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Assignment -2

Data Visualization and Pre -processing in ipynb

Assignment Date	21 September 2022
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Team ID	PNT2022TMI D01549
Maximum Marks	2 Marks

1.Download the dataset

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

plt
```

2.Load the dataset

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

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
```

```
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-  int64
```

			null	
1	CustomerId	10000	non-null	int64
2	Surname	10000	non-null	object
3	CreditScore	10000	non-null	int64

```
     Geography      10000 non- null object
 4   Gender         10000 non- null object
 5   Age            10000 non- null int64
 6   Tenure         10000 non- null int64
 7   Balance        10000 non- null float64
 8   NumOfProducts  10000 non- null int64
 9   HasCrCard      10000 non- null int64
 10  IsActiveMember 10000 non- null int64
 11  EstimatedSalary 10000 non- null float64
 12  Exited         10000 non- null
    int64 dtypes : float64(2),
int64(9), object(3) memory usage: 1.1+
MB
```

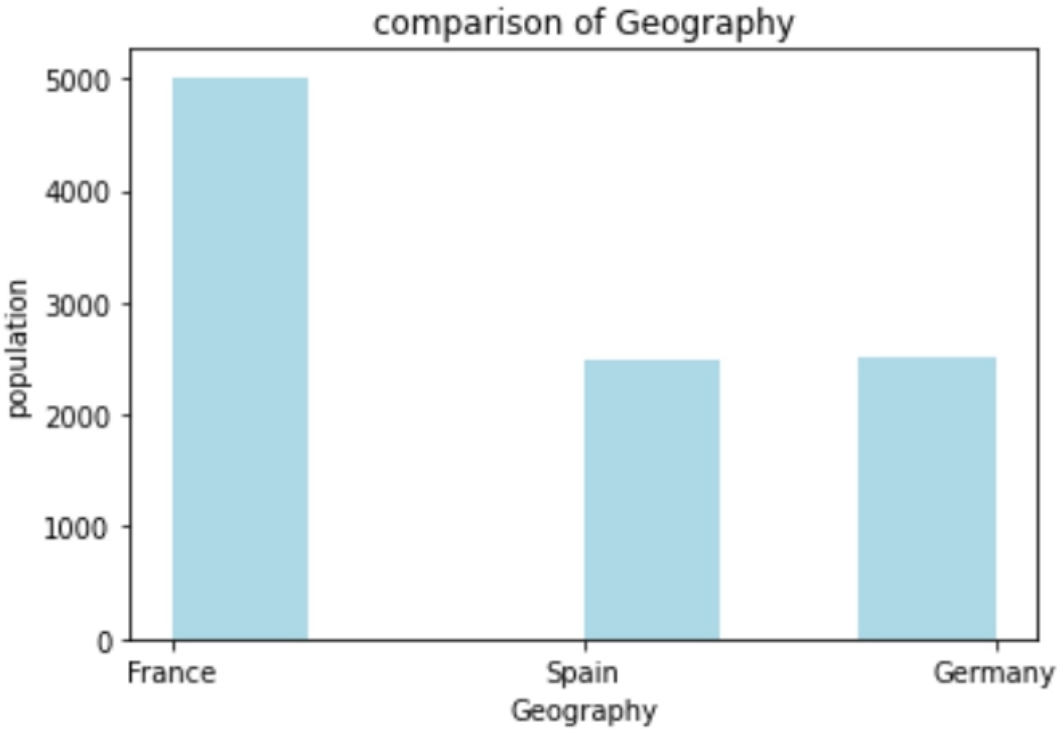
3. **Perform Below Visualisations**

Univariate Analysis

```
df['Geography' ].value_count

s()
```

```
France  5014
Germany  2509
Spain    2477
Name: Geography, dtype: int64
```

```
# comparison of geography

plt.hist(x = df.Geography, bins = 6, color =
'lightblue') plt.title('comparison of Geography' )
plt.xlabel('Geography' )
plt.ylabel('population')
plt.show()
```



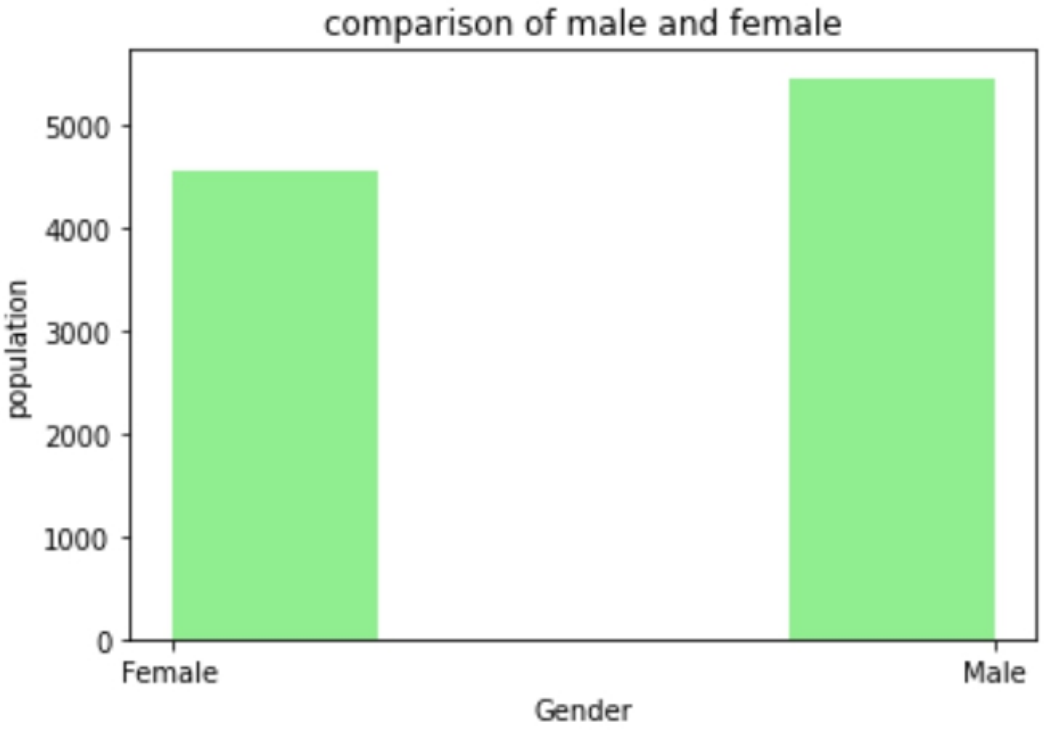
```
df['IsActiveMember'].value_counts()
```

```
1  5151
0  4849
Name: IsActiveMember, dtype: int64
```

```
# How many active member does the bank have ?

plt.hist(x = df.IsActiveMember, bins = 5, color =
'pink' ) plt.title( 'Active Members' )
plt.xlabel('Customers' )
plt.ylabel('population')
plt.show()
```


```
df['Gender'].value_count
s() Male 5457
Female  4543
Name: Gender, dtype: int64
```

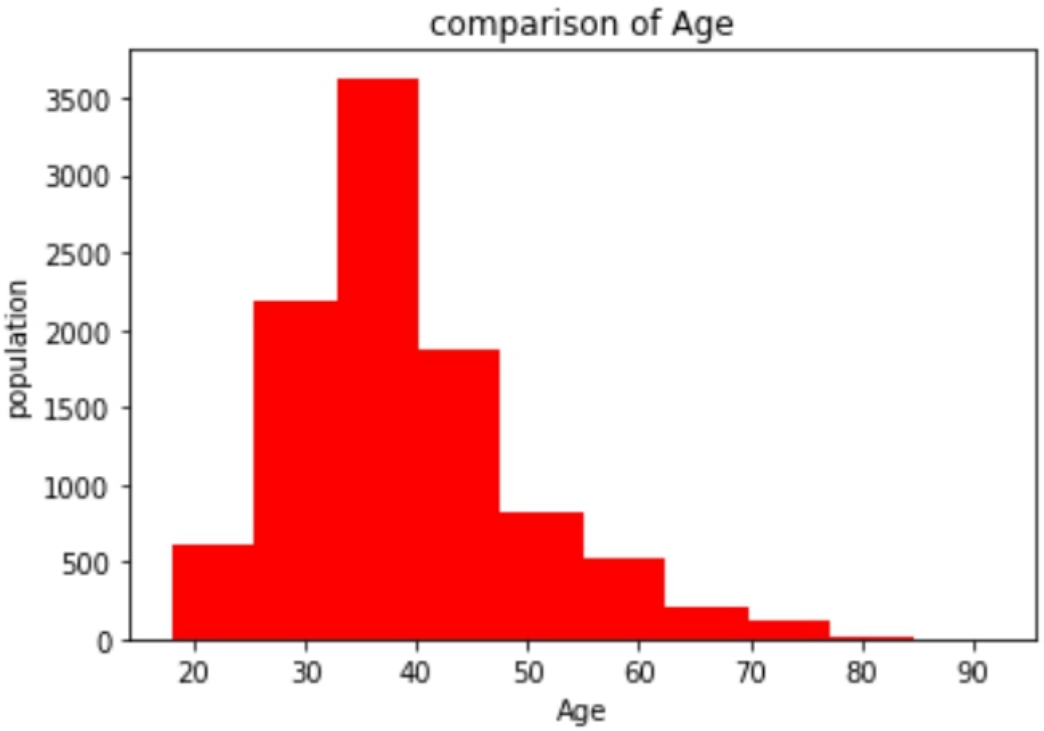
```
# Plotting the features of the dataset to see the correlation
between them plt.hist(x = df.Gender, bins = 4 , color = 'lightgreen' )
plt.title( 'comparison of male and female' )
plt.xlabel('Gender')
plt.ylabel('population')
plt.show()
```




```
df['Age' ].value_counts()
```

```
37   478
38   477
35   474
36   456
34    447
      ...
92      2
82      1
88      1
85      1
83      1
Name: Age, Length: 70, dtype:
     int64
```

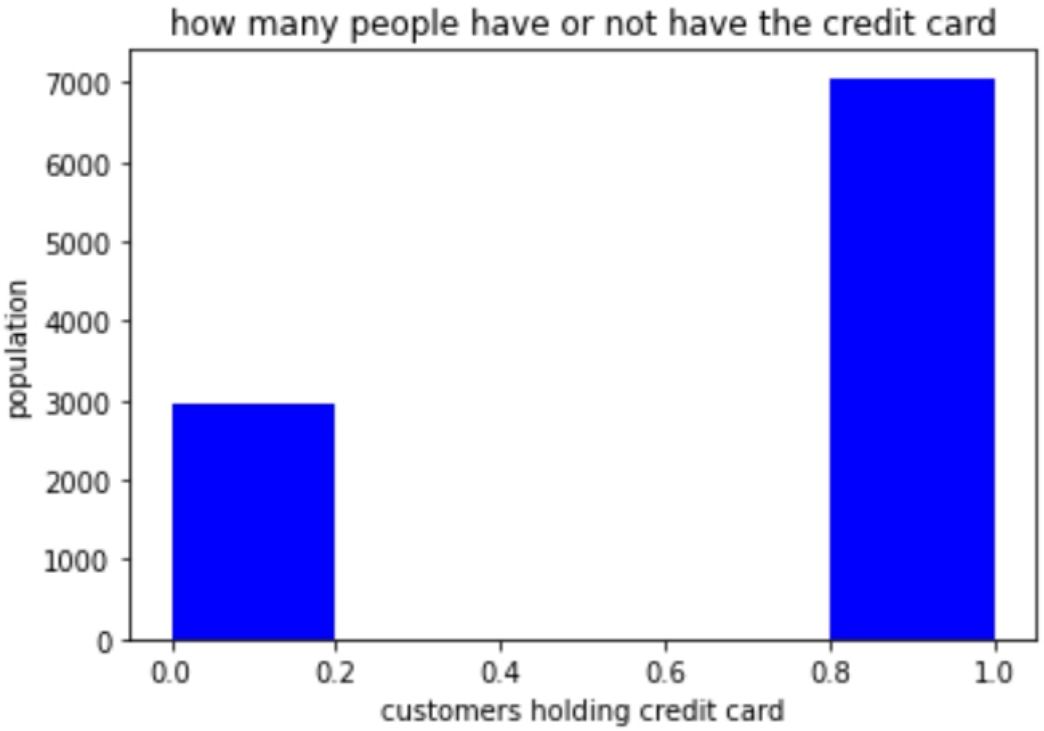
```
# comparison of age in the dataset

plt.hist(x = df.Age, bins = 10 , color = 'red' )
plt.title( 'comparison of Age')
plt.xlabel('Age' )
plt.ylabel('population')
plt.show()
```




```
df['HasCrCard' ].value_counts()
```

```
1  7055
0  2945
Name: HasCrCard, dtype: int64
```

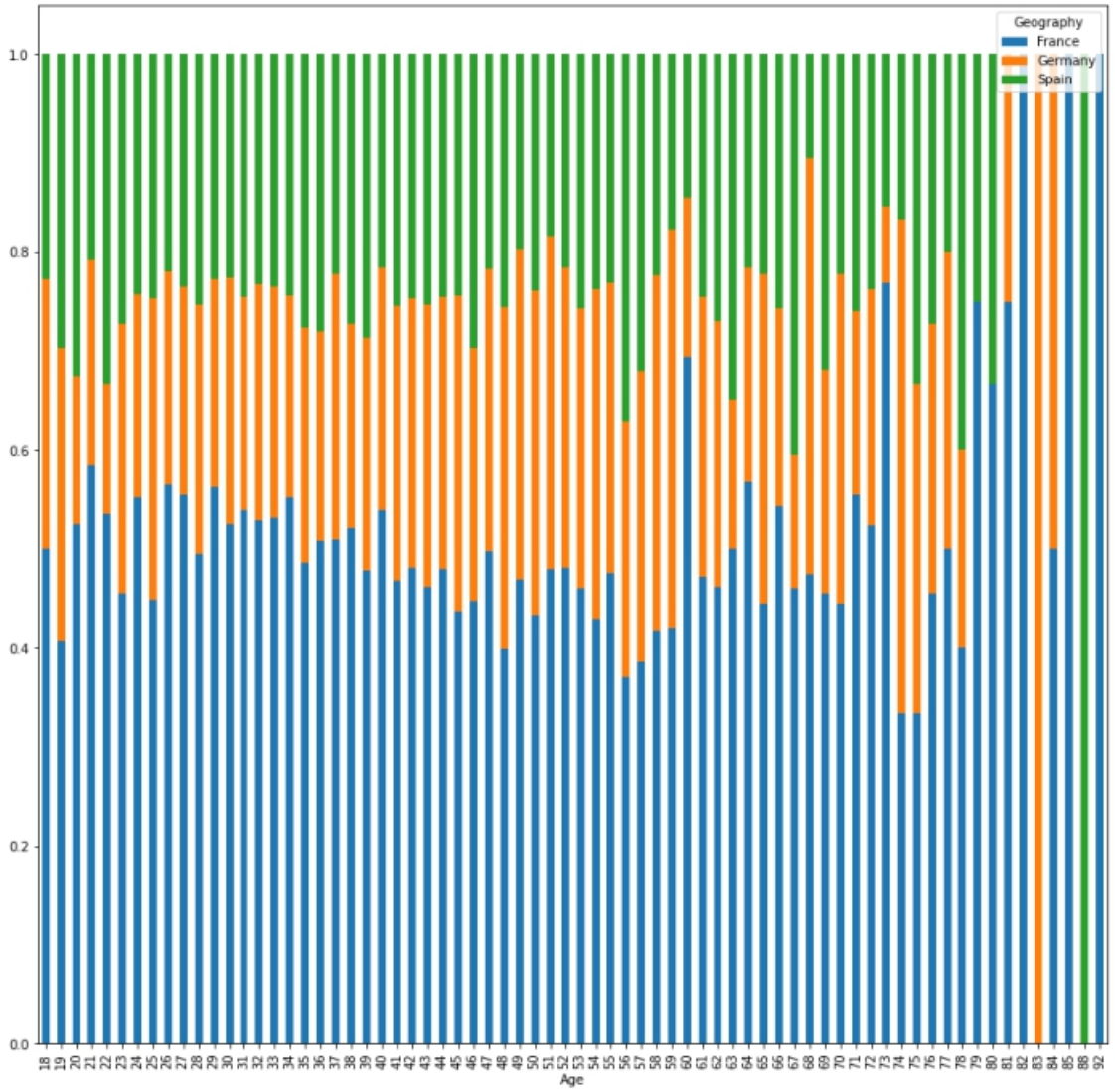
```
# comparison of how many customers hold the credit card

plt.hist(x = df.HasCrCard, bins = 5, color = 'blue' )
plt.title( 'how many people have or not have the credit
card') plt.xlabel( 'customers holding credit card' )
plt.ylabel('population')
plt.show()
```



Bi - Variate Analysis

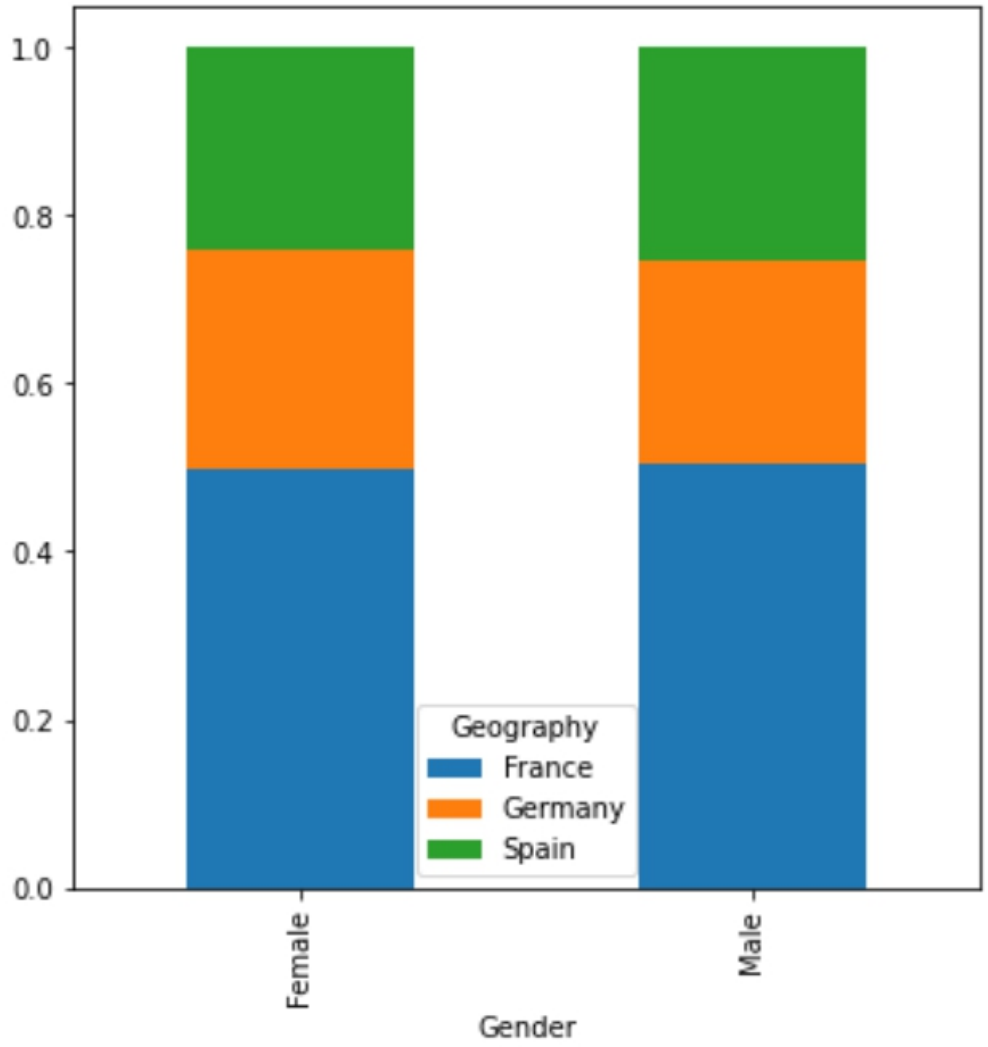
```
# comparing ages in different geographies

Age = pd.crosstab(df['Age' ], df[ 'Geography' ])
Age.div(Age.sum( 1).astype(float), axis = 0).plot(kind = 'bar' ,
stacked = True , figsize = (15, 15 ))
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa1a78a13d0>
```



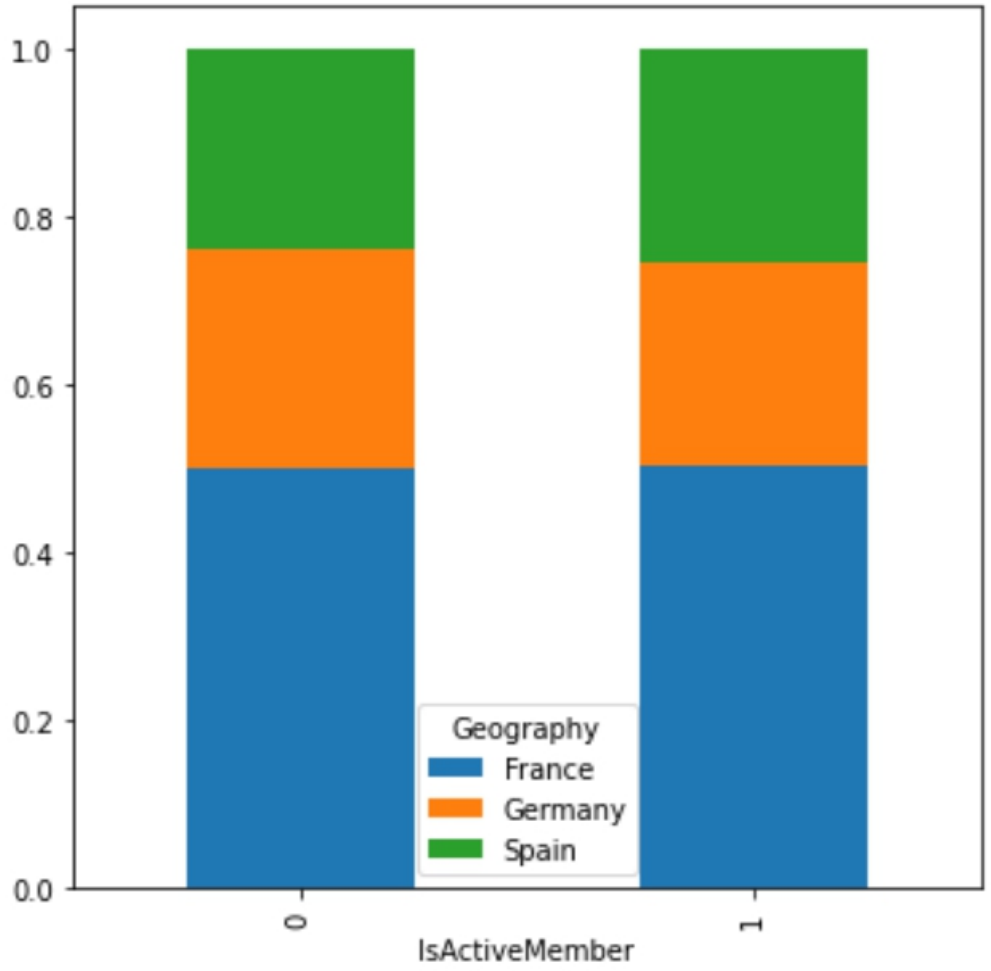

```
# comparison between Geography and Gender

Gender = pd.crosstab(df[ 'Gender' ],df['Geography'])
Gender.div(Gender.sum( 1).astype(float), axis= 0).plot(kind ="bar" ,
stacked= True , figsize= (6 , 6))
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa1a6c48bd0>
```



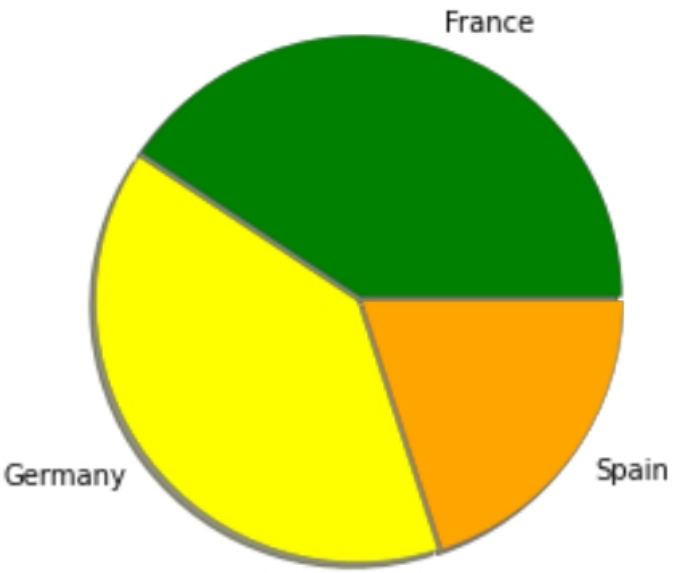

```
# comparison of active member in differnt geographies

IsActiveMember = pd.crosstab(df[ 'IsActiveMember'], df['Geography' ])
IsActiveMember.div(IsActiveMember.sum( 1 ).astype(float), axis =
0 ).plot(kind = 'bar' ,stacked = True, figsize= ( 6, 6 ))
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa1a6c36810>
```



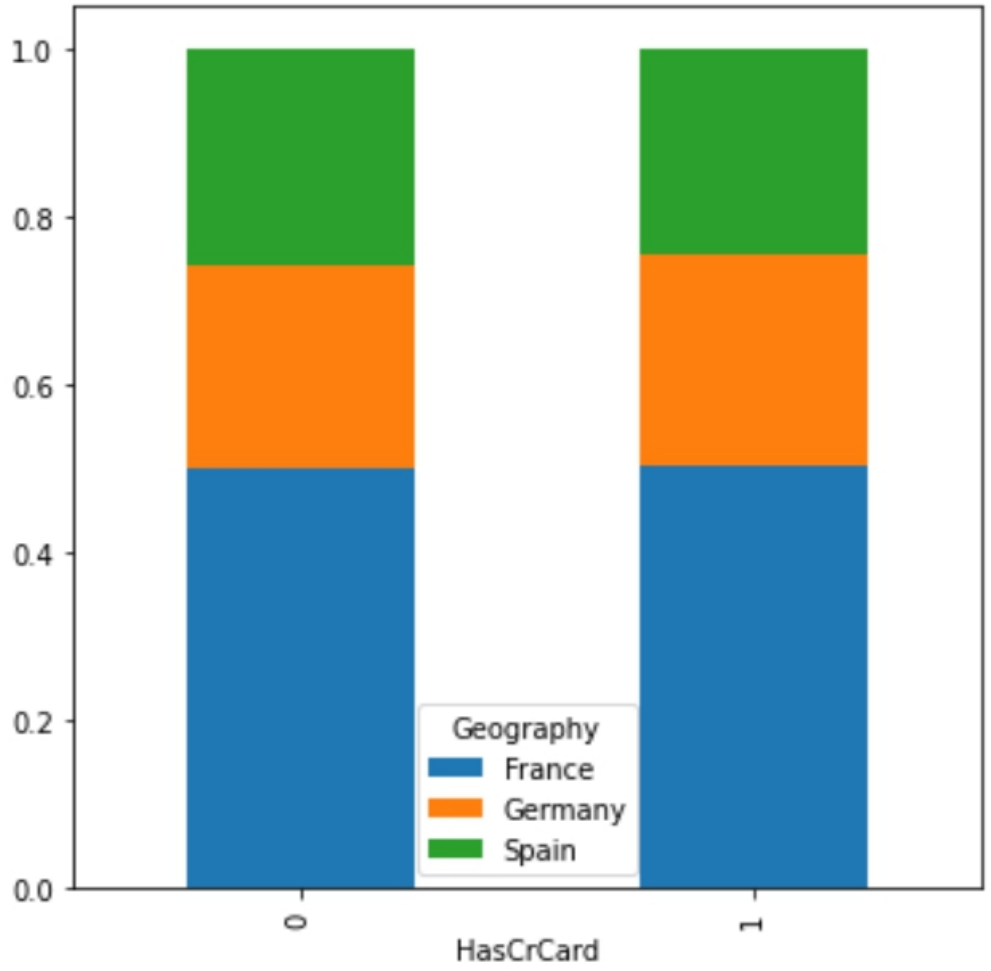

```
# calculating total balance in france, germany and spain

total_france = df.Balance[df.Geography == 'France'].sum()
total_germany = df.Balance[df.Geography == 'Germany'].sum()
total_spain = df.Balance[df.Geography == 'Spain'].sum()

print( "Total Balance in France
:" ,total_france) print( "Total Balance in
Germany :" ,total_germany) print( "Total Balance
in Spain :",total_spain)

Total Balance in France :
311332479.49 Total Balance in
Germany : 300402861.38 Total
Balance in Spain : 153123552.01

# plotting a pie chart

labels = 'France', 'Germany' ,
'Spain' colors = [ 'green',
'yellow' , 'orange' ] sizes =
       [ 311 , 300, 153 ]
explode = [ 0.01 , 0.01 , 0.01 ]

plt.pie(sizes, colors = colors, labels = labels, explode = explode,
shadow
= True )
```

```
plt.axis('equal' )
plt.show()
```




```
# comparison between geography and card holders

HasCrCard = pd.crosstab(df['HasCrCard' ], df['Geography' ])
HasCrCard.div( HasCrCard.sum( 1).astype(float), axis = 0).plot(kind =
'bar',stacked = True ,figsize = ( 6, 6 ))
```

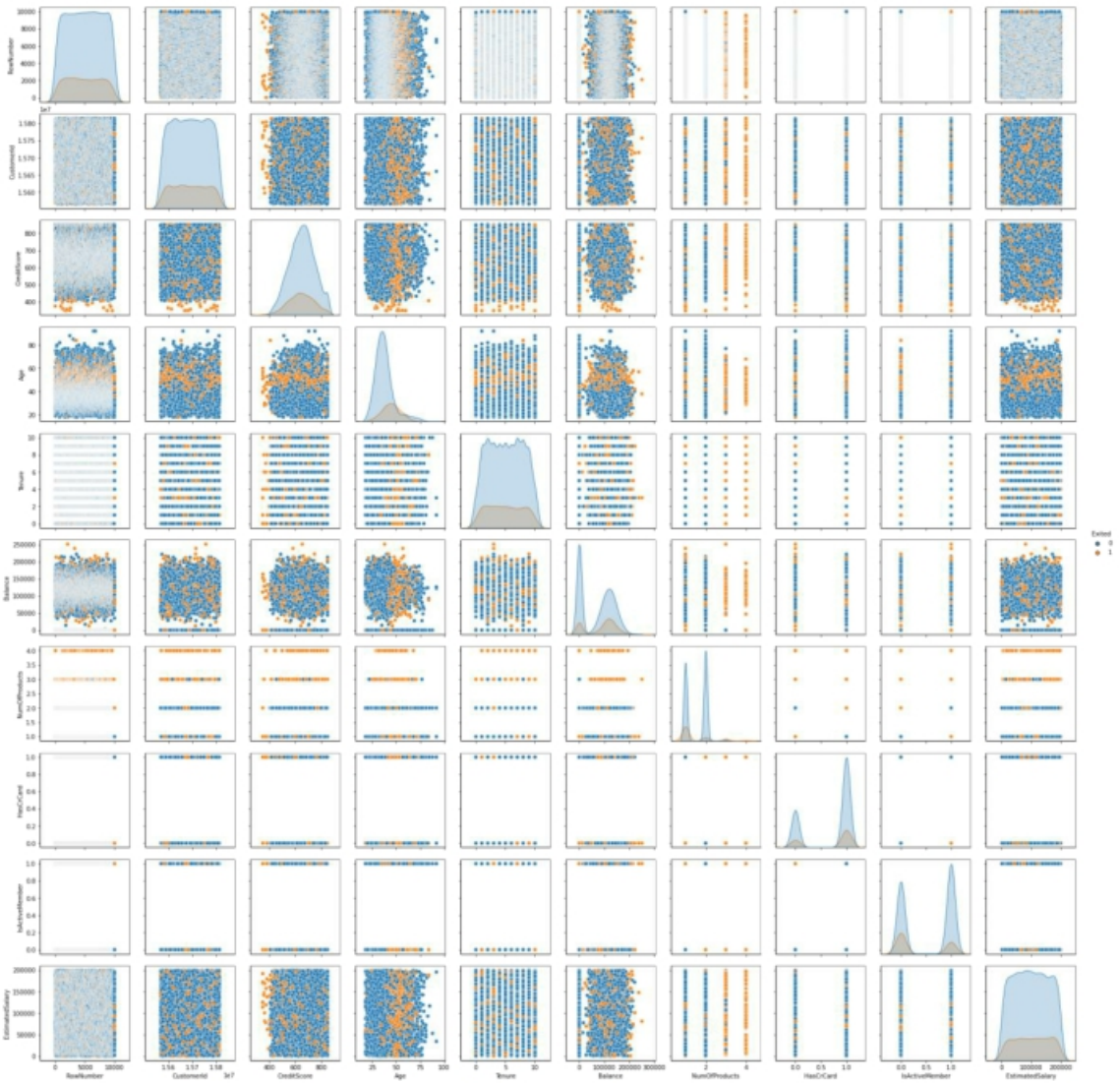
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa1a6b0c0d0>
```



Multi - Variate Analysis

```
sns.pairplot(data= df, hue= 'Exited' )
```

```
< seaborn.axisgrid.PairGrid at 0x7fa1a1860550>
```



4. Perform descriptive statistics on the dataset

```
df.describe()
```

```
         RowNumber  CustomerId  CreditScore         Age        Tenur
\
count 10000.00000 1.000000e+0  10000.000000 10000.00000  10000.00000
                           4                         0   0
mean    5000.50000 1.569094e+0    650.528800  38.921800       5.01280
                           7                                         0
std     2886.89568 7.193619e+0     96.653299   10.487806       2.89217
                           4                                         4
min        1.00000 1.556570e+0    350.000000  18.000000       0.00000
                           7                                         0
25%     2500.75000 1.562853e+0    584.000000  32.000000       3.00000
                           7                                         0
50%     5000.50000 1.569074e+0    652.000000  37.000000       5.00000
                           7                                         0
75%     7500.25000 1.575323e+0    718.000000  44.000000       7.00000
                           7                                         0
max    10000.00000 1.581569e+0    850.000000  92.000000      10.00000
                           7                                         0

            Balance NumOfProduct    HasCrCard IsActiveMembe   \
                          s                             r
count 10000.000000  10000.00000  10000.00000    10000.00000
                          0                             0
```

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
```

```
       EstimatedSalar       Exited
       y
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
```

5. Handle the Missing values

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

```
RowNumber
```

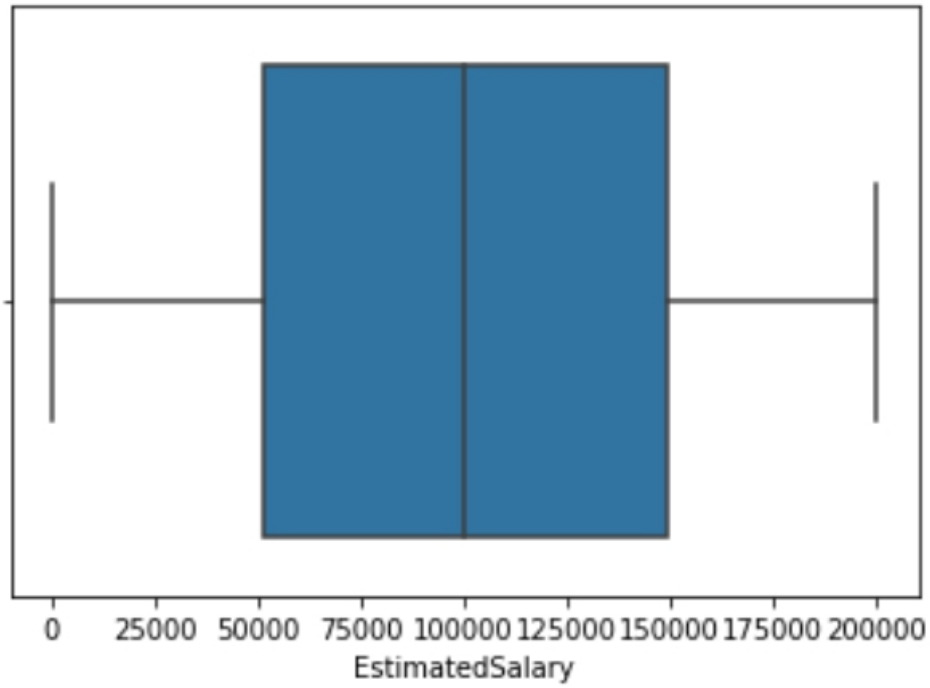
```
0
```

```
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
```

6. Find the outliers and replace the outliers

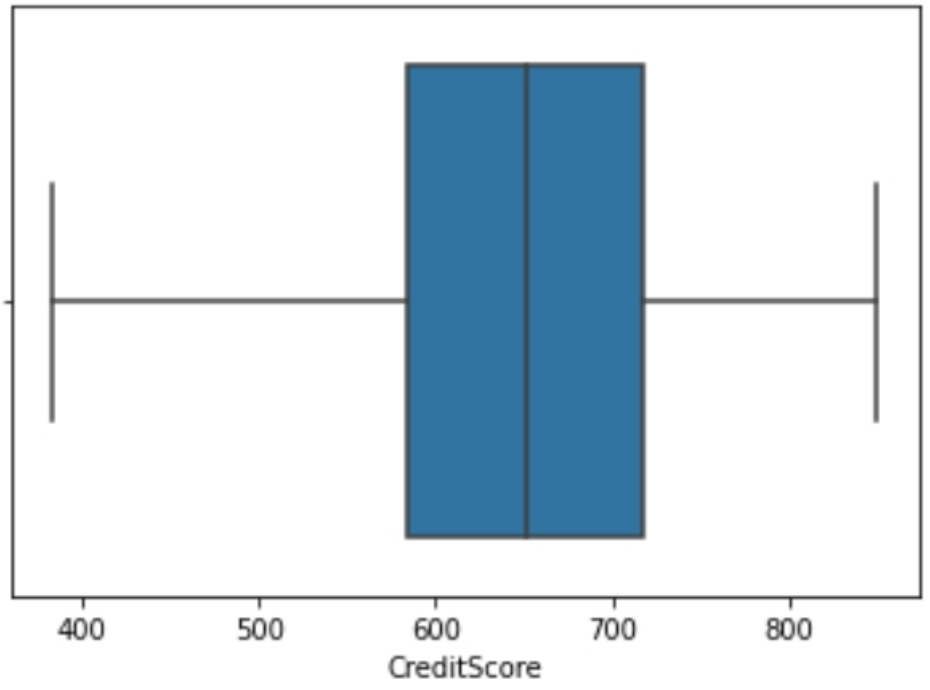
```
sns.boxplot(data = df, x = 'EstimatedSalary')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa19f13e510>
```



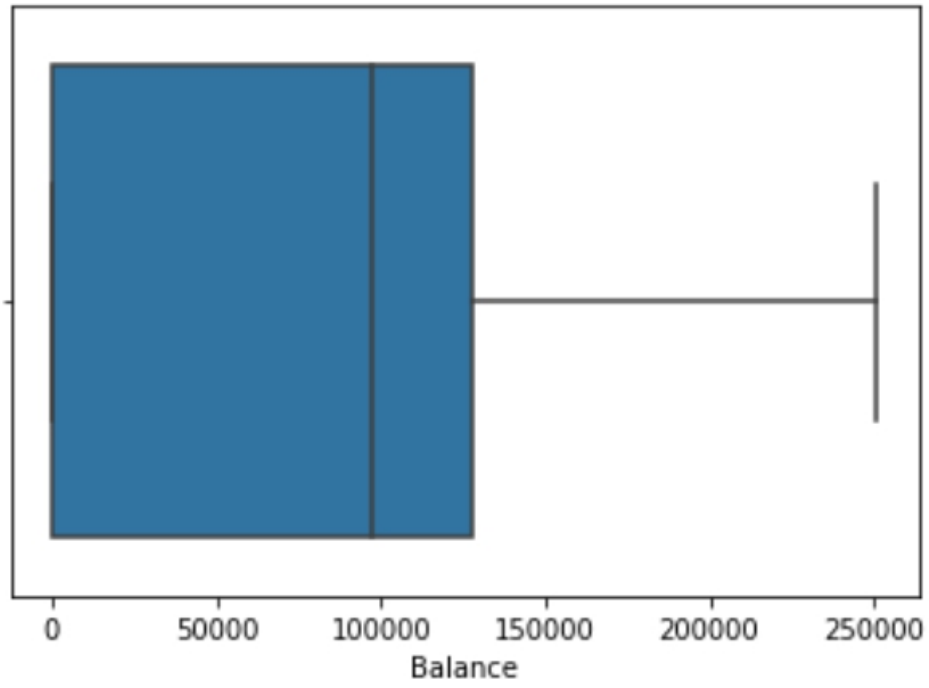

```
sns.boxplot(data = df, x = 'CreditScore')
```

```
< matplotlib.axes._subplots.AxesSubplot at 0x7fa19f0c2410>
```



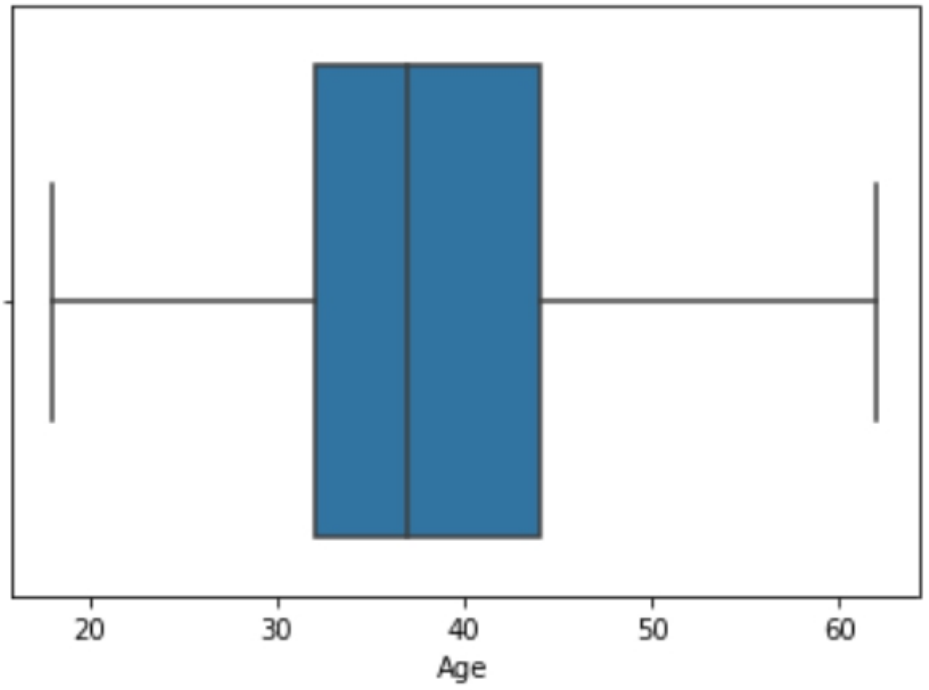

```
sns.boxplot(data = df, x = 'Balance' )
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa19f03d1d0>
```



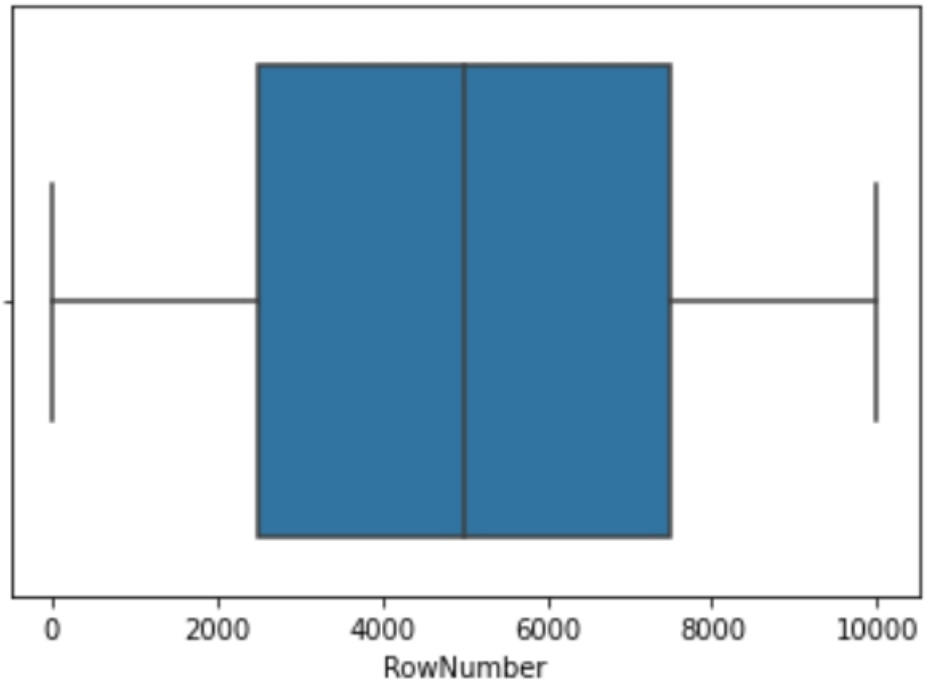

```
sns.boxplot(data = df, x = 'Age' )
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa19d74fb10>
```



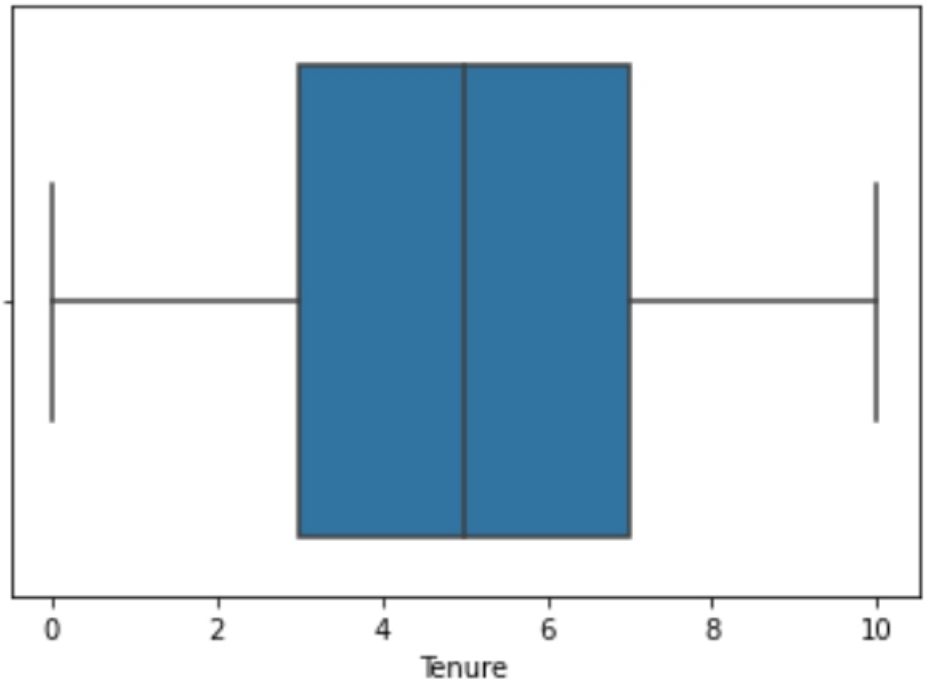

```
sns.boxplot(data = df, x = 'RowNumber' )
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa19d7c2b90>
```




```
sns.boxplot(data = df, x = 'Tenure')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa19be57c90>
```



7. Check for Categorical columns and perform encoding

```
x =
```

```
pd.get_dummies(x)
```

```
x.head()
```

```
   RowNumber CustomerId CreditScor    Age Tenure Surname_Abaz   \
                           e                          u
0        1.0 15634602.0        619.  42.0    2.0             0
                                  0
1        2.0 15647311.0        608.  41.0    1.0             0
                                  0
2        3.0 15619304.0        502.  42.0    8.0             0
                                  0
3        4.0 15701354.0        699.  39.0    1.0             0
                                  0
4        5.0 15737888.0        850.  43.0    2.0             0
                                  0

   Surname_Abbie Surname_Abbot Surname_Abdullah Surname_Abdul  ...
\               t                              ov
0              0              0                0             0 ...
1              0              0                0             0 ...
2              0              0                0             0 ...
3              0              0                0             0 ...
4              0              0                0             0 ...

   Surname_Zubar   Surname_Zubarev  Surname_Zuev Surname_Zuyev \
   ev              a
0              0                0            0             0
1              0                0            0             0
2              0                0            0             0
3              0                0            0             0
4              0                0            0             0

   Surname_Zuyev  Geography_France Geography_German Geography_Spain \
   a                             y
0              0                1                0              0
1              0                0                0              1
2              0                1                0              0
3              0                1                0              0
4              0                0                0              1

   Gender_Female Gender_Male
0              1           0
1              1           0
2              1           0
3              1           0
4              1           0

[5 rows x 2942 columns]
```

8. Split the data into dependent and independent variables

```
# splitting the dataset into x(independent variables) and
y(dependent variables)

x = df.iloc[:, 0: 8]
y = df.iloc[:, 8]

print(x.shape)
print(y.shape)
```

```
print(x.columns)
```

```
(10000, 8)
(10000,)
Index(['RowNumber', 'CustomerId', 'Surname', 'CreditScore',
       'Geography', 'Gender', 'Age', 'Tenure'],
      dtype='object')
```

9. Scale the independent variables

```
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
x_train =
sc.fit_transform(x_train) x_test
= sc.fit_transform(x_test)

x_train =
pd.DataFrame(x_train)
x_train.head()
```

```
       0         1         2         3         4         5     6       7
\
0 -        -         -         0.042283  0.00886 - 0.016332 0.0
0.702176   1.343330  0.736828            0
- 0.0231
1 -         1.55833   1.02525 - 0.674496 0.00886- 0.016332 0.0
1.485722    0         7                  0
- 0.0231
2 -        -          0.80886 - 0.469702 1.39329- 0.016332 0.0
0.524522   0.655156   1                  3
- 0.0231
3 -         1.20059   0.39667 - 0.060114 0.00886- 0.016332 0.0
1.167396    4         7                  0
- 0.0231
4 -         0.77879 -          1.373444 0.70107  - 0.016332 0.0
1.451159    8        0.468908            7
- 0.0231

 8       9     ...      2932 2933      2934      2935      2936      2937
\
0  0.0   0.0 ... - 0.011548 0.0 -          -         -         -
                                0.011548   0.011548  0.016332  1.015588
1  0.0   0.0 ... - 0.011548 0.0 -          -         -          0.98465
                                0.011548   0.011548  0.016332   1
2  0.0   0.0 ... - 0.011548 0.0 -          -         -         -
                                0.011548   0.011548  0.016332  1.015588
3  0.0   0.0 ... - 0.011548 0.0 -          -         -         -
                                0.011548   0.011548  0.016332  1.015588
4  0.0   0.0 ... - 0.011548 0.0 -          -         -          0.98465
                                0.011548   0.011548  0.016332   1

       2938     2939      2940      2941
         0         -   1.087261        -
    1.76021  0.574682            1.087261
         6
       1 -         -   1.087261        -
   0.568112  0.574682            1.087261
       2 -   1.740094  1.087261        -
   0.568112                      1.087261
       3 -   1.740094        -   0.919743
   0.568112            0.919743
```

```
      4 -        -        -  0.919743
  0.568112  0.574682  0.919743

[5 rows x 2942 columns]
```

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
= 0.25 , random_state = 0 )

print(x_train.shape)
```

```
print(y_ train.shape)
print(x_test.shape)
print(y_test.shape)
```

```
(7500, 2942)
(7500,)
(2500, 2942)
(2500,)
```