```
import numpy as np
```

```
import pandas as pd
```

```
df=pd.read_csv("Churn_Modelling.csv")
```

```
df
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure
0	1	15634602	Hargrave	619	France	Female	42	2
1	2	15647311	Hill	608	Spain	Female	41	1
2	3	15619304	Onio	502	France	Female	42	8
3	4	15701354	Boni	699	France	Female	39	1
4	5	15737888	Mitchell	850	Spain	Female	43	2
...	...	...	...	...	...	...	...	...
9995	9996	15606229	Obijiaku	771	France	Male	39	5
9996	9997	15569892	Johnstone	516	France	Male	35	10
9997	9998	15584532	Liu	709	France	Female	36	7
9998	9999	15682355	Sabbatini	772	Germany	Male	42	3
9999	10000	15628319	Walker	792	France	Female	28	4

10000 rows × 14 columns

Visualizations

```
import matplotlib.pyplot as plt
import seaborn as sns
```

```
%matplotlib inline
```

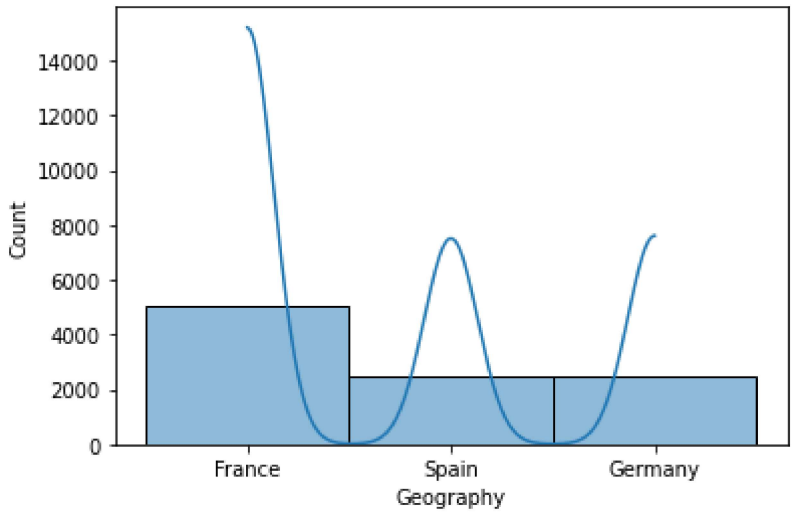
```
df[['RowNumber', 'CustomerId', 'Surname', 'CreditScore', 'Geography',
       'Gender', 'Age', 'Tenure']].describe()
```

	RowNumber	CustomerId	CreditScore	Age	Tenure
count	10000.00000	1.000000e+04	10000.000000	10000.000000	10000.000000
mean	5000.50000	1.569094e+07	650.528800	38.921800	5.012800
std	2886.89568	7.193619e+04	96.653299	10.487806	2.892174
min	1.00000	1.556570e+07	350.000000	18.000000	0.000000
25%	2500.75000	1.562853e+07	584.000000	32.000000	3.000000
50%	5000.50000	1.569074e+07	652.000000	37.000000	5.000000
75%	7500.25000	1.575323e+07	718.000000	44.000000	7.000000

[1] Univariate Analysis

```
sns.histplot(df.Geography,kde= True)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f685ef65dd0>
```




```
# plot count plot for the gender column
sns.countplot(df.Gender)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f685ecf6350>
```

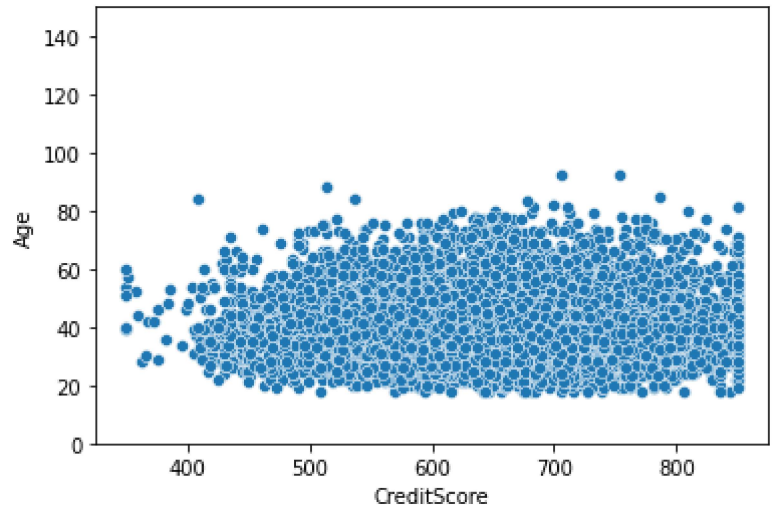
[2] Bi-Variate Analysis

```
df[['RowNumber', 'CustomerId', 'Surname', 'CreditScore', 'Geography',
       'Gender', 'Age', 'Tenure']].corr()
```

	RowNumber	CustomerId	CreditScore	Age	Tenure
RowNumber	1.000000	0.004202	0.005840	0.000783	-0.006495
CustomerId	0.004202	1.000000	0.005308	0.009497	-0.014883
CreditScore	0.005840	0.005308	1.000000	-0.003965	0.000842
Age	0.000783	0.009497	-0.003965	1.000000	-0.009997
Tenure	-0.006495	-0.014883	0.000842	-0.009997	1.000000

```
sns.scatterplot(df.CreditScore,df.Age)
plt.ylim(0,150)
```

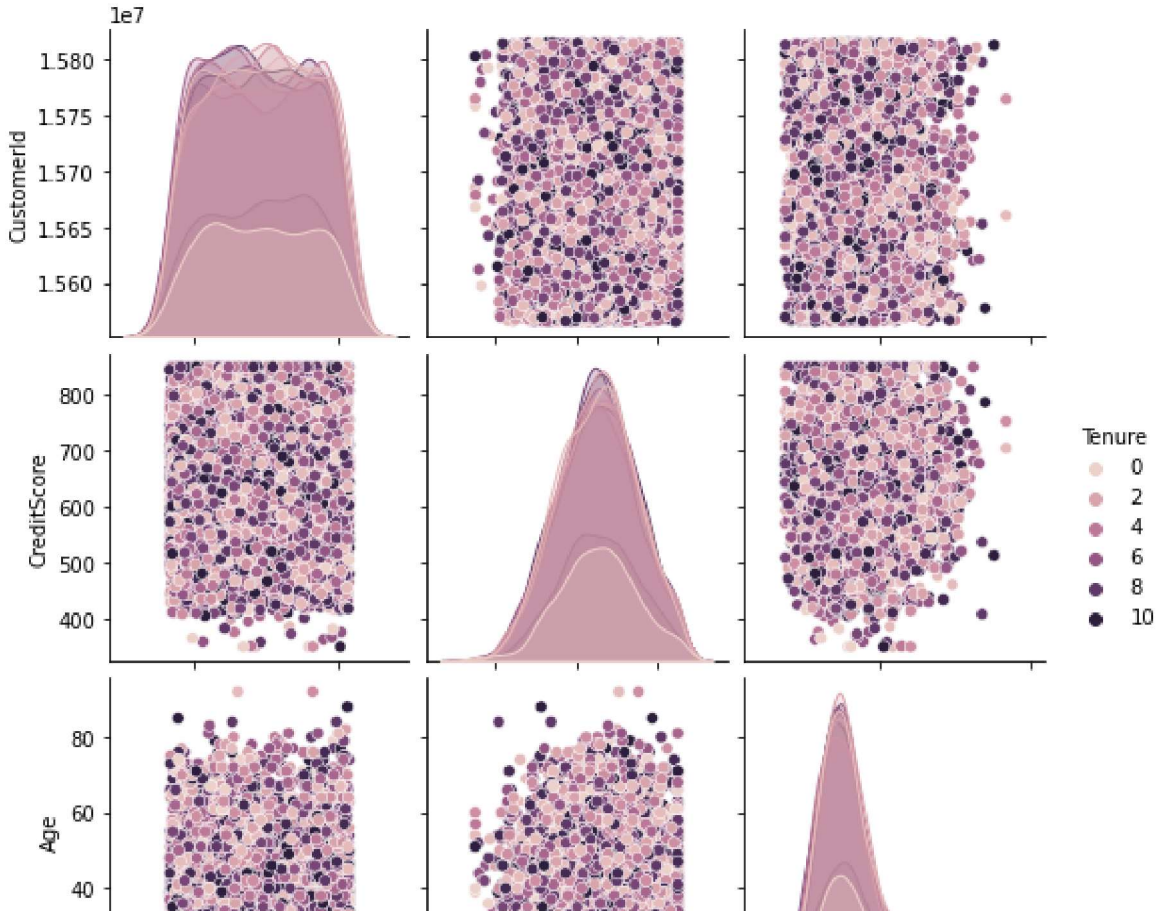
```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass
  FutureWarning
(0.0, 150.0)
```



[3] Multi - Variate Analysis

```
sns.pairplot(data=df[['CustomerId', 'Surname', 'CreditScore', 'Geography','Gender', 'Age',
```

```
<seaborn.axisgrid.PairGrid at 0x7f685f099190>
```



[4] **Descriptive statistics**

```
1.56        1.58        400    600    800        50        100
```

```
# summary statistics
df.describe()
```

	RowNumber	CustomerId	CreditScore	Age	Tenure	Balar
count	10000.00000	1.000000e+04	10000.000000	10000.000000	10000.000000	10000.000(
mean	5000.50000	1.569094e+07	650.528800	38.921800	5.012800	76485.889:
std	2886.89568	7.193619e+04	96.653299	10.487806	2.892174	62397.405:
min	1.00000	1.556570e+07	350.000000	18.000000	0.000000	0.000(
25%	2500.75000	1.562853e+07	584.000000	32.000000	3.000000	0.000(
50%	5000.50000	1.569074e+07	652.000000	37.000000	5.000000	97198.540(
75%	7500.25000	1.575323e+07	718.000000	44.000000	7.000000	127644.240(
max	10000.00000	1.581569e+07	850.000000	92.000000	10.000000	250898.090(

```
df.dtypes
```

```
RowNumber           int64
CustomerId          int64
Surname            object
CreditScore         int64
Geography          object
Gender             object
Age                 int64
Tenure              int64
Balance           float64
NumOfProducts       int64
HasCrCard           int64
IsActiveMember      int64
EstimatedSalary   float64
Exited              int64
dtype: object
```

```
# mode
df['Age'].mode()
```

```
0    37
dtype: int64
```

```
# calculation of the mean
df["Age"].mean()
```

```
38.9218
```

```
# calculation of the mean and round the result
round(df["Age"].mean(), 3)
```

```
38.922
```

```
# calculation of the median
df["Age"].median()
```

```
37.0
```

[5] **Handling Missing Values**

```
df.isna().any()
```

```
RowNumber          False
CustomerId         False
Surname            False
CreditScore        False
Geography          False
Gender             False
Age                False
Tenure             False
Balance            False
```

```
NumOfProducts      False
HasCrCard          False
IsActiveMember     False
EstimatedSalary    False
Exited             False
dtype: bool
```

```
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
```

```
df.isnull()
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure
0	False	False	False	False	False	False	False	False
1	False	False	False	False	False	False	False	False
2	False	False	False	False	False	False	False	False
3	False	False	False	False	False	False	False	False
4	False	False	False	False	False	False	False	False
...	...	...	...	...	...	...	...	...
9995	False	False	False	False	False	False	False	False
9996	False	False	False	False	False	False	False	False
9997	False	False	False	False	False	False	False	False
9998	False	False	False	False	False	False	False	False
9999	False	False	False	False	False	False	False	False

10000 rows × 14 columns

```
df.notnull()
```

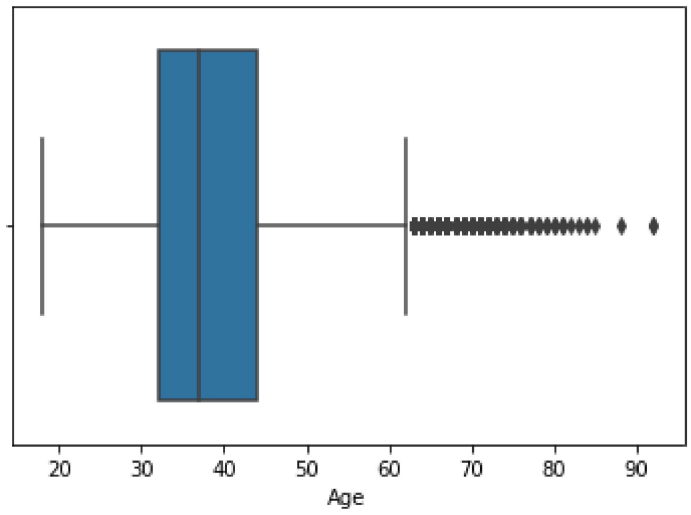
	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	B
0	True	True	True	True	True	True	True	True	
1	True	True	True	True	True	True	True	True	
2	True	True	True	True	True	True	True	True	
3	True	True	True	True	True	True	True	True	
4	True	True	True	True	True	True	True	True	
...	...	...	...	...	...	...	...	...	
9995	True	True	True	True	True	True	True	True	
9996	True	True	True	True	True	True	True	True	
9997	True	True	True	True	True	True	True	True	
9998	True	True	True	True	True	True	True	True	
9999	True	True	True	True	True	True	True	True	

10000 rows × 14 columns

[6] **Find the outliers and replace the outliers**

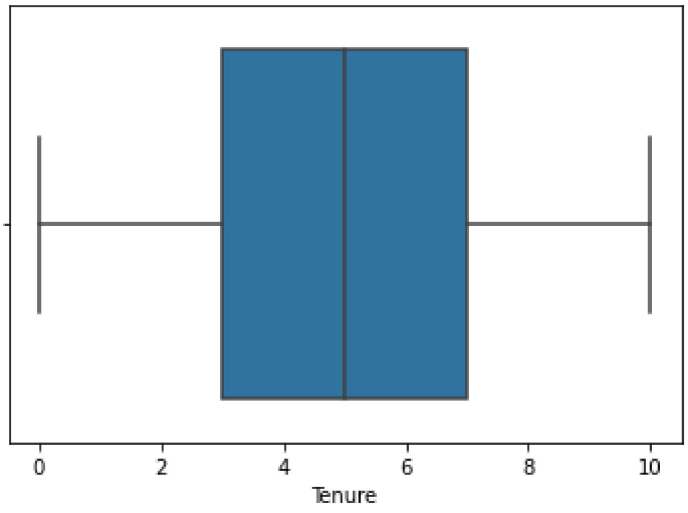
```
sns.boxplot(x=df['Age'])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f685baae7d0>
```




```
sns.boxplot(x=df['Tenure'])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f685e7ecfd0>
```



[7] **Check for Categorical columns and perform encoding**.

```
a=df.columns
```

```
b=df._get_numeric_data().columns
```

```
b
```

```
Index(['RowNumber', 'CustomerId', 'CreditScore', 'Age', 'Tenure', 'Balance',
       'NumOfProducts', 'HasCrCard', 'IsActiveMember', 'EstimatedSalary',
       'Exited'],
      dtype='object')
```

```
list(set(a) - set(b))
```

```
['Surname', 'Geography', 'Gender']
```

[8] **Split the data into dependent and independent variables**.

```
# x  -Independent
# y  -Dependent
x =df.drop('Exited',axis=1)
y=df['Exited']
```

```
x.head()
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Ba
0	1	15634602	Hargrave	619	France	Female	42	2	
1	2	15647311	Hill	608	Spain	Female	41	1	838
2	3	15619304	Onio	502	France	Female	42	8	1596
3	4	15701354	Boni	699	France	Female	39	1	
4	5	15737888	Mitchell	850	Spain	Female	43	2	1255

```
y.head()
```

```
0    1
1    0
2    1
3    0
4    0
Name: Exited, dtype: int64
```

[9] **Scale the independent variables**

```
from sklearn import linear_model
from sklearn.preprocessing import StandardScaler
scale = StandardScaler()
scale = StandardScaler()
x=df[['Age','Tenure']]
scaledx = scale.fit_transform(x)
print(scaledx)
```

```
[[ 0.29351742 -1.04175968]
 [ 0.19816383 -1.38753759]
 [ 0.29351742  1.03290776]
 ...
 [-0.27860412  0.68712986]
 [ 0.29351742 -0.69598177]
 [-1.04143285 -0.35020386]]
```

[10] **Split the data into training and testing**

```
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)
```

```
print('X Train shape:{},Y.Train SHape:{}'.format(x_train.shape,y_train.shape))
```

```
X Train shape:(8000, 2),Y.Train SHape:(8000,)
```

```
print('X Test Shape :{},Y Test SHape:{}'.format(x_test.shape,y_test.shape))
```

```
X Test Shape :(2000, 2),Y Test SHape:(2000,)
```