

## Assignment -2

### Data Visualization and Pre-processing in ipynb

Student Name	DHARSHINI M
Team ID	PNT2022TM1D43508

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-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

```

### 3.Perform Below Visualisations

#### Univariate Analysis

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

```

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

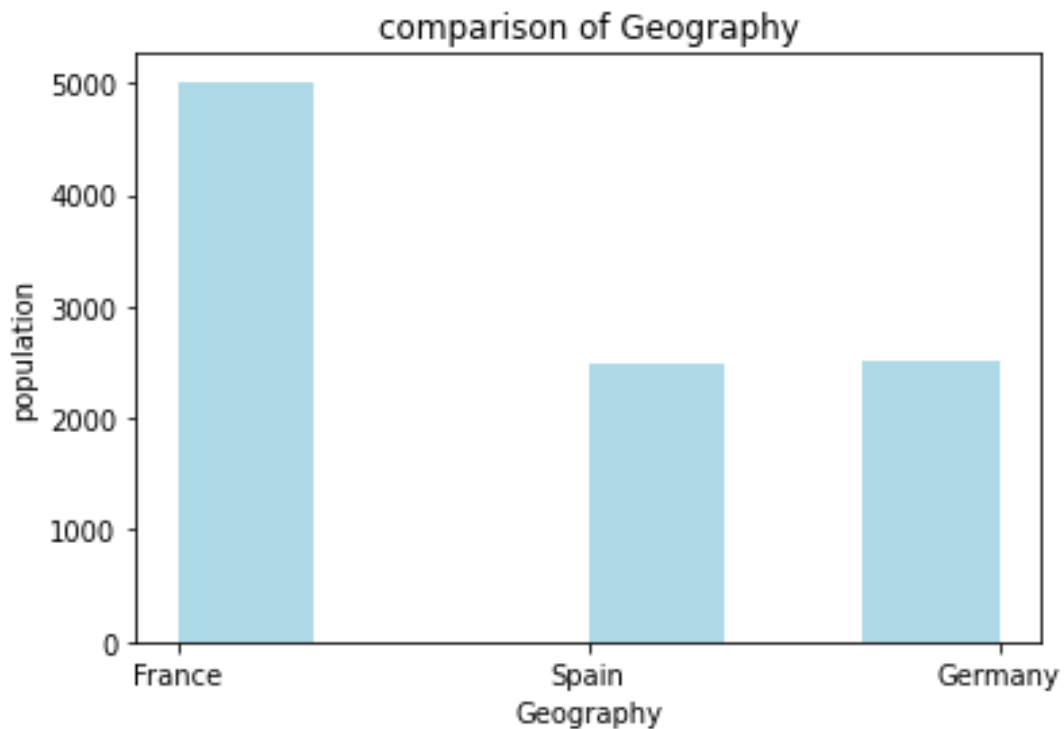
```

```
# 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 ?
```

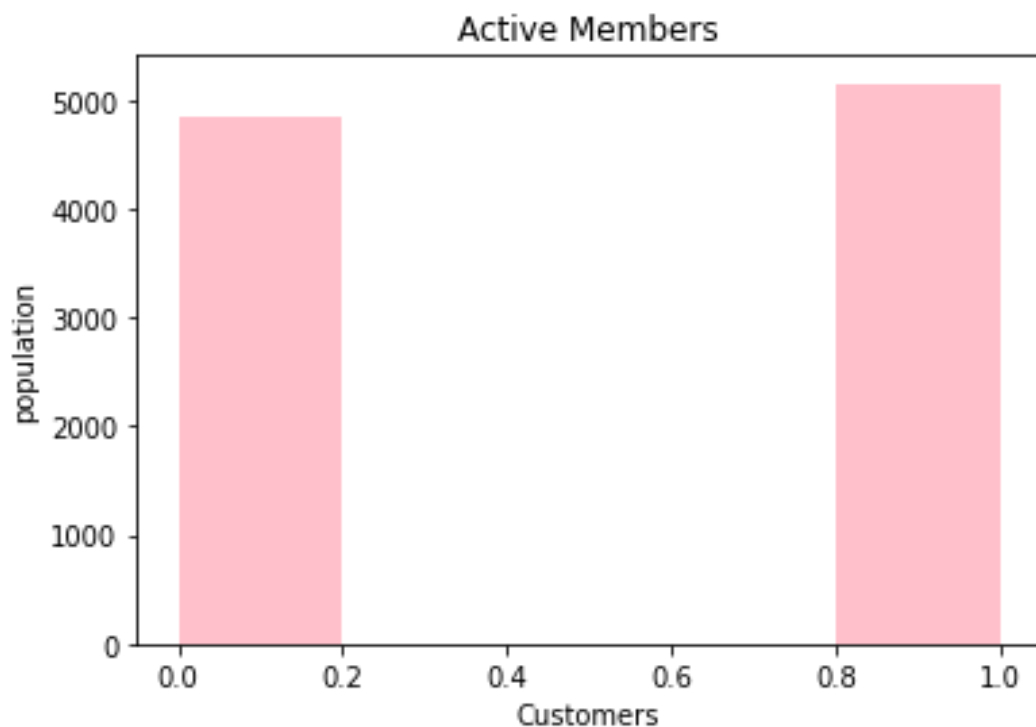
```
plt.hist(x=df.IsActiveMember, bins=5, color='pink')
```

```
plt.title('Active Members')
```

```
plt.xlabel('Customers')
```

```
plt.ylabel('population')
```

```
plt.show()
```



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

```
Male    5457
```

```
Female  4543
```

```
Name: Gender, dtype: int64
```

```
# Plotting the features of the dataset to see the correlation between them
```

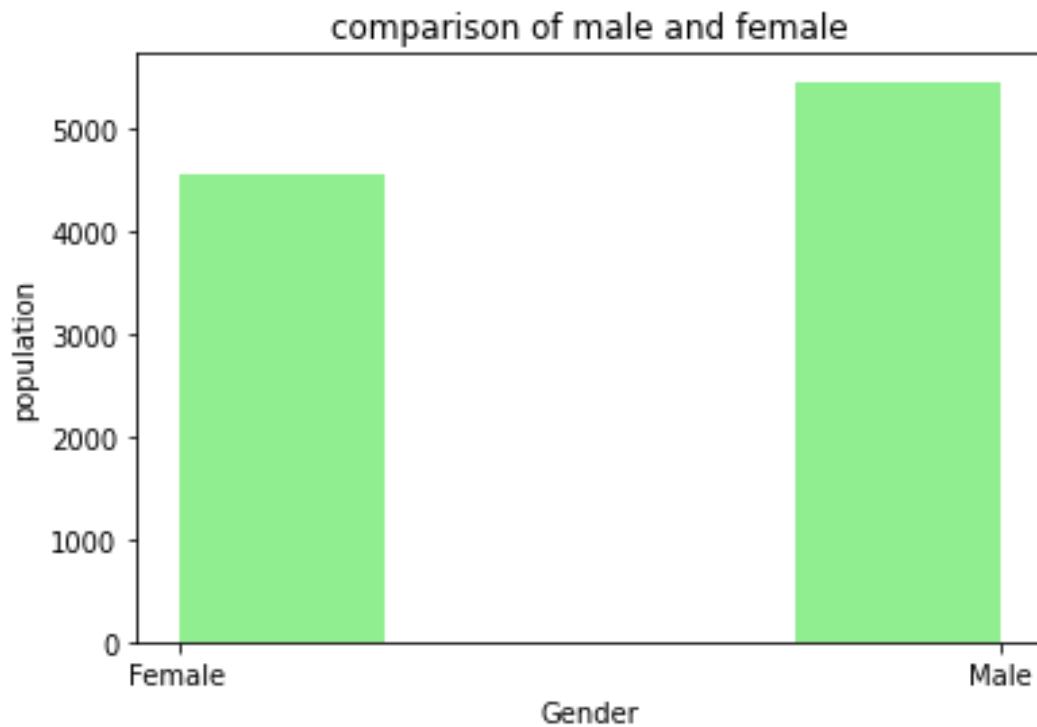
```
plt.hist(x = df.Gender, bins = 4, color = 'lightgreen')
```

```
plt.title('comparison of male andfemale')
```

```
plt.xlabel('Gender')
```

```
plt.ylabel('population')
```

```
plt.show()
```



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

```
37    478
38    477
35    474
36    456
34    447
```

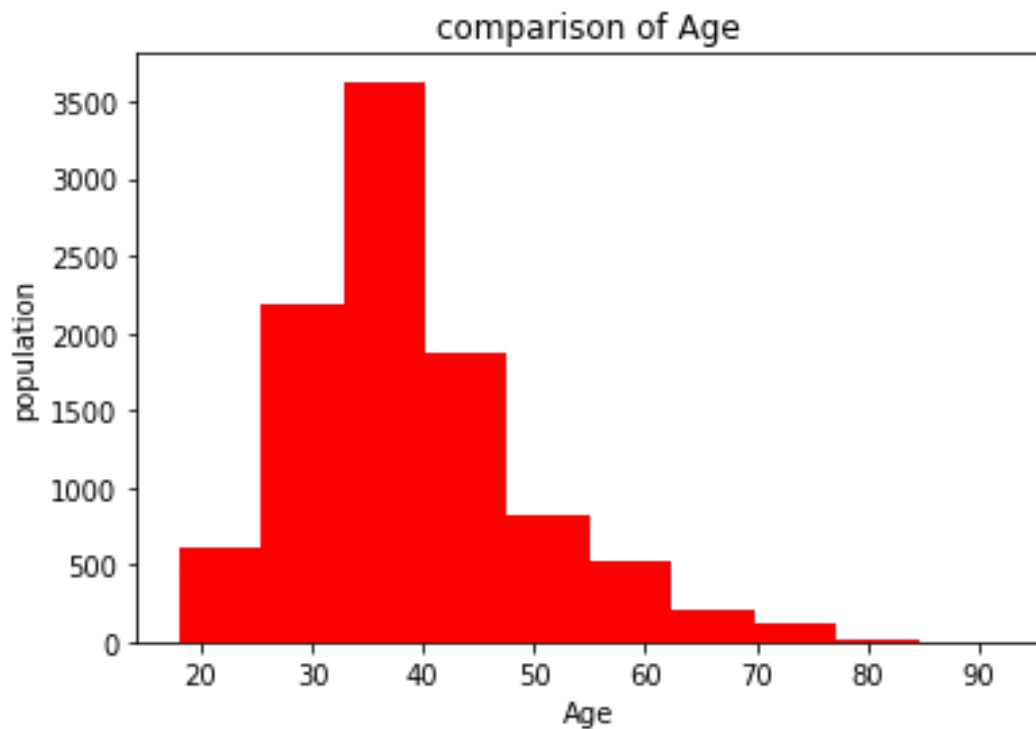
```
...
```

```
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
```

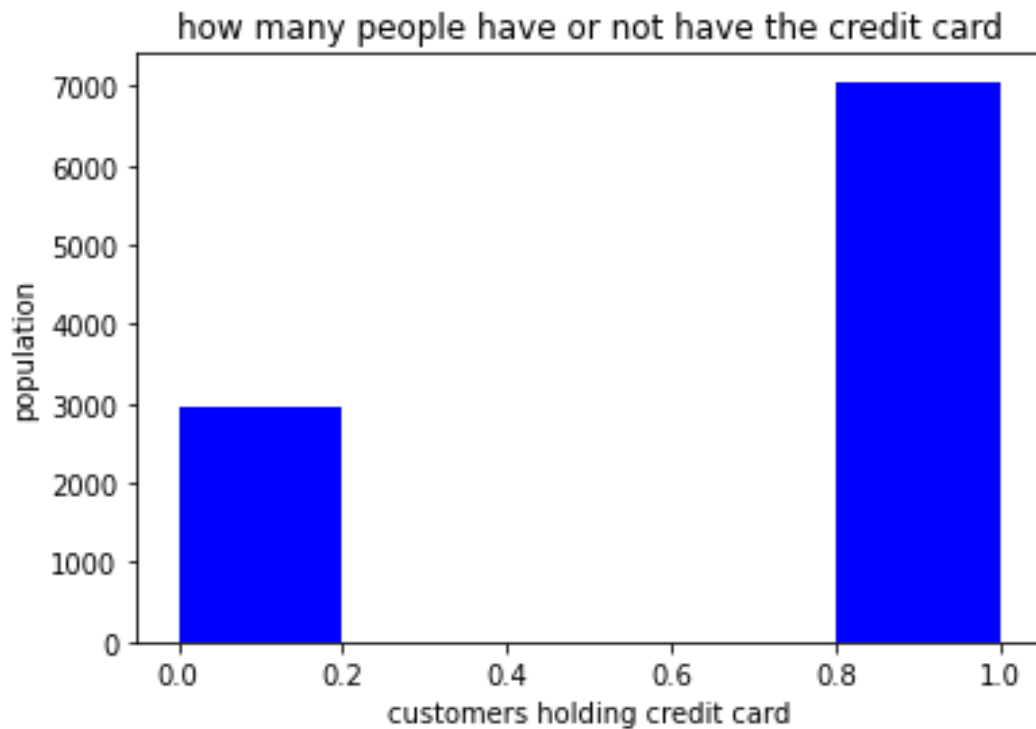
```
plt.hist(x = df.HasCrCard, bins = 5, color = 'blue')
```

```
plt.title('how many people have or not have the credit card')
```

```
plt.xlabel('customers holding credit card')
```

```
plt.ylabel('population')
```

```
plt.show()
```

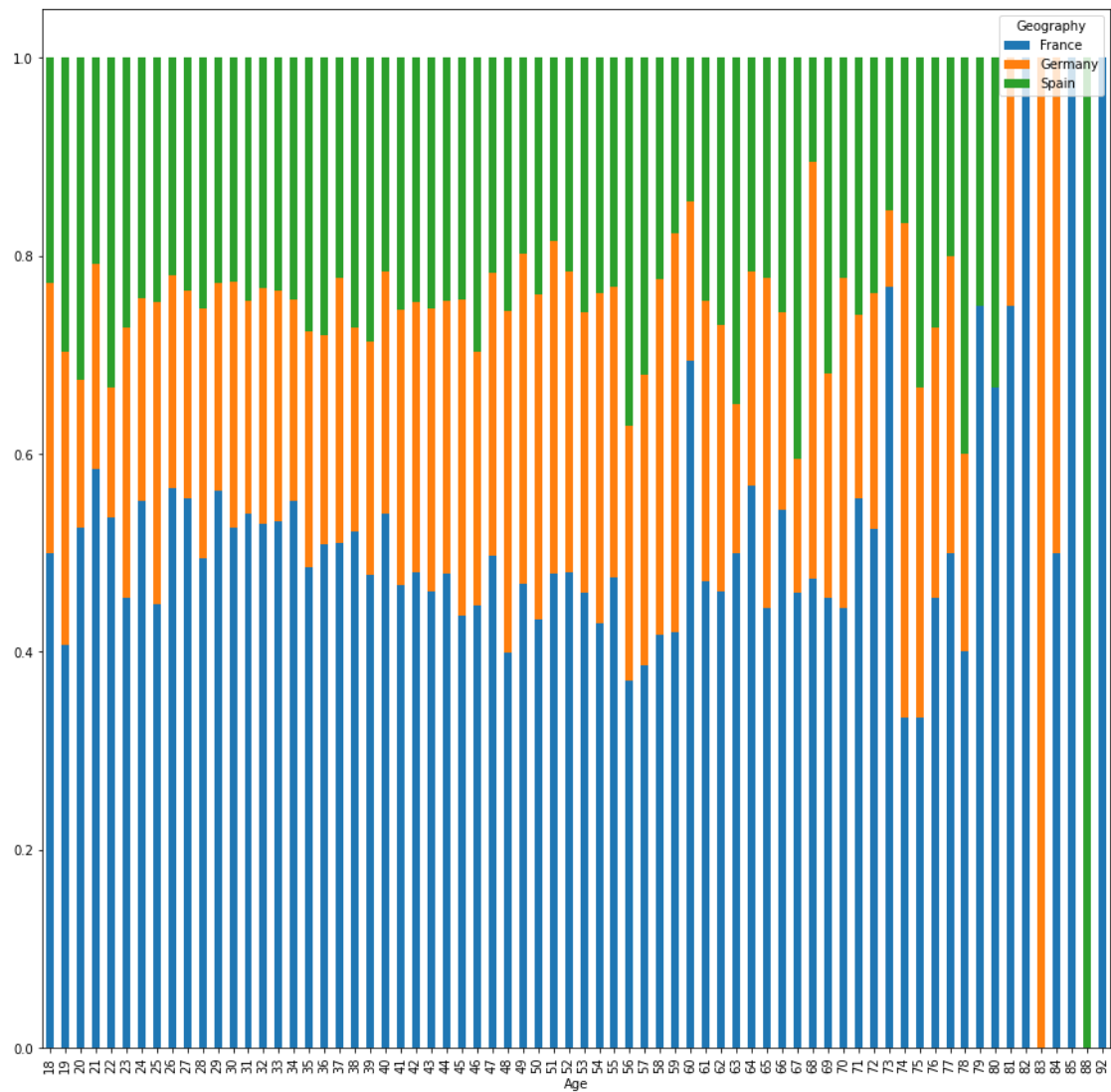


## Bi - Variate Analysis

*# 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))
```

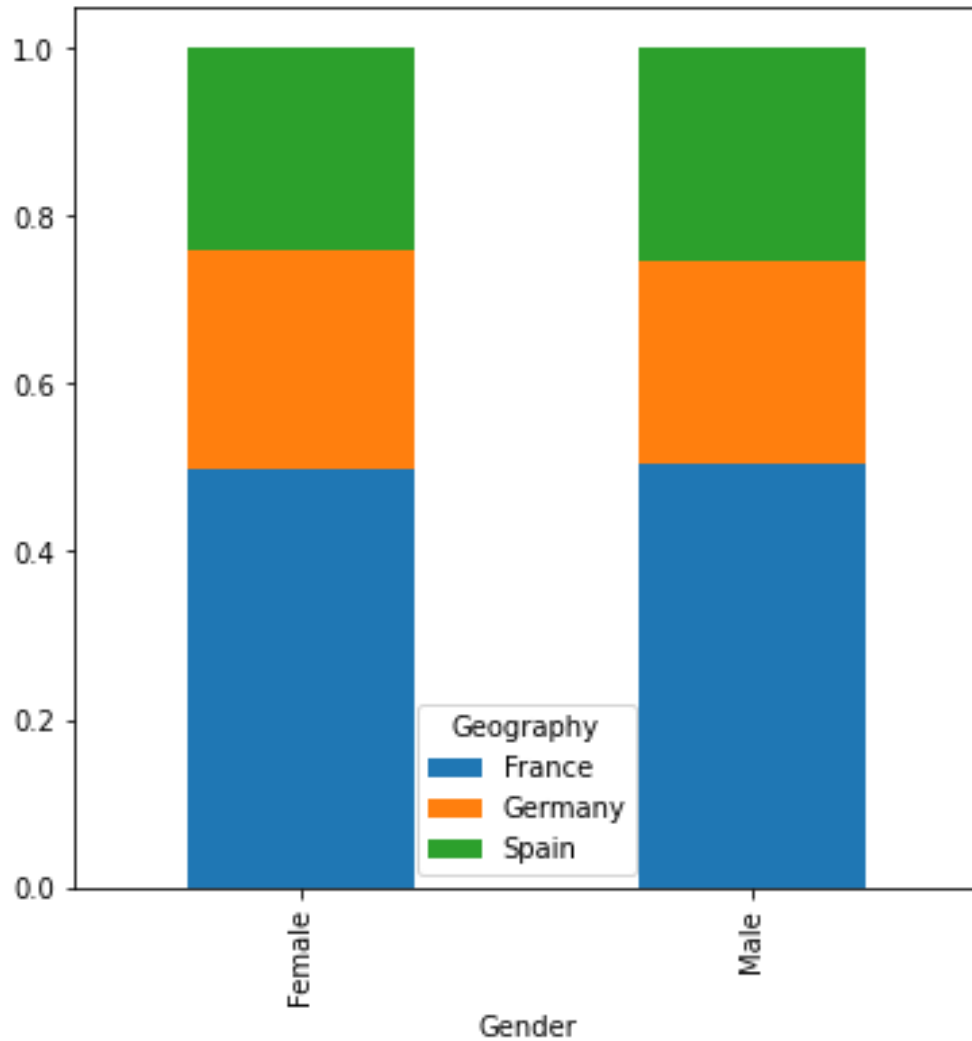
<matplotlib.axes.\_subplots.AxesSubplot at 0x7fa1a78a13d0>



*# 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 0x7fala6c48bd0>

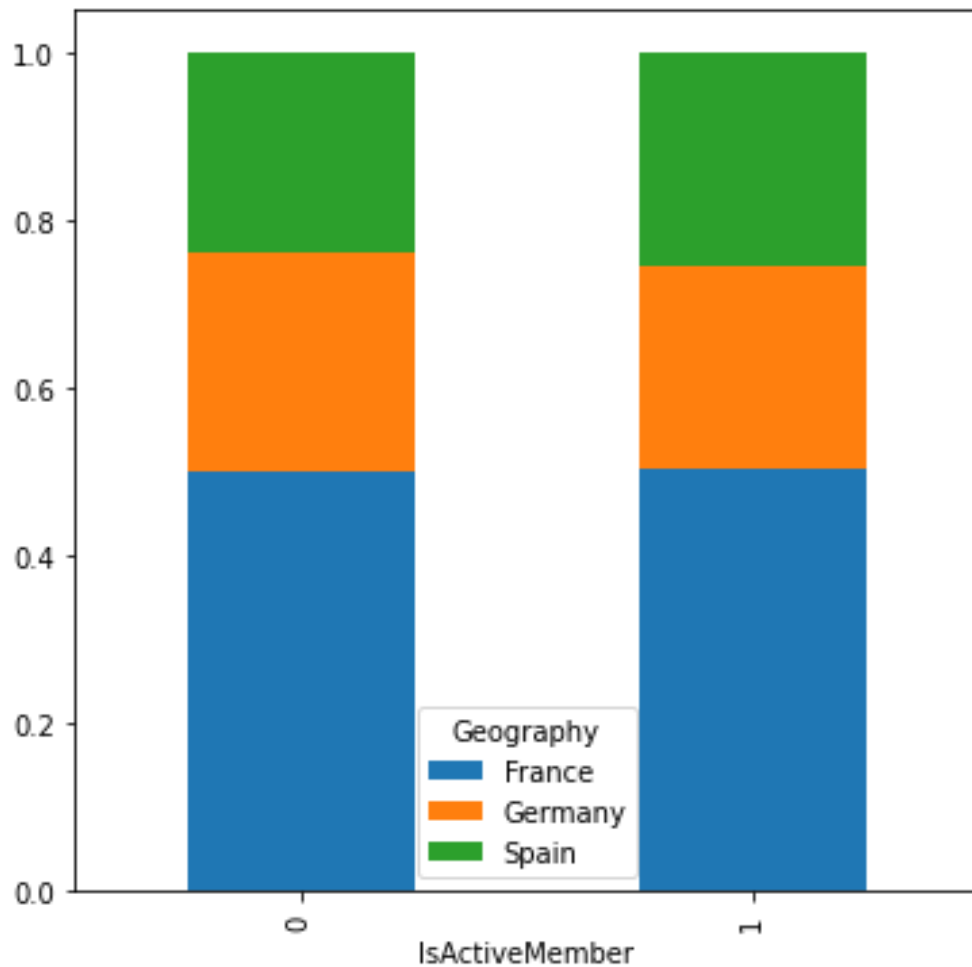


*# comparison of active member in different geographies*

```
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 0x7fala6c36810>





```
# 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)
```

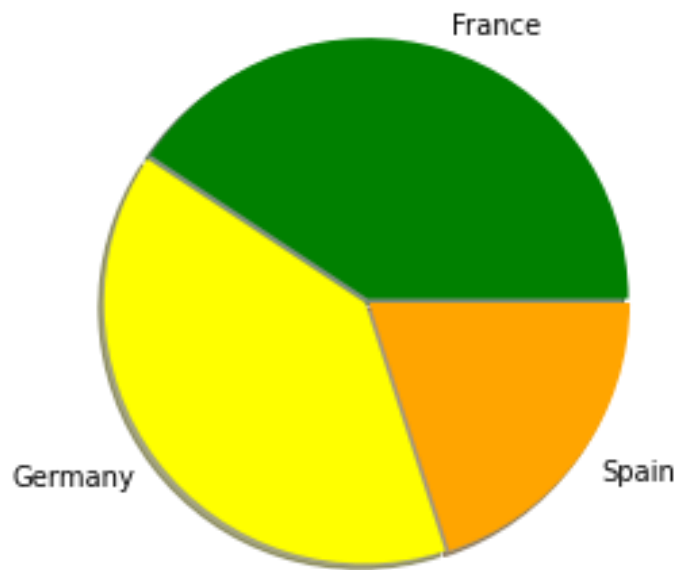
```
Total Balance in France : 311332479.49
Total Balance in Germany : 300402861.38
Total Balance in Spain : 153123552.01
```

```
# plotting a pie chart
```

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

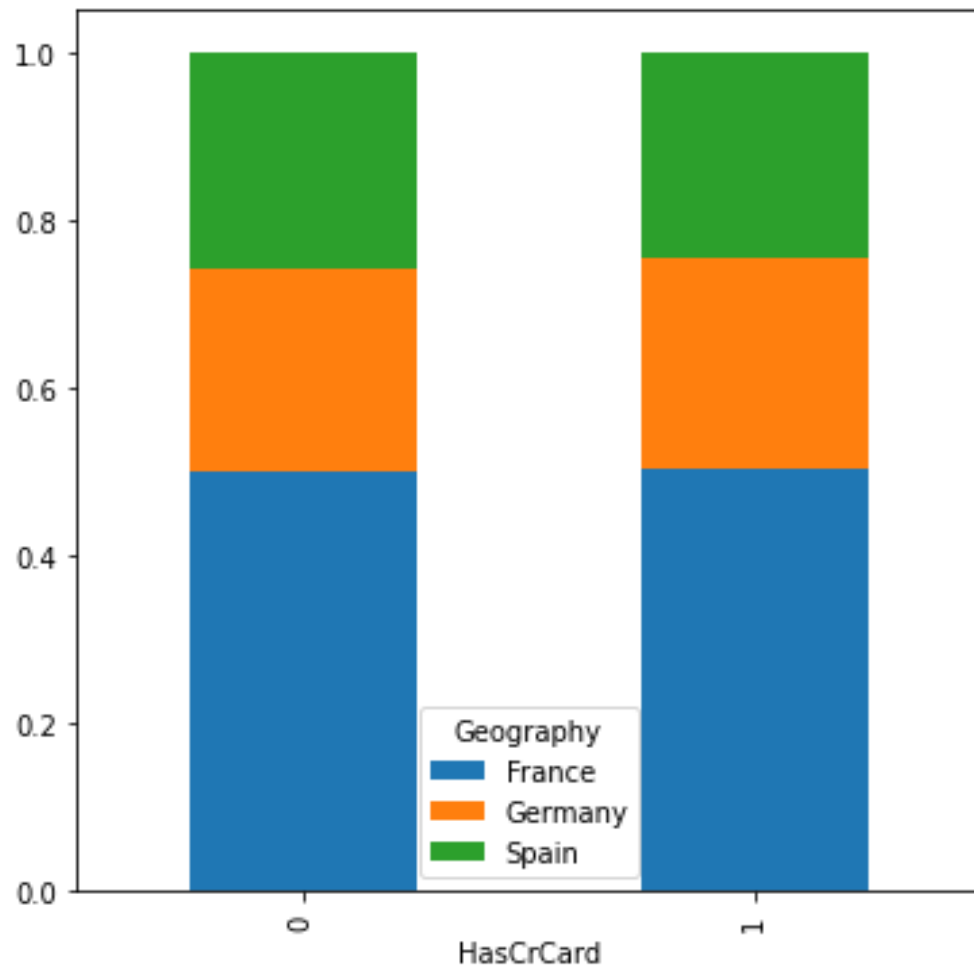
```
plt.pie(sizes, colors = colors, labels = labels, explode = explode, shadow
= True)
```

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



```
# comparison between geography and card holders
```

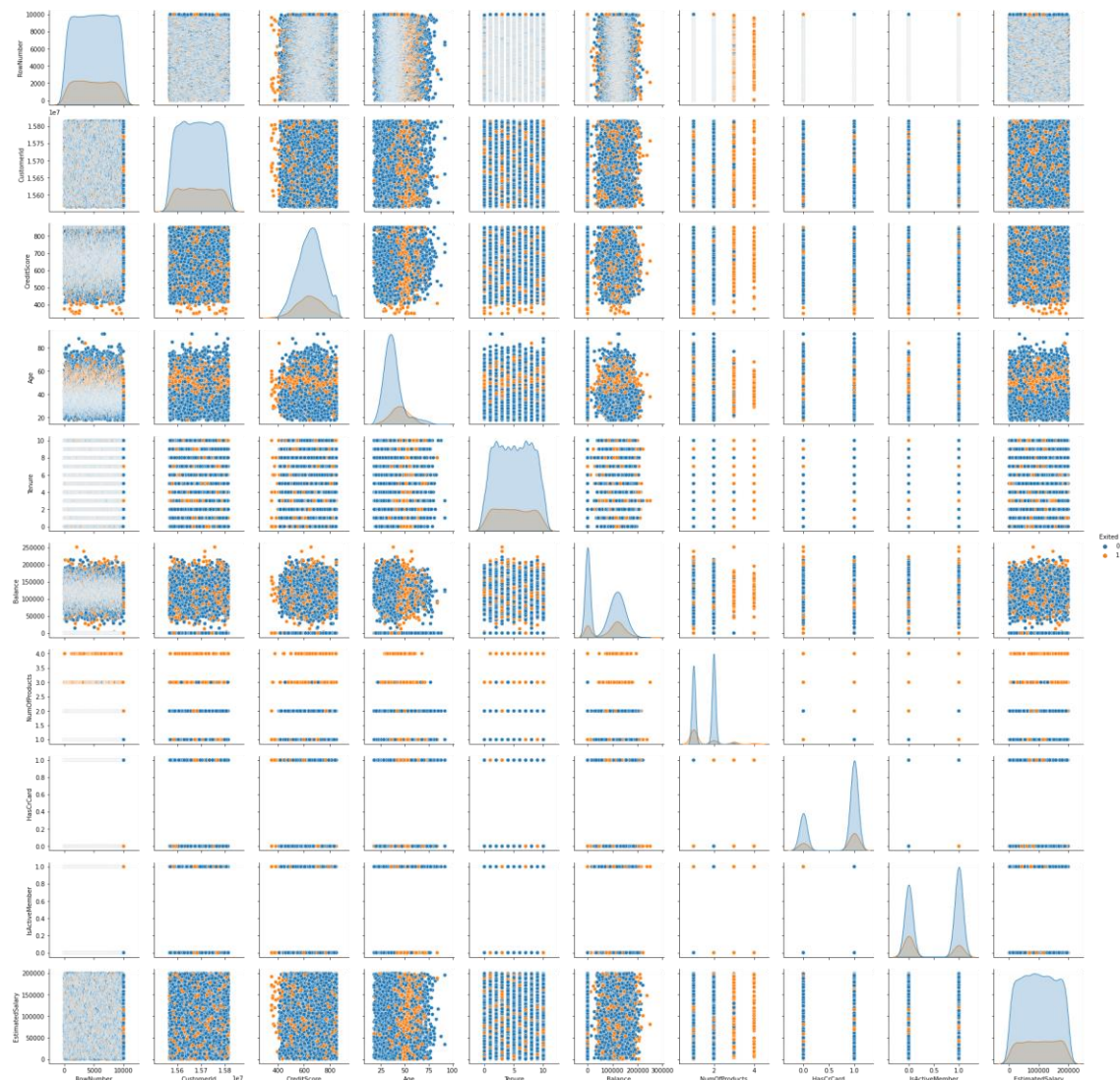
```
HasCrCard = pd.crosstab(df['HasCrCard'], df['Geography'])  
HasCrCard.div(HasCrCard.sum(1).astype(float), axis=0).plot(kind=  
'bar', stacked = True, figsize = (6, 6))  
  
<matplotlib.axes._subplots.AxesSubplot at 0x7fa1a6b0c0d0>
```



### Multi - Variate Analysis

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

```
<seaborn.axisgrid.PairGrid at 0x7fala1860550>
```



#### 4. Perform descriptive statistics on the dataset

```
df.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
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	1.000000	1.000000
75%	127644.240000	2.000000	1.000000	1.000000
max	250898.090000	4.000000	1.000000	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

## 5. Handle the Missing values

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

```

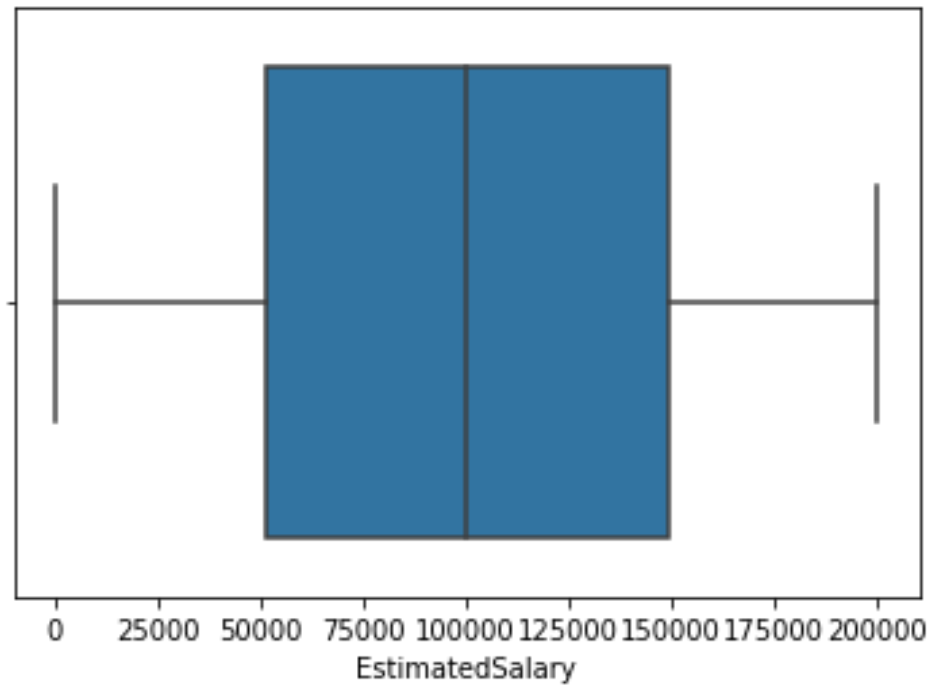
RowNumber      0
CustomerId      0
Surname         0
CreditScore     0
Geography       0
Gender          0
Age             0
Tenure          0
Balance         0
NumOfProducts  0
HasCrCard       0
IsActiveMember  0
EstimatedSalary 0
Exited          0
dtype: int64

```

## 6. Find the outliers and replace the outliers

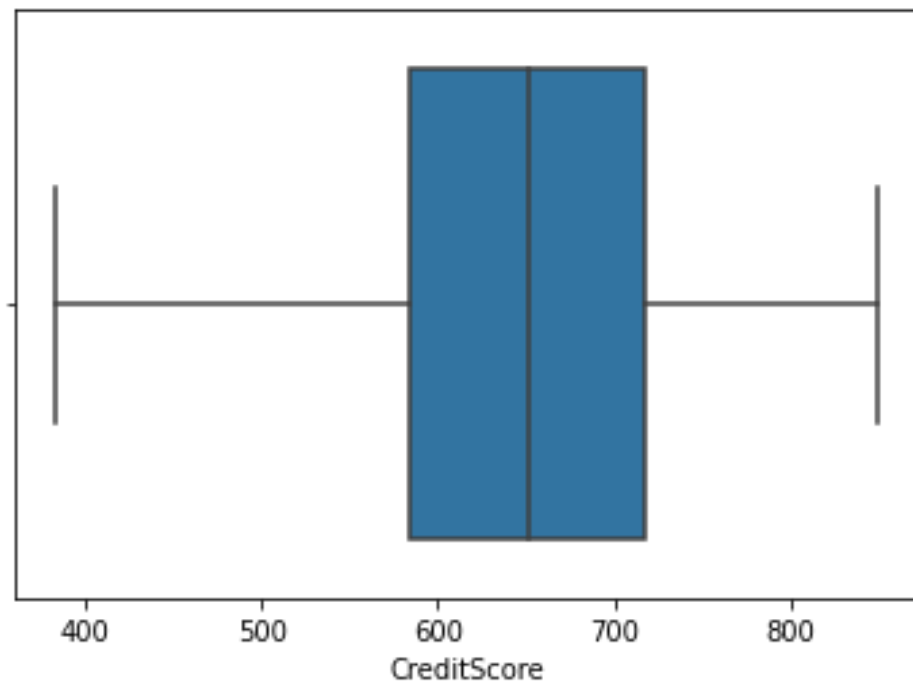
```
sns.boxplot(data = df, x = 'EstimatedSalary')
```

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



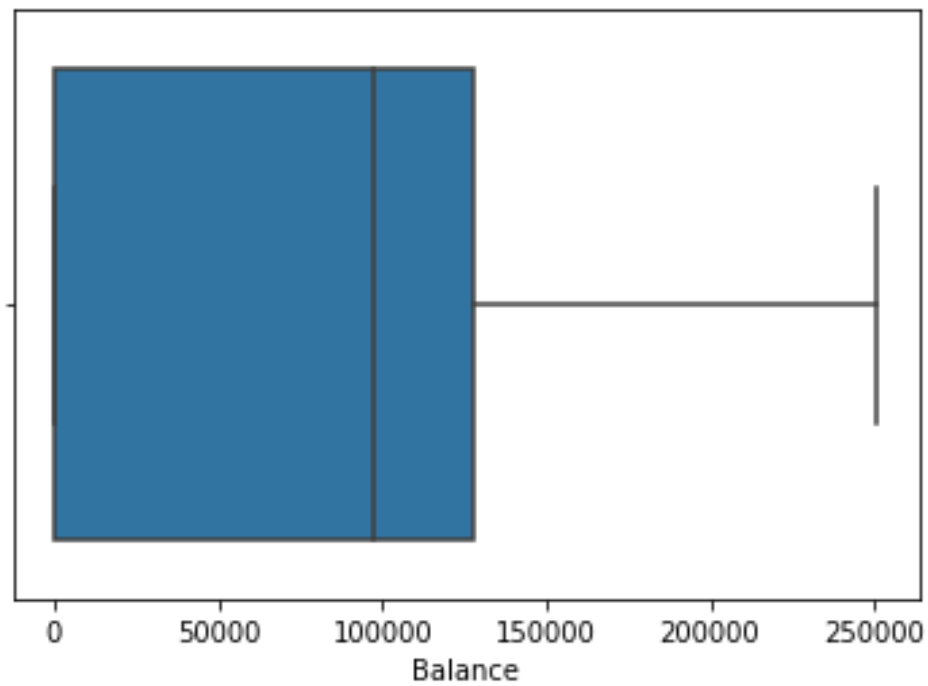
```
sns.boxplot(data = df, x = 'CreditScore')
```

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



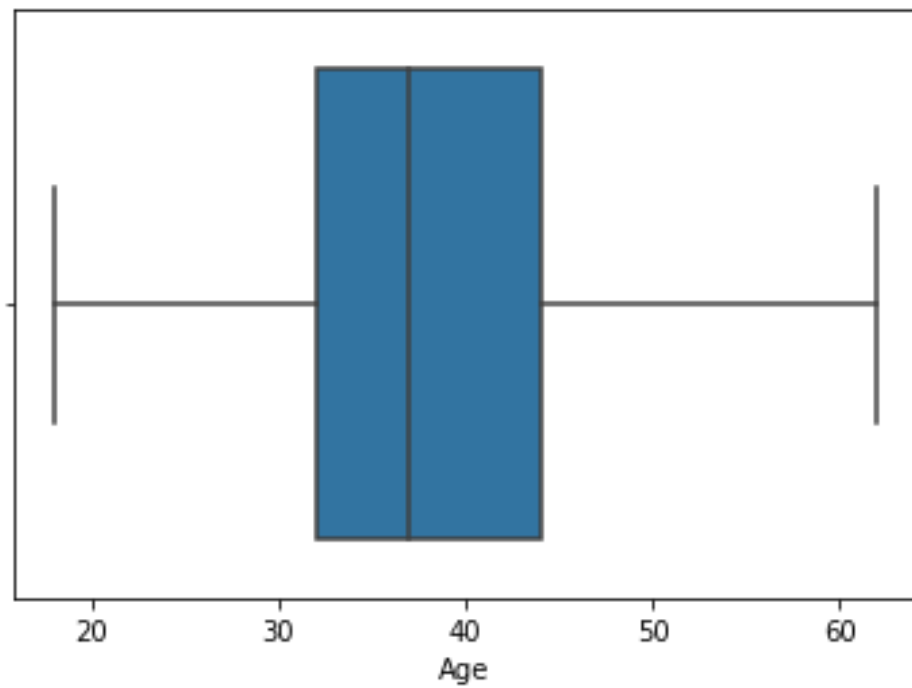
```
sns.boxplot(data = df, x = 'Balance')
```

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



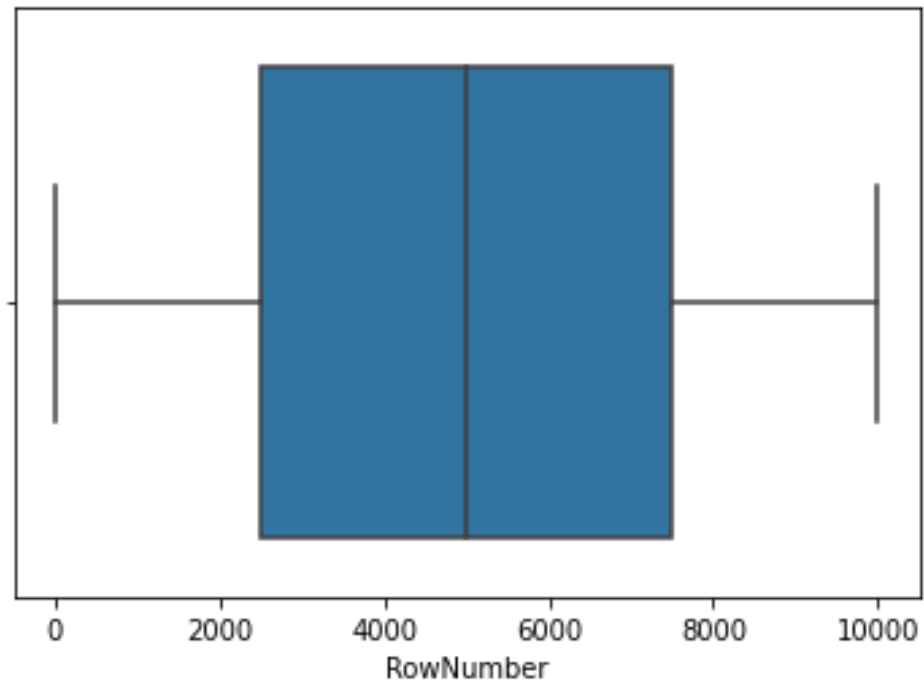
```
sns.boxplot(data = df, x = 'Age')
```

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

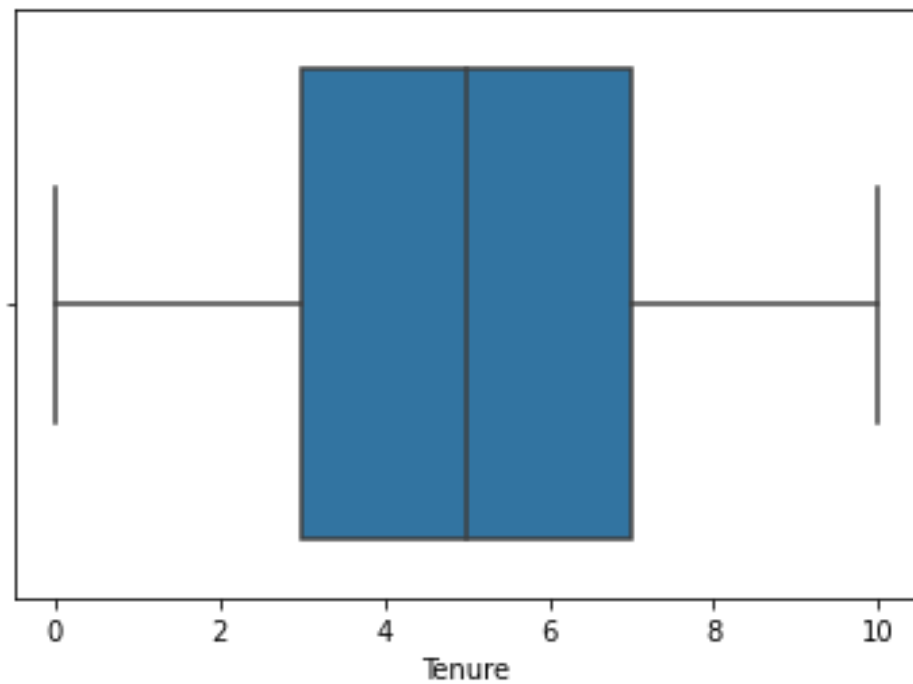


```
sns.boxplot(data = df, x = 'RowNumber')
```

```
<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	CreditScore	Age	Tenure	Surname_Abazu	\
0	1.0	15634602.0	619.0	42.0	2.0	0	
1	2.0	15647311.0	608.0	41.0	1.0	0	
2	3.0	15619304.0	502.0	42.0	8.0	0	
3	4.0	15701354.0	699.0	39.0	1.0	0	
4	5.0	15737888.0	850.0	43.0	2.0	0	

	Surname_Abbie	Surname_Abbott	Surname_Abdullah	Surname_Abdulov	...
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_Zubarev	Surname_Zubareva	Surname_Zuev	Surname_Zuyev	\
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_Zuyeva	Geography_France	Geography_Germany	Geography_Spain	\
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	-0.702176	-1.343330	-0.736828	0.042283	0.008860	-0.016332	0.0	
	-0.0231							
1	-1.485722	1.558330	1.025257	-0.674496	0.008860	-0.016332	0.0	
	-0.0231							
2	-0.524522	-0.655156	0.808861	-0.469702	1.393293	-0.016332	0.0	
	-0.0231							
3	-1.167396	1.200594	0.396677	-0.060114	0.008860	-0.016332	0.0	
	-0.0231							
4	-1.451159	0.778798	-0.468908	1.373444	0.701077	-0.016332	0.0	
	-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	-0.011548	-0.011548	-0.016332	0.984651
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	-0.011548	-0.011548	-0.016332	0.984651

	2938	2939	2940	2941
0	1.760216	-0.574682	1.087261	-1.087261
1	-0.568112	-0.574682	1.087261	-1.087261
2	-0.568112	1.740094	1.087261	-1.087261
3	-0.568112	1.740094	-0.919743	0.919743
4	-0.568112	-0.574682	-0.919743	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,)
```