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  \
1          1    15634602  Hargrave          619    France  Female   42
2          2    15647311      Hill          608     Spain  Female   41
3          3    15619304      Onio          502    France  Female   42
4          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
```

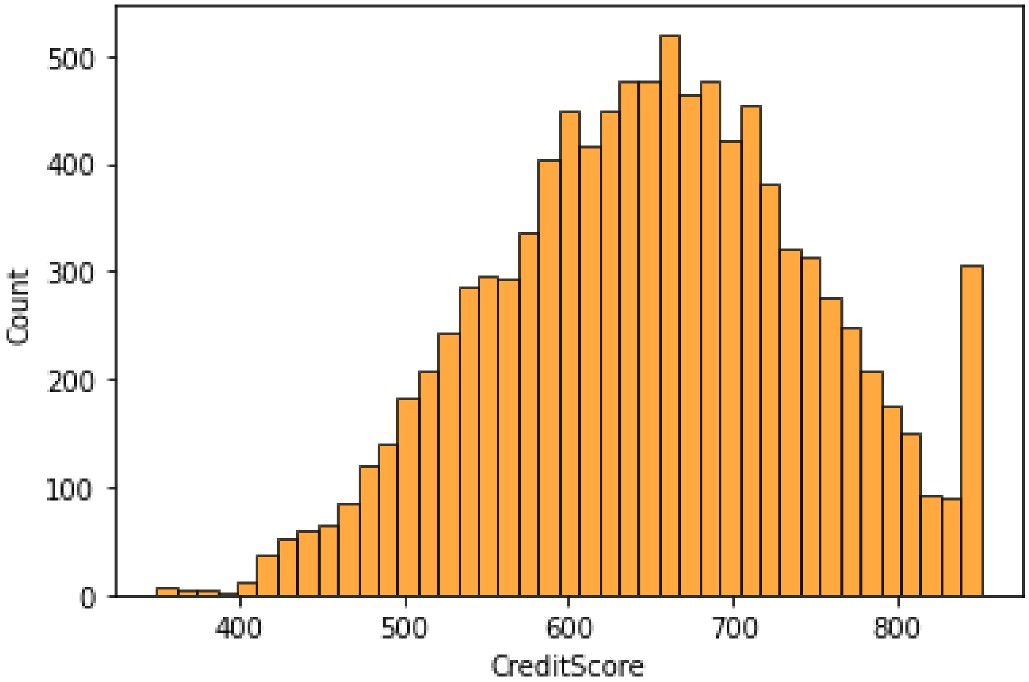
```
RowNumber            int64
CustomerId           int64
Surname             object
CreditScore          int64
Geography           object
Gender              object
Age                  int64
Tenure               int64
Balance            float64
NumOfProducts        int64
HasCrCard            int64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

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

Univariate Analysis

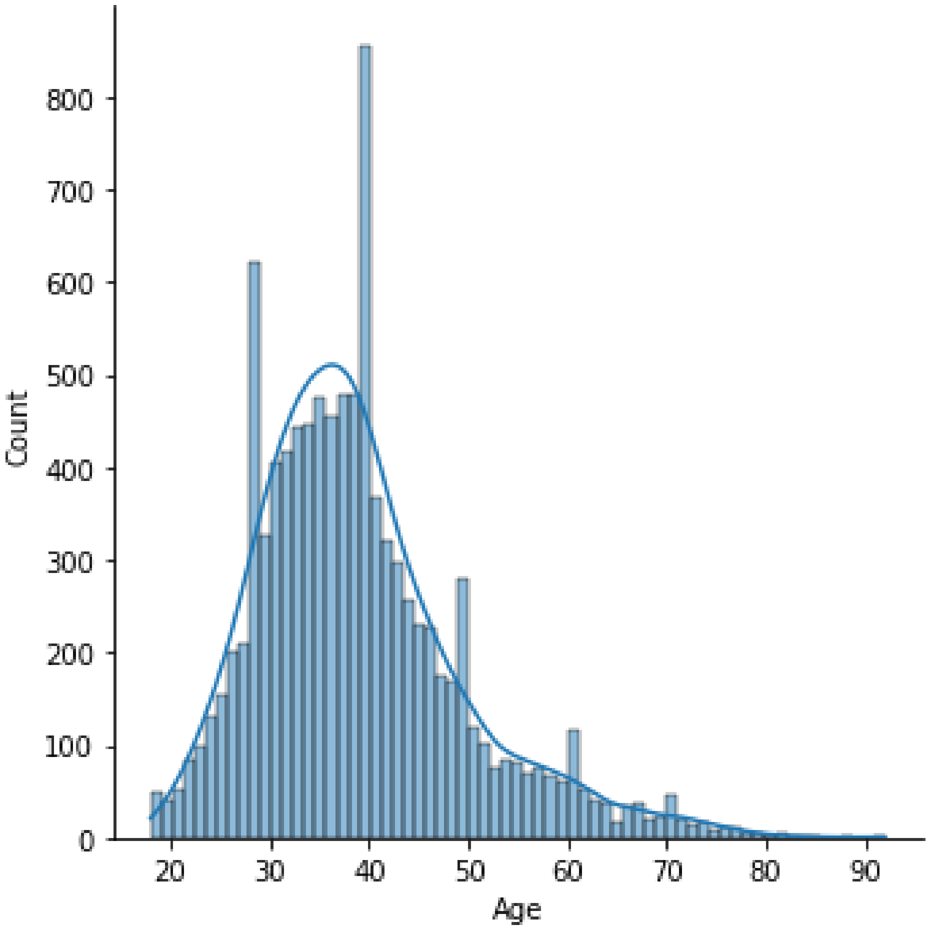
```
sns.histplot(data["CreditScore"],color='darkorange')
```

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



```
sns.displot(data['Age'], kde=True)
```

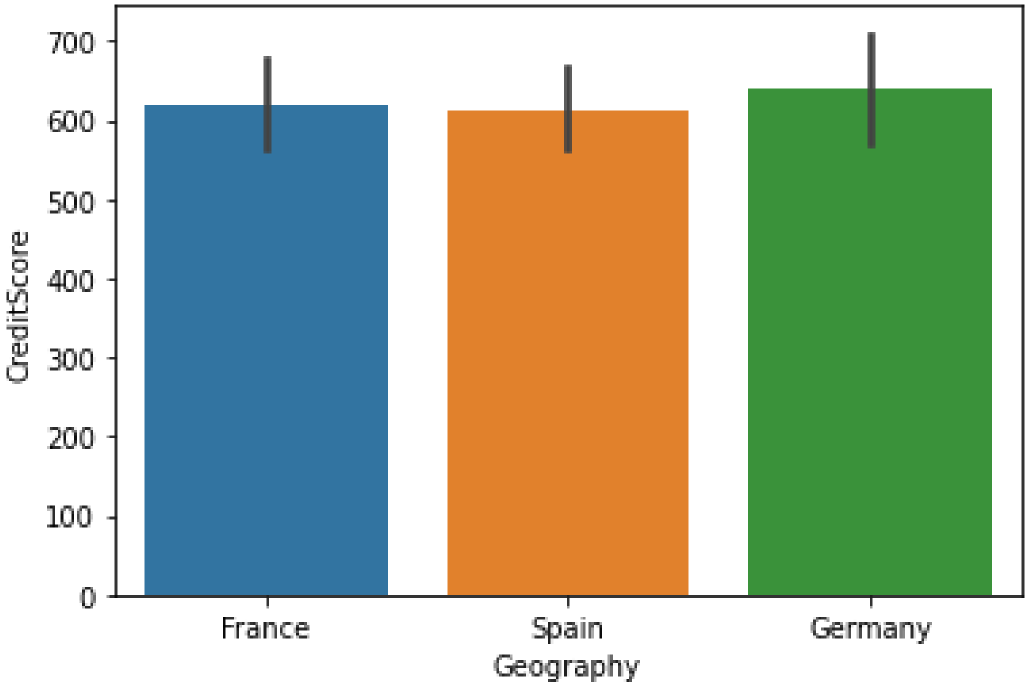
```
<seaborn.axisgrid.FacetGrid at 0x7f831661b210>
```



Bi - Variate Analysis

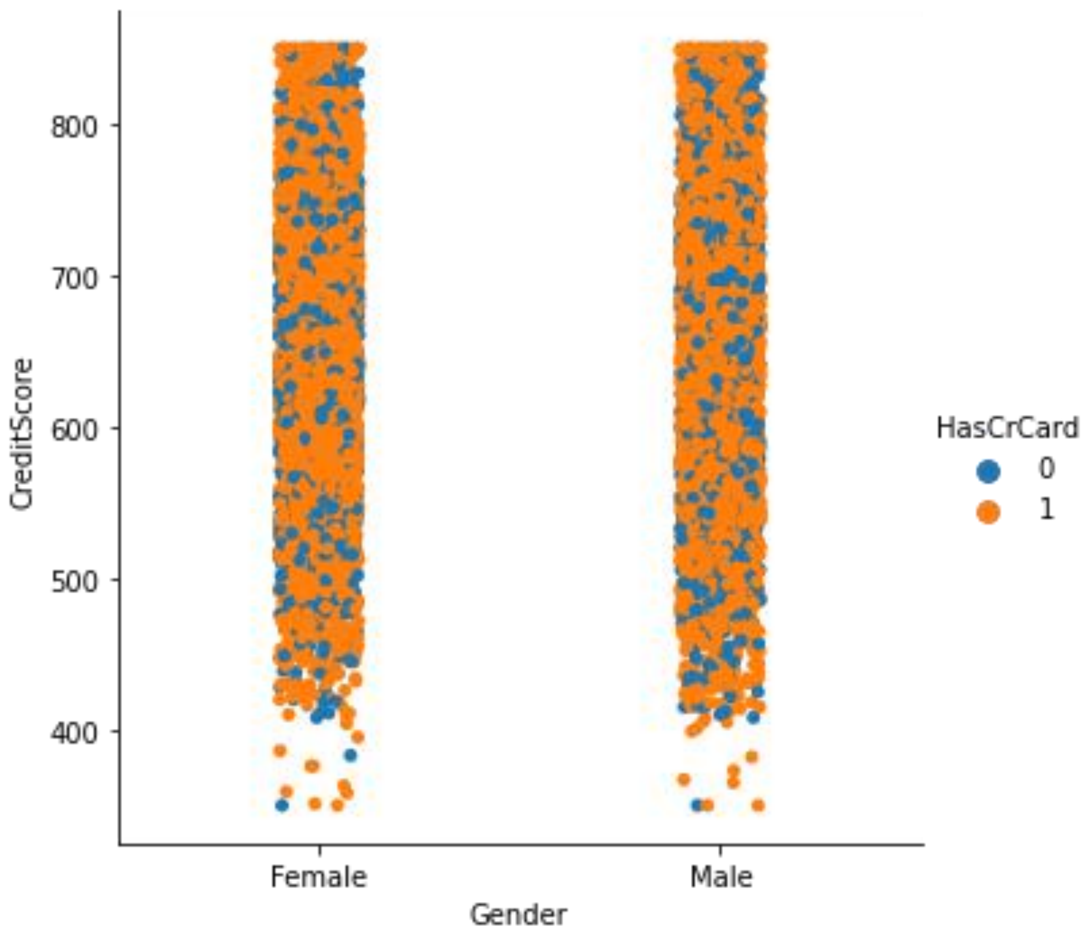
```
sns.barplot(data=data.head(50),
x="Geography", y="CreditScore")
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f8313ce63d0>
```



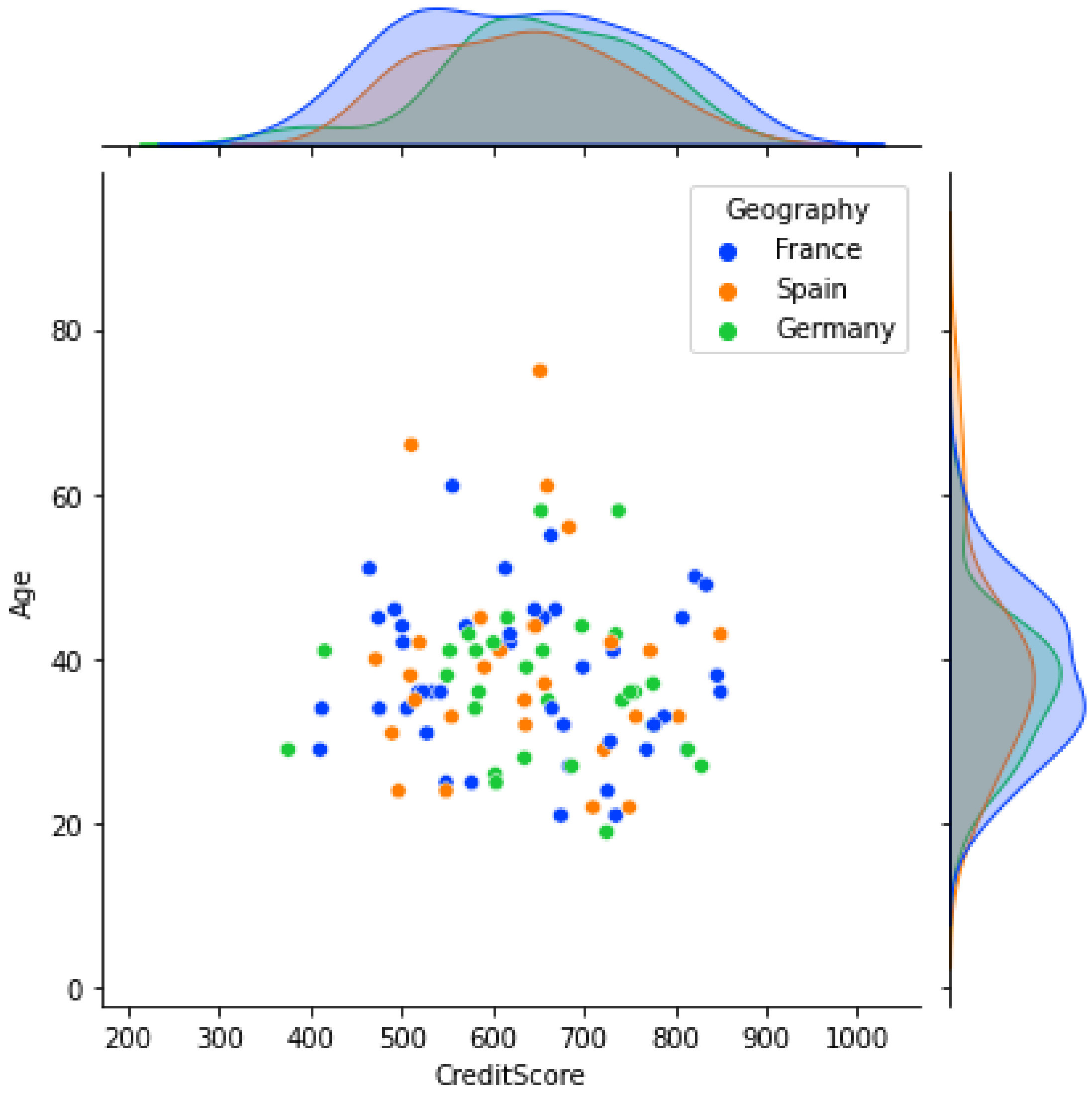
```
sns.catplot(x='Gender', y='CreditScore', hue='HasCrCard', data=data)
```

```
<seaborn.axisgrid.FacetGrid at 0x7f8317198a90>
```

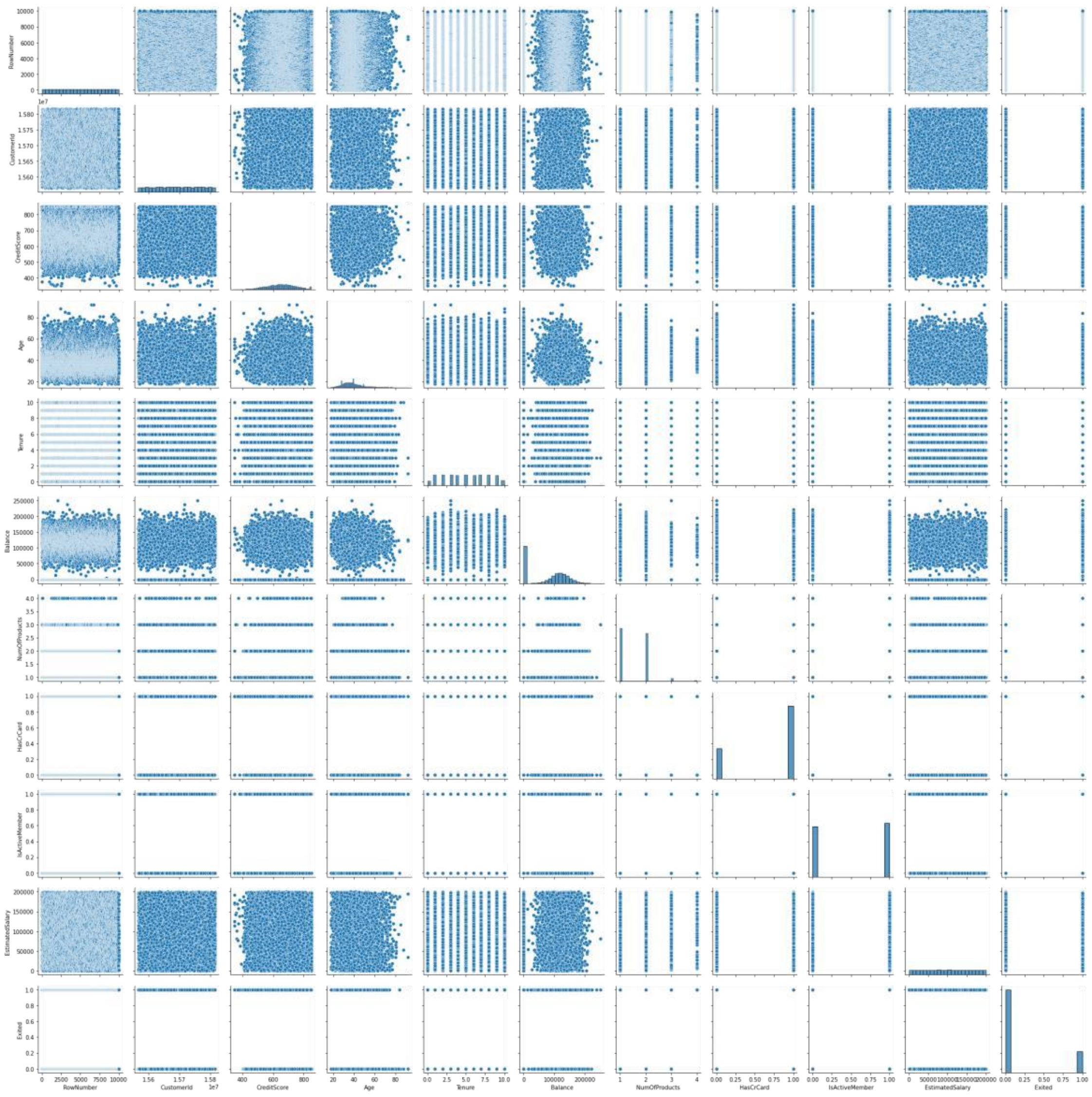


Multi - Variate Analysis

```
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    10000.00000       10000.000000      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()`

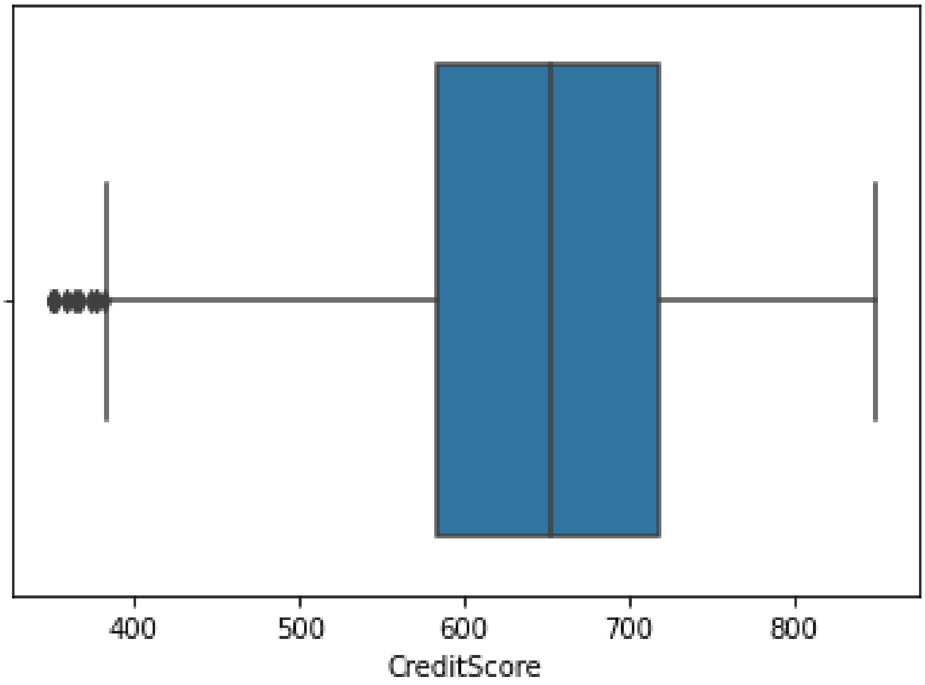
```
RowNumber          0
CustomerId         0
Surname            0
CreditScore        0
Geography          0
Gender             0
Age                0
Tenure             0
Balance            0
NumOfProducts      0
HasCrCard          0
IsActiveMember     0
EstimatedSalary    0 Exited
0 dtype: int64
```

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'])
```

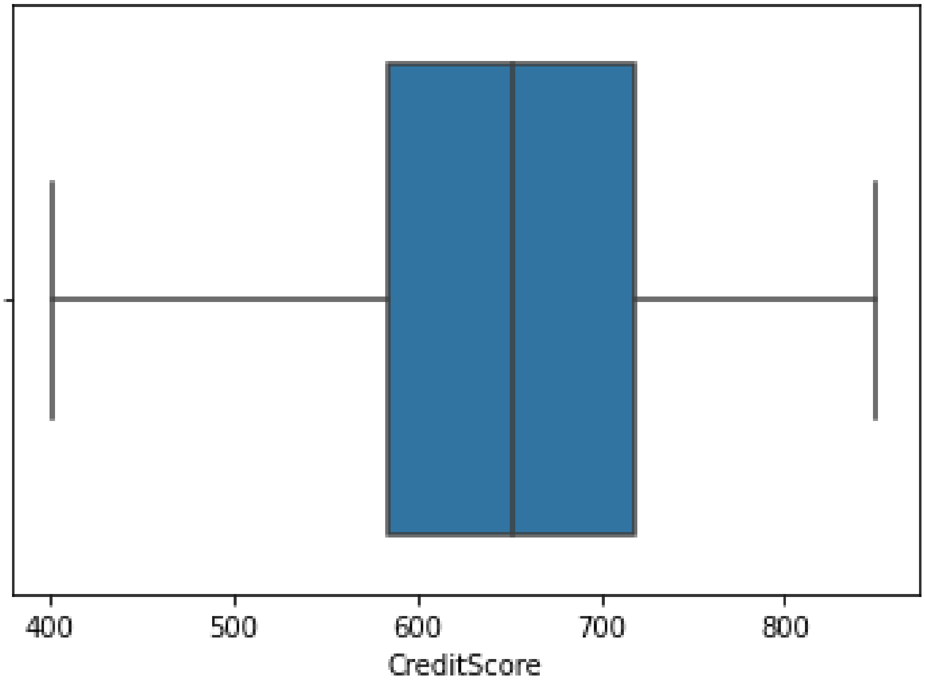
```
data["CreditScore"] = np.where(data["CreditScore"] < 400, mean,
data['CreditScore'])
```

```
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  \
1          1    15634602  Hargrave        619.0          0       0   42
2          2    15647311      Hill        608.0          2       0   41
3          3    15619304      Onio        502.0          0       0   42
4          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
\
1          1    15634602  Hargrave          0       0   42       2       0.00
2          2    15647311      Hill          2       0   41       1   83807.86
3          3    15619304      Onio          0       0   42       8  159660.80
4          4    15701354      Boni          0       0   39       1       0.00
           4          5    15737888  Mitchell        2       0   43       2
           125510.82

   NumOfProducts  HasCrCard  IsActiveMember  EstimatedSalary  Exited
1              1          1               1        101348.88       1
2              1          0               1        112542.58       0
3              3          1               0        113931.57       1
4              2          0               0         93826.63       0
5              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
\
1  -1.731878   -0.783213  -0.901886 -1.095988  0.293517 -1.041760 -1.225848
2  -1.731531   -0.606534   1.515067 -1.095988  0.198164 -1.387538  0.117350
3  -1.731185   -0.995885  -0.901886 -1.095988  0.293517  1.032908  1.333053
4  -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
1      -0.911583   0.646092        0.970243         0.021886  1.977165
2      -0.911583  -1.547768        0.970243         0.216534 -0.505775
3       2.527057   0.646092       -1.030670         0.240687  1.977165
4       0.807737  -1.547768       -1.030670        -0.108918 -0.505775
5      -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))
```