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

```
df=pd.read_csv('/content/Churn_Modelling.csv')
```

```
df.head()
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balan
0	1	15634602	Hargrave	619	France	Female	42	2	0.0
1	2	15647311	Hill	608	Spain	Female	41	1	83807.8
2	3	15619304	Onio	502	France	Female	42	8	159660.8
3	4	15701354	Boni	699	France	Female	39	1	0.0
4	5	15737888	Mitchell	850	Spain	Female	43	2	125510.8

```
df.describe()
```

	RowNumber	CustomerId	CreditScore	Age	Tenure	Ba
count	10000.00000	1.000000e+04	10000.000000	10000.000000	10000.000000	10000.0
mean	5000.50000	1.569094e+07	650.528800	38.921800	5.012800	76485.8
std	2886.89568	7.193619e+04	96.653299	10.487806	2.892174	62397.4
min	1.00000	1.556570e+07	350.000000	18.000000	0.000000	0.0
25%	2500.75000	1.562853e+07	584.000000	32.000000	3.000000	0.0
50%	5000.50000	1.569074e+07	652.000000	37.000000	5.000000	97198.5
75%	7500.25000	1.575323e+07	718.000000	44.000000	7.000000	127644.2
max	10000.00000	1.581569e+07	850.000000	92.000000	10.000000	250898.0

```
df.info()
```

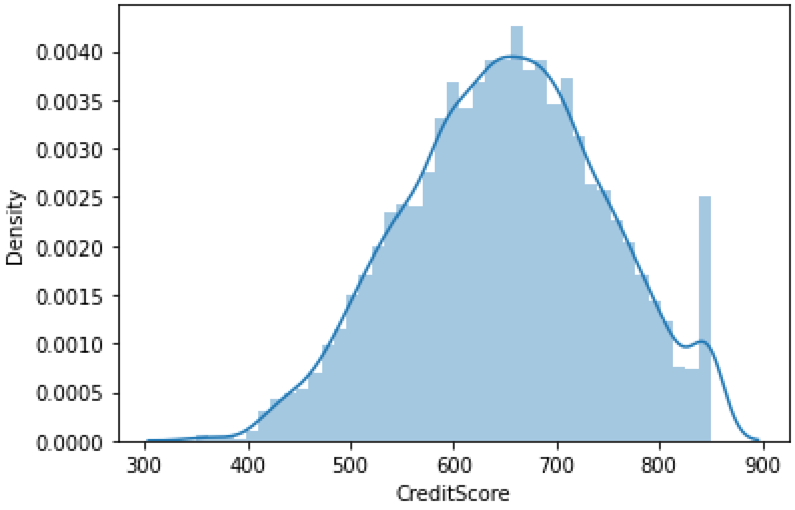
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 14 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   RowNumber        10000 non-null  int64  
 1   CustomerId       10000 non-null  int64  
 2  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

```
df.head(2)
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	E
0	1	15634602	Hargrave	619	France	Female	42	2	
1	2	15647311	Hill	608	Spain	Female	41	1	8:

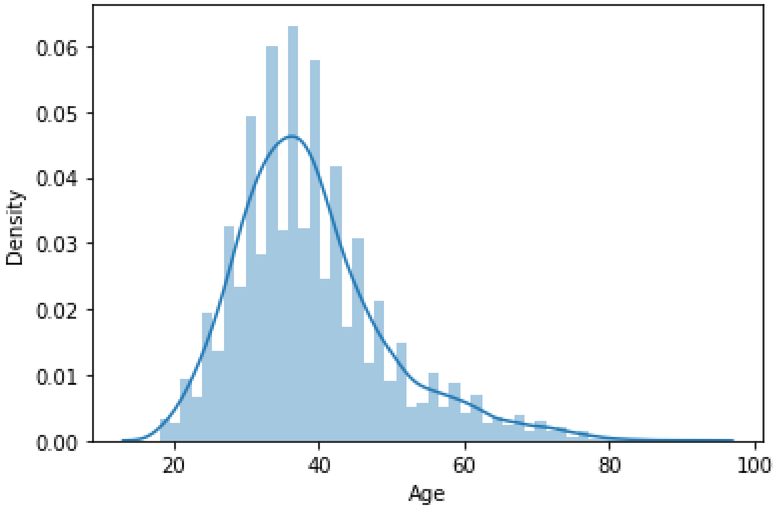
```
sns.distplot(df.CreditScore)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2619: FutureWarning: `di
  warnings.warn(msg, FutureWarning)
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bb4b6b1d0>
```



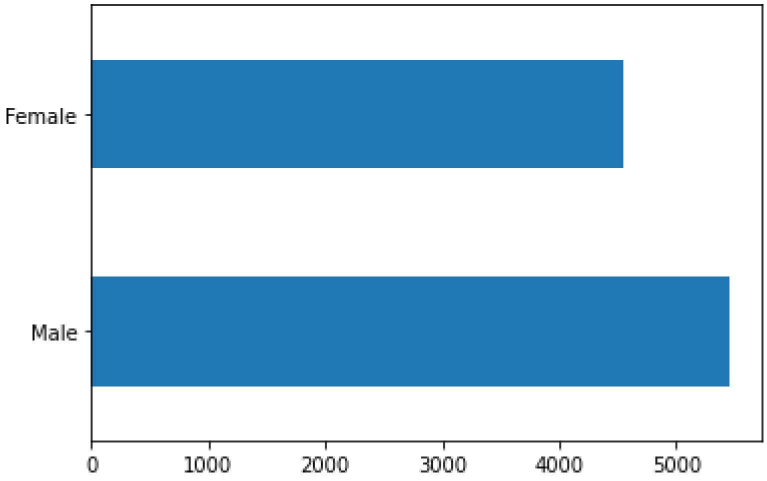
```
sns.distplot(df.Age)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2619: FutureWarning: `di
  warnings.warn(msg, FutureWarning)
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bb49df710>
```



```
df.Gender.value_counts().plot(kind='barh')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bb4461490>
```

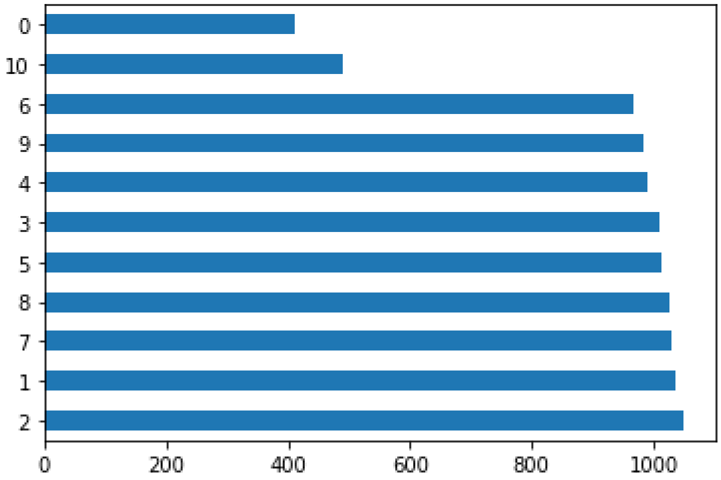


```
df.Geography.value_counts().plot(kind='barh')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bb44d2e90>
```

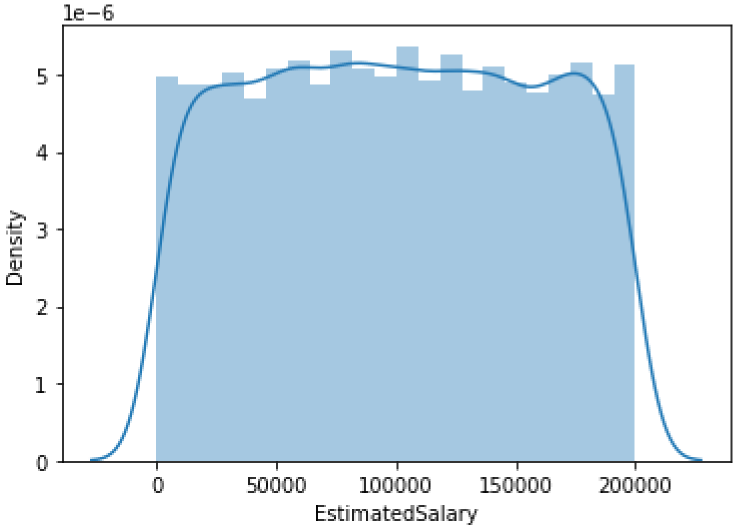
```
df.Tenure.value_counts().plot(kind='barh')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bb4332050>
```



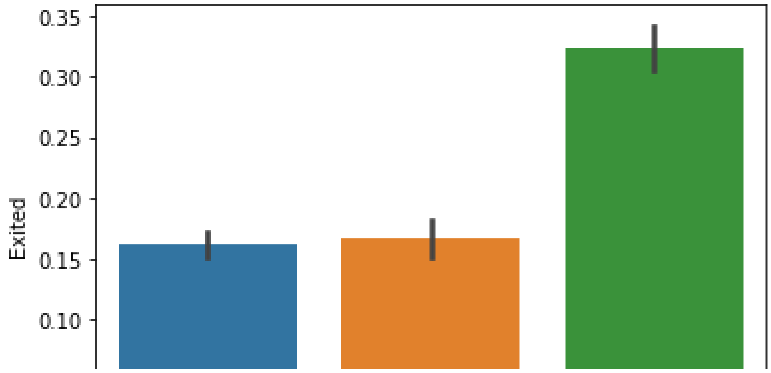
```
sns.distplot(df.EstimatedSalary)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2619: FutureWarning: `di
  warnings.warn(msg, FutureWarning)
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bb42dd050>
```



```
sns.barplot(df.Geography, df.Exited)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass th
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bb41faf50>
```

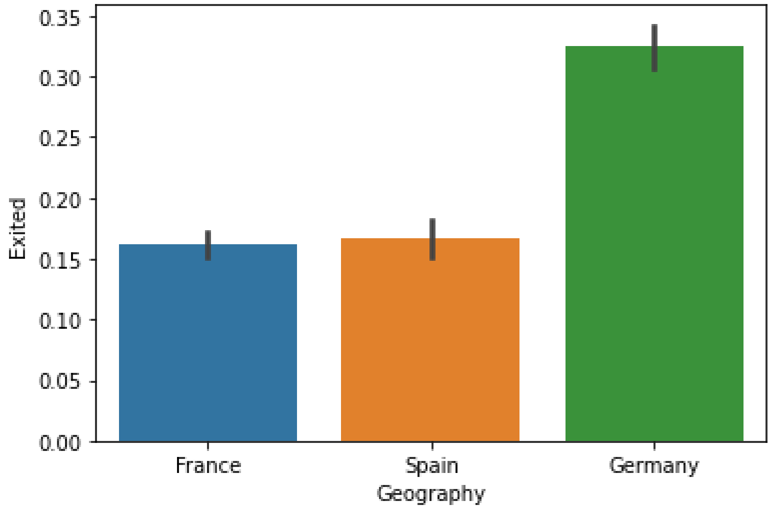


```
df.head(2)
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	E
0	1	15634602	Hargrave	619	France	Female	42	2	
1	2	15647311	Hill	608	Spain	Female	41	1	8:

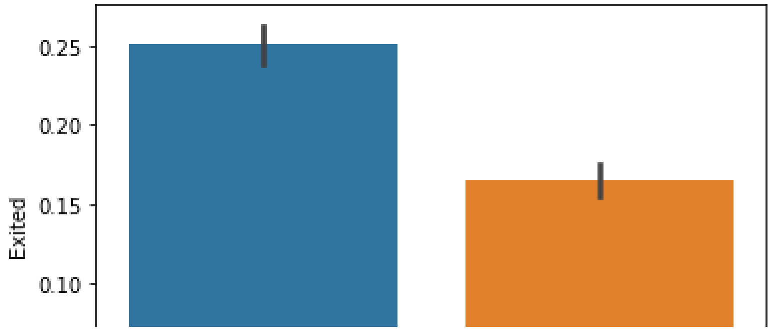
```
sns.barplot(x='Geography',y='Exited',data=df)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bb41709d0>
```



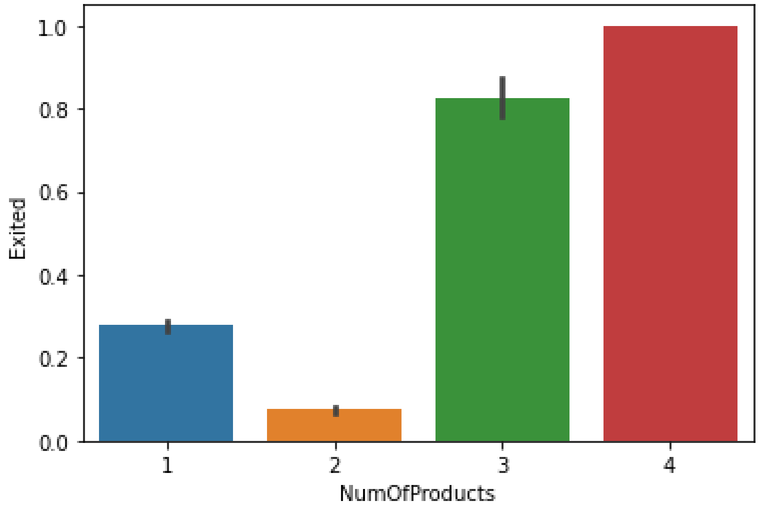
```
sns.barplot(x='Gender',y='Exited',data=df)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bb40f1c90>
```



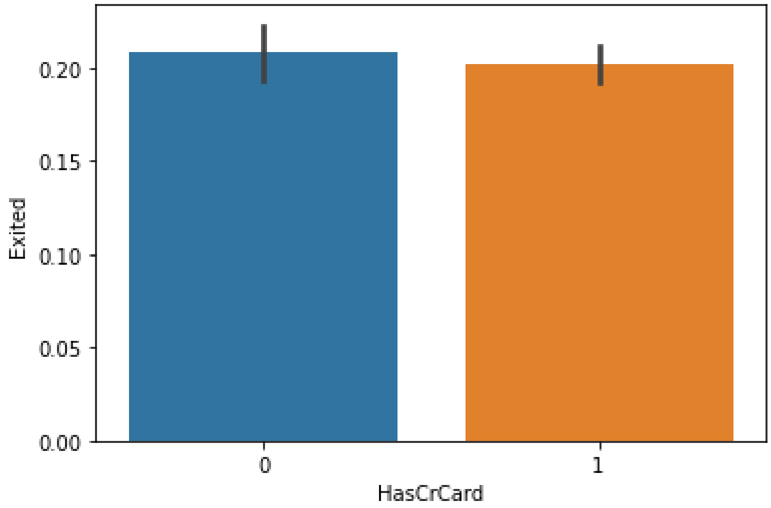
```
sns.barplot(x='NumOfProducts',y='Exited',data=df)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bb40d60d0>
```



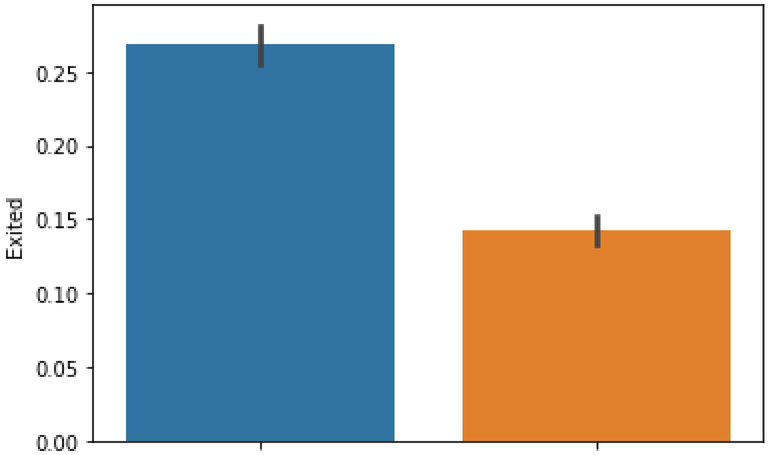
```
sns.barplot(x='HasCrCard',y='Exited',data=df)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bb403db10>
```



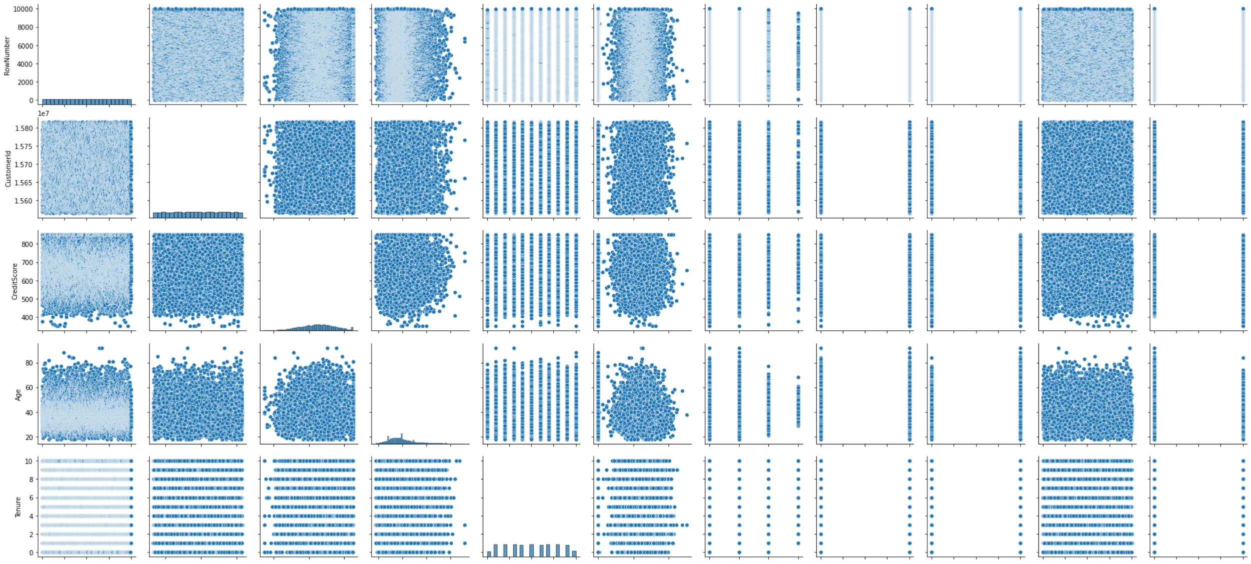
```
sns.barplot(x='IsActiveMember',y='Exited',data=df)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bb4011e10>
```



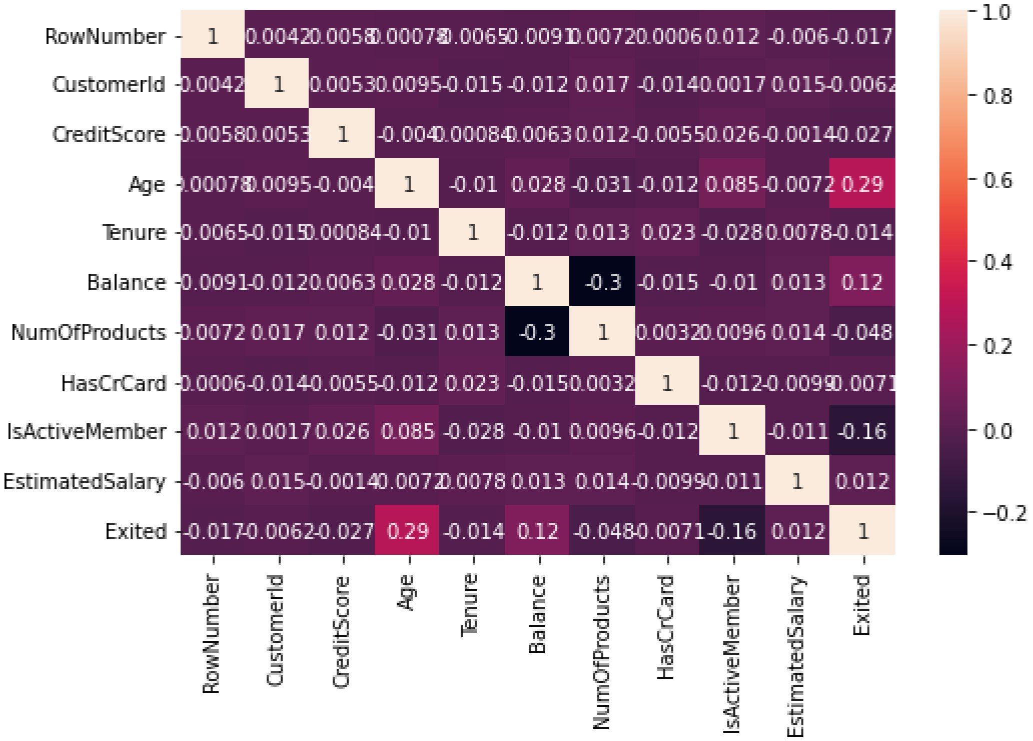
```
sns.pairplot(df)
```

```
<seaborn.axisgrid.PairGrid at 0x7f4bb428f750>
```



```
plt.figure(figsize=(8,5))
sns.heatmap(df.corr(),annot=True)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bc6252a50>
```



```
df.Exited.value_counts()
```

```
0    7963
1    2037
Name: Exited, dtype: int64
```

```
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
```

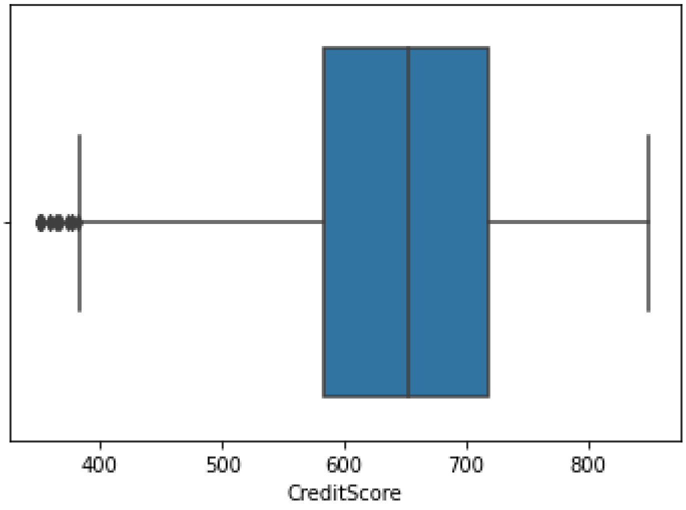
```
#No missing values
```

```
df.head(2)
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	E
0	1	15634602	Hargrave	619	France	Female	42	2	
1	2	15647311	Hill	608	Spain	Female	41	1	8

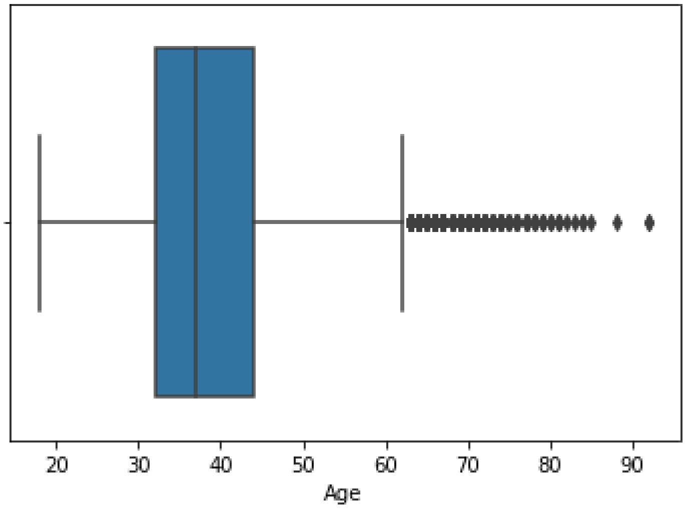
```
sns.boxplot(df.CreditScore)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass t
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bacb745d0>
```



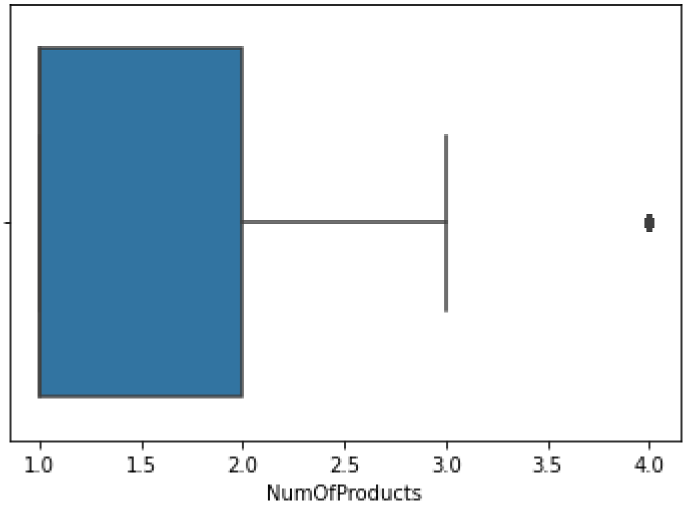
```
sns.boxplot(df.Age)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass th
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bacb5a590>
```



```
sns.boxplot(df.NumOfProducts)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass th
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bacac4750>
```

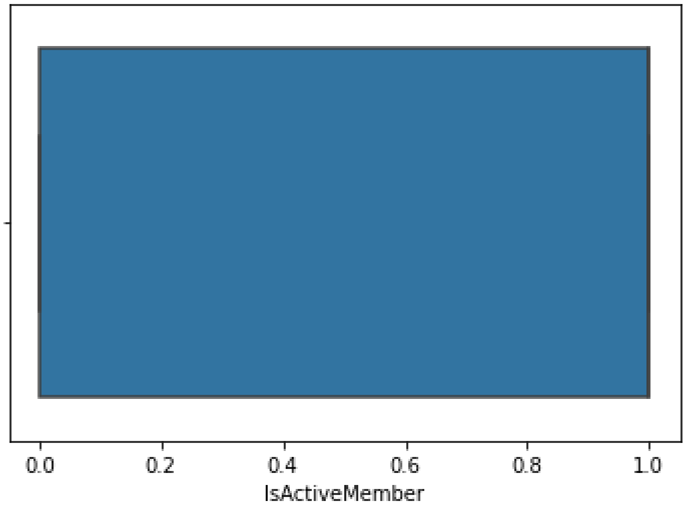


```
sns.boxplot(df.HasCrCard)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass tl
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f4baca430d0>
```

```
sns.boxplot(df.IsActiveMember)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass tl
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bae48e690>
```

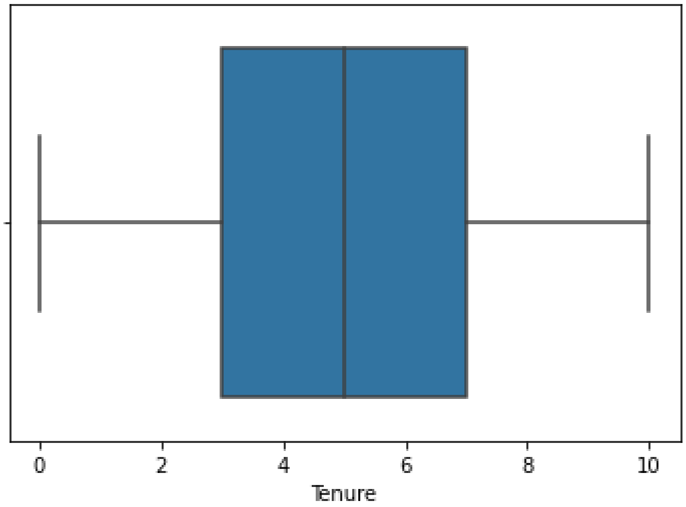


```
sns.boxplot(df.EstimatedSalary)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass th
```

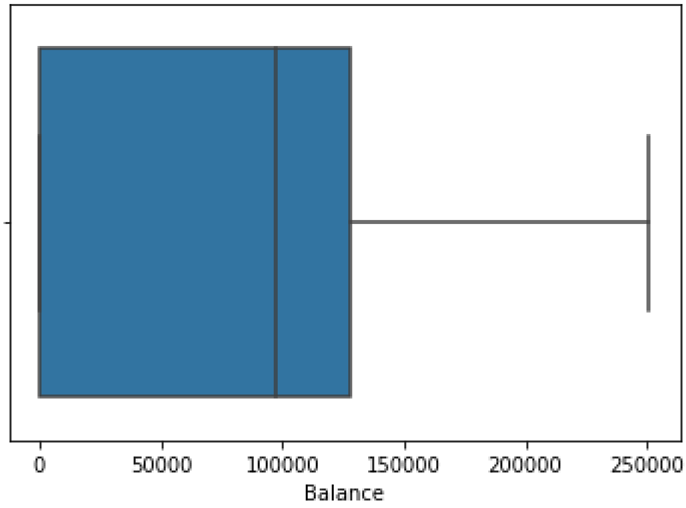
```
sns.boxplot(df.Tenure)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass th
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bac907c90>
```



```
sns.boxplot(df.Balance)
```

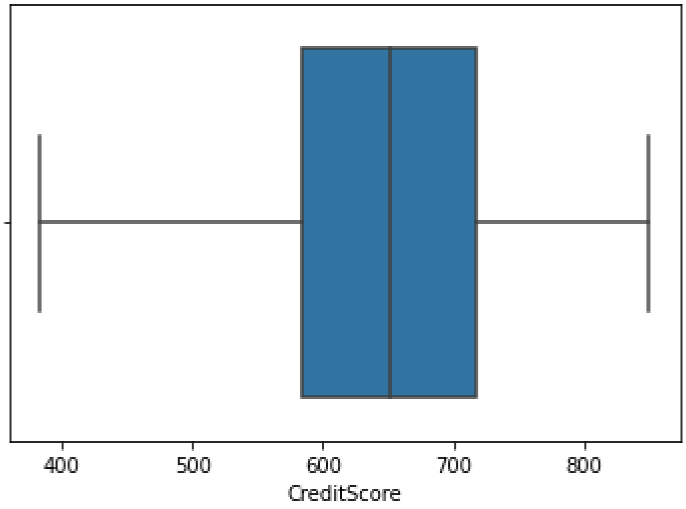
```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass th
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bac868910>
```



```
#Outlier Removal


def outlier_credit_score(df):
    IQR = df['CreditScore'].quantile(0.75) - df['CreditScore'].quantile(0.25)

    lower_range = df['CreditScore'].quantile(0.25) - (1.5 * IQR)
    upper_range = df['CreditScore'].quantile(0.75) + (1.5 * IQR)

    df.loc[df['CreditScore'] <= lower_range, 'CreditScore'] = lower_range
    df.loc[df['CreditScore'] >= upper_range, 'CreditScore'] = upper_range

outlier_credit_score(df)
```

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

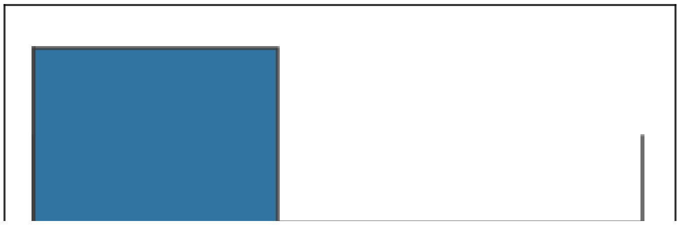
```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass th
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bac85f510>
```



```
def outlier_NOP(df):
    IQR = df['NumOfProducts'].quantile(0.75) - df['NumOfProducts'].quantile(0.25)

    lower_range = df['NumOfProducts'].quantile(0.25) - (1.5 * IQR)
    upper_range = df['NumOfProducts'].quantile(0.75) + (1.5 * IQR)

    df.loc[df['NumOfProducts'] <= lower_range, 'NumOfProducts'] = lower_range
    df.loc[df['NumOfProducts'] >= upper_range, 'NumOfProducts'] = upper_range

outlier_NOP(df)
```

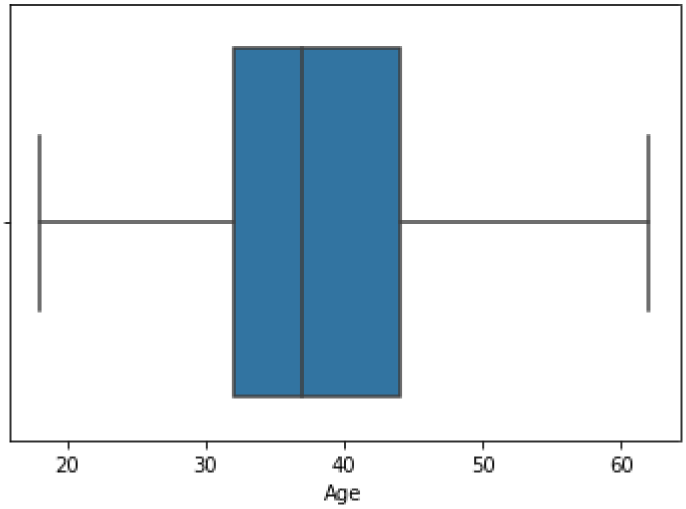
```
sns.boxplot(df.NumOfProducts)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass tl
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bac7aa350>
```



```
def outlier_age(df):
    IQR = df['Age'].quantile(0.75) - df['Age'].quantile(0.25)

    lower_range = df['Age'].quantile(0.25) - (1.5 * IQR)
    upper_range = df['Age'].quantile(0.75) + (1.5 * IQR)

    df.loc[df['Age'] <= lower_range, 'Age'] = lower_range
    df.loc[df['Age'] >= upper_range, 'Age'] = upper_range

outlier_age(df)


sns.boxplot(df.Age)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass tl
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f4bac724410>
```



```
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  float64
 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(3), int64(8), object(3)
memory usage: 1.1+ MB
```

```
df.head(2)
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	B
0	1	15634602	Hargrave	619	France	Female	42	2	
1	2	15647311	Hill	608	Spain	Female	41	1	83

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

```
df.head(2)
```

	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard
0	619	France	Female	42	2	0.00	1.0	1
1	608	Spain	Female	41	1	83807.86	1.0	0

```
from sklearn.preprocessing import LabelEncoder
le_geo = LabelEncoder()
le_gen = LabelEncoder()
df['Sex']=le_gen.fit_transform(df.Gender)
df['Country']=le_geo.fit_transform(df.Geography)
df.drop(['Geography','Gender'],axis=1,inplace=True)
```

```
df.head(2)
```

	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	E
0	619	42	2	0.00	1.0	1	1	
1	608	41	1	83807.86	1.0	0	1	

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

```
X
```

	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	Est
0	619	42	2	0.00	1.0	1	1	
1	608	41	1	83807.86	1.0	0	1	
2	502	42	8	159660.80	3.0	1	0	
3	699	39	1	0.00	2.0	0	0	
4	850	43	2	125510.82	1.0	1	1	
...	...	...	...	...	...	...	...	
9995	771	39	5	0.00	2.0	1	0	
9996	516	35	10	57369.61	1.0	1	1	
9997	709	36	7	0.00	1.0	0	1	
9998	772	42	3	75075.31	2.0	1	0	
9999	792	28	4	130142.79	1.0	1	0	

10000 rows × 10 columns

```
from sklearn.preprocessing import StandardScaler
sc=StandardScaler()
X = sc.fit_transform(X)
```

Colab paid products - Cancel contracts here

● ✕