

```

import pandas as pd
import numpy as np
from scipy import stats
import matplotlib.pyplot as plt
import seaborn as sns
import statsmodels.api as sm
from sklearn.model_selection import train_test_split

churn=pd.read_csv("E:/Churn_Modelling.csv")

churn.head(10)

```

	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
	5	6	15574012	Chu	645	Spain	Male	44
	6	7	15592531	Bartlett	822	France	Male	50
	7	8	15656148	Obinna	376	Germany	Female	29
	8	9	15792365	He	501	France	Male	44
	9	10	15592389	H?	684	France	Male	27

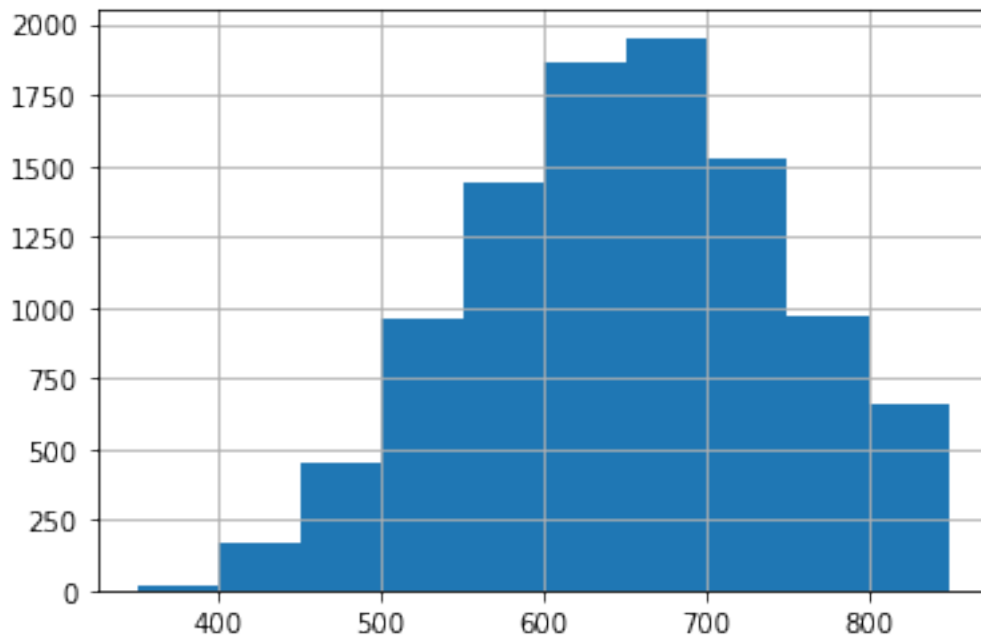
	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	\
0	2	0.00	1	1	1	
1	1	83807.86	1	0	1	
2	8	159660.80	3	1	0	
3	1	0.00	2	0	0	
4	2	125510.82	1	1	1	
5	8	113755.78	2	1	0	
6	7	0.00	2	1	1	
7	4	115046.74	4	1	0	
8	4	142051.07	2	0	1	
9	2	134603.88	1	1	1	

	EstimatedSalary	Exited
0	101348.88	1
1	112542.58	0

2	113931.57	1
3	93826.63	0
4	79084.10	0
5	149756.71	1
6	10062.80	0
7	119346.88	1
8	74940.50	0
9	71725.73	0

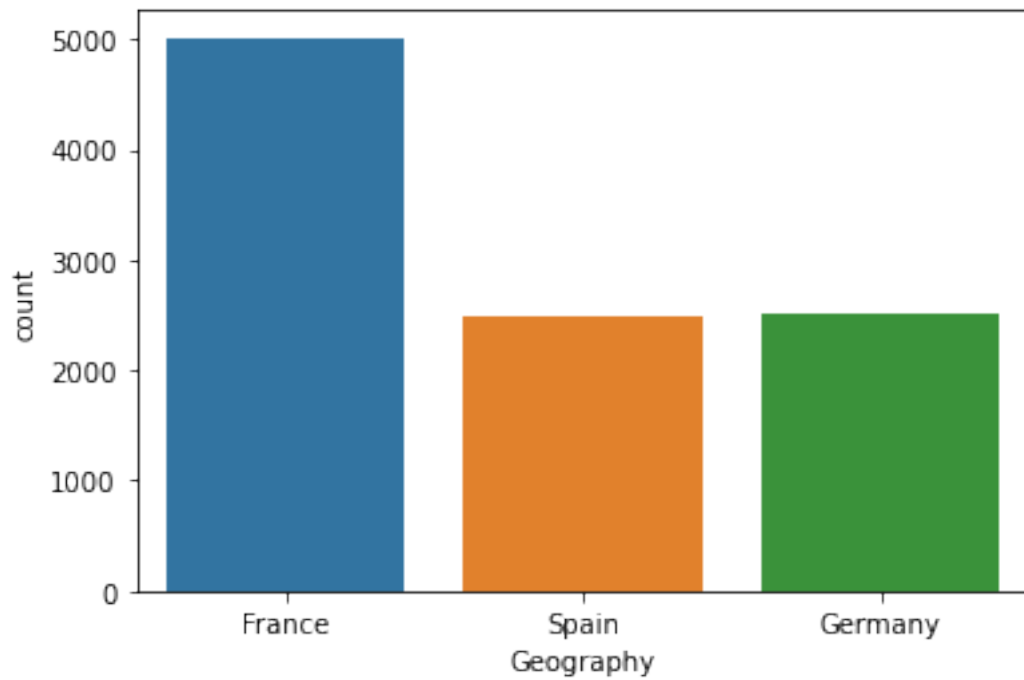
```
churn.CreditScore.hist()
```

```
<AxesSubplot:>
```



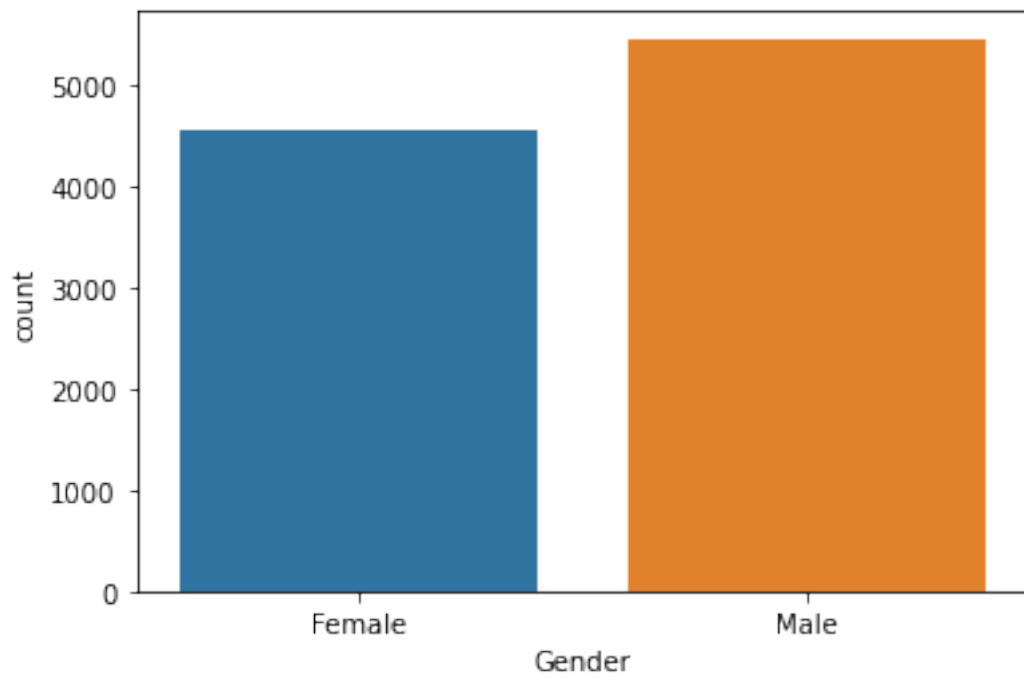
```
sns.countplot(x="Geography", data=churn)
```

```
<AxesSubplot:xlabel='Geography', ylabel='count'>
```



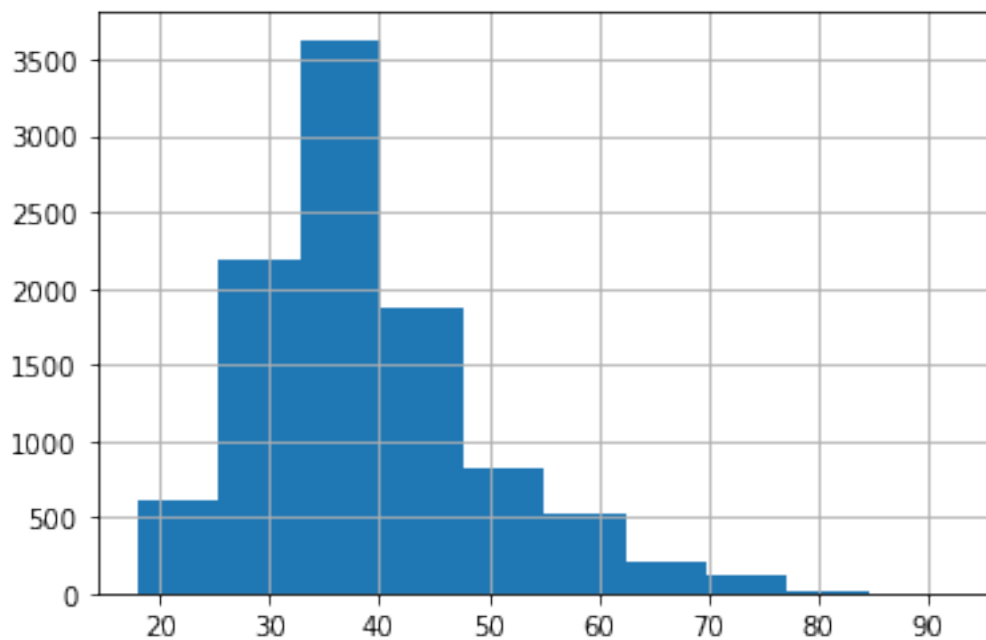
```
sns.countplot(x="Gender",data=churn)
```

```
<AxesSubplot:xlabel='Gender', ylabel='count'>
```

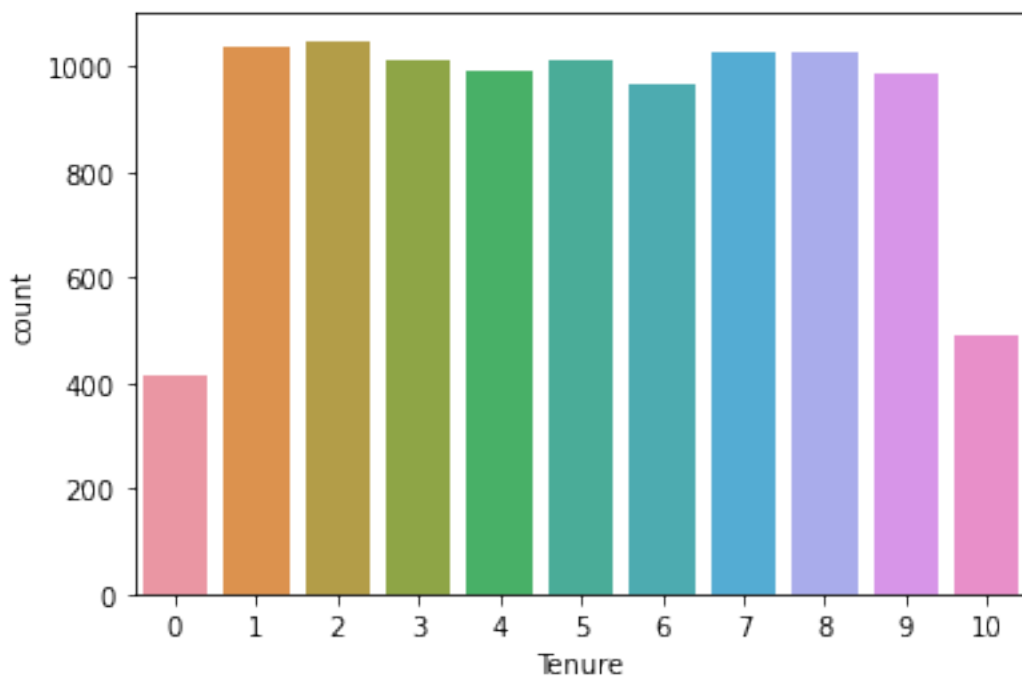


```
churn.Age.hist()
```

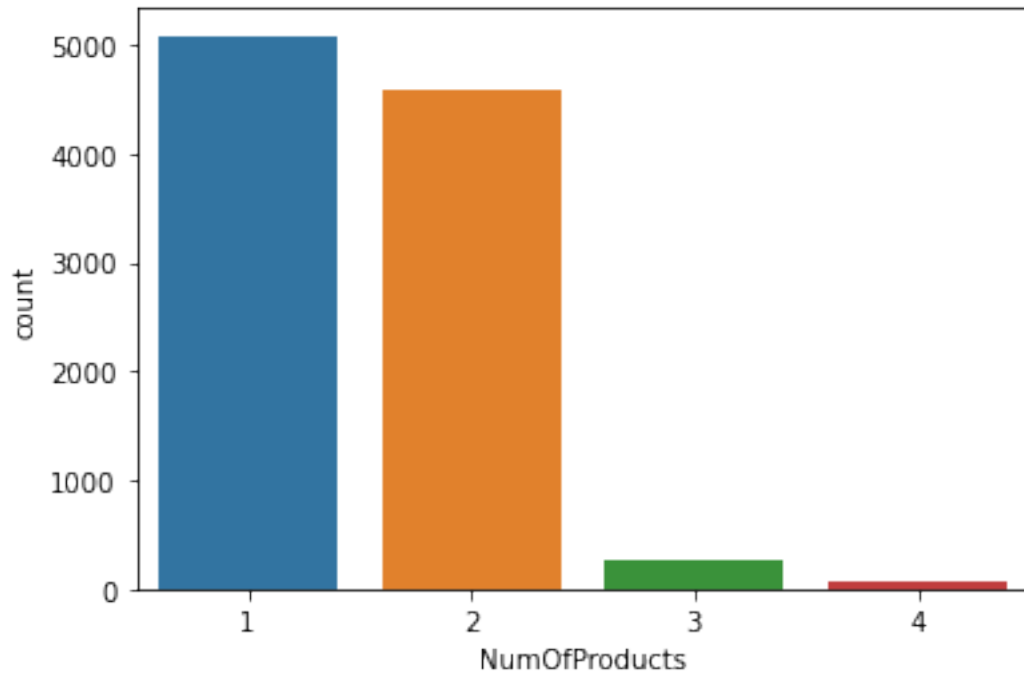
```
<AxesSubplot:>
```



```
sns.countplot(x="Tenure",data=churn)  
<AxesSubplot:xlabel='Tenure', ylabel='count'>
```

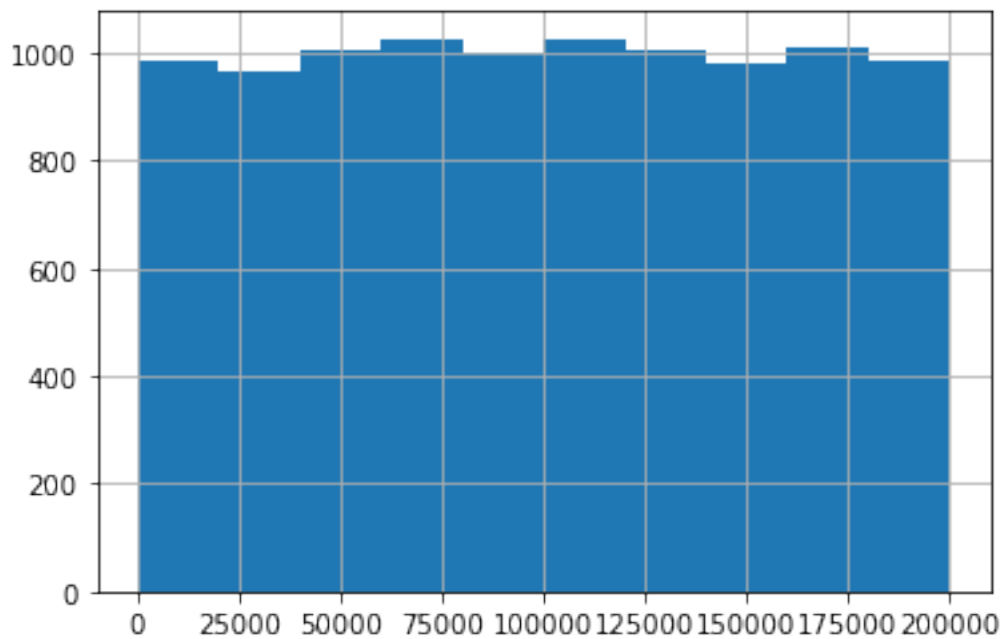


```
sns.countplot(x="NumOfProducts",data=churn)  
<AxesSubplot:xlabel='NumOfProducts', ylabel='count'>
```

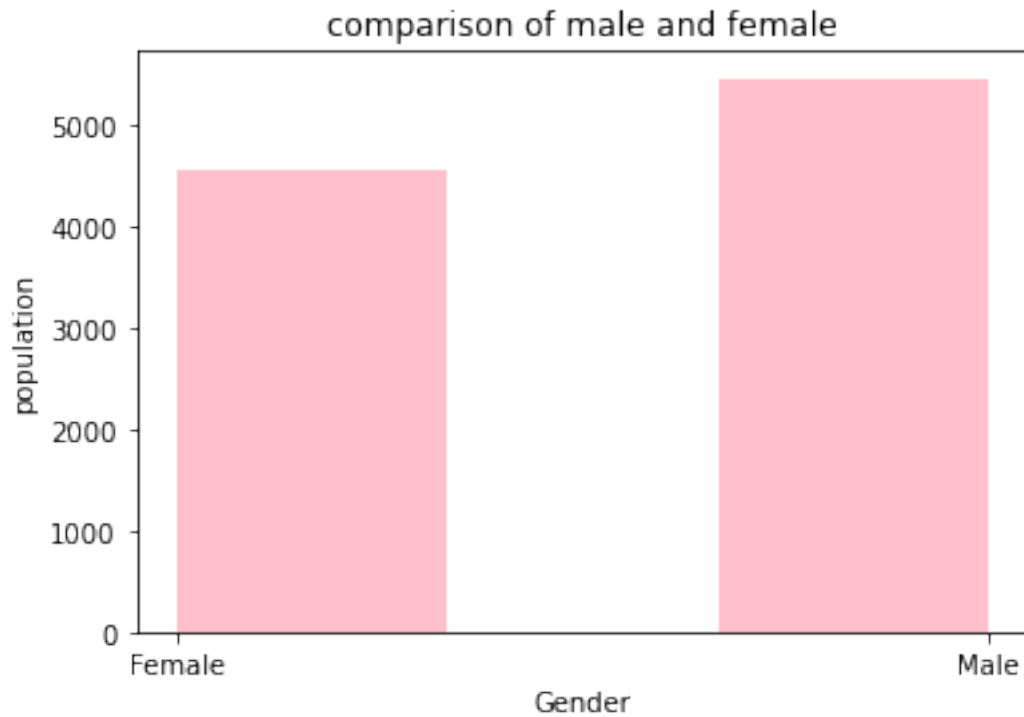


```
churn.EstimatedSalary.hist()
```

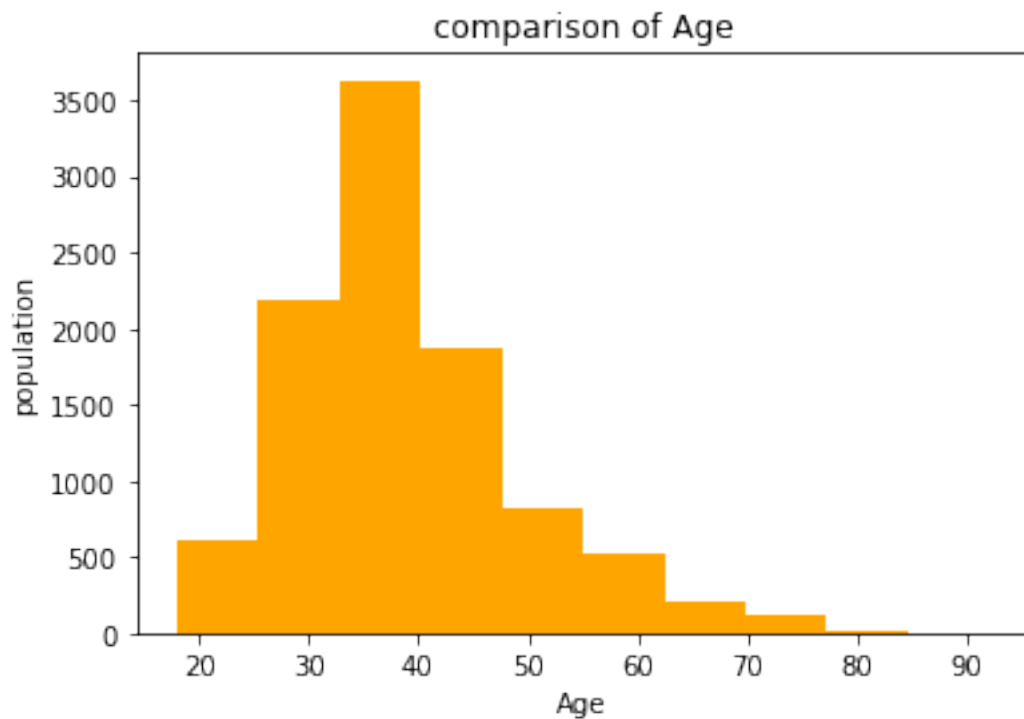
<AxesSubplot:>



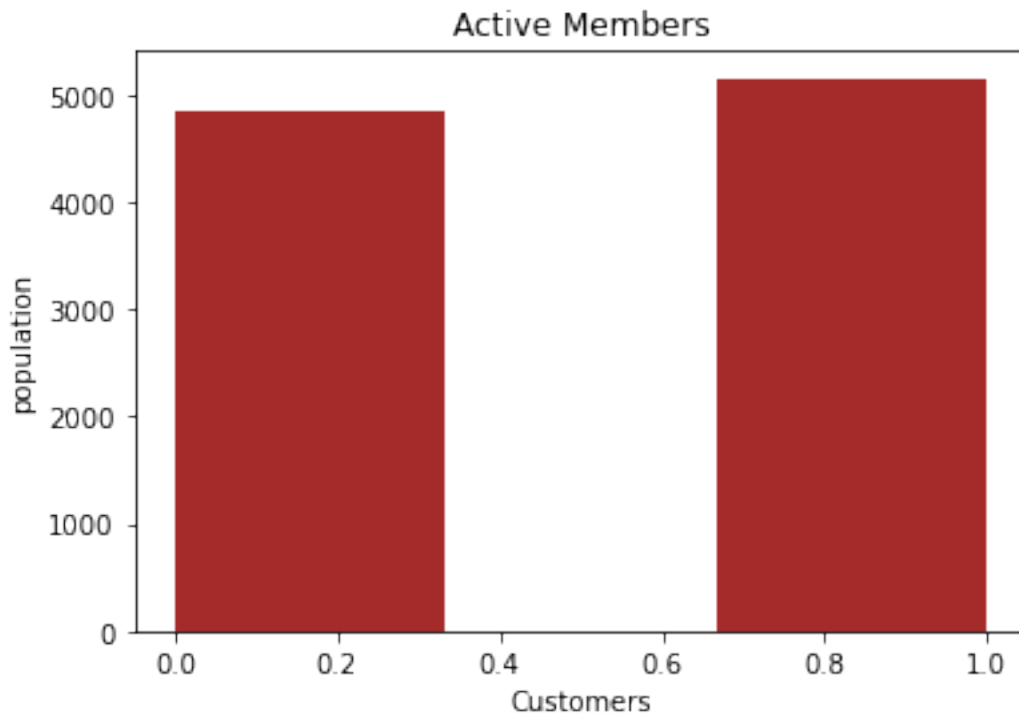
```
plt.hist(x = churn.Gender, bins = 3, color = 'pink')  
plt.title('comparison of male and female')  
plt.xlabel('Gender')  
plt.ylabel('population')  
plt.show()
```



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



```
plt.hist(x = churn.IsActiveMember, bins = 3, color = 'brown')
plt.title('Active Members')
plt.xlabel('Customers')
plt.ylabel('population')
plt.show()
```



```
churn.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
```

```
churn.CreditScore.describe()
```

```
count      10000.000000
mean        650.528800
std         96.653299
min         350.000000
25%         584.000000
50%         652.000000
75%         718.000000
max         850.000000
Name: CreditScore, dtype: float64
```

```
churn.Geography.describe()
```

```
count      10000
unique        3
top      France
freq       5014
Name: Geography, dtype: object
```

```
churn.Gender.describe()
```

```
count      10000
unique        2
top      Male
freq       5457
Name: Gender, dtype: object
```

```
churn.Age.describe()
```

```
count      10000.000000
mean        38.921800
std         10.487806
min         18.000000
25%         32.000000
50%         37.000000
75%         44.000000
max         92.000000
Name: Age, dtype: float64
```

```
churn.Tenure.describe()
```

```
count      10000.000000
mean         5.012800
std          2.892174
min          0.000000
25%          3.000000
50%          5.000000
75%          7.000000
```



```
max          10.000000
```

```
Name: Tenure, dtype: float64
```

```
churn.EstimatedSalary.describe()
```

```
count      10000.000000
```

```
mean       100090.239881
```

```
std        57510.492818
```

```
min         11.580000
```

```
25%        51002.110000
```

```
50%        100193.915000
```

```
75%        149388.247500
```

```
max        199992.480000
```

```
Name: EstimatedSalary, dtype: float64
```

```
churn.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
```

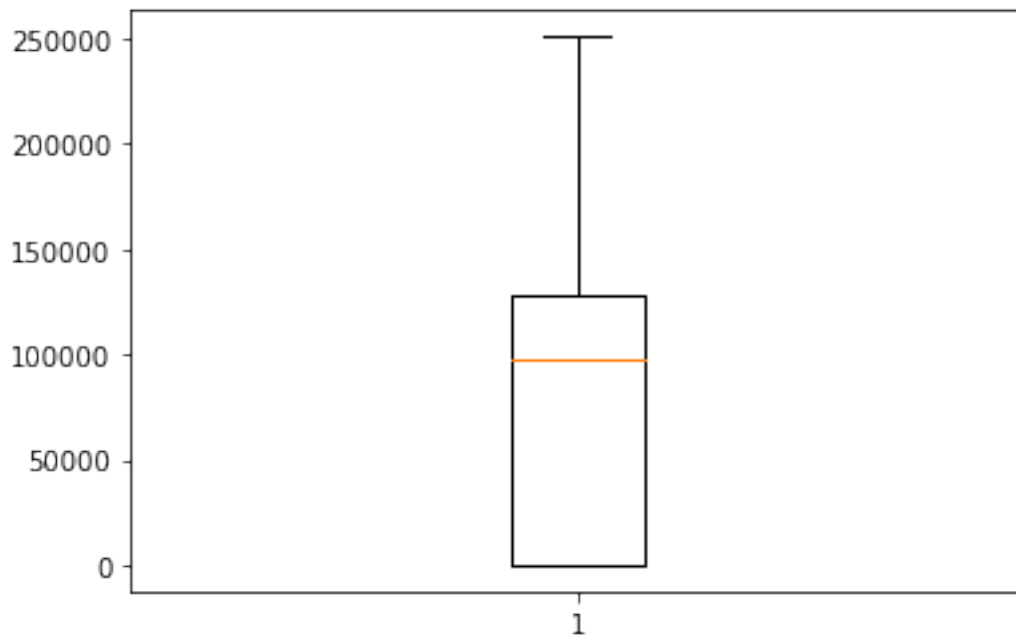
```
EstimatedSalary 0
```

```
Exited         0
```

```
dtype: int64
```

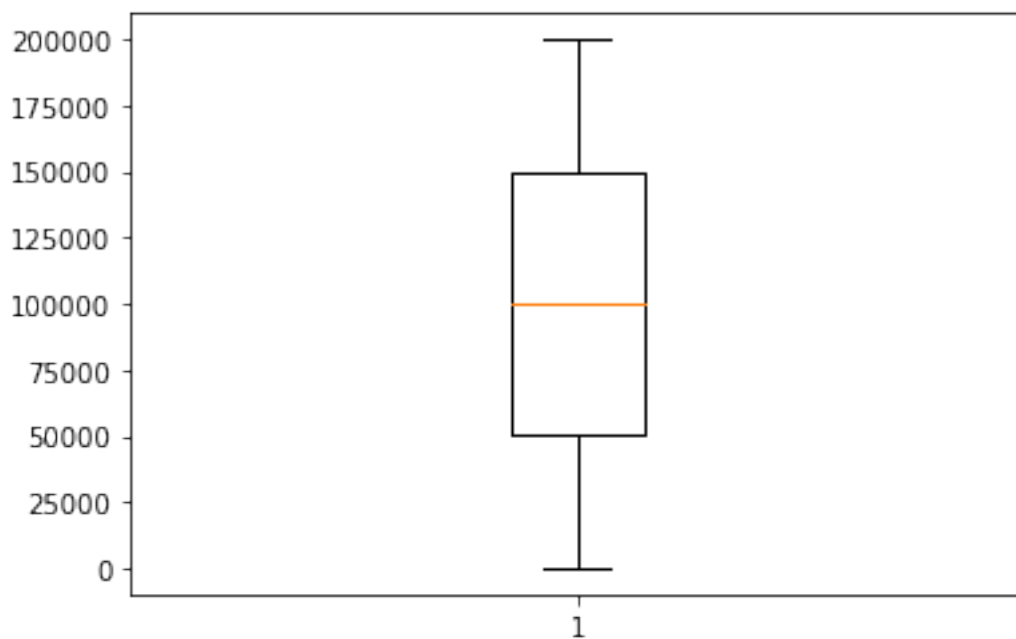
```
plt.boxplot(churn.Balance)
```

```
{'whiskers': [<matplotlib.lines.Line2D at 0x1c6e4427340>,  
             <matplotlib.lines.Line2D at 0x1c6e4427610>],  
 'caps': [<matplotlib.lines.Line2D at 0x1c6e44279a0>,  
         <matplotlib.lines.Line2D at 0x1c6e4427bb0>],  
 'boxes': [<matplotlib.lines.Line2D at 0x1c6e4427070>],  
 'medians': [<matplotlib.lines.Line2D at 0x1c6e4427e80>],  
 'fliers': [<matplotlib.lines.Line2D at 0x1c6e4439190>],  
 'means': []}
```



```
plt.boxplot(churn.EstimatedSalary)
```

```
{'whiskers': [<matplotlib.lines.Line2D at 0x1c6e4491670>,  
<matplotlib.lines.Line2D at 0x1c6e4491940>],  
'caps': [<matplotlib.lines.Line2D at 0x1c6e4491c10>,  
<matplotlib.lines.Line2D at 0x1c6e4491ee0>],  
'boxes': [<matplotlib.lines.Line2D at 0x1c6e4491370>],  
'medians': [<matplotlib.lines.Line2D at 0x1c6e449b1f0>],  
'fliers': [<matplotlib.lines.Line2D at 0x1c6e449b4c0>],  
'means': []}
```



```

from sklearn import preprocessing
label_encoder = preprocessing.LabelEncoder()
churn['Geography']= label_encoder.fit_transform(churn['Geography'])
churn['Gender']= label_encoder.fit_transform(churn['Gender'])

churn = churn.drop(['CustomerId', 'Surname', 'RowNumber'], axis = 1)

y=churn.Exited
churn.drop(['Exited'], axis = 1,inplace=True)
x=churn

from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler().fit(x)
scaled_data=scaler.transform(x)

x= pd.DataFrame(scaled_data)

x_train,x_test,y_train,y_test= train_test_split(x,y,train_size = 0.8,
test_size = 0.2,random_state =42)

x_train.head(5)

```

	0	1	2	3	4	5	6	7	8
9254	0.672	0.0	1.0	0.189189	0.6	0.000000	0.333333	1.0	1.0
1561	0.564	0.5	1.0	0.324324	0.4	0.476786	0.333333	1.0	1.0
1670	0.418	1.0	1.0	0.081081	0.3	0.457317	0.000000	1.0	0.0
6087	0.422	0.0	0.0	0.121622	0.9	0.540606	0.000000	1.0	0.0
6669	0.334	0.0	1.0	0.513514	0.9	0.566554	0.000000	0.0	0.0

```

y_train.head(5)

```

9254	0
1561	0
1670	1
6087	1
6669	1

Name: Exited, dtype: int64

```

x_test.head(5)

```

	0	1	2	3	4	5	6	7	8
6252	0.492	0.5	1.0	0.189189	0.3	0.385452	0.333333	0.0	0.0
4684	0.546	0.0	1.0	0.337838	0.1	0.000000	0.333333	1.0	1.0
1731	0.502	1.0	0.0	0.351351	0.4	0.000000	0.333333	1.0	0.0

```
0.292777
4742  0.312  0.5  1.0  0.554054  0.8  0.474902  0.333333  1.0  1.0
0.853422
4521  0.420  1.0  0.0  0.121622  0.7  0.498194  0.000000  1.0  1.0
0.573346
```

```
y_test.head(5)
```

```
6252    0
4684    0
1731    0
4742    0
4521    0
Name: Exited, dtype: int64
```