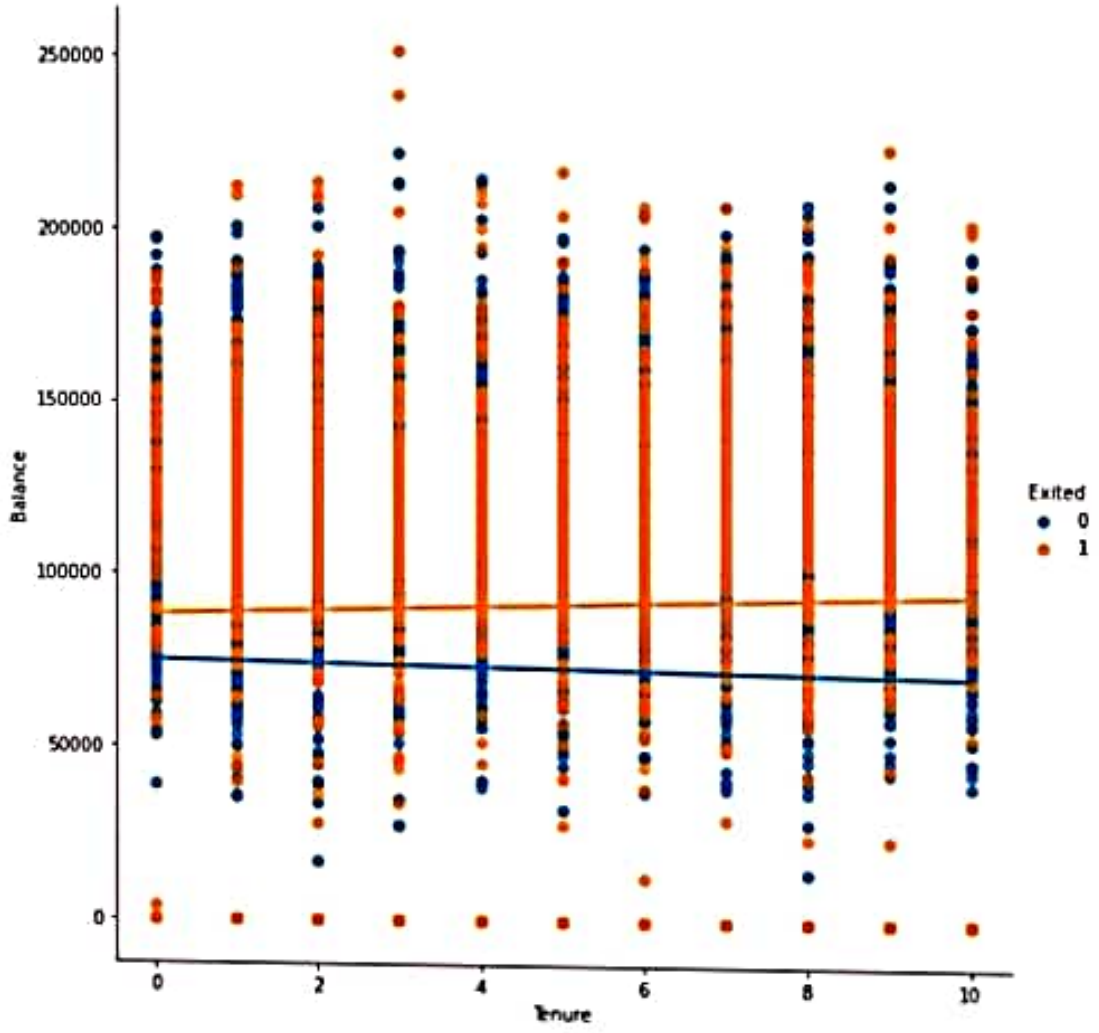
```
lt.bar(df.CustomerId, df.CreditScore)
lt.title('CreditScore')
lt.xlabel('CustomerId')
lt.ylabel('CreditScore')
ext(0, 0.5, 'CreditScore')
```



```
ns.lmplot(x='Tenure', y='Balance', data=df ,hue='Exited',size=8)
usr/local/lib/python3.7/dist-packages/seaborn/regression.py:581:
JserWarning: The `size` parameter has been renamed to `height`; please
pdate your code.
 warnings.warn(msg, UserWarning)
seabom.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));
```

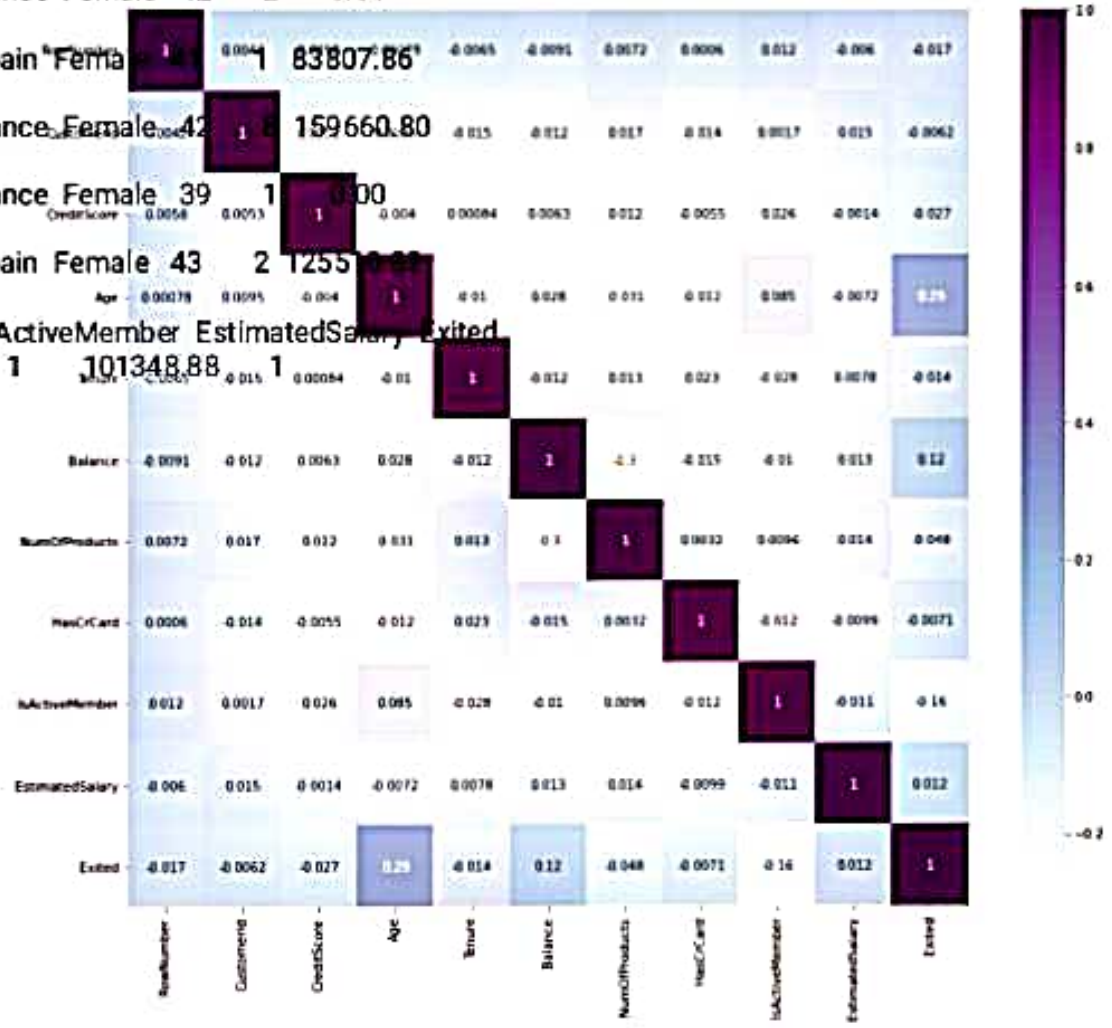


```
df.isnull().sum()
RowNumber        0
CustomerId       0
Surname          0
CreditScore      0
Geography        0
Gender           0
Age              0
Tenure           0
Balance          0
NumOfProducts    0
HasCrCard        0
IsActiveMember   0
EstimatedSalary  0
Exited           0
dtype: int64
plt.figure(figsize=(15,13))
sns.heatmap(df.corr(),annot=True,cmap='BuPu')
plt.show()
```

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

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

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

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

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

   Spain  Female  Male
0      0       1     0
```

```
      619  France Female  42    2     0.00
      608   Spain Female  41    1  83807.86
      502  France Female  42    8 159660.80
      699  France Female  39    1     0.00
      850   Spain Female  43    2 125510.82

...    ...    ... ...   ...      ...
9995    771  France   Male  39    5     0.00
9996    516  France   Male  35   10  57369.61
9997    709  France Female  36    7     0.00
9998    772 Germany   Male  42    3  75075.31
9999    792  France Female  28    4 130142.79

   HasCrCard IsActiveMember EstimatedSalary Exited France
Germany \
      1              1       101348.88      1      1
      0              1       112542.58      0      0
      1              0       113931.57      1      1
      0              0        93826.63      0      1
      1              1        79084.10      0      0

...       ...          ...          ...    ...    ...
9995      1              0     96270.64      0      1
9996      1              1    101699.77      0      1
9997      0              1     42085.58      1      1
9998      1              0     92888.52      1      0
9999      1              0     38190.78      0      1

   Spain Female  Male
0      0      1     0
```

```
      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        112542.58       0       0        0      1

2               0        113931.57       1       1        0      0

3               0         93826.63       0       1        0      0

4               1         79084.10       0       0        0      1

   Male
0     0
1     0
2     0
3     0
4     0
=df.drop('Exited',axis=1)

   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        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

9996            1        101699.77       1        0      0       0

9997            1         42085.58       1        0      0       1
0
9998            0         92888.52       0        1      0       0

9999            0         38190.78       1        0      0       1
0
10000 rows x 13 columns]
r=df['Exited']

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

```
9999    0
Name: Exited, Length: 10000, dtype: int64
lf.shape
10000, 14)
.shape
10000, 13)
.shape
10000,)
rom sklearn.model_selection import train_test_split
_train,x_test, y_train,y_test = train_test_split(x,y,
est_size=0.2,random_state=0)
_train.shape
8000, 13)
_test.shape
2000, 13)
_test.shape
2000,)
rom sklearn.preprocessing import StandardScaler

c = StandardScaler()
_train = sc.fit_transform(x_train)

_train
rray([[ 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]])
_test = sc.transform(x_test)
```

```
_test
rray([[-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]])
```