

**Assignment -2**  
Data Visualization and Pre-processing in ipynb

Assignment Date	21 October 2022
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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	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-   int64
                        null
2   Surname                10000 non-   object
                        null
3   CreditScore            10000 non-   int64
                        null
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
```

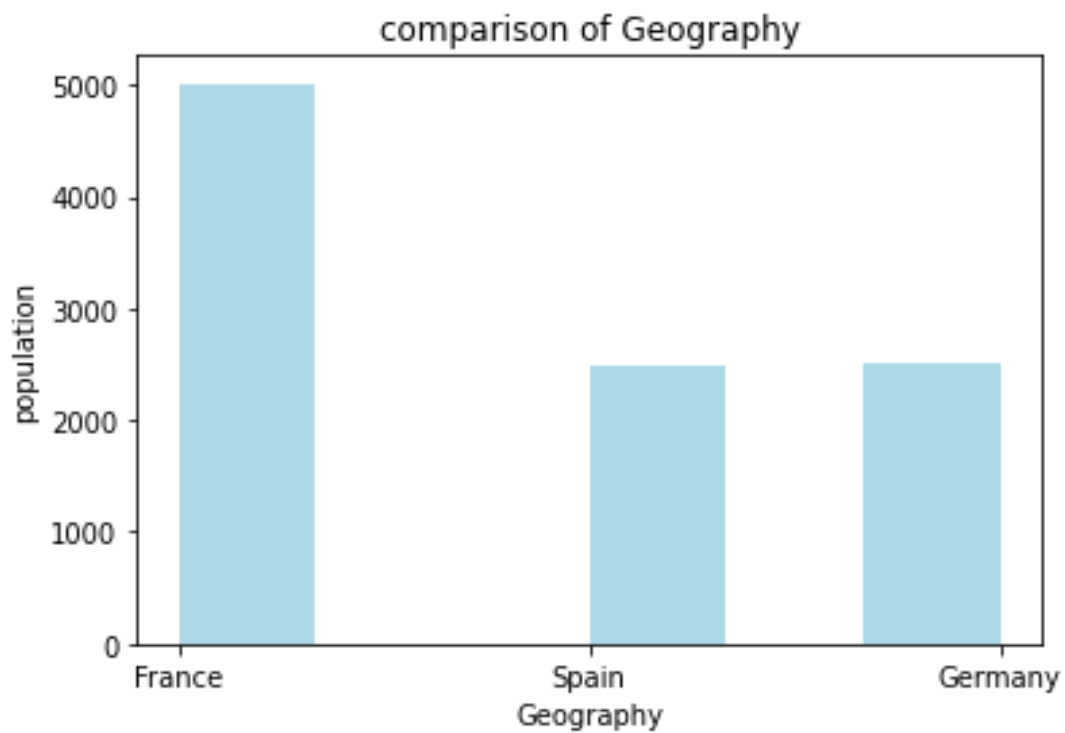
### 3. Perform Below Visualisations

#### Univariate Analysis

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



```

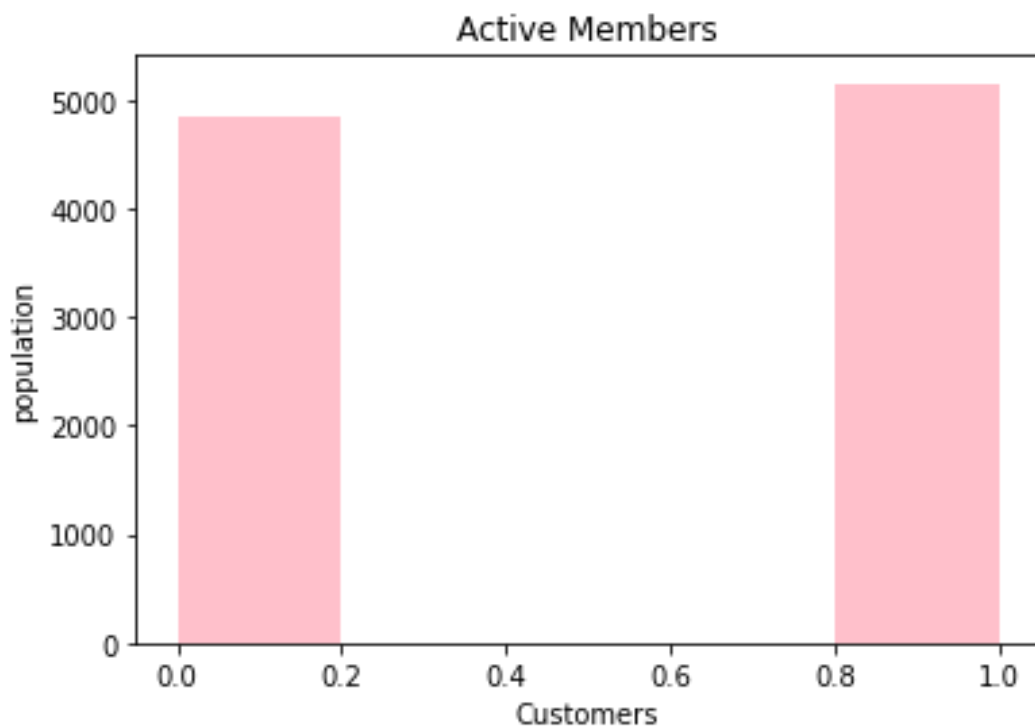
df['IsActiveMember'].value_counts()

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()

```

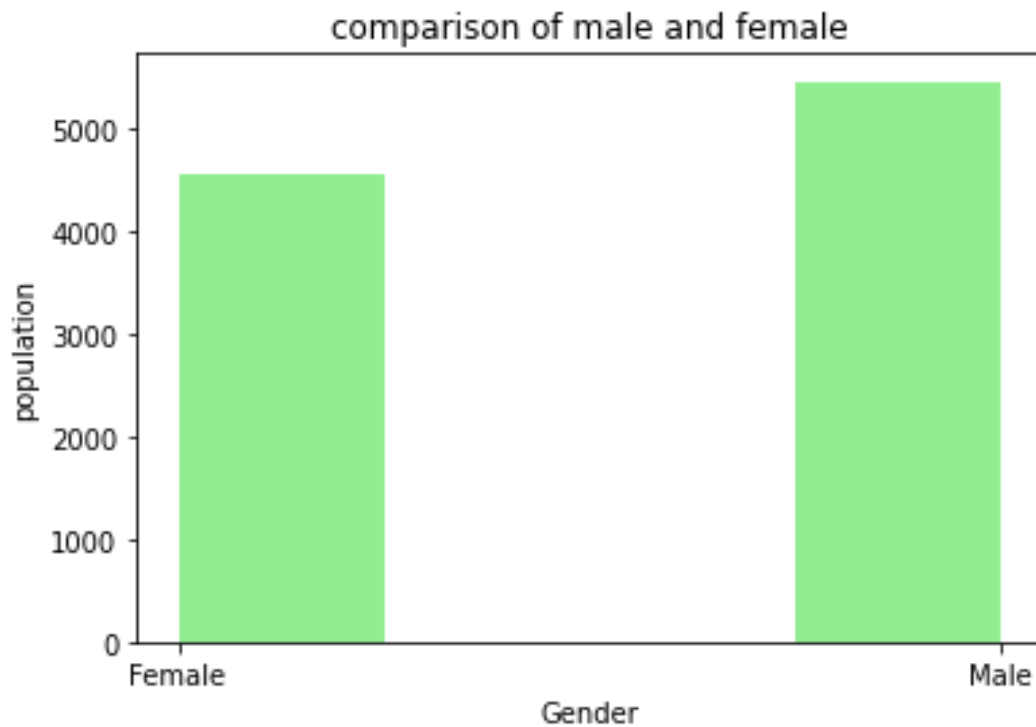


```

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
```

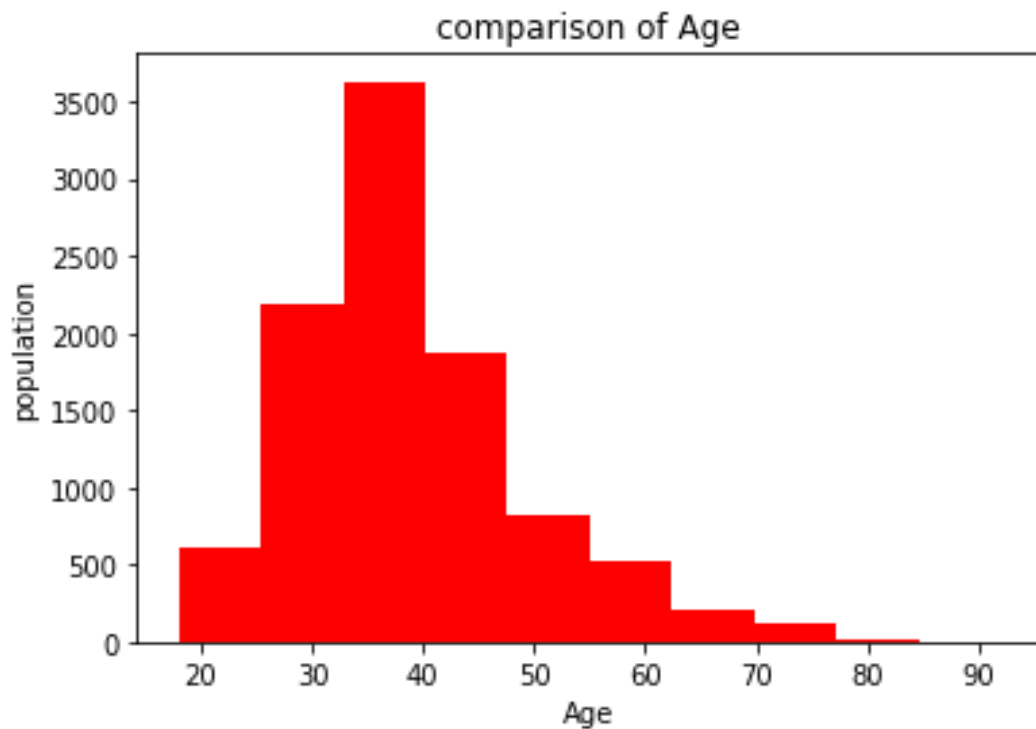
```
...
```

```
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()
```

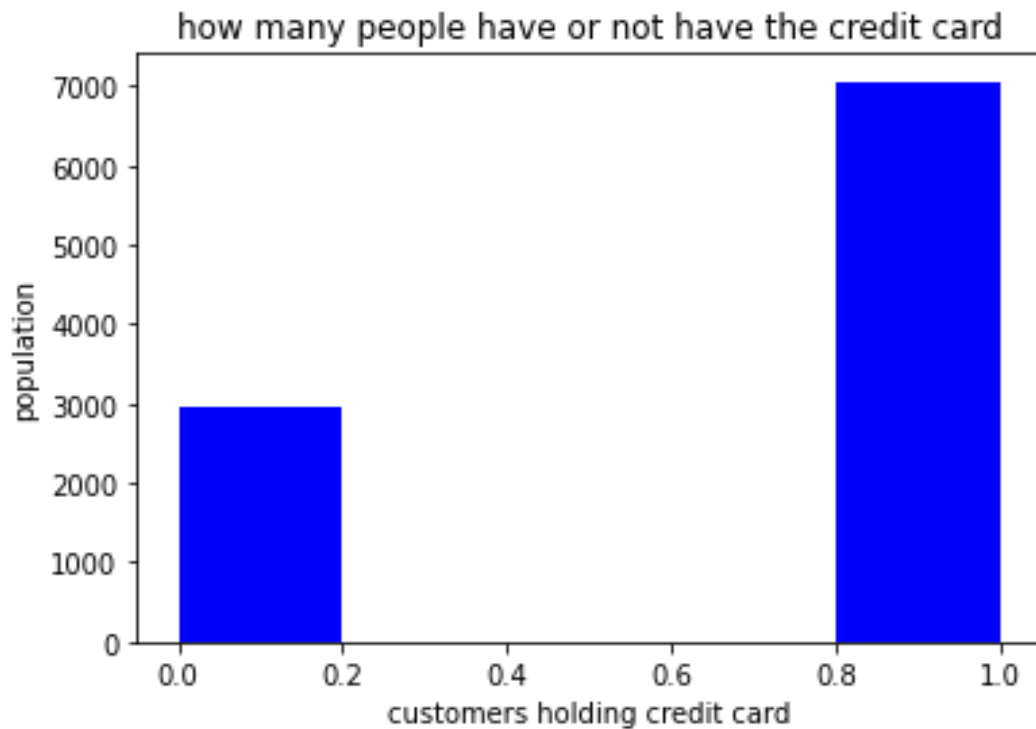
```
1    7055
```

```
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()
```

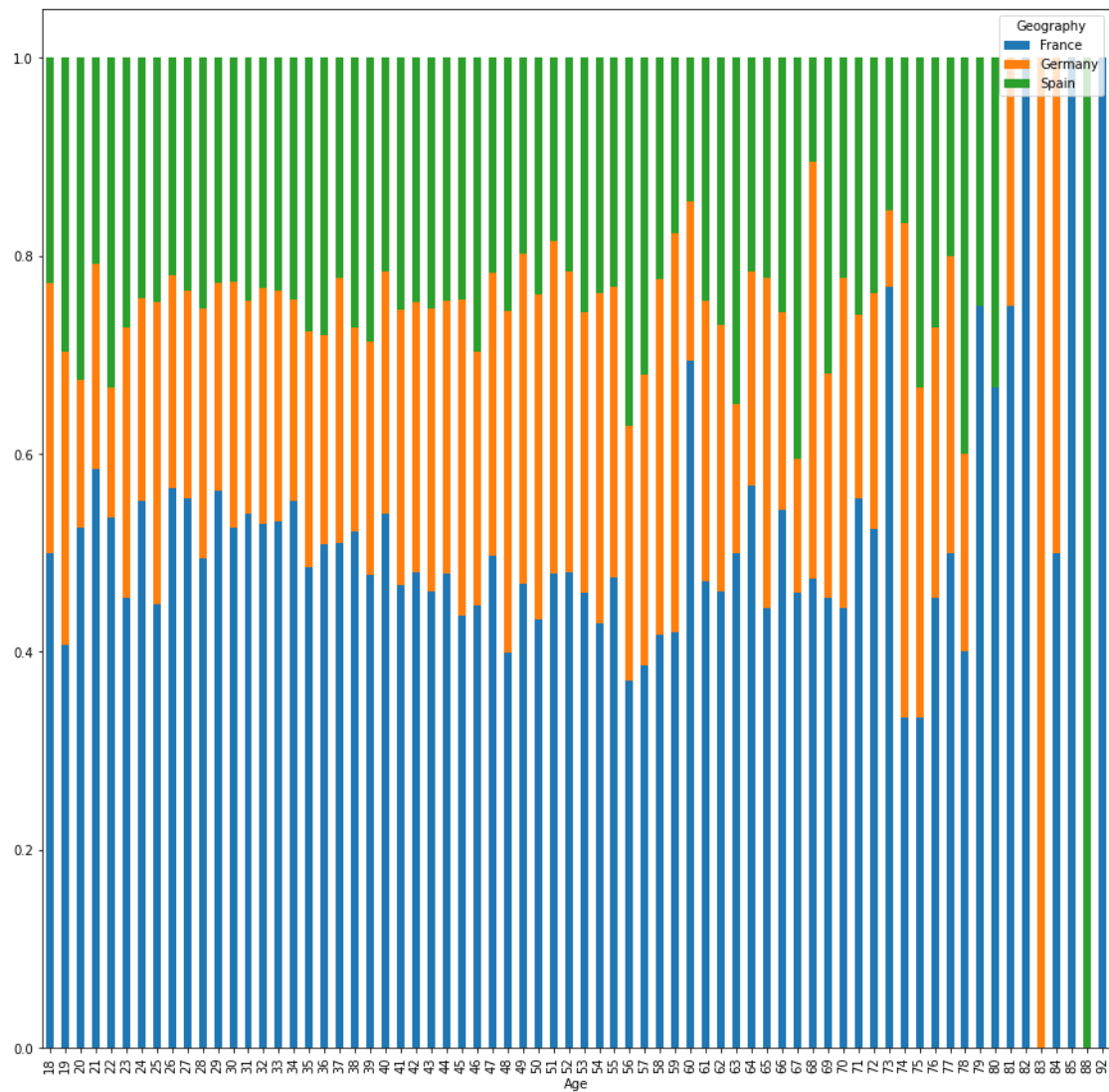


## Bi - Variate Analysis

*# 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>

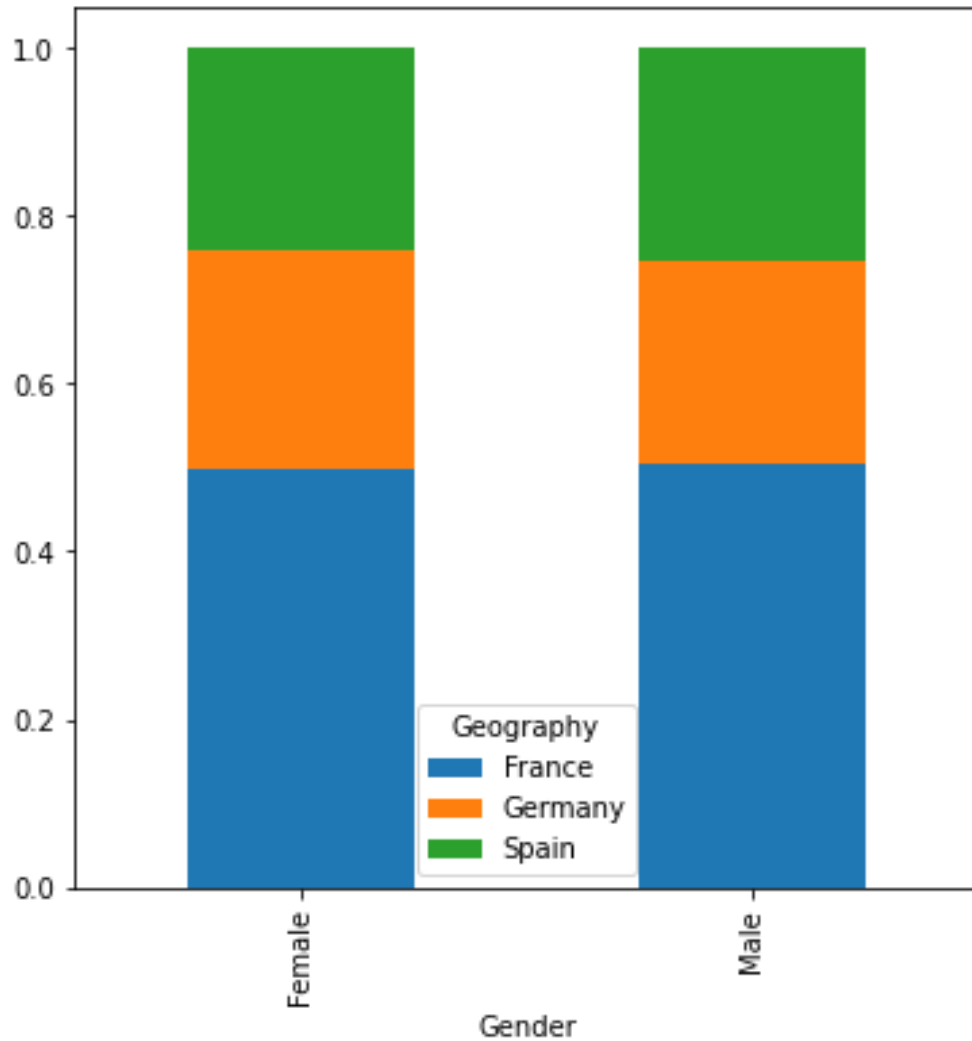


*# comparison between Geography and Gender*

```
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>

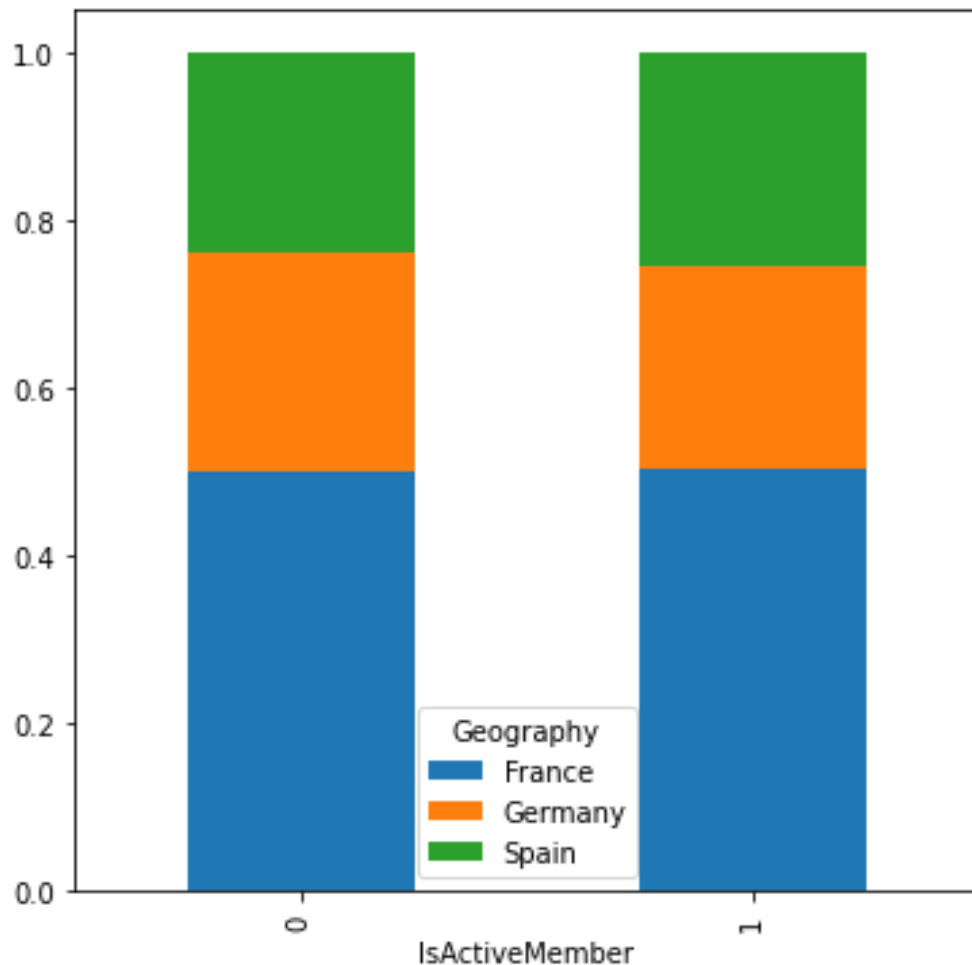




*# comparison of active member in differnt geographies*

```
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)
```

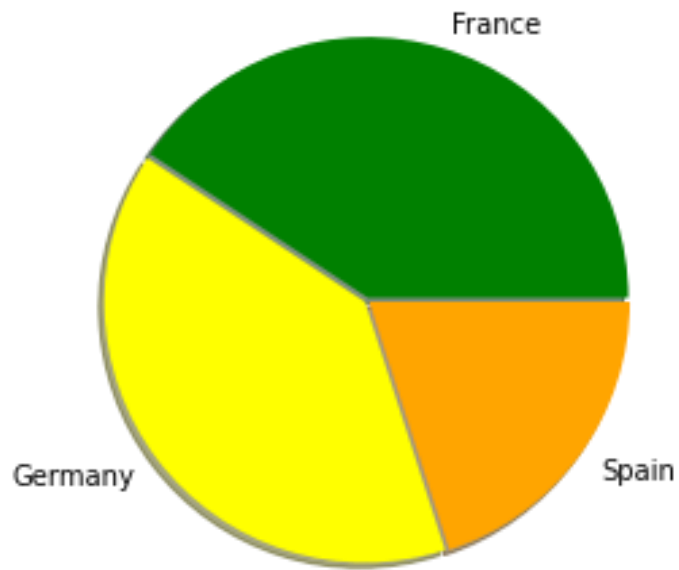
```
Total Balance in France :
311332479.49 Total Balance in
Germany : 300402861.38 Total
Balance in Spain : 153123552.01
```

```
# plotting a pie chart
```

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

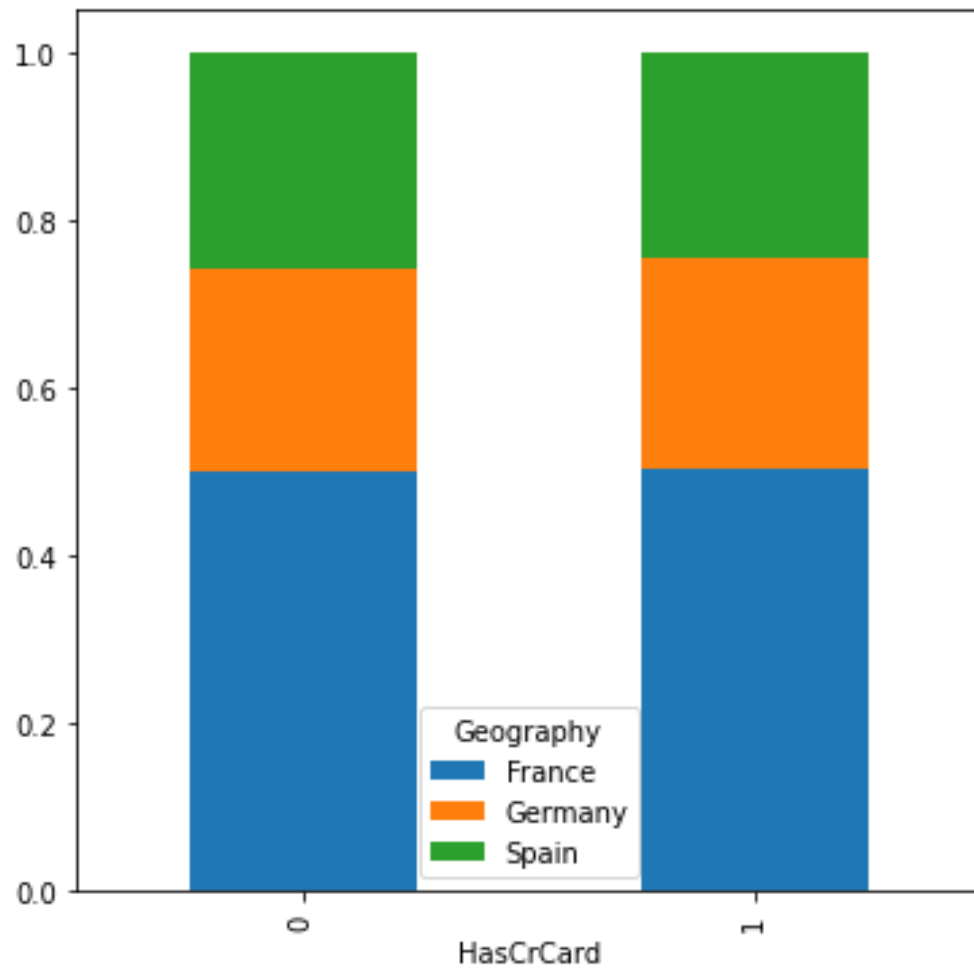
```
plt.pie(sizes, colors = colors, labels = labels, explode = explode,
shadow
= True)
```

```
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 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
```

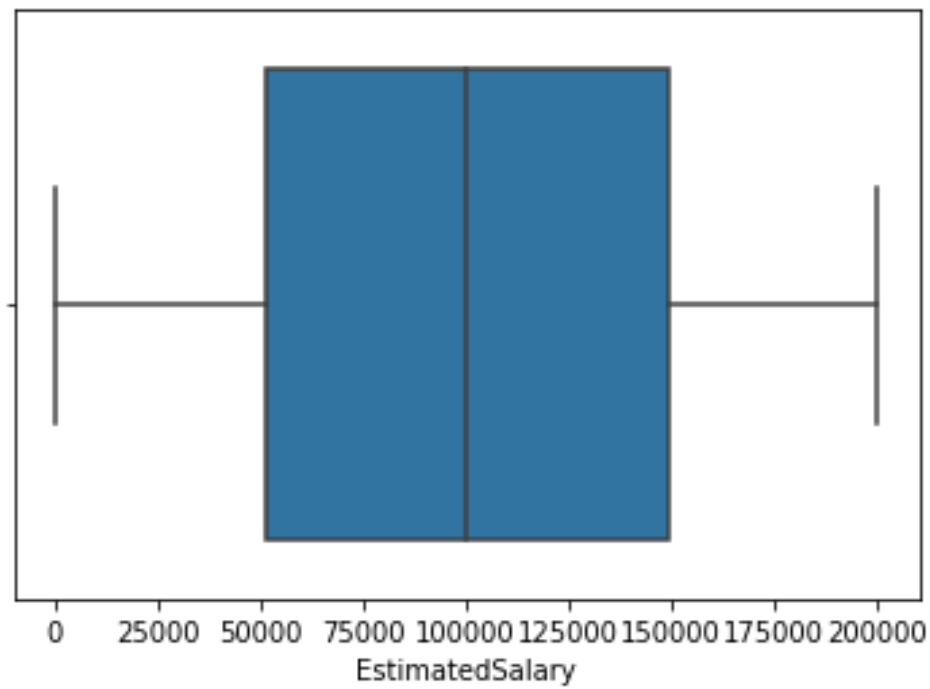
```
0
```

```
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

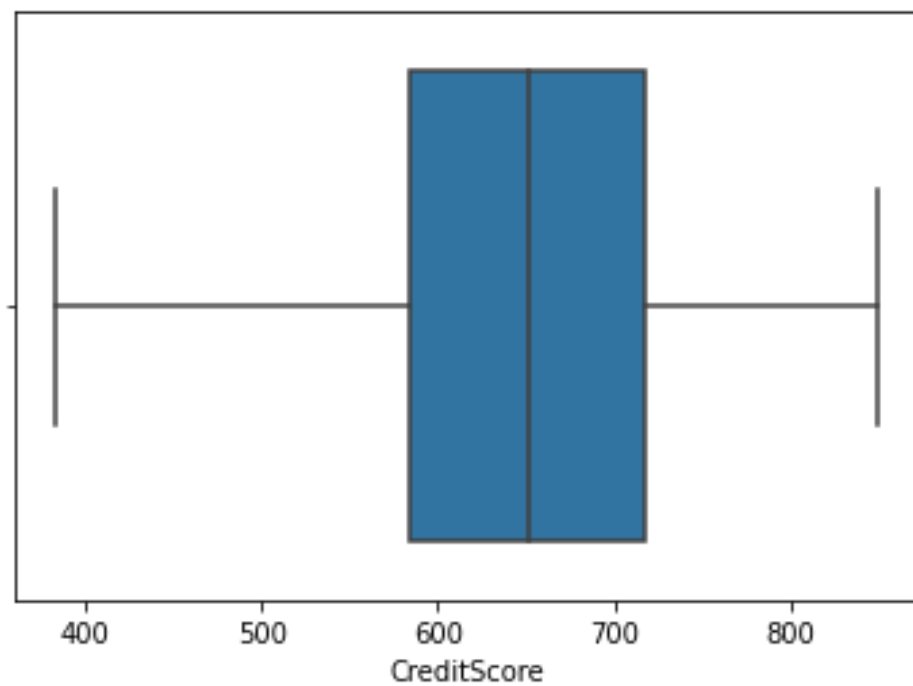
```
sns.boxplot(data = df, x = 'EstimatedSalary')
```

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



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

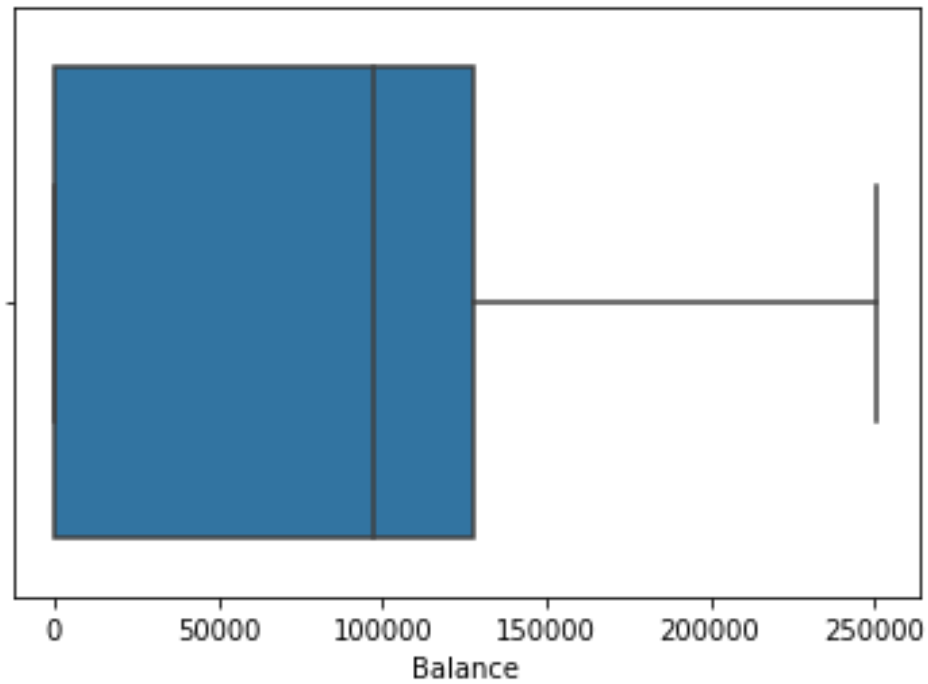
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa19f0c2410>
```



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

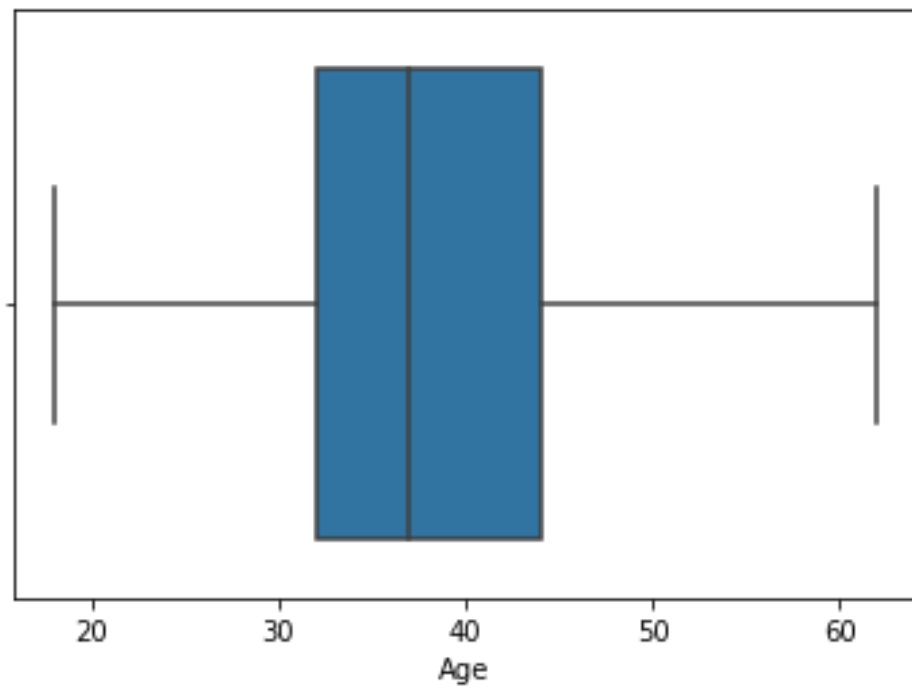
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa19f03d1d0>
```





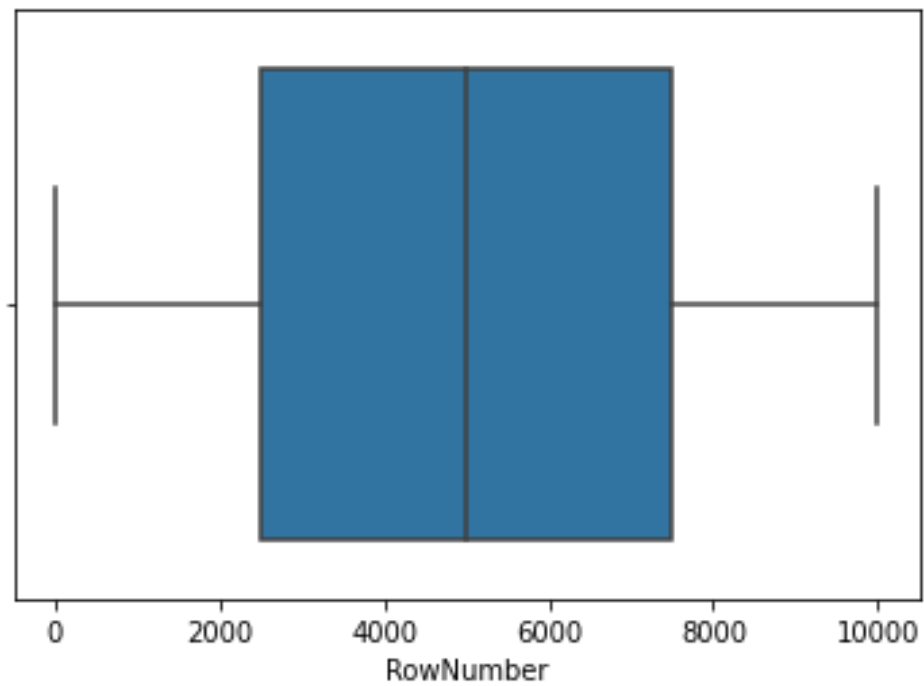
```
sns.boxplot(data = df, x = 'Age')
```

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

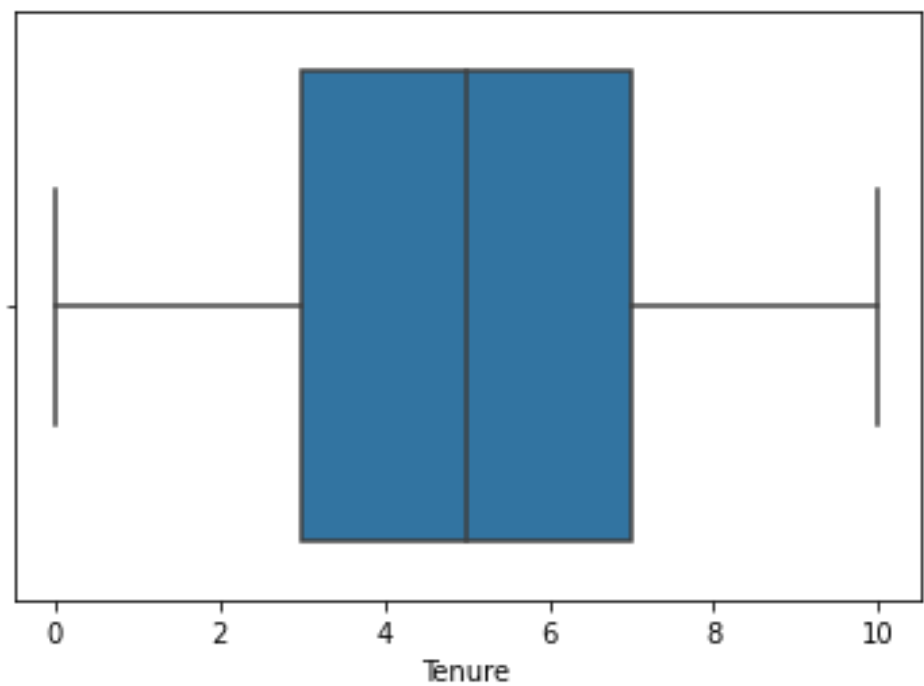


```
sns.boxplot(data = df, x = 'RowNumber')
```

```
<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_Abbot	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_Zuyeva	\
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	-	-	-	0.042283	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,)
```