Assignment -2

Python Programming

Question-1: Download the dataset: Dataset **Solution:**

Downloaded successfully

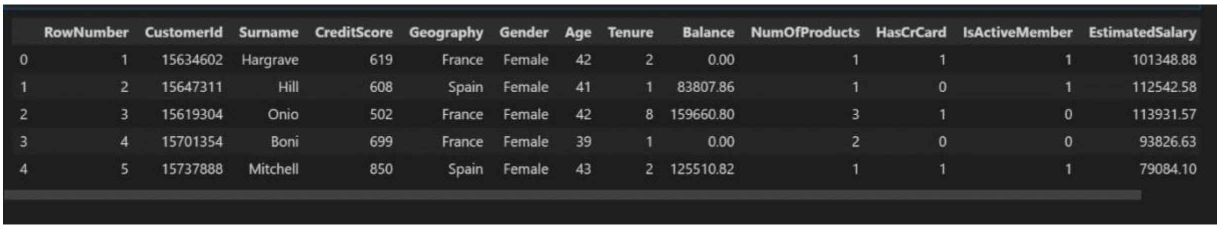
Question-2:

Load the dataset.

Solution:

```
import pandas as pd
importnumpyas np
```

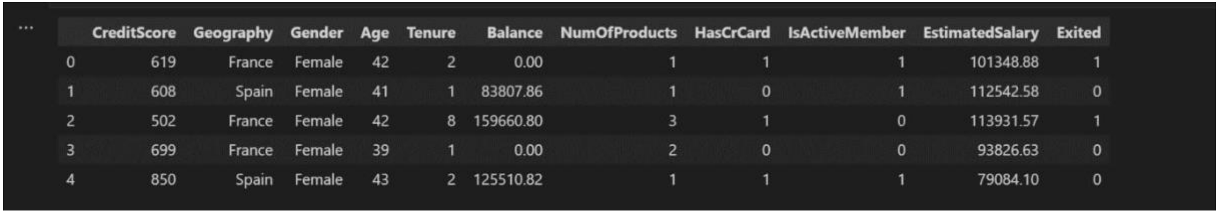
```
file=pd.read_csv("/content/Churn_Modelling (1).csv")
df=pd.DataFrame(file) df.head()
```



```
   RowNumber  CustomerId  Surname  CreditScore  Geography  Gender  Age  Tenure    Balance  NumOfProducts  HasCrCard  IsActiveMember  EstimatedSalary
0          1    15634602  Hargrave         619     France  Female   42       2       0.00              1          1               1        101348.88
1          2    15647311      Hill         608      Spain  Female   41       1   83807.86              1          0               1        112542.58
2          3    15619304      Onio         502     France  Female   42       8  159660.80              3          1               0        113931.57
3          4    15701354      Boni         699     France  Female   39       1       0.00              2          0               0         93826.63
4          5    15737888  Mitchell         850      Spain  Female   43       2  125510.82              1          1               1         79084.10
```

```
df['HasCrCard'] = df['HasCrCard'].astype('category')

df['IsActiveMember'] = df['IsActiveMember'].astype('category')
df['Exited'] = df['Exited'].astype('category')

df = df.drop(columns=['RowNumber', 'CustomerId', 'Surname'])
```

```
df.head()
```



```
...
   CreditScore  Geography  Gender  Age  Tenure    Balance  NumOfProducts  HasCrCard  IsActiveMember  EstimatedSalary  Exited
0          619     France  Female   42       2       0.00              1          1               1        101348.88       1
1          608      Spain  Female   41       1   83807.86              1          0               1        112542.58       0
2          502     France  Female   42       8  159660.80              3          1               0        113931.57       1
3          699     France  Female   39       1       0.00              2          0               0         93826.63       0
4          850      Spain  Female   43       2  125510.82              1          1               1         79084.10       0
```

Question 3:

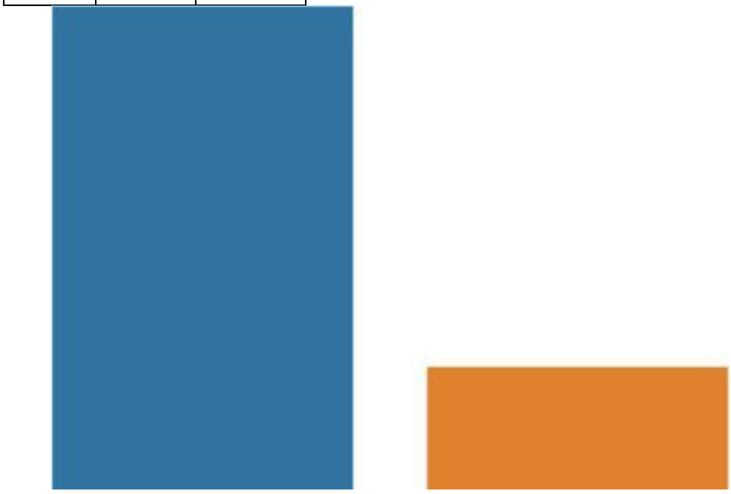
Perform Below Visualizations:

Univariate Analysis, Bi - Variate Analysis, Multi - Variate Analysis

Solution:

```
import seaborn assns
density = df['Exited'].value_counts(normalize=True).reset_index()
sns.barplot(data=density, x='index', y='Exited', ); density
```

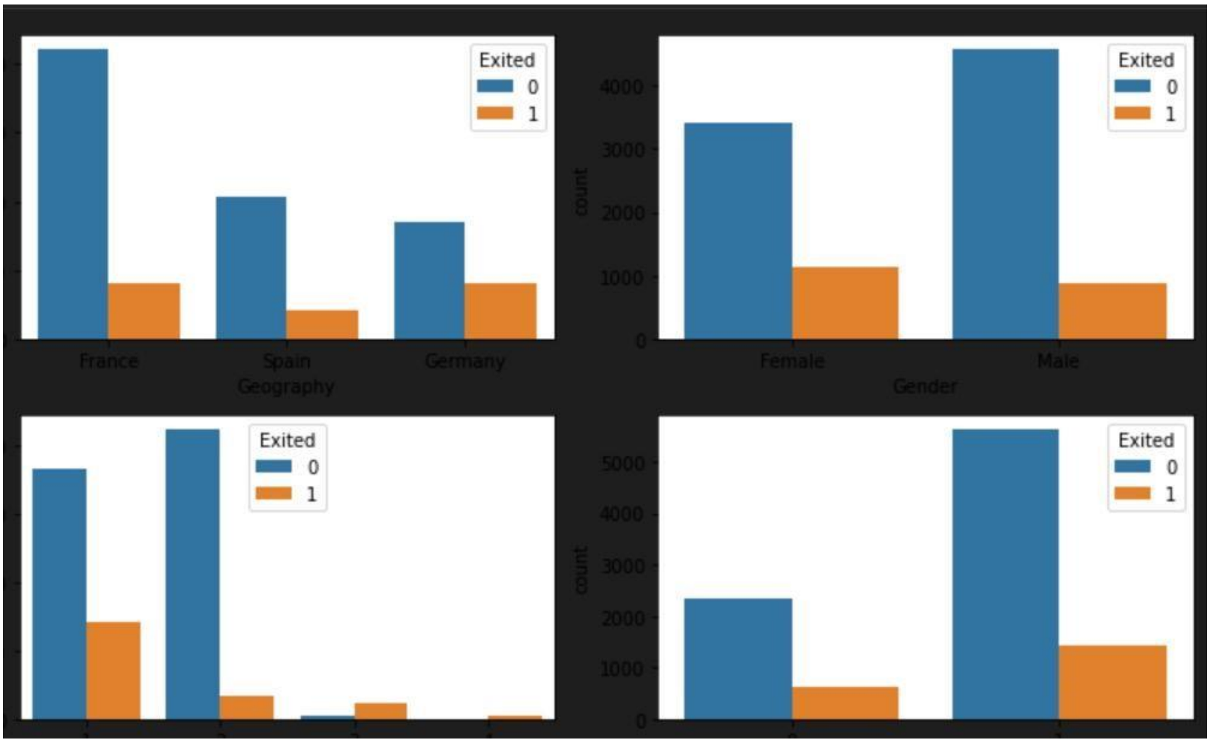
	index	Exited
0	0	0.7963
1	1	0.2037



The data is significantly imbalanced

```
importmatplotlib.pyplotasplt

categorical = df.drop(columns=['CreditScore', 'Age', 'Tenure', 'Balance', 'EstimatedSalary'])
rows = int(np.ceil(categorical.shape[1] / 2)) - 1
```

```
# create sub-plots anf title them
fig, axes = plt.subplots(nrows=rows, ncols=2, figsize=(10,6))
axes = axes.flatten()

for row inrange(rows): cols = min(2,
    categorical.shape[1] - row*2) for col
    inrange(cols):
        col_name = categorical.columns[2 * row + col] ax = axes[row*2 +
col] sns.countplot(data=categorical, x=col_name, hue="Exited", ax=ax);
plt.tight_layout()
```

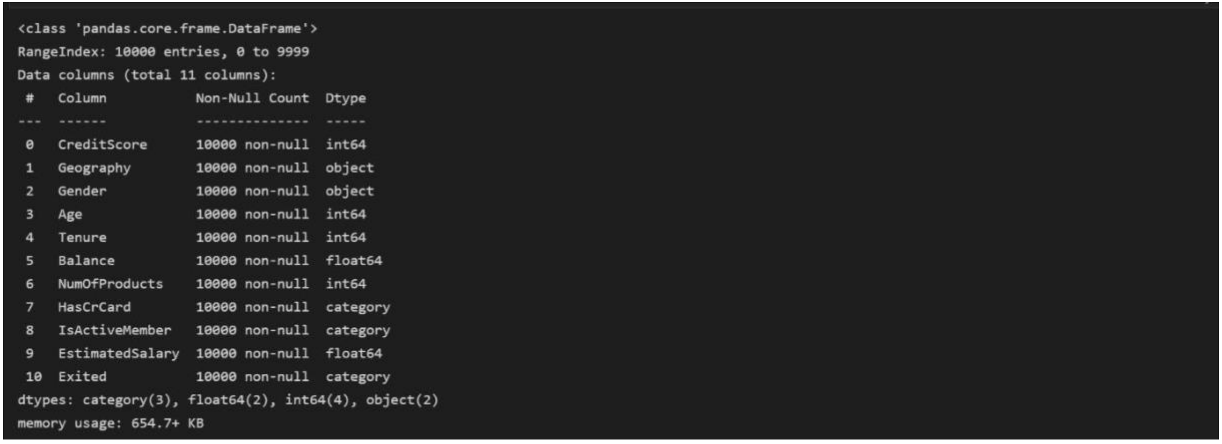


Question 4:

Perform descriptive statistics on the dataset.

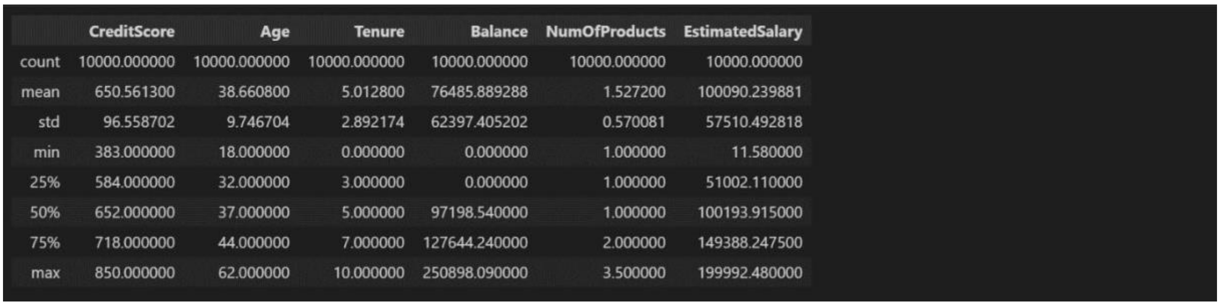
Solution:

```
df.info()
```



```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 11 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   CreditScore      10000 non-null  int64
 1   Geography        10000 non-null  object
 2   Gender           10000 non-null  object
 3   Age              10000 non-null  int64
 4   Tenure           10000 non-null  int64
 5   Balance          10000 non-null  float64
 6   NumOfProducts    10000 non-null  int64
 7   HasCrCard        10000 non-null  category
 8   IsActiveMember   10000 non-null  category
 9   EstimatedSalary  10000 non-null  float64
 10  Exited           10000 non-null  category
dtypes: category(3), float64(2), int64(4), object(2)
memory usage: 654.7+ KB
```

```
df.describe()
```



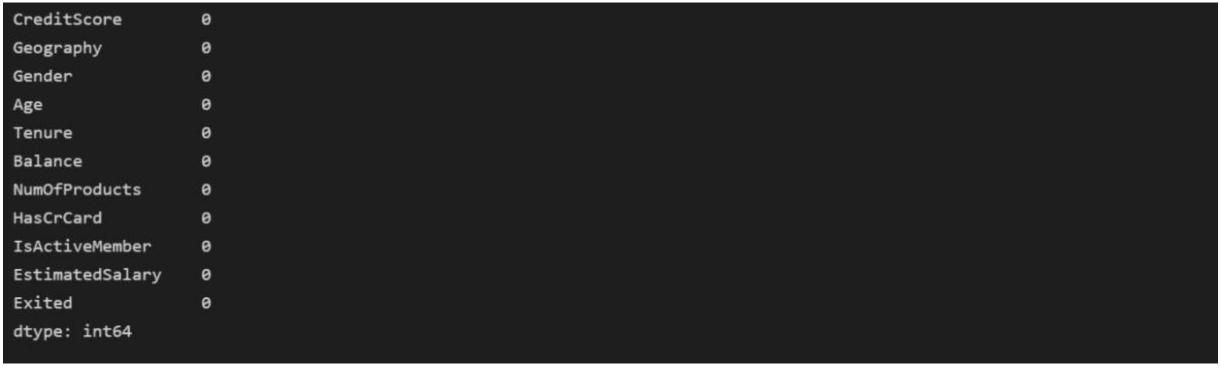
	CreditScore	Age	Tenure	Balance	NumOfProducts	EstimatedSalary
count	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000
mean	650.561300	38.660800	5.012800	76485.889288	1.527200	100090.239881
std	96.558702	9.746704	2.892174	62397.405202	0.570081	57510.492818
min	383.000000	18.000000	0.000000	0.000000	1.000000	11.580000
25%	584.000000	32.000000	3.000000	0.000000	1.000000	51002.110000
50%	652.000000	37.000000	5.000000	97198.540000	1.000000	100193.915000
75%	718.000000	44.000000	7.000000	127644.240000	2.000000	149388.247500
max	850.000000	62.000000	10.000000	250898.090000	3.500000	199992.480000

Question 5:

Handle the Missing values.

Solution:

```
df.isna().sum()
```



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

There is no missing values in dataset

```
foriindf:
    ifdf[i].dtype=='object'ordf[i].dtype=='category':
        print("unique of "+i+" is "+str(len(set(df[i])))+" they are "+str(set(df[i])))
```

unique of Geography is 3 they are {‘France’,’Germany’,’Spain’}
unique of Gender is 2 they are {‘Male’,’Female’} unique of Has
CrCard is 2 they are {0,1} unique of Is Active Member is 2 they
are {0,1} unique of Exited is 2 they are {0,1}

Question 6:

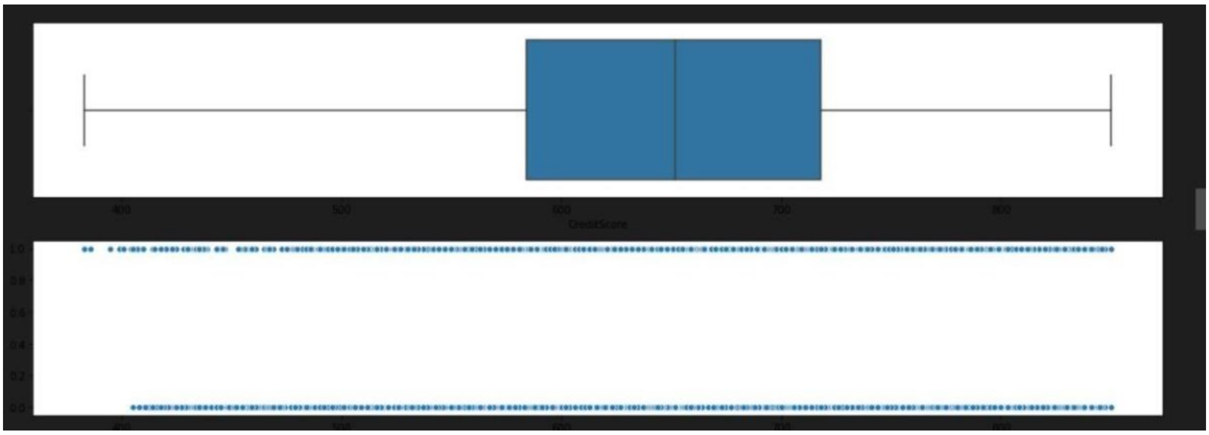
Find the outliers and replace the outliers.

Solution:

Checking for outliers

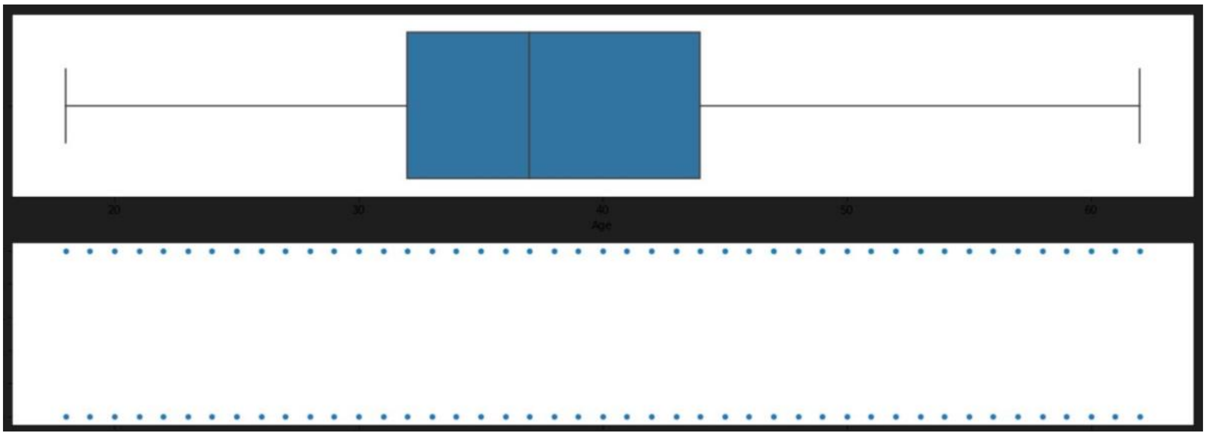
```
defbox_scatter(data, x, y):
    fig, (ax1, ax2) = plt.subplots(nrows=2, ncols=1, figsize=(16,6)) sns.boxplot(data=data, x=x, ax=ax1)
    sns.scatterplot(data=data, x=x,y=y,ax=ax2)


box_scatter(df,'CreditScore','Exited');
plt.tight_layout()
print(f"# of Bivariate Outliers: {len(df.loc[df['CreditScore'] <400])}")
```

```
# of bivariate Outliers:19
```



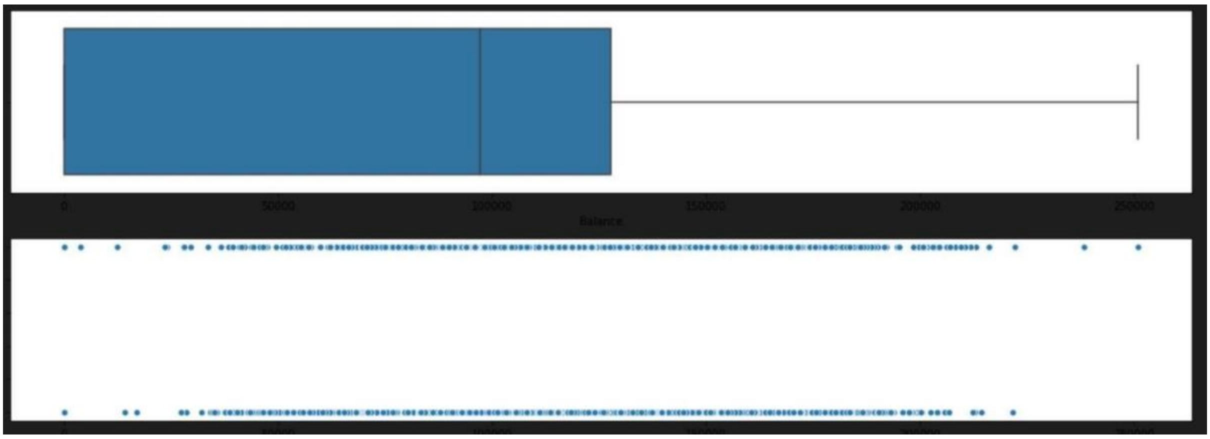
```
box_scatter(df,'Age','Exited');
plt.tight_layout()
print(f"# of Bivariate Outliers: {len(df.loc[df['Age'] >87])}")
```

```
# of bivariate Outliers:0
```

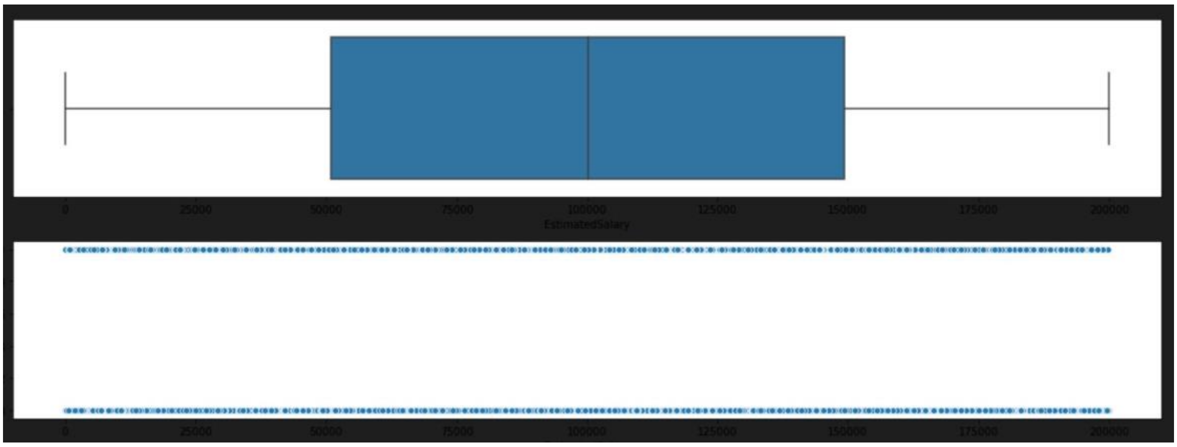


```
box_scatter(df,'Balance','Exited');
plt.tight_layout()
print(f"# of Bivariate Outliers: {len(df.loc[df['Balance'] >220000])}")
```

# of bivariate Outliers:4



```
box_scatter(df,'EstimatedSalary','Exited');
plt.tight_layout()
```



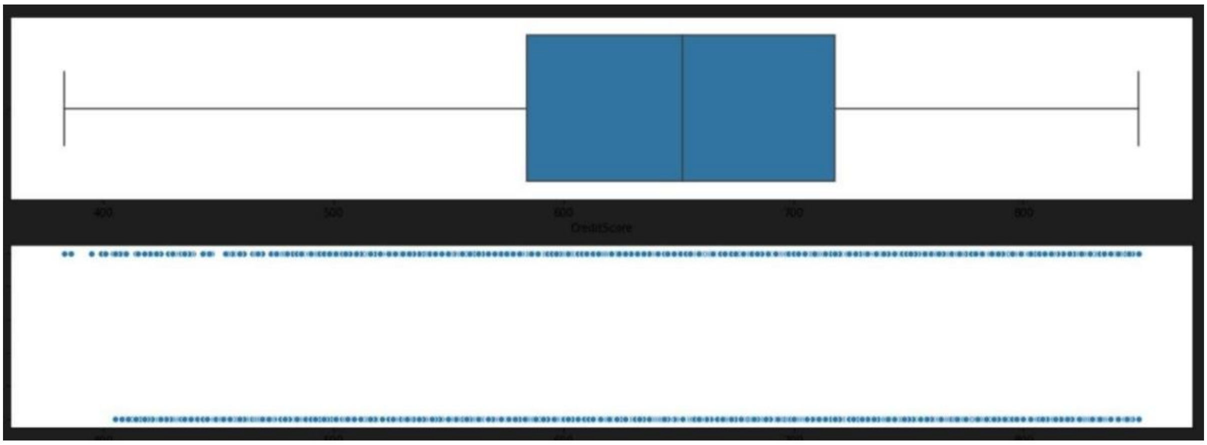
Removing Outliers

```
foriindf:
    ifdf[i].dtype=='int64'ordf[i].dtypes=='float64':
        q1=df[i].quantile(0.25)
        q3=df[i].quantile(0.75)
        iqr=q3-q1   upper=q3+1.5*iqr   lower=q1-
        1.5*iqr      df[i]=np.where(df[i]      >upper,
        upper, df[i]) df[i]=np.where(df[i] <lower,
        lower, df[i])
```

After removing outliers,boxplot will be like

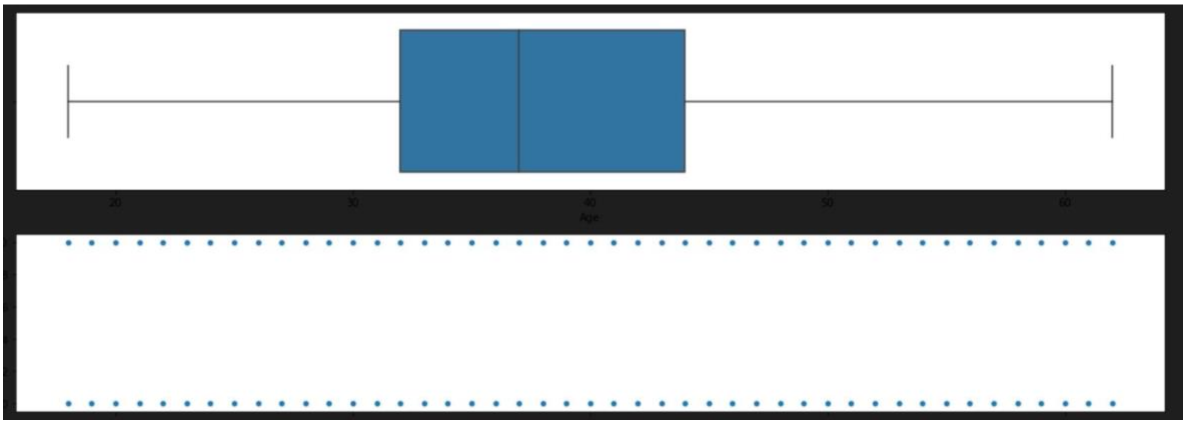
```
box_scatter(df,'CreditScore','Exited');
plt.tight_layout()
print(f"# of Bivariate Outliers: {len(df.loc[df['CreditScore'] <400])}")
```

```
# of bivariate Outliers:19
```



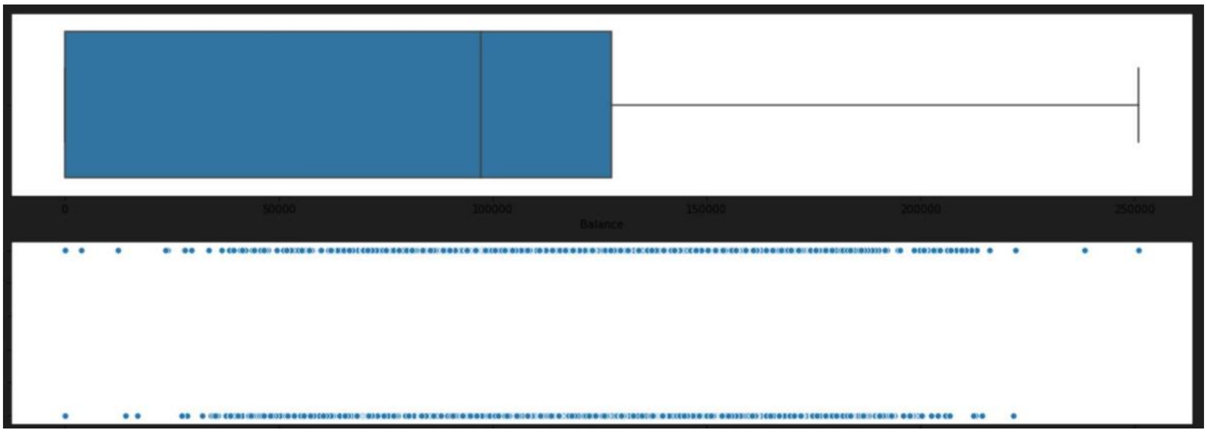
```
box_scatter(df,'Age','Exited');
plt.tight_layout()
print(f"# of Bivariate Outliers: {len(df.loc[df['Age'] >87])}")
```

```
# of bivariate Outliers:0
```



```
box_scatter(df,'Balance','Exited');
plt.tight_layout()
print(f"# of Bivariate Outliers: {len(df.loc[df['Balance'] >220000])}")
```

```
# of bivariate Outliers:4
```



Question 7:

Check for Categorical columns and perform encoding.

Solution:

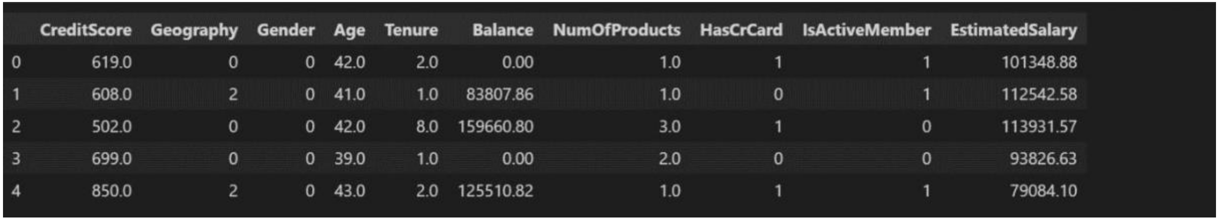
```
fromsklearn.preprocessingimportLabelEncoder
encoder=LabelEncoder() foriindf:
   ifdf[i].dtype=='object'ordf[i].dtype=='category':
      df[i]=encoder.fit_transform(df[i])
```

Question 8:

Split the data into dependent and independent variables.

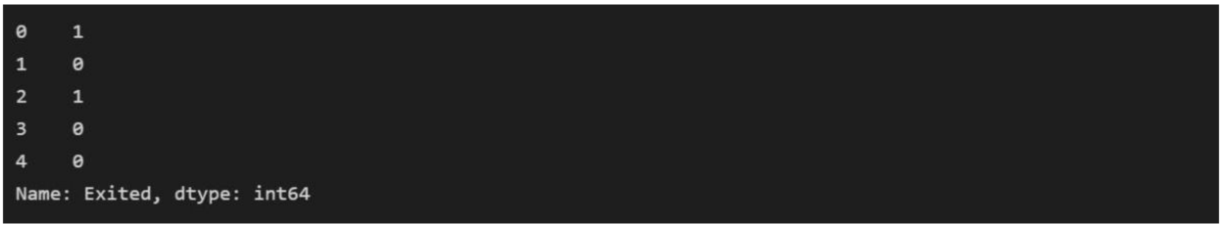
Solution:

```
x=df.iloc[:,:-1]
x.head()
```



	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary
0	619.0	0	0	42.0	2.0	0.00	1.0	1	1	101348.88
1	608.0	2	0	41.0	1.0	83807.86	1.0	0	1	112542.58
2	502.0	0	0	42.0	8.0	159660.80	3.0	1	0	113931.57
3	699.0	0	0	39.0	1.0	0.00	2.0	0	0	93826.63
4	850.0	2	0	43.0	2.0	125510.82	1.0	1	1	79084.10

```
y=df.iloc[:,-1]
y.head()
```



```
0    1
1    0
2    1
3    0
4    0
Name: Exited, dtype: int64
```

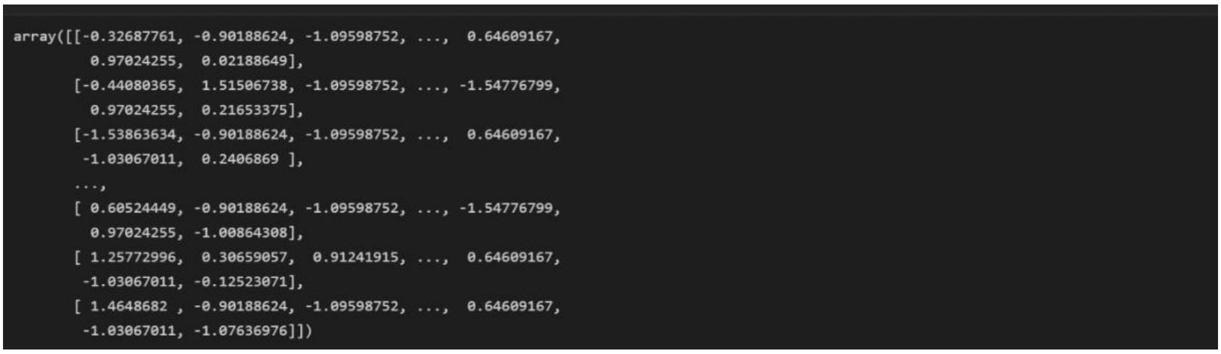
Question 9: Scale the

independent variables

Solution:

```
fromsklearn.preprocessingimportStandardScaler
scaler=StandardScaler()
x=scaler.fit_transform(x)
```

```
x
```



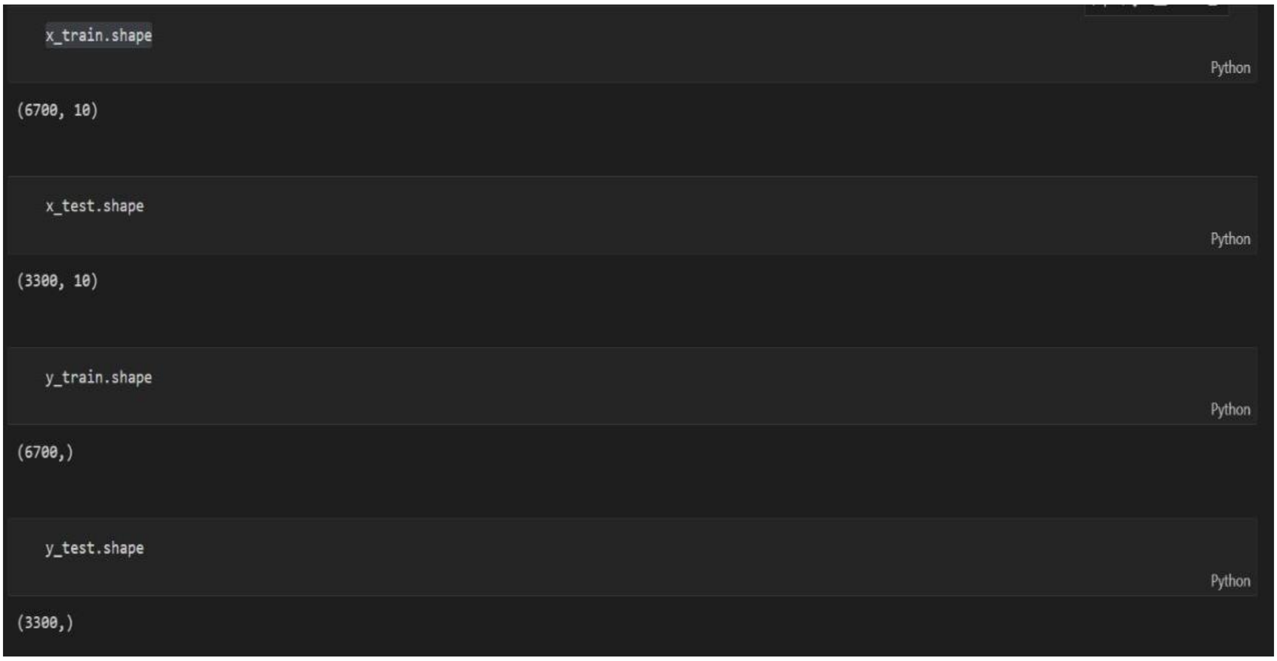
```
array([[-0.32687761, -0.90188624, -1.09598752, ...,  0.64609167,
         0.97024255,  0.02188649],
       [-0.44080365,  1.51506738, -1.09598752, ..., -1.54776799,
         0.97024255,  0.21653375],
       [-1.53863634, -0.90188624, -1.09598752, ...,  0.64609167,
        -1.03067011,  0.2406869 ],
       ...,
       [ 0.60524449, -0.90188624, -1.09598752, ..., -1.54776799,
         0.97024255, -1.00864308],
       [ 1.25772996,  0.30659057,  0.91241915, ...,  0.64609167,
        -1.03067011, -0.12523071],
       [ 1.4648682 , -0.90188624, -1.09598752, ...,  0.64609167,
        -1.03067011, -1.07636976]])
```

Question 10:

Split the data into training and testing

Solution:

```
fromsklearn.model_selectionimporttrain_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.33)
```



```
x_train.shape
```

```
(6700, 10)
```

```
x_test.shape
```

```
(3300, 10)
```

```
y_train.shape
```

```
(6700,)
```

```
y_test.shape
```

```
(3300,)
```