Assignment -2

Data Visualization and Pre-processing

Assignment Date	24 September 2022
Leader Name	Arshad Yusuf Khan
Student Roll Number	611719205003
Maximum Marks	2 Marks

To Perform Below Tasks to complete the assignment:-

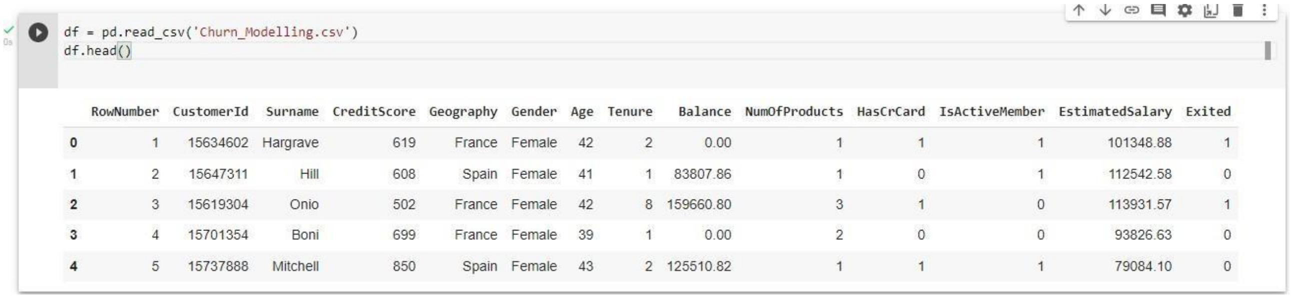
Step 1. Download the dataset: Dataset

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 :



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

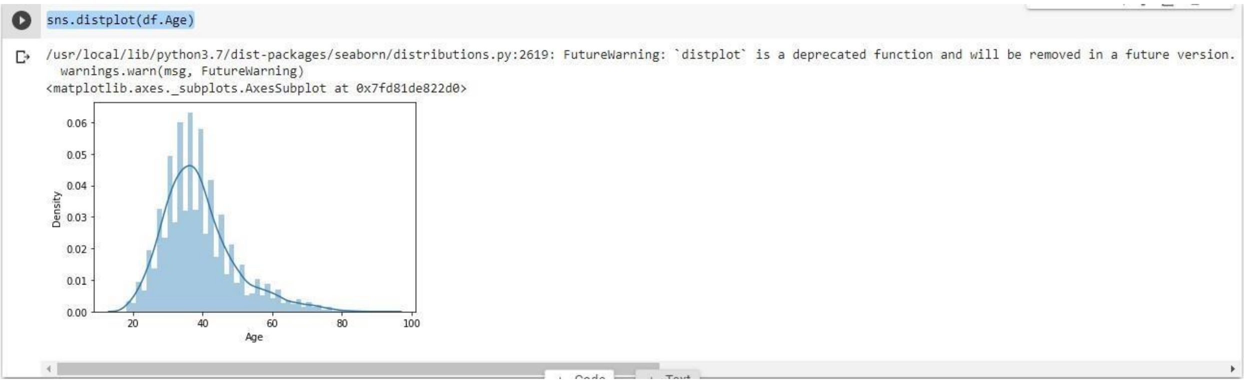
	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	1	1	101348.88	1
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0
2	3	15619304	Onio	502	France	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 :

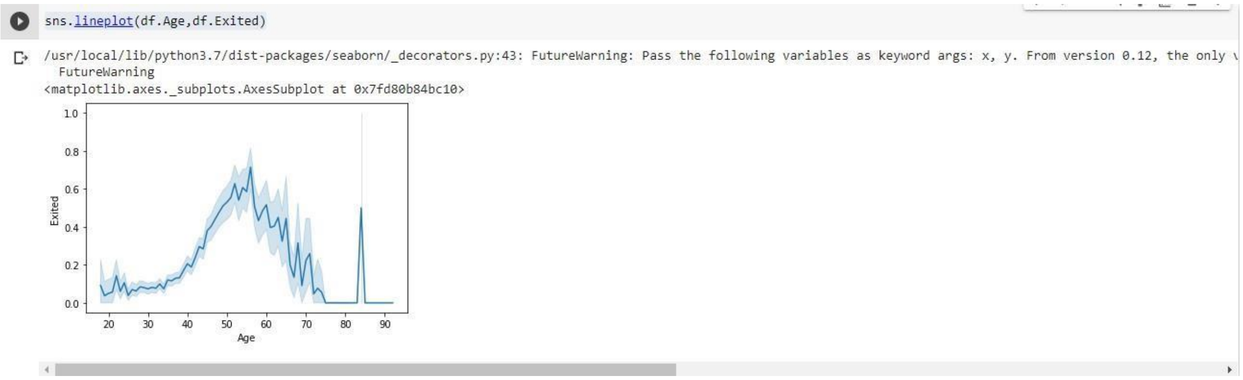


```
sns.distplot(df.Age)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2619: FutureWarning: `distplot` is a deprecated function and will be removed in a future version.
  warnings.warn(msg, FutureWarning)
<matplotlib.axes._subplots.AxesSubplot at 0x7fd81de822d0>
```

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

Output :

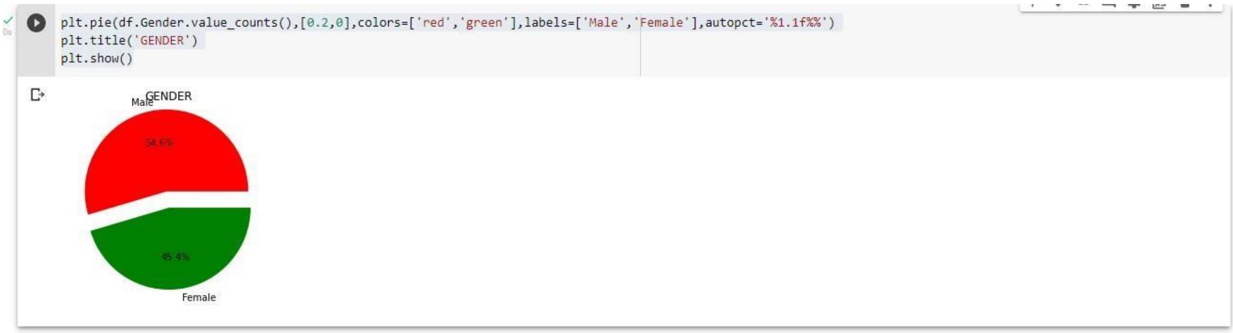


```
sns.lineplot(df.Age,df.Exited)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variables as keyword args: x, y. From version 0.12, the only v
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7fd80b84bc10>
```

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

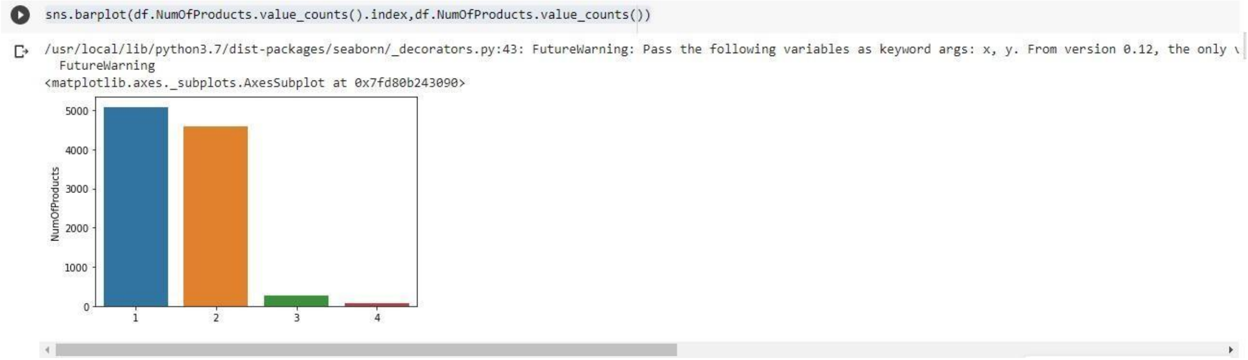
Output :



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

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

Output :



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

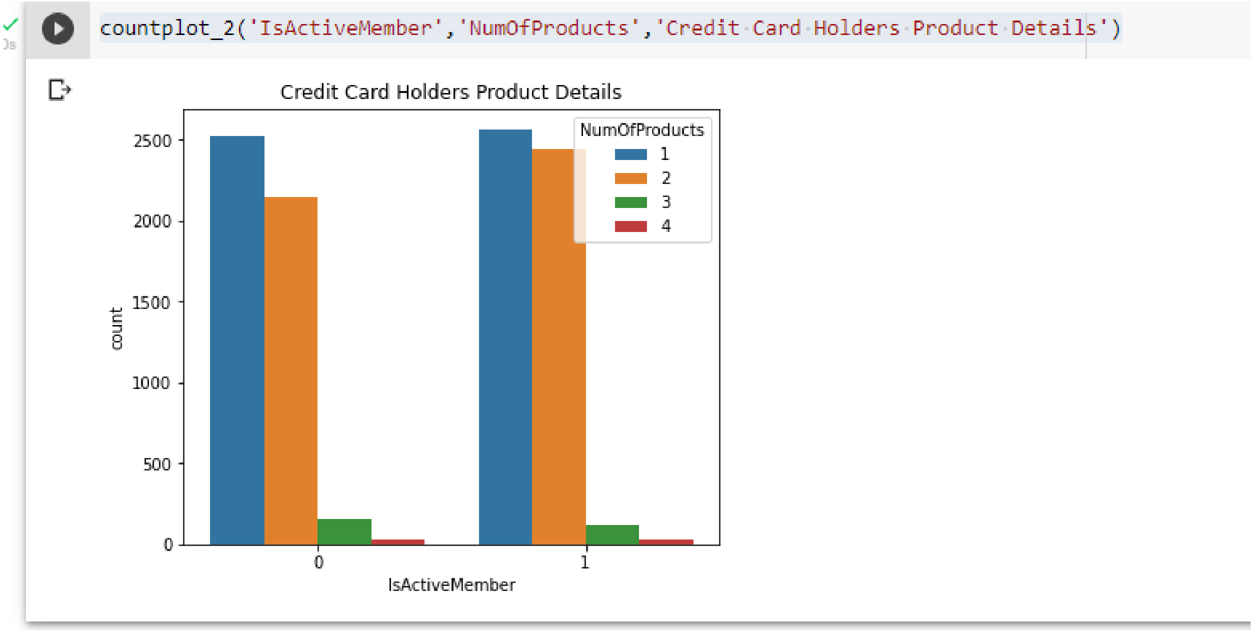
```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variables as keyword args: x, y. From version 0.12, the only v
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7fd80b243090>
```

- Bi - Variate Analysis

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

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

Output :

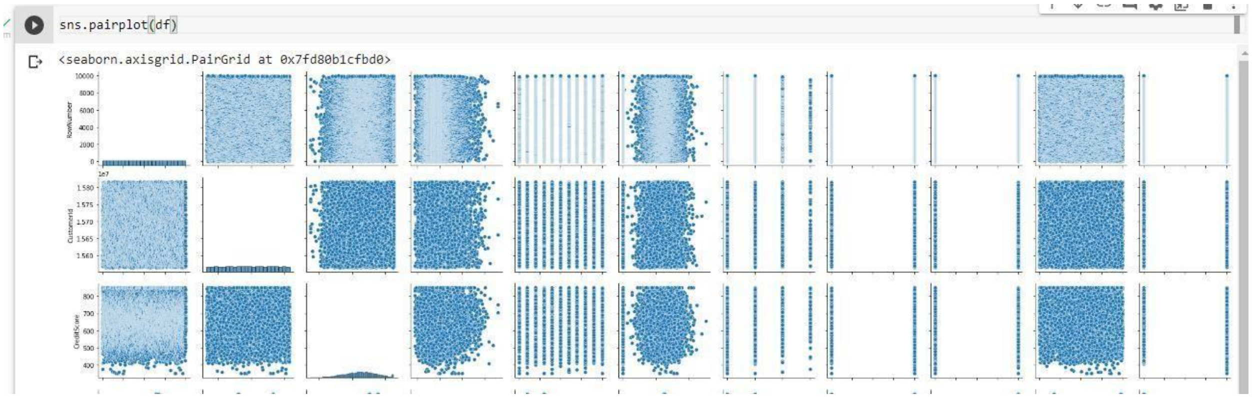


```
countplot_2('IsActiveMember','NumOfProducts','Credit Card Holders Product Details')
```

- Multi - Variate Analysis

sns.pairplot(df)

Output :

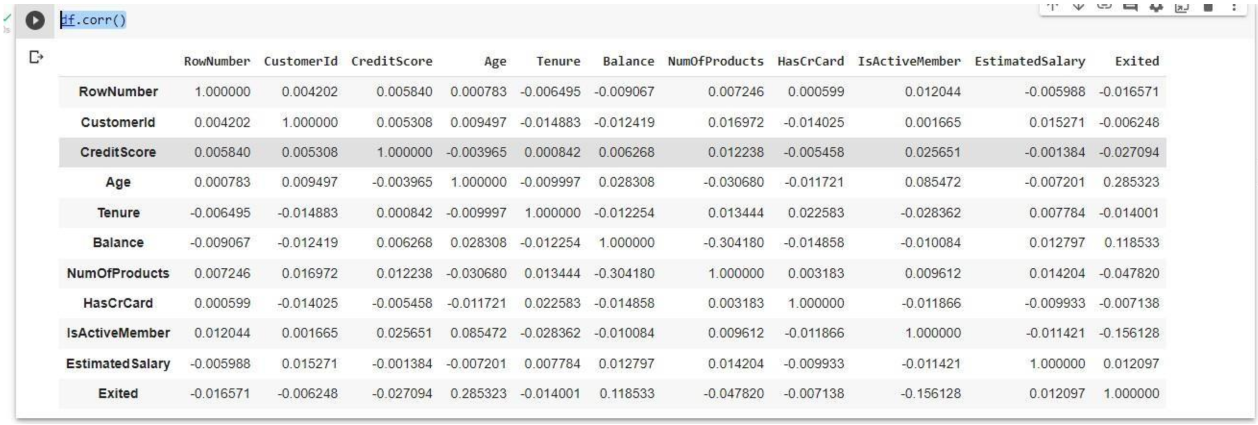


```
sns.pairplot(df)
```

```
<seaborn.axisgrid.PairGrid at 0x7fd80b1cfbd0>
```

df.corr()

Output :

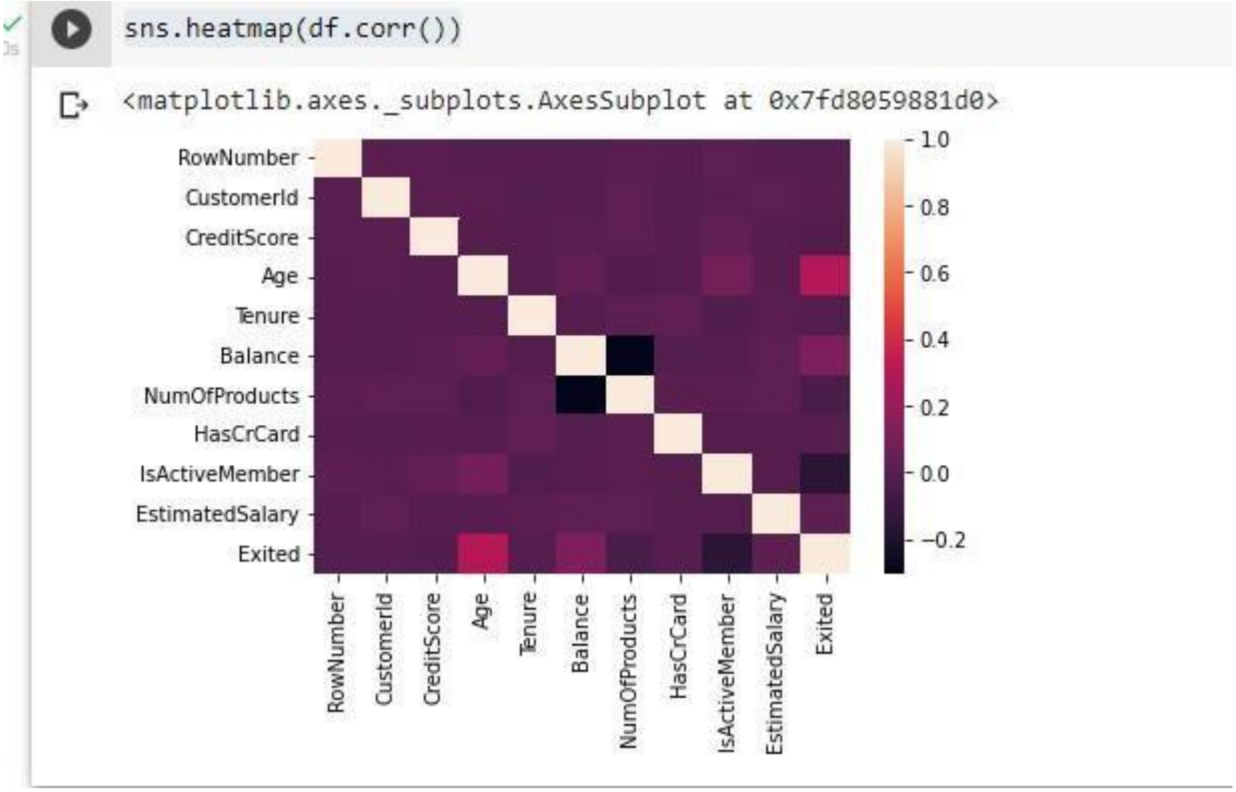


```
df.corr()
```

	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 :

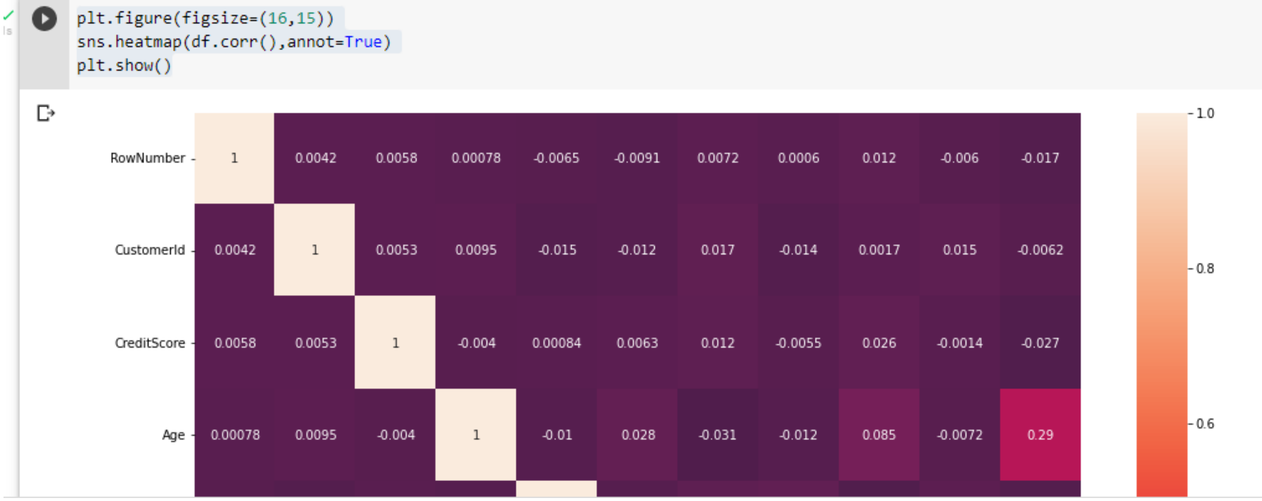


```
sns.heatmap(df.corr())
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd8059881d0>
```

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

Output :



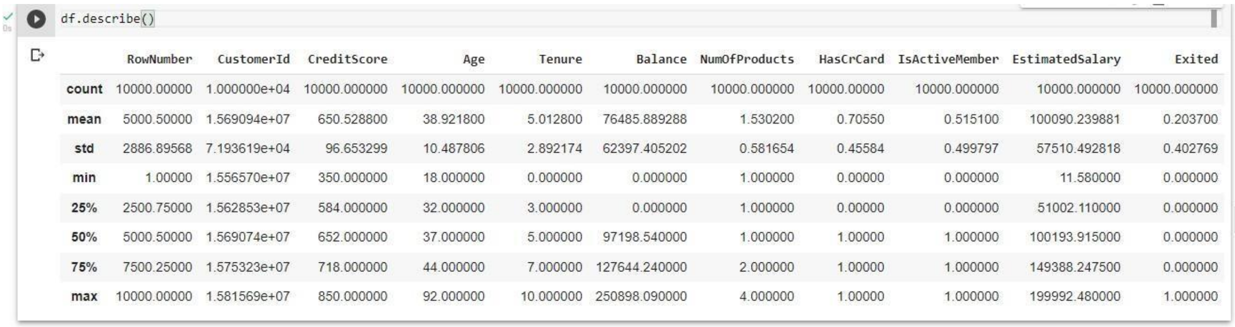
```
plt.figure(figsize=(16,15))
sns.heatmap(df.corr(),annot=True)
plt.show()
```

RowNumber	1	0.0042	0.0058	0.00078	-0.0065	-0.0091	0.0072	0.0006	0.012	-0.006	-0.017
CustomerId	0.0042	1	0.0053	0.0095	-0.015	-0.012	0.017	-0.014	0.0017	0.015	-0.0062
CreditScore	0.0058	0.0053	1	-0.004	0.00084	0.0063	0.012	-0.0055	0.026	-0.0014	-0.027
Age	0.00078	0.0095	-0.004	1	-0.01	0.028	-0.031	-0.012	0.085	-0.0072	0.29

Step 4. Perform descriptive statistics on the dataset.

df.describe()

Output :

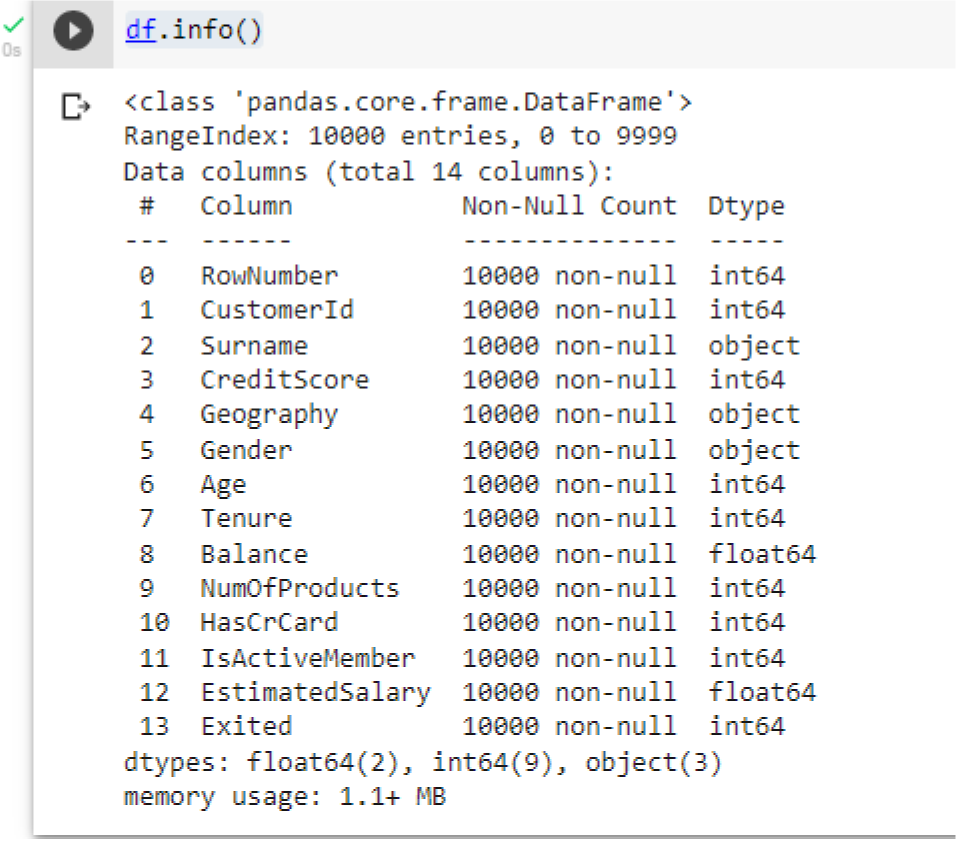


```
df.describe()
```

	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	10000.00000	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 :



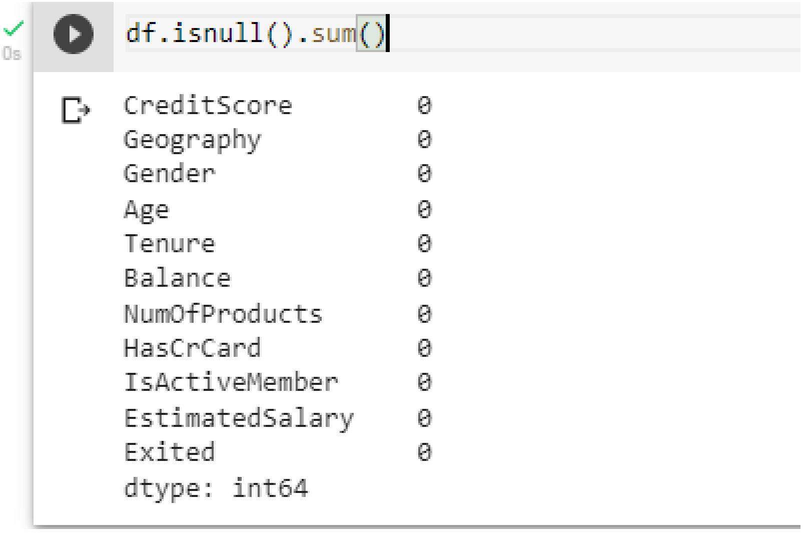
```
df.info()
```

```
<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
```

Step 5. Handle the Missing values.

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

Output :

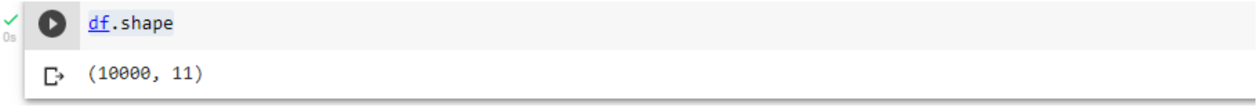


```
df.isnull().sum()
```

```
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 :



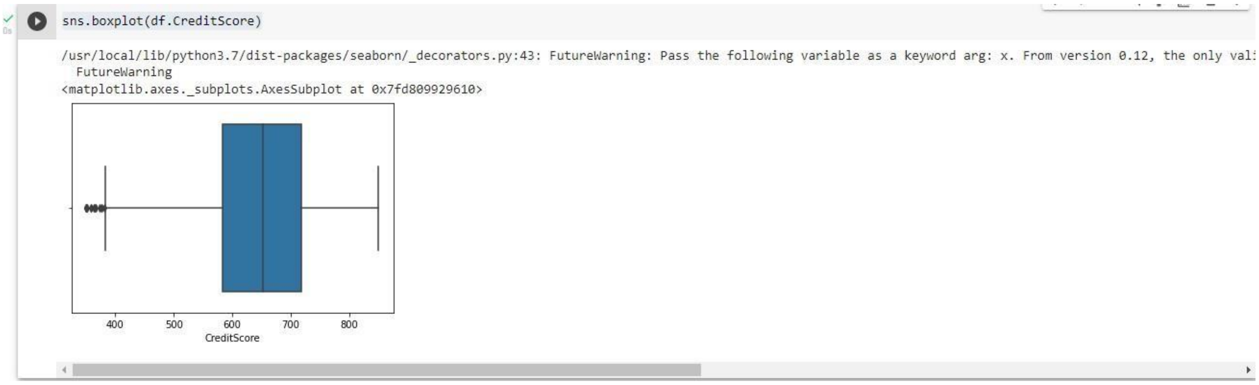
```
df.shape
```

```
(10000, 11)
```

Step 6. Find the outliers and replace the outliers

sns.boxplot(df.CreditScore)

Output :



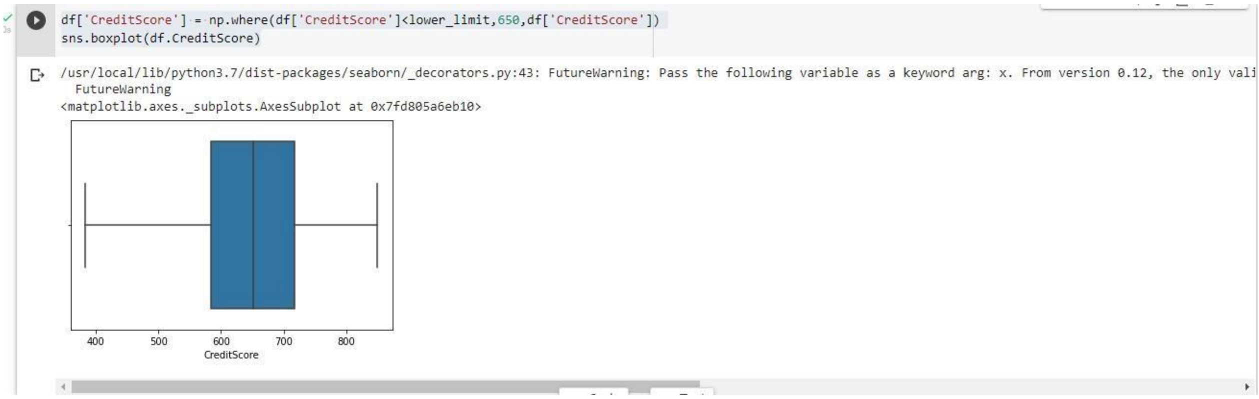
```
sns.boxplot(df.CreditScore)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only vali
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7fd809929610>
```

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 :



```
df['CreditScore'] = np.where(df['CreditScore']<lower_limit,650,df['CreditScore'])
sns.boxplot(df.CreditScore)
```

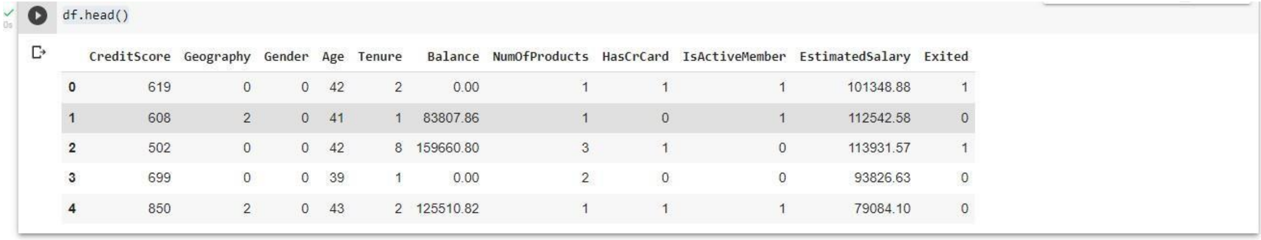
```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only vali
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7fd805a6eb10>
```

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 :



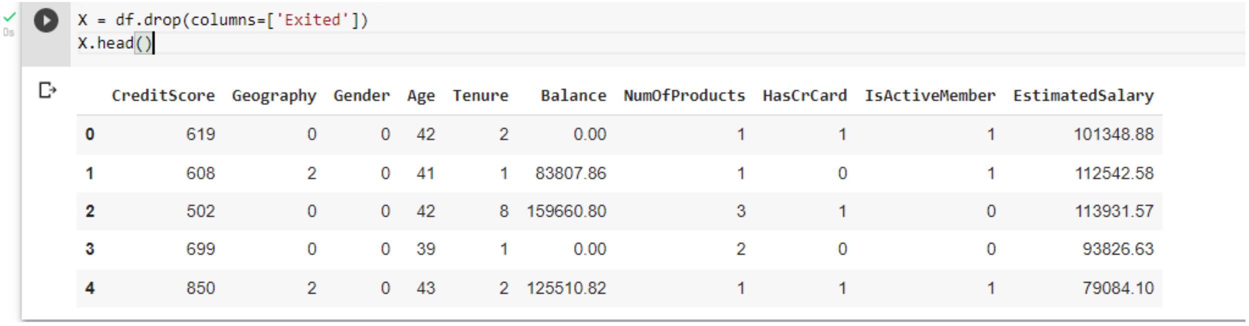
```
df.head()
```

	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 :

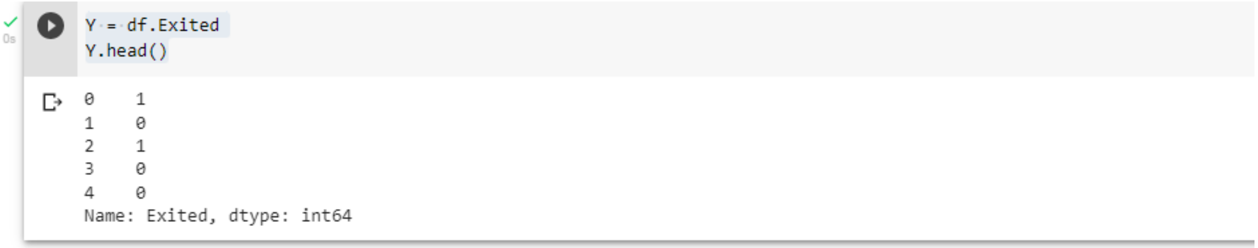


```
X = df.drop(columns=['Exited'])
X.head()
```

	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
```

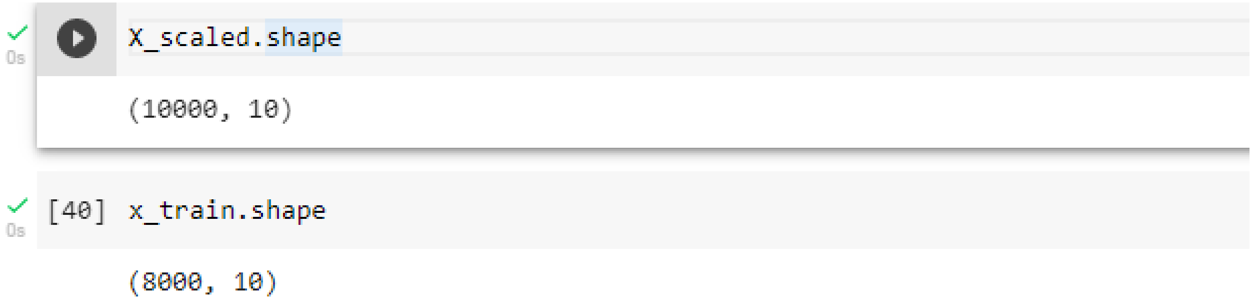
Step 9. Scale the independent variables

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 :



```
X_scaled.shape
```

```
(10000, 10)
```

```
[40] x_train.shape
```

```
(8000, 10)
```