

REG.NO:611419104052

NAME:POONCHOLAI C

CLASS:IV YEAR-CSE

SUBJECT:IBM(AI)

*#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
```

REG.NO:611419104052

NAME:POONCHOLAI C

CLASS:IV YEAR-CSE

SUBJECT:IBM(AI)

```
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
```

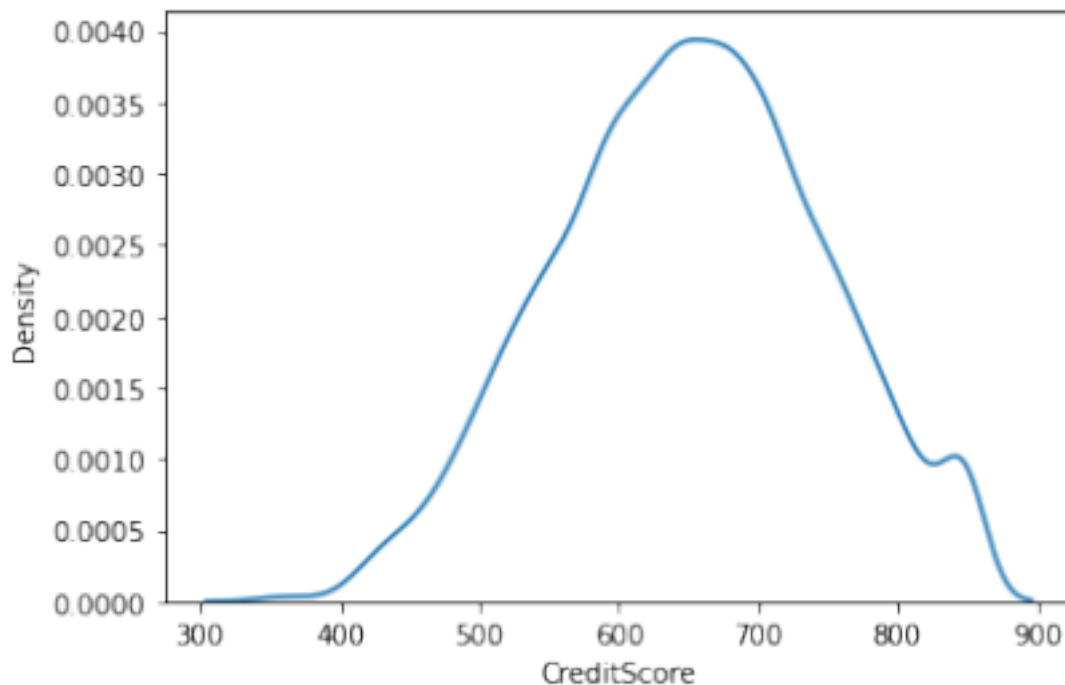
*#Visualizations*

*#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')
```

REG.NO:611419104052

NAME:POONCHOLAI C

CLASS:IV YEAR-CSE

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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)
```

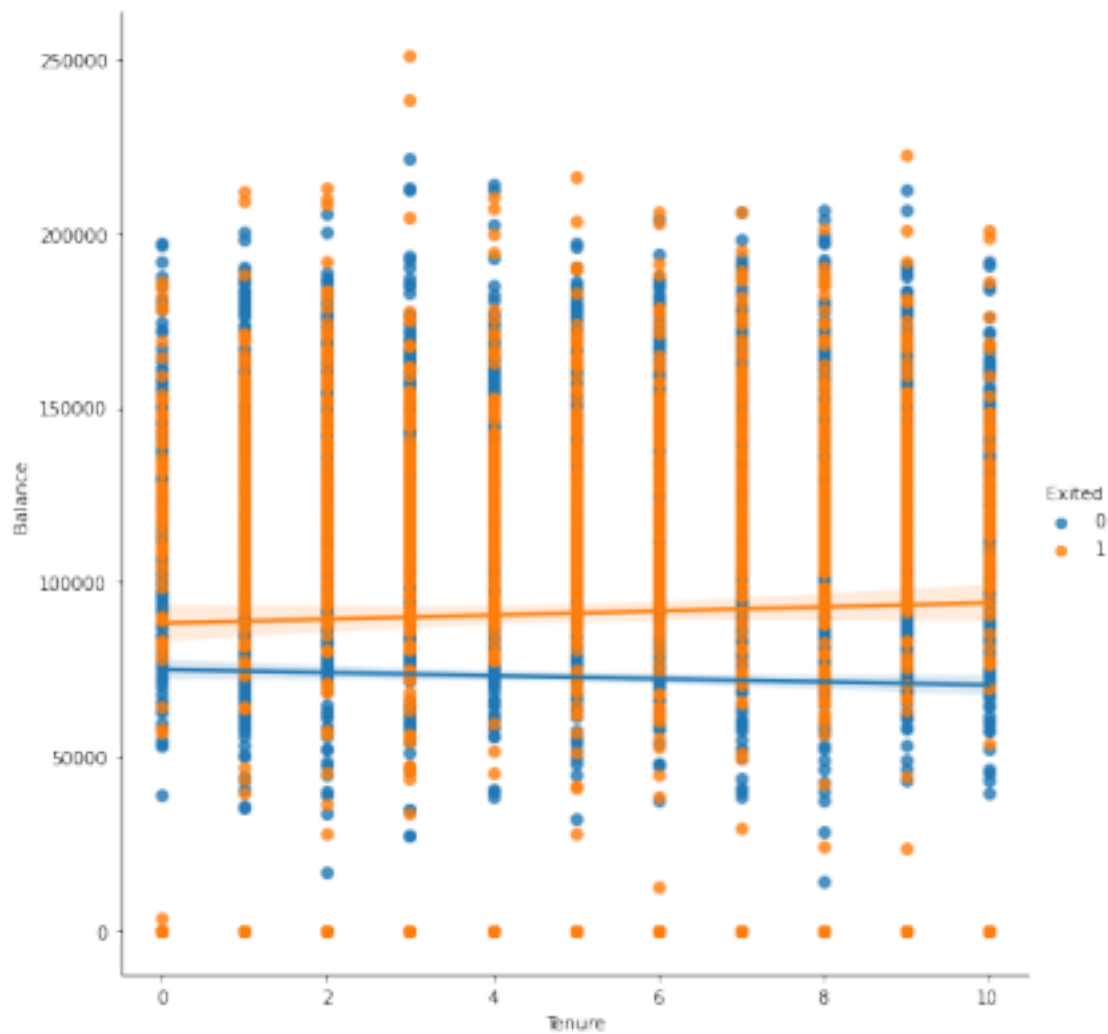
<seaborn.axisgrid.FacetGrid at 0x7fc4a149e2d0>

REG.NO:611419104052

NAME:POONCHOLAI C

CLASS:IV YEAR-CSE

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*#Multi - Variate Analysis*

ax =

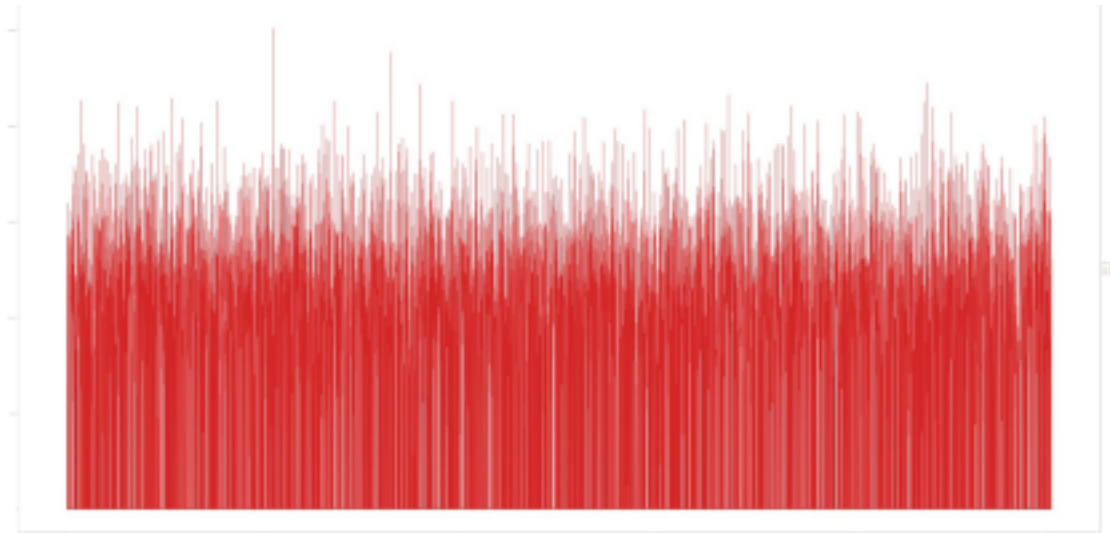
df[["CreditScore","Age","Tenure","Balance"]].plot(figsize=(80,40)) ax.legend(loc='center left', bbox\_to\_anchor=(1, 0.5));

REG.NO:611419104052

NAME:POONCHOLAI C

CLASS:IV YEAR-CSE

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```
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')
```

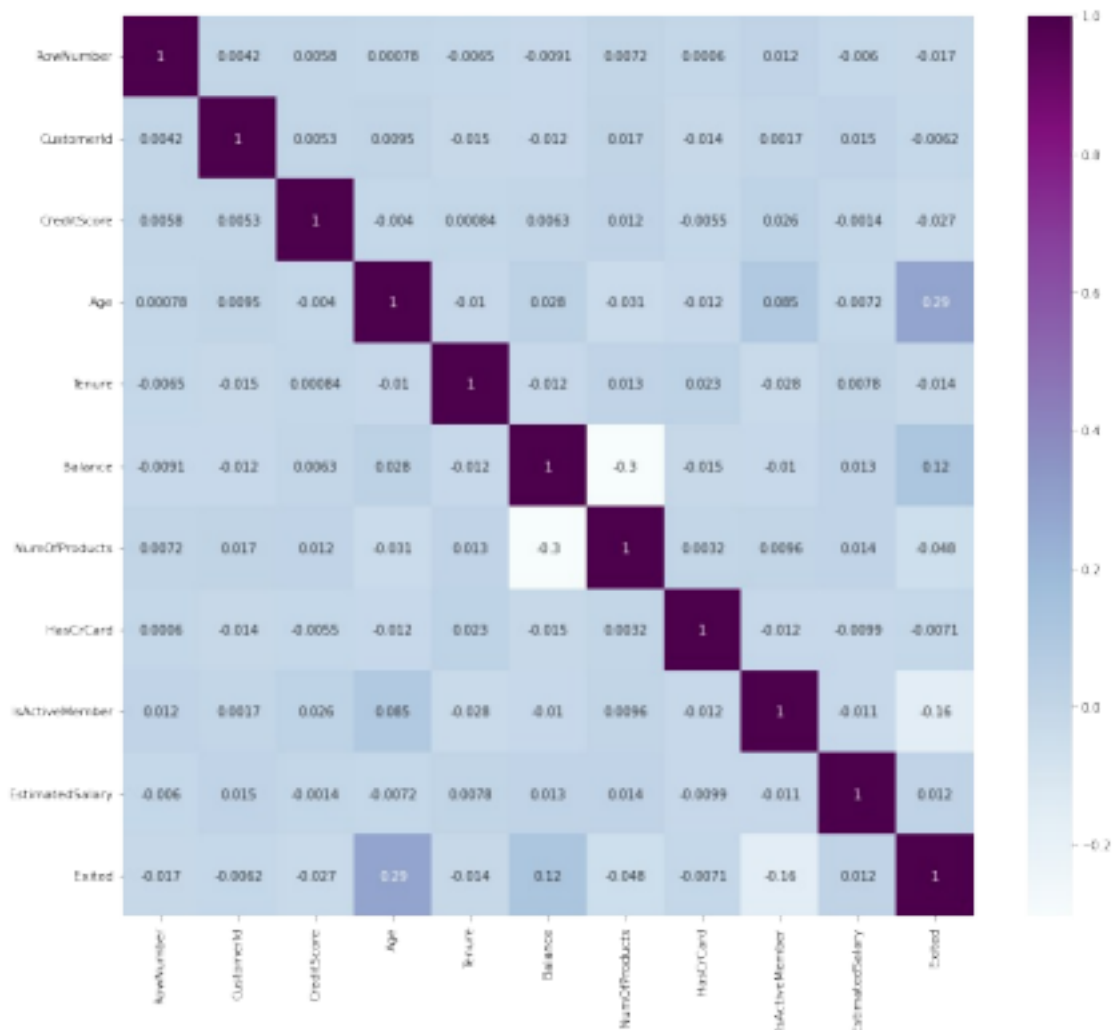
```
plt.show()
```

REG.NO:611419104052

NAME:POONCHOLAI C

CLASS:IV YEAR-CSE

SUBJECT:IBM(AI)



```
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
```

REG.NO:611419104052

NAME:POONCHOLAI C

CLASS:IV YEAR-CSE

SUBJECT:IBM(AI)

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

REG.NO:611419104052

NAME:POONCHOLAI C

CLASS:IV YEAR-CSE

SUBJECT:IBM(AI)

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



REG.NO:611419104052  
 NAME:POONCHOLAI C  
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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

REG.NO:611419104052

NAME:POONCHOLAI C

CLASS:IV YEAR-CSE

SUBJECT:IBM(AI)

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]])

REG.NO:611419104052

NAME:POONCHOLAI C

CLASS:IV YEAR-CSE

SUBJECT:IBM(AI)

```
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]])
```