

Assignment -2

Data Visualization and Pre-processing

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Maximum Marks	2 Marks

To Perform Below Tasks to complete the assignment:-


Step 1. Download the dataset: [Dataset](#)

Step 2. Load the dataset.

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

```
df = pd.read_csv('Churn_Modelling.csv')
df.head()
```

Output :



The screenshot shows a Jupyter Notebook interface. The code cell contains the following code:

```
df = pd.read_csv('Churn_Modelling.csv')
df.head()
```

The output cell displays the first five rows of the dataset as a table:

	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

Step 3. Perform Below Visualizations.

- Univariate Analysis

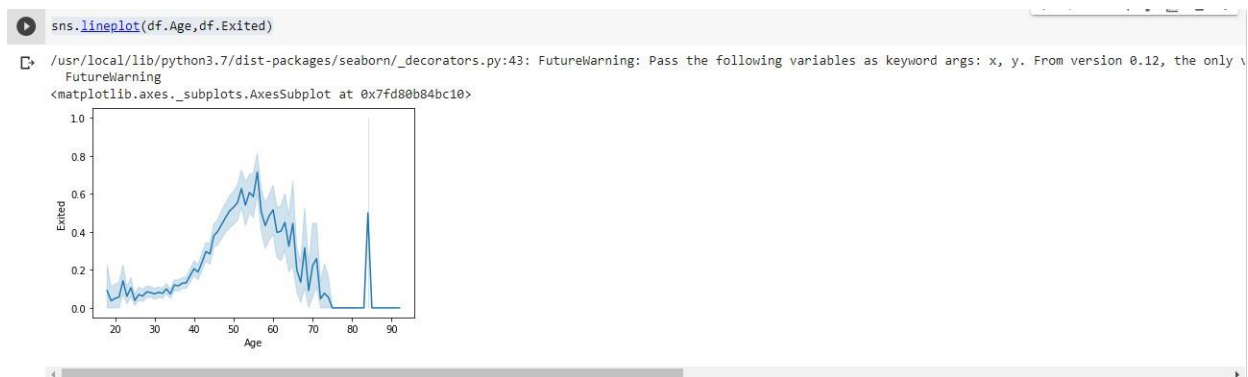
```
sns.distplot(df.Age)
```

Output :



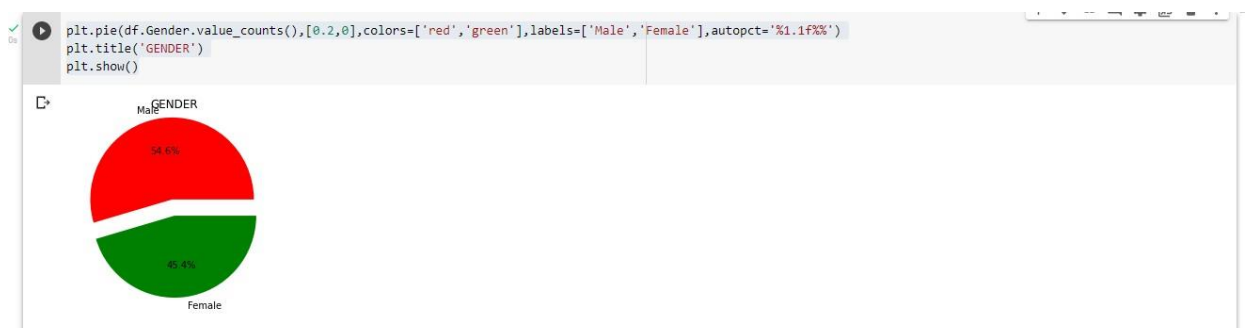
`sns.lineplot(df.Age,df.Exited)`

Output :



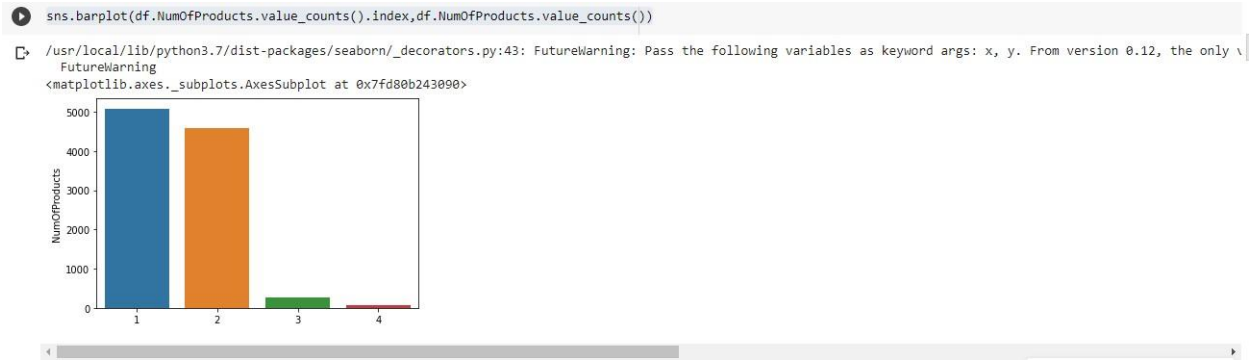
```
plt.pie(df.Gender.value_counts(),[0.2,0],colors=['red','green'],labels=['Male','Female'],autopct='%1.1f%%')  
plt.title('GENDER')  
plt.show()
```

Output :



`sns.barplot(df.NumOfProducts.value_counts().index,df.NumOfProducts.value_counts())`

Output :



● Bi - Variate Analysis

```
def countplot_2(x,hue,title=None,figsize=(6,5)):\n    plt.figure(figsize=figsize)\n    sns.countplot(data=df[[x,hue]],x=x,hue=hue)\n    plt.title(title)\n    plt.show()
```

countplot_2('IsActiveMember','NumOfProducts','Credit Card Holders Product Details')

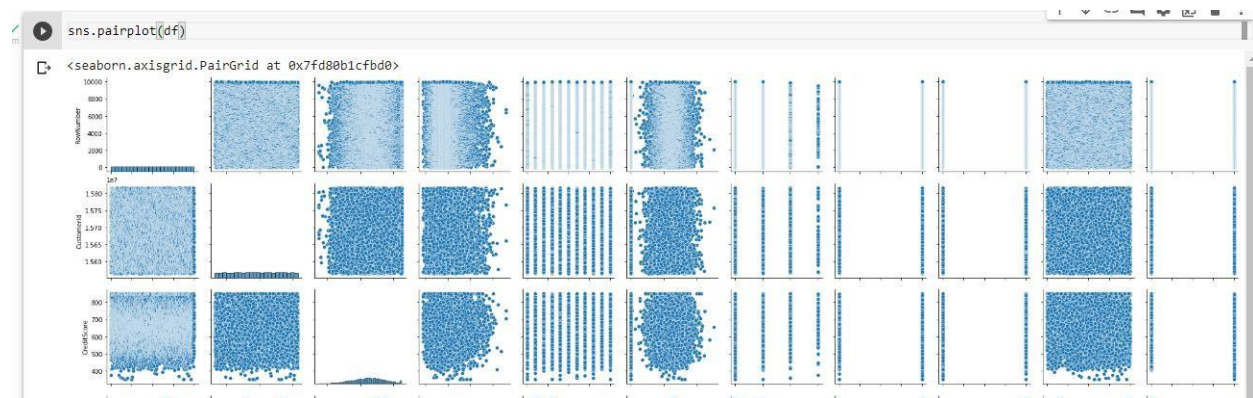
Output :



● Multi - Variate Analysis

```
sns.pairplot(df)
```

Output :



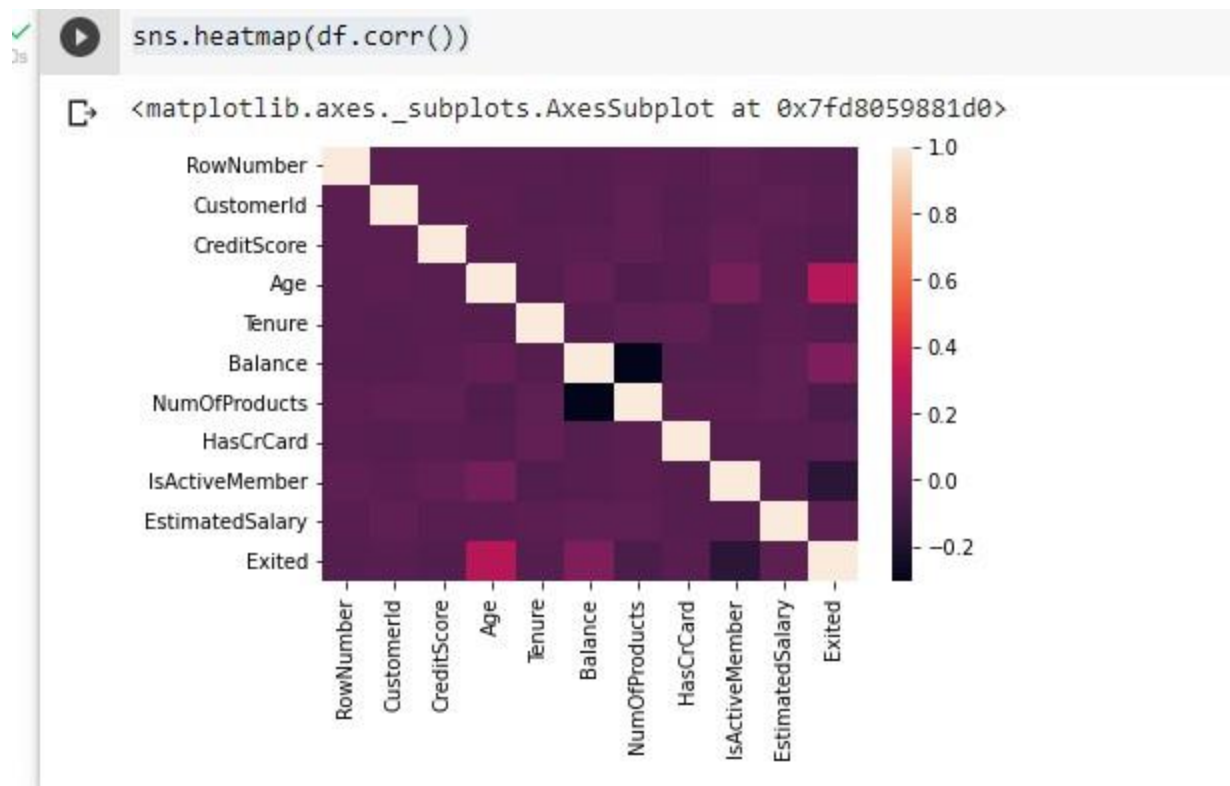
df.corr()

Output :

	RowNumber	CustomerId	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
RowNumber	1.000000	0.004202	0.005840	0.000783	-0.006495	-0.009067	0.007246	0.000599	0.012044	-0.005988	-0.016571
CustomerId	0.004202	1.000000	0.005308	0.009497	-0.014883	-0.012419	0.016972	-0.014025	0.001665	0.015271	-0.006248
CreditScore	0.005840	0.005308	1.000000	-0.003965	0.000842	0.006268	0.012238	-0.005458	0.025651	-0.001384	-0.027094
Age	0.000783	0.009497	-0.003965	1.000000	-0.009997	0.028308	-0.030680	-0.011721	0.085472	-0.007201	0.285323
Tenure	-0.006495	-0.014883	0.000842	-0.009997	1.000000	-0.012254	0.013444	0.022583	-0.028362	0.007784	-0.014001
Balance	-0.009067	-0.012419	0.006268	0.028308	-0.012254	1.000000	-0.304180	-0.014858	-0.010084	0.012797	0.118533
NumOfProducts	0.007246	0.016972	0.012238	-0.030680	0.013444	-0.304180	1.000000	0.003183	0.009612	0.014204	-0.047820
HasCrCard	0.000599	-0.014025	-0.005458	-0.011721	0.022583	-0.014858	0.003183	1.000000	-0.011866	-0.009933	-0.007138
IsActiveMember	0.012044	0.001665	0.025651	0.085472	-0.028362	-0.010084	0.009612	-0.011866	1.000000	-0.011421	-0.156128
EstimatedSalary	-0.005988	0.015271	-0.001384	-0.007201	0.007784	0.012797	0.014204	-0.009933	-0.011421	1.000000	0.012097
Exited	-0.016571	-0.006248	-0.027094	0.285323	-0.014001	0.118533	-0.047820	-0.007138	-0.156128	0.012097	1.000000

sns.heatmap(df.corr())

Output :



```
plt.figure(figsize=(16,15))
sns.heatmap(df.corr(),annot=True)
plt.show()
```

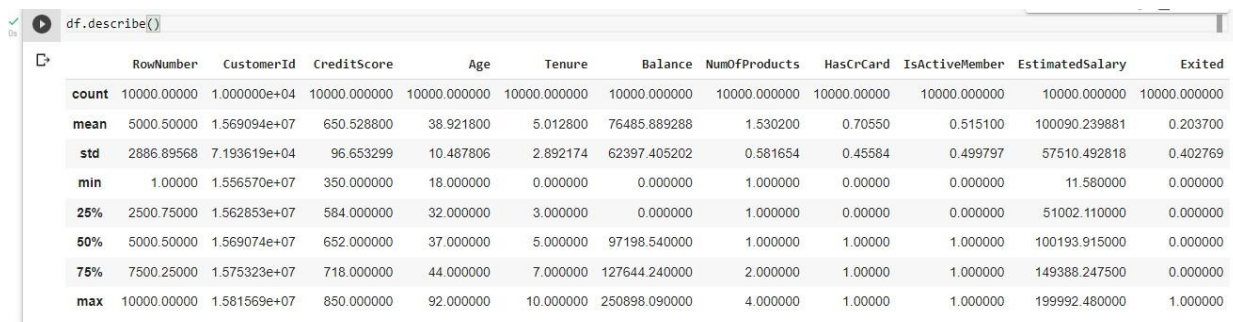
Output :



Step 4. Perform descriptive statistics on the dataset.

```
df.describe()
```

Output :

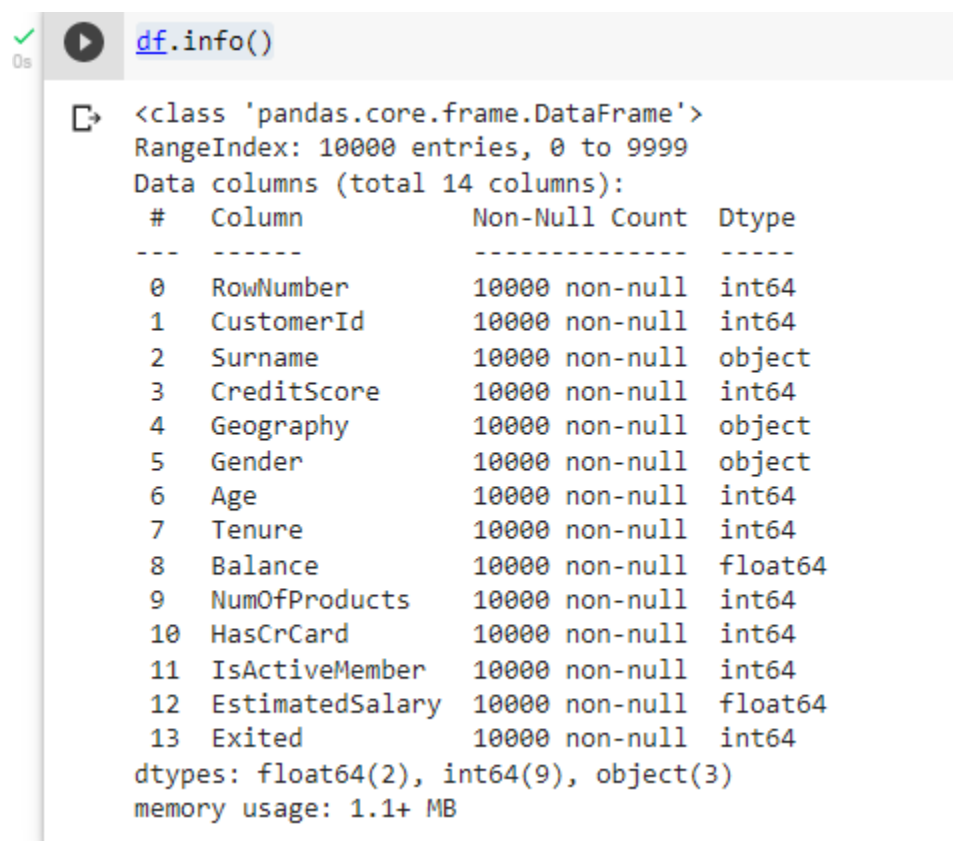


A screenshot of a Jupyter Notebook cell showing the output of the `df.describe()` function. The output is a summary table of the DataFrame's statistics.

	RowNumber	CustomerId	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
count	10000.00000	1.000000e+04	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000
mean	5000.50000	1.569094e+07	650.528800	38.921800	5.012800	76485.889288	1.530200	0.70550	0.515100	100090.239881	0.203700
std	2886.89568	7.193619e+04	96.653299	10.487806	2.892174	62397.405202	0.581654	0.45584	0.499797	57510.492818	0.402769
min	1.00000	1.556570e+07	350.000000	18.000000	0.000000	0.000000	1.000000	0.00000	0.000000	11.580000	0.000000
25%	2500.75000	1.562853e+07	584.000000	32.000000	3.000000	0.000000	1.000000	0.00000	0.000000	51002.110000	0.000000
50%	5000.50000	1.569074e+07	652.000000	37.000000	5.000000	97198.540000	1.000000	1.00000	1.000000	100193.915000	0.000000
75%	7500.25000	1.575323e+07	718.000000	44.000000	7.000000	127644.240000	2.000000	1.00000	1.000000	149388.247500	0.000000
max	10000.00000	1.581569e+07	850.000000	92.000000	10.000000	250898.090000	4.000000	1.00000	1.000000	199992.480000	1.000000

`df.info()`

Output :



A screenshot of a Jupyter Notebook cell showing the output of the `df.info()` function. The output provides detailed information about the DataFrame, including the number of entries, column names, data types, and memory usage.

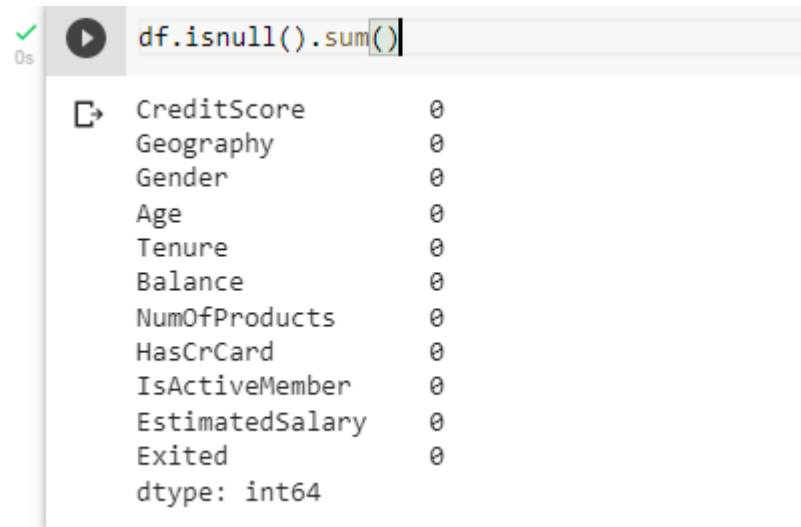
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 14 columns):
#   Column                Non-Null Count  Dtype  
---  -
0   RowNumber             10000 non-null  int64  
1   CustomerId            10000 non-null  int64  
2   Surname               10000 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
```

Step 5. Handle the Missing values.

```
df = df.drop(columns=['RowNumber','CustomerId','Surname'])
```

```
df.isnull().sum()
```

Output :

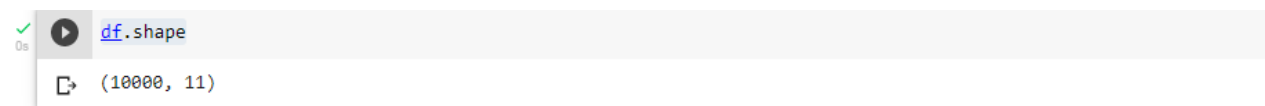


A screenshot of a Jupyter Notebook cell showing the execution of the code `df.isnull().sum()`. The cell has a green checkmark and a play button icon. The output is a table with two columns: the variable name and the count of null values. All counts are 0. The data type for the last row is `dtype: int64`.

CreditScore	0
Geography	0
Gender	0
Age	0
Tenure	0
Balance	0
NumOfProducts	0
HasCrCard	0
IsActiveMember	0
EstimatedSalary	0
Exited	0
dtype: int64	

```
df.shape
```

Output :



A screenshot of a Jupyter Notebook cell showing the execution of the code `df.shape`. The cell has a green checkmark and a play button icon. The output is a tuple `(10000, 11)`.

```
(10000, 11)
```

Step 6. Find the outliers and replace the outliers

```
sns.boxplot(df.CreditScore)
```

Output :



$Q1 = df.CreditScore.quantile(0.25)$

$Q3 = df.CreditScore.quantile(0.75)$

$IQR = Q3 - Q1$

$upper_limit = Q3 + (1.5 * IQR)$

$lower_limit = Q1 - (1.5 * IQR)$

$df['CreditScore'] = np.where(df['CreditScore'] < lower_limit, 650, df['CreditScore'])$

$sns.boxplot(df.CreditScore)$

Output :



Step 7. Check for Categorical columns and perform encoding.

$from sklearn.preprocessing import LabelEncoder$

$le = LabelEncoder()$

$df.Geography = le.fit_transform(df.Geography)$

$df.Gender = le.fit_transform(df.Gender)$

$df.head()$

Output :


```
df.head()
```

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

Step 8. Split the data into dependent and independent variables.

```
X = df.drop(columns=['Exited'])
X.head()
```

Output :

```
X = df.drop(columns=['Exited'])
X.head()
```

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

```
Y = df.Exited
Y.head()
```

Output :

```
Y = df.Exited
Y.head()
```

0	1
1	0
2	1
3	0
4	0

Name: Exited, dtype: int64


Step 9. Scale the independent variables

```
from sklearn.preprocessing import MinMaxScaler
scale = MinMaxScaler()
X_scaled = pd.DataFrame(scale.fit_transform(X),columns=X.columns)
```

Step 10. Split the data into training and testing

```
from sklearn.model_selection import train_test_split
x_train , y_train , x_test , y_test = train_test_split(X_scaled,Y,test_size=0.2,random_state=0)
```

Output :

✓ 0s  `X_scaled.shape`
(10000, 10)

✓ 0s [40] `x_train.shape`
(8000, 10)