

## ASSIGNMENT 2

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*# Importin required libraries*

```
import numpy as np
import pandas as pd
```

*# Reading the dataset*

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

*# Visualizing 1st 50 data*

```
df.head()
```

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

	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	\
0	2	0.00	1	1	1	
1	1	83807.86	1	0	1	
2	8	159660.80	3	1	0	
3	1	0.00	2	0	0	
4	2	125510.82	1	1	1	

	EstimatedSalary	Exited
0	101348.88	1
1	112542.58	0
2	113931.57	1
3	93826.63	0
4	79084.10	0

*# Checking for null 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 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

```

```

import matplotlib.pyplot as plt
import seaborn as sns

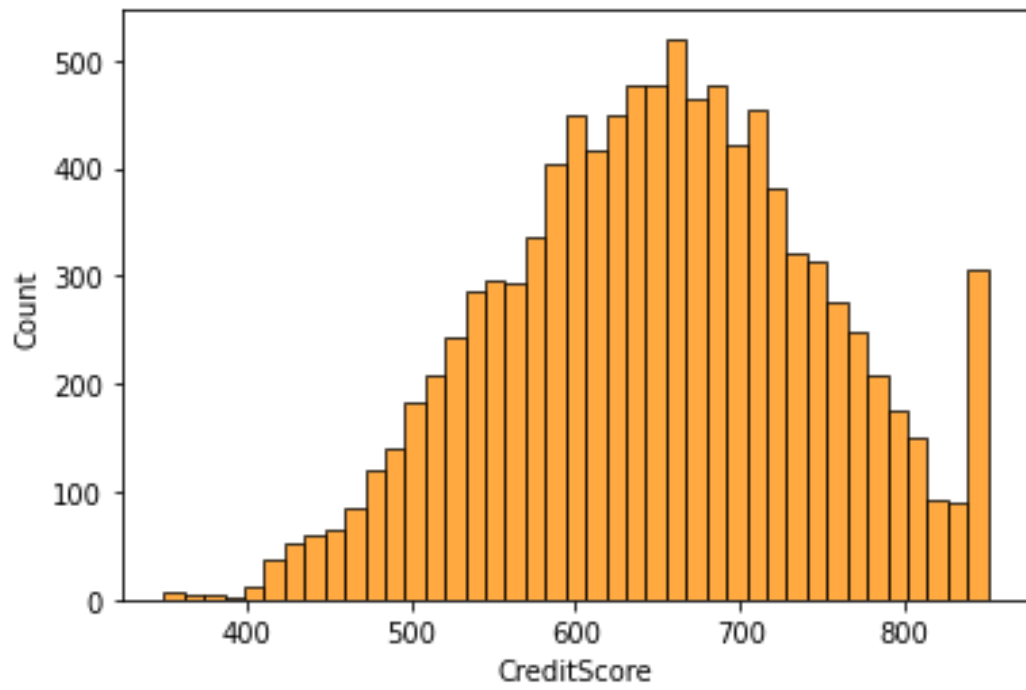
```

**Univariate Analysis** `sns.histplot(data["CreditScore"],color='darkorange')`

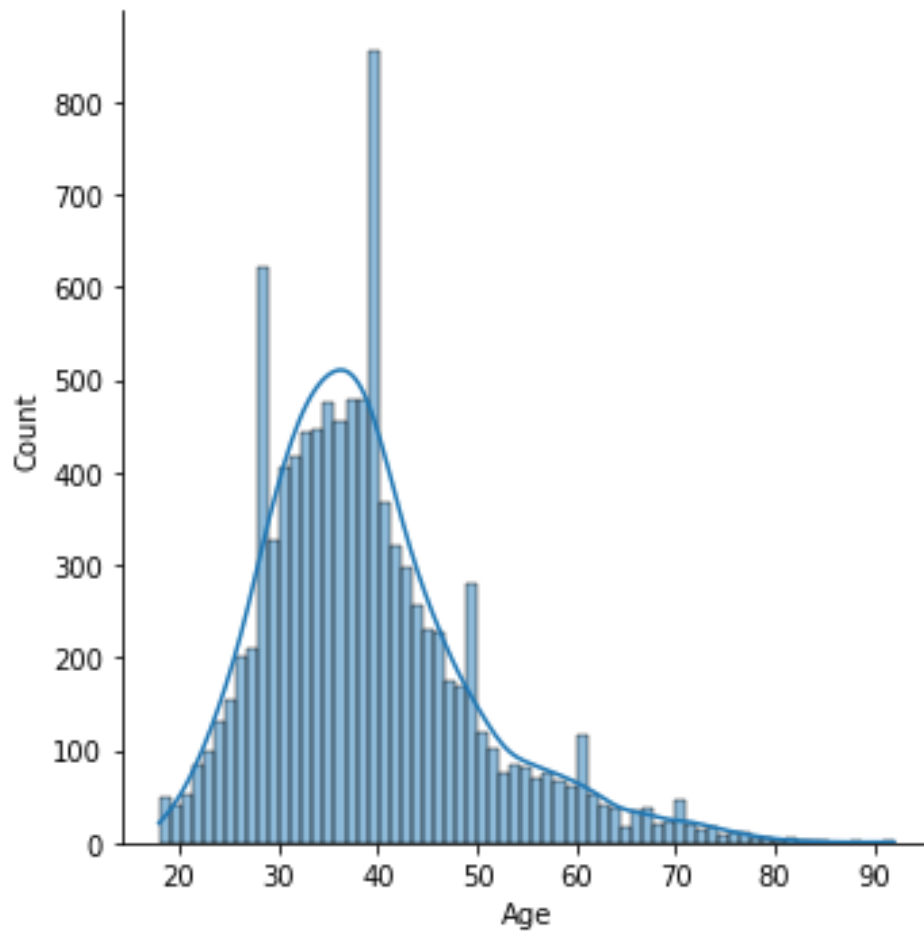
```

<matplotlib.axes._subplots.AxesSubplot at 0x7f831677f6d0>

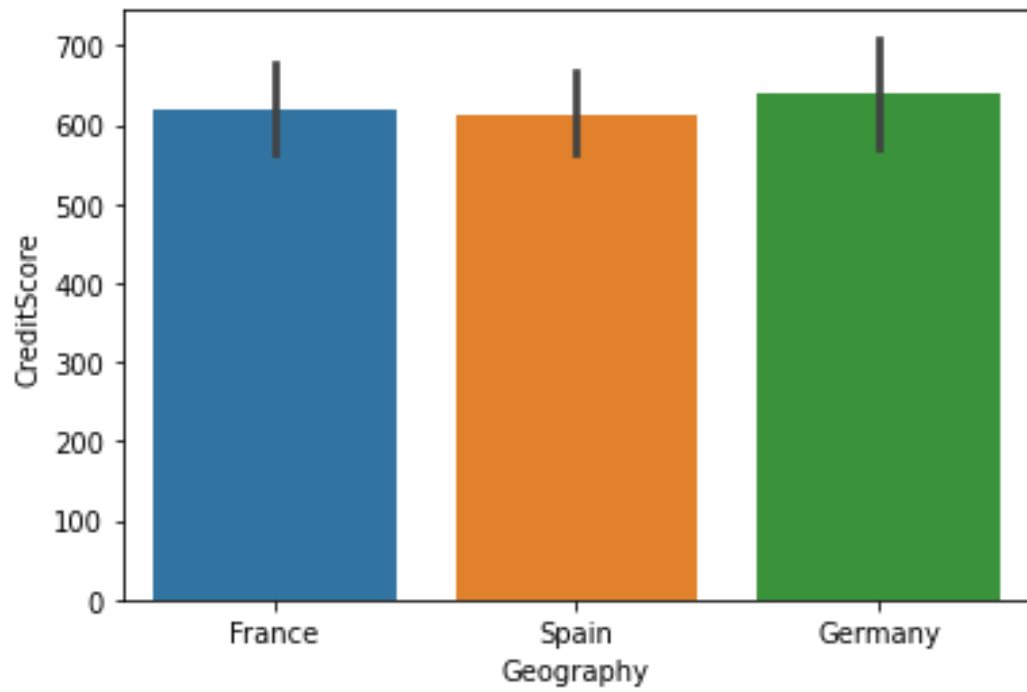
```



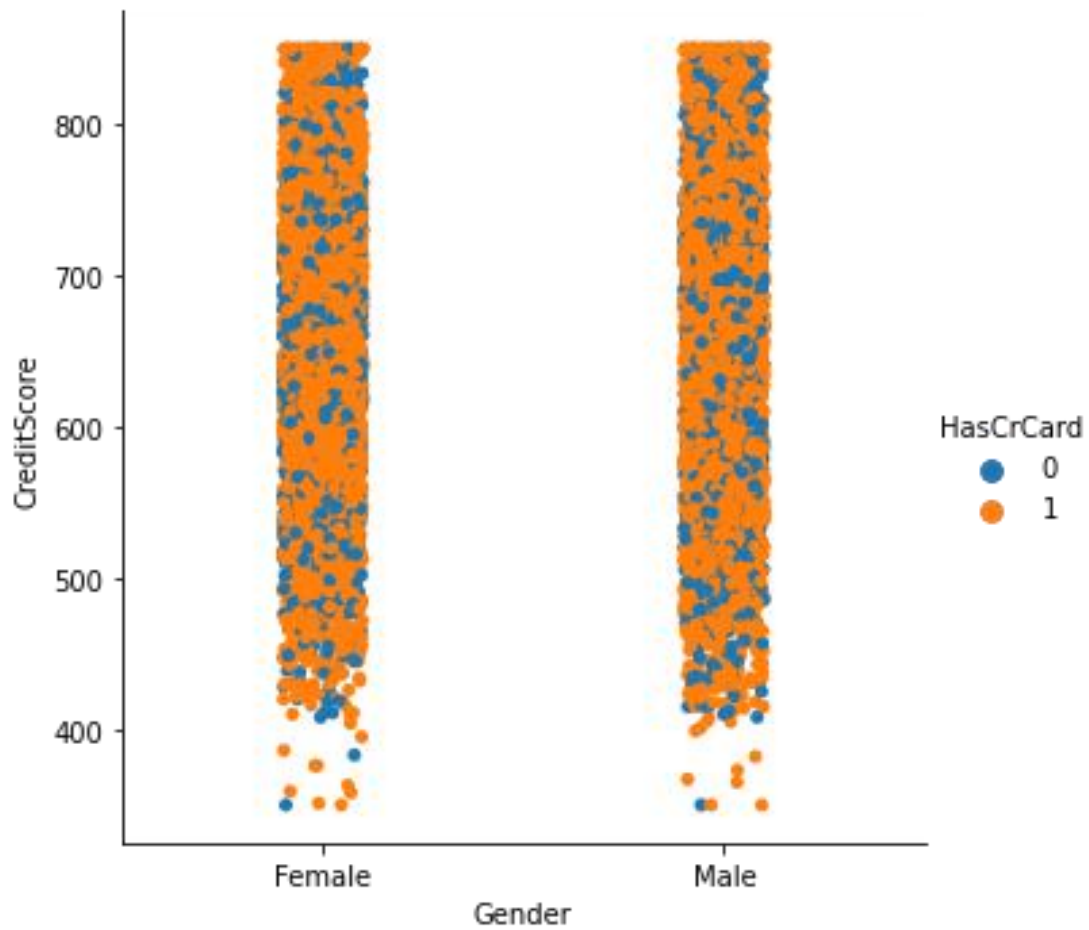
```
sns.displot(data['Age'], kde=True)  
<seaborn.axisgrid.FacetGrid at 0x7f831661b210>
```



**Bi - Variate Analysis** sns.barplot(data=data.head(50),  
x="Geography", y="CreditScore")  
<matplotlib.axes.\_subplots.AxesSubplot at 0x7f8313ce63d0>

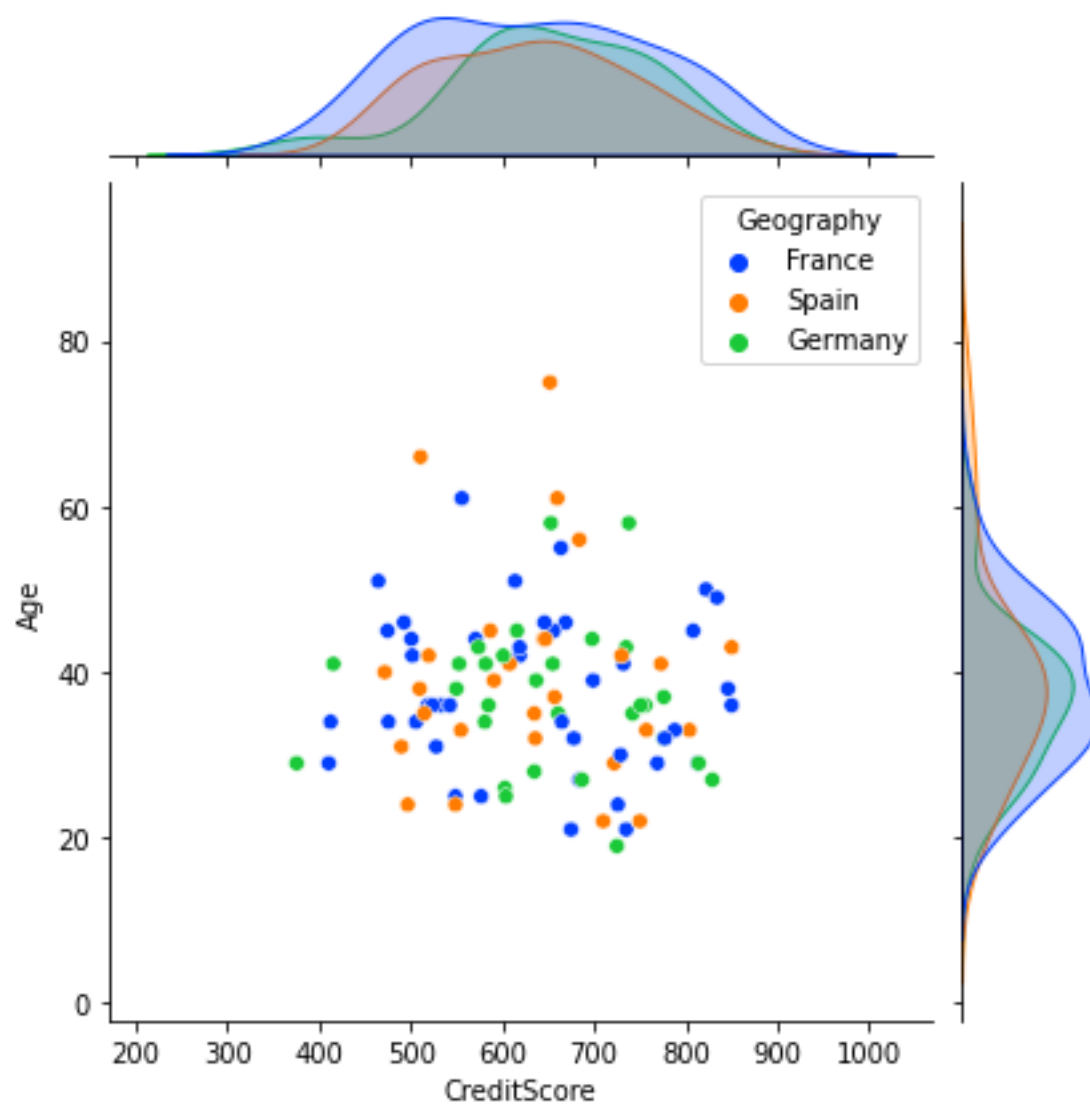


```
sns.catplot(x='Gender', y='CreditScore', hue='HasCrCard', data=data)  
<seaborn.axisgrid.FacetGrid at 0x7f8317198a90>
```

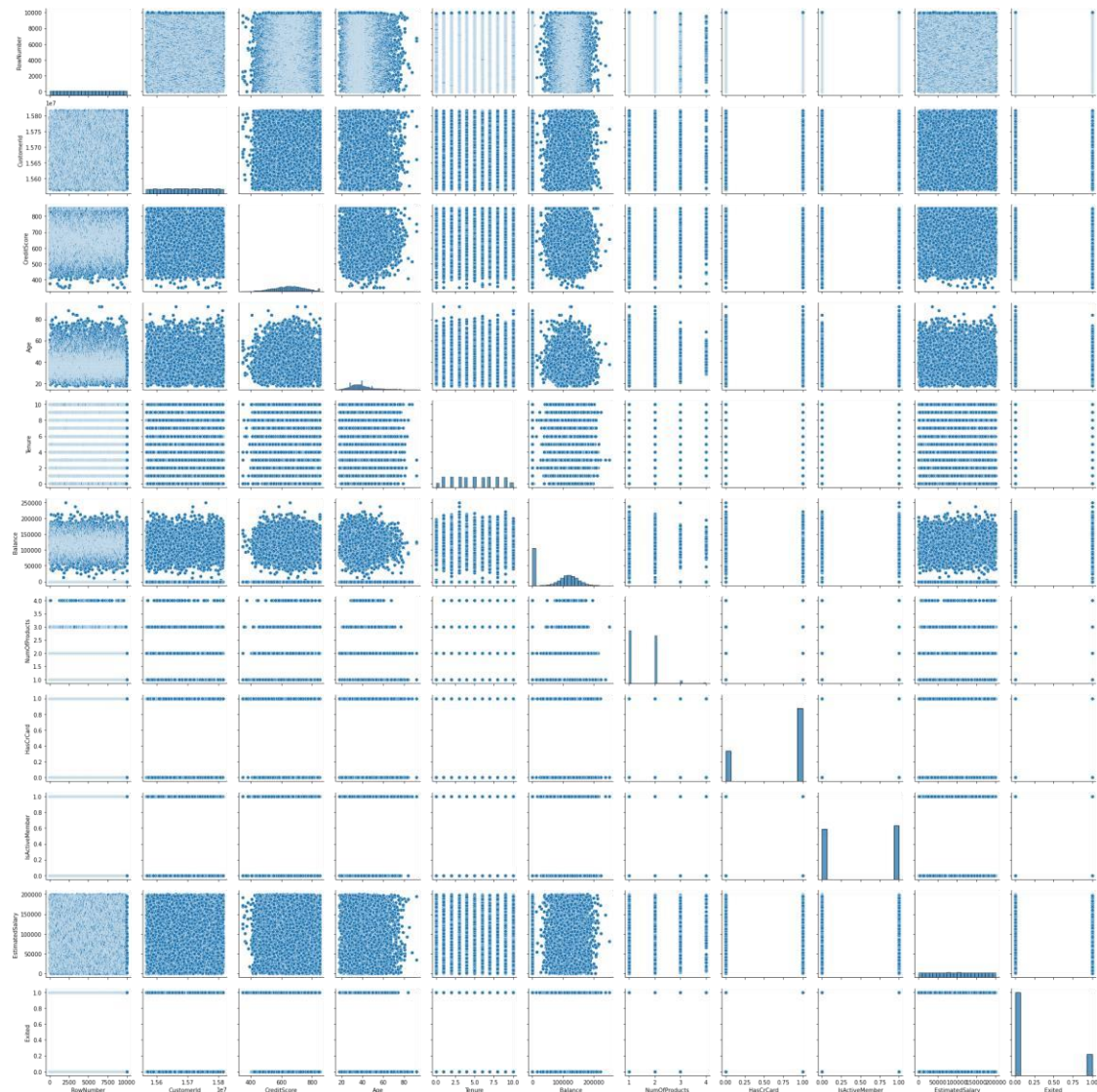


## Multi - Variate Analysis

```
sns.jointplot(  
x='CreditScore',    y='Age',  
data=data.head(100),  
palette='bright',  
hue='Geography');
```



```
sns.pairplot(data)  
<seaborn.axisgrid.PairGrid at 0x7f8313a71390>
```



Perform descriptive statistics on the dataset `data.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	
max	10000.00000	1.581569e+07	850.000000	92.000000	10.000000	
	Balance	NumOfProducts	HasCrCard	IsActiveMember		\
count	10000.000000	10000.000000	10000.000000	10000.000000		count
						mean



```

76485.889288      1.530200      0.70550      0.515100      std
62397.405202      0.581654      0.45584      0.499797      min
0.000000      1.000000      0.00000      0.000000      25%      0.000000
1.000000      0.00000      0.000000
50%      97198.540000      1.000000      1.00000      1.000000      75%
127644.240000      2.000000      1.00000      1.000000      max
250898.090000      4.000000      1.00000      1.000000

```

```

      EstimatedSalary      Exited
count      10000.000000  10000.000000
mean      100090.239881      0.203700      std
57510.492818      0.402769      min
11.580000      0.000000      25%
51002.110000      0.000000
50%      100193.915000      0.000000      75%
149388.247500      0.000000      max
199992.480000      1.000000

```

**Handle the Missing values** `data.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
dtype: int64

```

## Find the outliers and replace the outliers

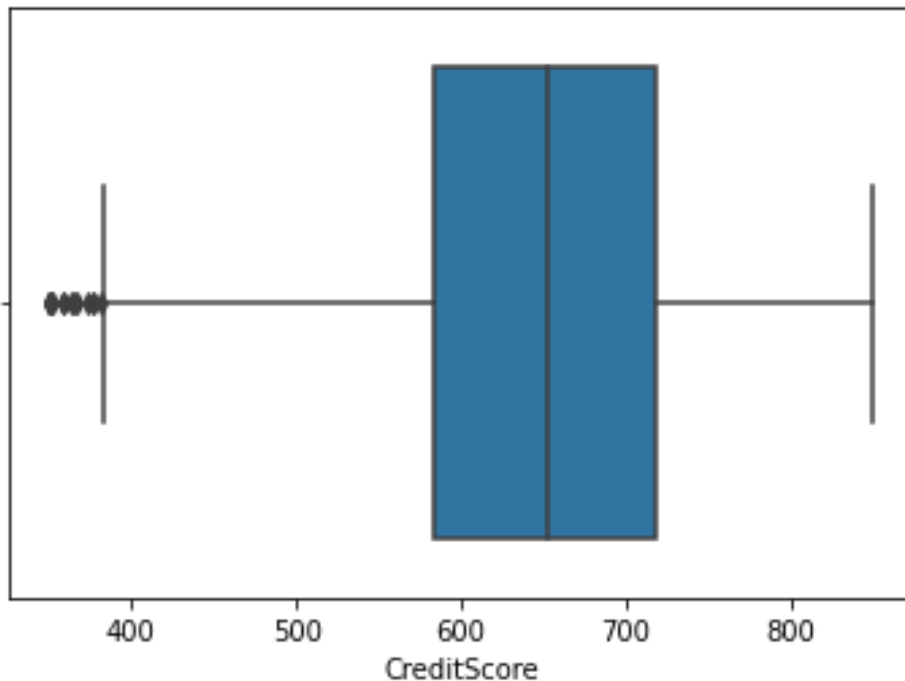
```
import seaborn as sns
```

```
sns.boxplot(data['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 valid positional argument will be `data`, and passing other
arguments without an explicit keyword will result in an error or
misinterpretation. FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f8310b82990>

```



```
import numpy as np
```

```
Q1 = np.percentile(data['CreditScore'], 25,  
interpolation = 'midpoint')
```

```
Q3 = np.percentile(data['CreditScore'], 75,  
interpolation = 'midpoint')  
IQR = Q3 - Q1
```

```
#Upper bound upper = np.where(data['CreditScore'] >=  
(Q3+1.5*IQR))  
#Lower bound lower = np.where(data['CreditScore'] <=  
(Q1-1.5*IQR))
```

```
print("Q3: ",Q3) print("Q1:  
",Q1)  
print("IQR: ",IQR)
```

```
mean = data["CreditScore"].mean()
```

```
data["CreditScore"] = np.where(data["CreditScore"] > 850, mean,  
data['CreditScore'])
```

```
data["CreditScore"] = np.where(data["CreditScore"] < 400, mean,
data['CreditScore'])
```

```
sns.boxplot(data['CreditScore'])
```

Q3: 718.0

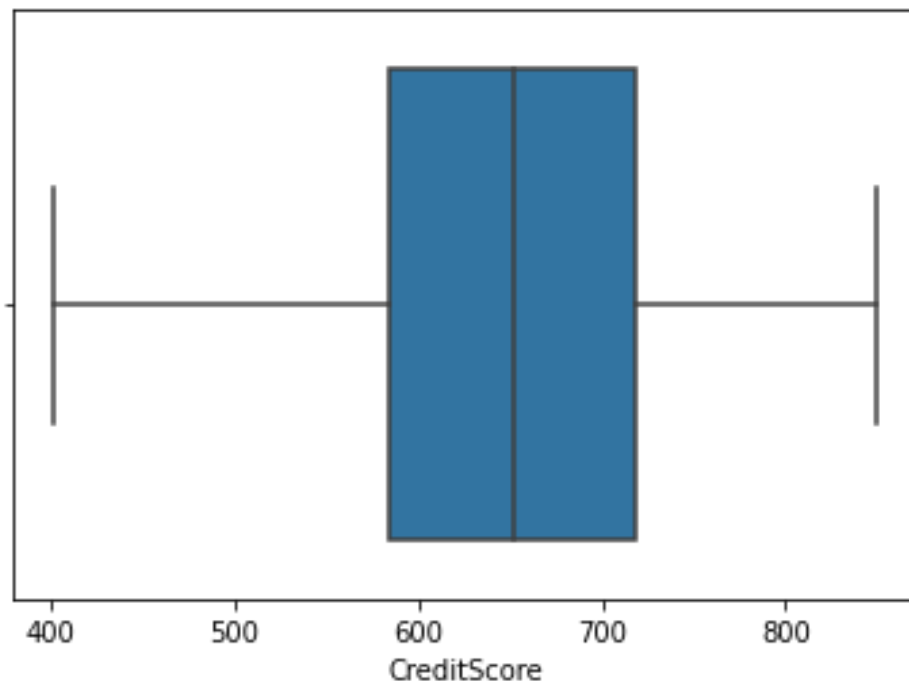
Q1: 584.0

IQR: 134.0

/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 valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation. FutureWarning

<matplotlib.axes.\_subplots.AxesSubplot at 0x7f83177a7310>



## Check for Categorical columns and perform encoding

```
from sklearn.preprocessing import LabelEncoder
```

```
le = LabelEncoder() data['Geography'] =
le.fit_transform(data['Geography']) data['Gender'] =
le.fit_transform(data['Gender']) data.head()
```

```
RowNumber  CustomerId  Surname  CreditScore  Geography  Gender  Age  \
```

0	1	15634602	Hargrave	619.0	0	0	42	
1	2	15647311	Hill	608.0	2	0	41	
2	3	15619304	Onio	502.0	0	0	42	
3	4	15701354	Boni	699.0	0	0	39	4
	5	15737888	Mitchell	850.0	2	0	43	

	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	\	0	2
0.00		1	1					1
1	1	83807.86	1	0				1
3	1	0.00	2	0	0	4	2	
125510.82			1	1				1
	EstimatedSalary	Exited	0	101348.88				1
1	112542.58	0	2	113931.57				1
2	8	159660.80		3	1	0		
3		93826.63	0					
4		79084.10	0					

## Split the data into dependent and independent variables

```
y = data['CreditScore'] #dependent
x = data.drop(columns = ['CreditScore'],axis = 1) #independent x.head()
```

	RowNumber	CustomerId	Surname	Geography	Gender	Age	Tenure	Balance
\								
0	1	15634602	Hargrave		0	0	42	2 0.00
1	2	15647311	Hill		2	0	41	1 83807.86
2	3	15619304	Onio		0	0	42	8 159660.80
3	4	15701354	Boni		0	0	39	1 0.00
	4	5	15737888	Mitchell		2	0	43 2
								125510.82

	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	1	1	1	101348.88	1
1	1	0	1	112542.58	0
2	3	1	0	113931.57	1
3	2	0	0	93826.63	0
4	1	1	1	79084.10	0

## Scale the independent variables

```
names =
['RowNumber', 'CustomerId', 'Geography', 'Gender', 'Age', 'Tenure', 'Balance', 'NumO
fProducts', 'HasCrCard', 'IsActiveMember', 'EstimatedSalary', 'Exited']

from sklearn.preprocessing import scale

x = scale(x[names])
```

x

```
array([[ -1.73187761, -0.78321342, -0.90188624, ...,  0.97024255,
         0.02188649,  1.97716468],
       [ -1.7315312 , -0.60653412,  1.51506738, ...,  0.97024255,
         0.21653375, -0.50577476],
       [ -1.73118479, -0.99588476, -0.90188624, ..., -1.03067011,
         0.2406869 ,  1.97716468],
       ...,
       [  1.73118479, -1.47928179, -0.90188624, ...,  0.97024255,
        -1.00864308,  1.97716468],
       [  1.7315312 , -0.11935577,  0.30659057, ..., -1.03067011,
        -0.12523071,  1.97716468],
       [  1.73187761, -0.87055909, -0.90188624, ..., -1.03067011,
        -1.07636976, -0.50577476]])
```

```
x = pd.DataFrame(x,columns = names)x.head()
```

	RowNumber	CustomerId	Geography	Gender	Age	Tenure	Balance
\							
0	-1.731878	-0.783213	-0.901886	-1.095988	0.293517	-1.041760	-1.225848
1	-1.731531	-0.606534	1.515067	-1.095988	0.198164	-1.387538	0.117350
2	-1.731185	-0.995885	-0.901886	-1.095988	0.293517	1.032908	1.333053
3	-1.730838	0.144767	-0.901886	-1.095988	0.007457	-1.387538	-1.225848
4	-1.730492	0.652659	1.515067	-1.095988	0.388871	-1.041760	0.785728

	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	-0.911583	0.646092	0.970243	0.021886	1.977165
1	-0.911583	-1.547768	0.970243	0.216534	-0.505775
2	2.527057	0.646092	-1.030670	0.240687	1.977165
3	0.807737	-1.547768	-1.030670	-0.108918	-0.505775
4	-0.911583	0.646092	0.970243	-0.365276	-0.505775

## Split the data into training and testing

```
from sklearn.model_selection import train_test_split
```

```
# Split training and testing data
```

```
xtrain,xtest,ytrain,ytest =  
train_test_split(x,y,test_size=0.20,random_state=0)
```

```
# Checking shape of data
```

```
xtrain.shape,xtest.shape ((8000,  
12), (2000, 12))
```