Assignment-2

Real-Time Communication System Powered by AI for Specially Abled

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Student Roll no	621319104021
Maximum Marks	2 Marks

Data Visualization and Pre - processing:

1.Load the dataset

```
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	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	1	1	101348.88	1
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0
2	3	15619304	Onio	502	France	Female	42	8	159660.80	3	1	0	113931.57	1
3	4	15701354	Boni	699	France	Female	39	1	0.00	2	0	0	93826.63	0
4	5	15737888	Mitchell	850	Spain	Female	43	2	125510.82	1	1	1	79084.10	0
5	6	15574012	Chu	645	Spain	Male	44	8	113755.78	2	1	0	149756.71	1
6	7	15592531	Bartlett	822	France	Male	50	7	0.00	2	1	1	10062.80	0
7	8	15656148	Obinna	376	Germany	Female	29	4	115046.74	4	1	0	119346.88	1
8	9	15792365	He	501	France	Male	44	4	142051.07	2	0	1	74940.50	0
9	10	15592389	H?	684	France	Male	27	2	134603.88	1	1	1	71725.73	0

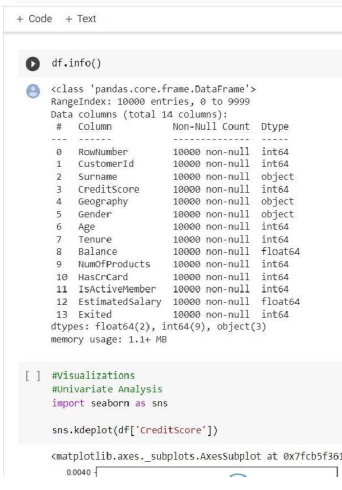
```
df.info()
```

```
<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 0x7fcb5f361950>
```

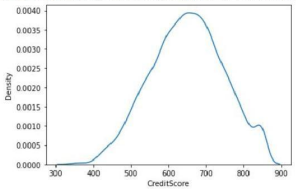


Univariate Analysis
Bi - Variate Analysis

```
#Visualizations
#Univariate Analysis
import seaborn as sns

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

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fcb5f361950>
```



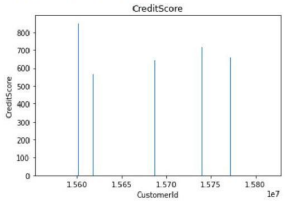

```
[ ] #Bi - Variate Analysis

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

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

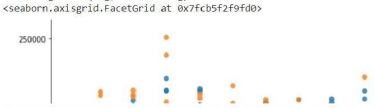

```
plt.title('CreditScore')
plt.xlabel('CustomerId')
plt.ylabel('CreditScore')
```

```
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 0x7fcb5f2f9fd0>
```



Kamali_Assignment_2.ipynb

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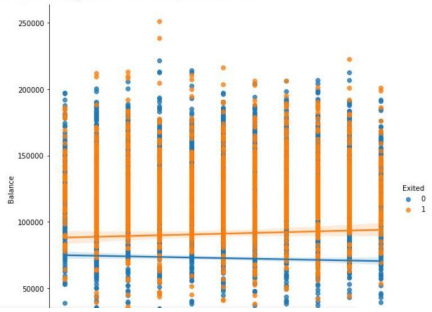
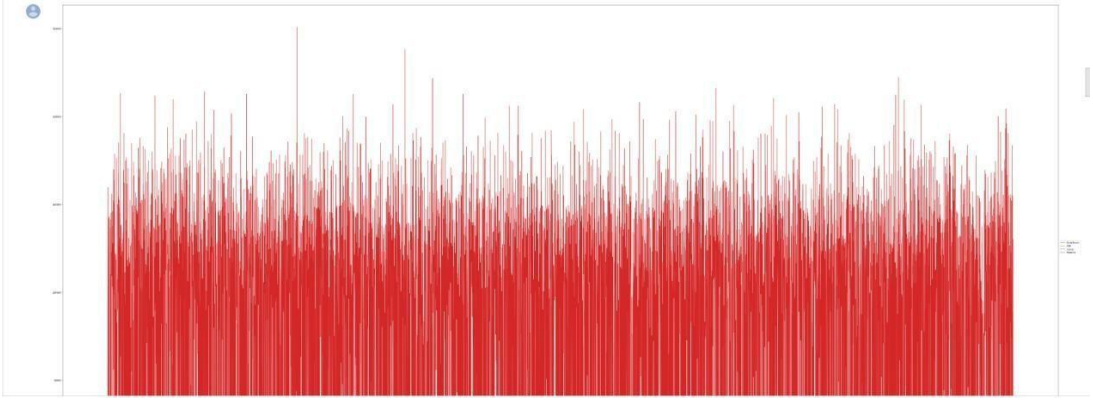
```
sns.lmplot(x='Tenure', y='Balance', data=df ,hue='Exited',height=8)
```

```
<seaborn.axisgrid.FacetGrid at 0x7f8163015f50>
```



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));
```

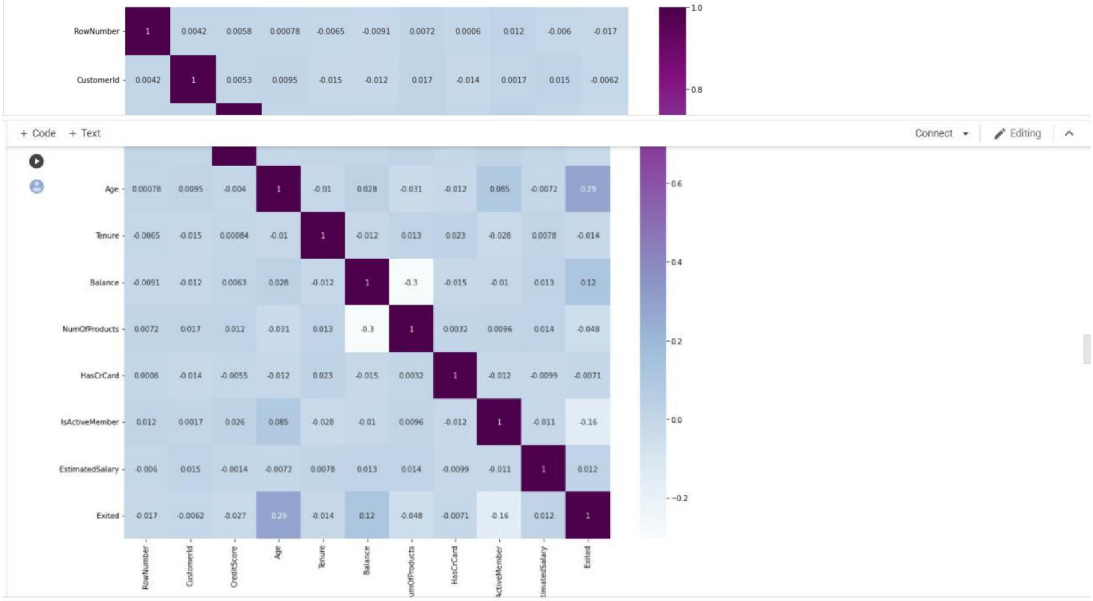


Handle the Missing values.

```
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()
```



Perform descriptive statistics on the dataset.

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

```
df.head()
```

	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	619	France	Female	42	2	0.00	1	1	1	101348.88	1
1	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0
2	502	France	Female	42	8	159660.80	3	1	0	113931.57	1
3	699	France	Female	39	1	0.00	2	0	0	93826.63	0
4	850	Spain	Female	43	2	125510.82	1	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	HasCrCard	IsActiveMember	EstimatedSalary	Exited	France	Germany	Spain	Female	Male
0	619	France	Female	42	2	0.00	1	1	1	101348.88	1	1	0	0	1	0
1	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0	0	0	1	1	0
2	502	France	Female	42	8	159660.80	3	1	0	113931.57	1	1	0	0	1	0
3	699	France	Female	39	1	0.00	2	0	0	93826.63	0	1	0	0	1	0
4	850	Spain	Female	43	2	125510.82	1	1	1	79084.10	0	0	0	1	1	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9995	771	France	Male	39	5	0.00	2	1	0	96270.64	0	1	0	0	0	1
9996	516	France	Male	35	10	57369.61	1	1	1	101699.77	0	1	0	0	0	1
9997	709	France	Female	36	7	0.00	1	0	1	42085.58	1	1	0	0	1	0
9998	772	Germany	Male	42	3	75075.31	2	1	0	92888.52	1	0	1	0	0	1
9999	792	France	Female	28	4	130142.79	1	1	0	38190.78	0	1	0	0	1	0

10000 rows × 16 columns

```
df.drop(["Geography","Gender"], axis=1, inplace=True)
```

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10000 rows × 16 columns

```
df.drop(["Geography","Gender"], axis=1, inplace=True)
```

```
df.head()
```

	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited	France	Germany	Spain	Female	Male
0	619	42	2	0.00	1	1	1	101348.88	1	1	0	0	1	0
1	608	41	1	83807.86	1	0	1	112542.58	0	0	0	1	1	0
2	502	42	8	159660.80	3	1	0	113931.57	1	1	0	0	1	0
3	699	39	1	0.00	2	0	0	93826.63	0	1	0	0	1	0
4	850	43	2	125510.82	1	1	1	79084.10	0	0	0	1	1	0

```
x=df.drop('Exited',axis=1)
```

```
x
```

	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	France	Germany	Spain	Female	Male
0	619	42	2	0.00	1	1	1	101348.88	1	0	0	1	0
1	608	41	1	83807.86	1	0	1	112542.58	0	0	1	1	0
2	502	42	8	159660.80	3	1	0	113931.57	1	0	0	1	0
3	699	39	1	0.00	2	0	0	93826.63	1	0	0	1	0

Check for Categorical columns and perform encoding. Split the data into dependent and independent variables.

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2	502	42	8	159660.80	3	1	0	113931.57	1	0	0	1	0
3	699	39	1	0.00	2	0	0	93826.63	1	0	0	1	0
4	850	43	2	125510.82	1	1	1	79084.10	0	0	1	1	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...
9995	771	39	5	0.00	2	1	0	96270.64	1	0	0	0	1
9996	516	35	10	57369.61	1	1	1	101699.77	1	0	0	0	1
9997	709	36	7	0.00	1	0	1	42085.58	1	0	0	1	0
9998	772	42	3	75075.31	2	1	0	92888.52	0	1	0	0	1
9999	792	28	4	130142.79	1	1	0	38190.78	1	0	0	1	0

10000 rows × 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
```

Scale the independent variables

+ Code + Text Connect Editi

```
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)
```

Split the data into training and testing

+ Code + Text Connect

```
(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)
```

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```
[ ]         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]])
```