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

Assignment -2

Python Programming

Assignment Date	26 September 2022
Student Name	SHYAM SUNDAR V
Team ID	PNT2022TMID28445
Maximum Marks	2 Marks

Question-1:

Download the dataset: Dataset

Solution:

Downloaded successfully

Question-2:

Load the dataset.

Solution:

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

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

```
df.head()
```

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

...

	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:

	index	Exited
0	0	0.7963
1	1	0.2037

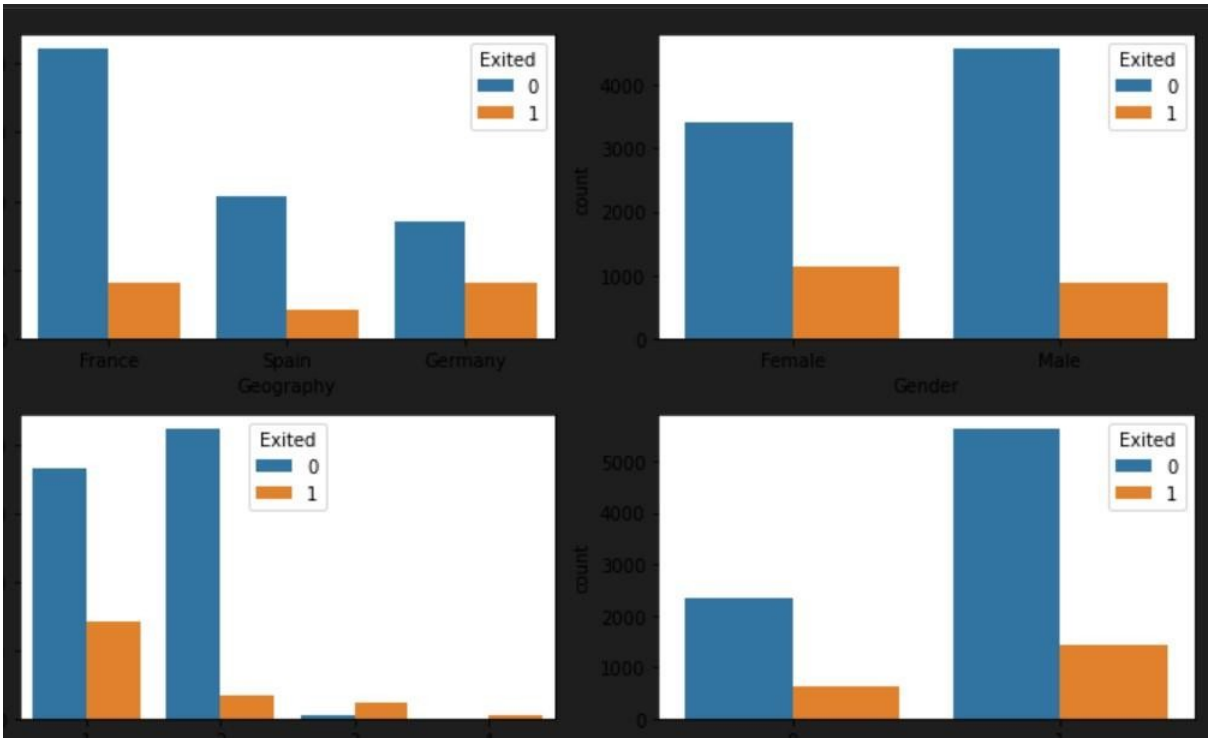
The data is significantly imbalanced

```
# 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:
```

```
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])}")
```

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

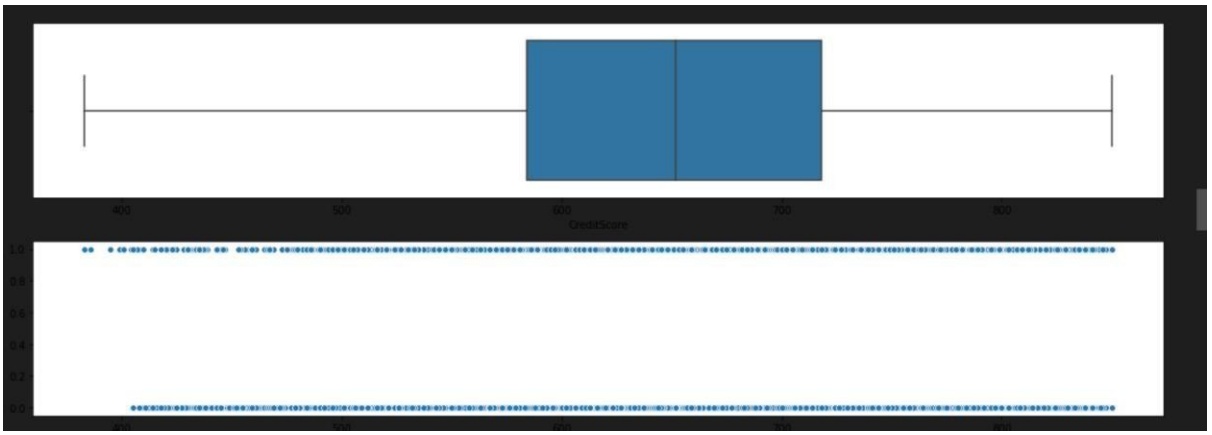
unique of Geography is 3 they are {'France','Germany','Spain'}
unique of Gender is 2 they are {'Male','Female'} unique of Has CrCard is 2 they are {0,1} unique of Is Active Member is 2 they are {0,1} unique of Exited is 2 they are {0,1}

Question 6:

Find the outliers and replace the outliers.

Solution:

Checking for outliers

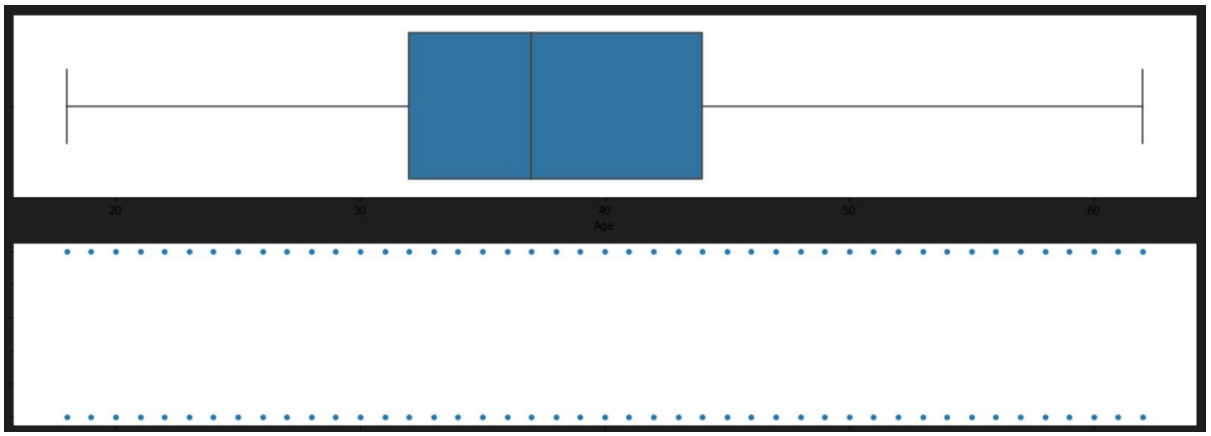


# of bivariate Outliers:19

```
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

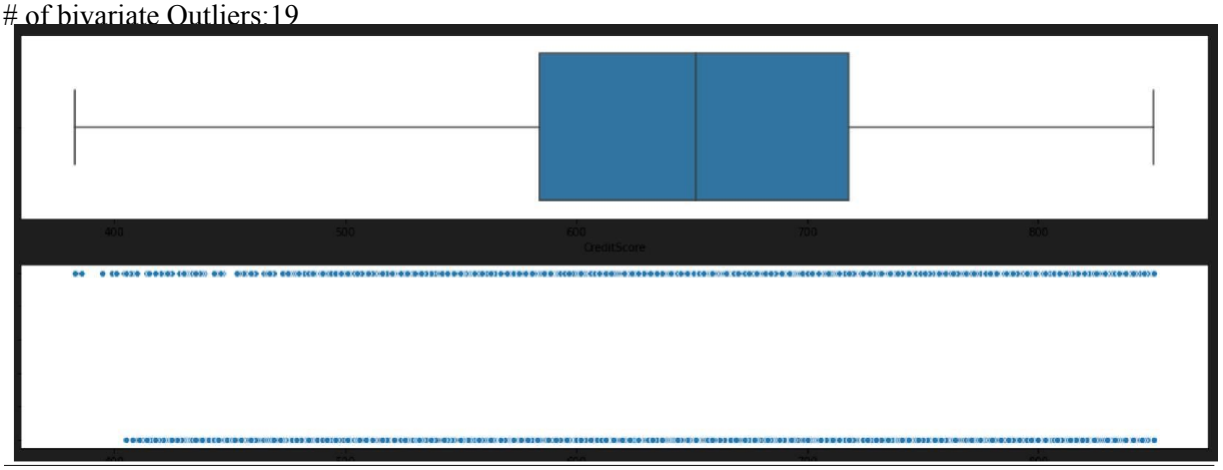

```
box_scatter(df,'EstimatedSalary','Exited'); plt.tight_layout()
```

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

Removing Outliers

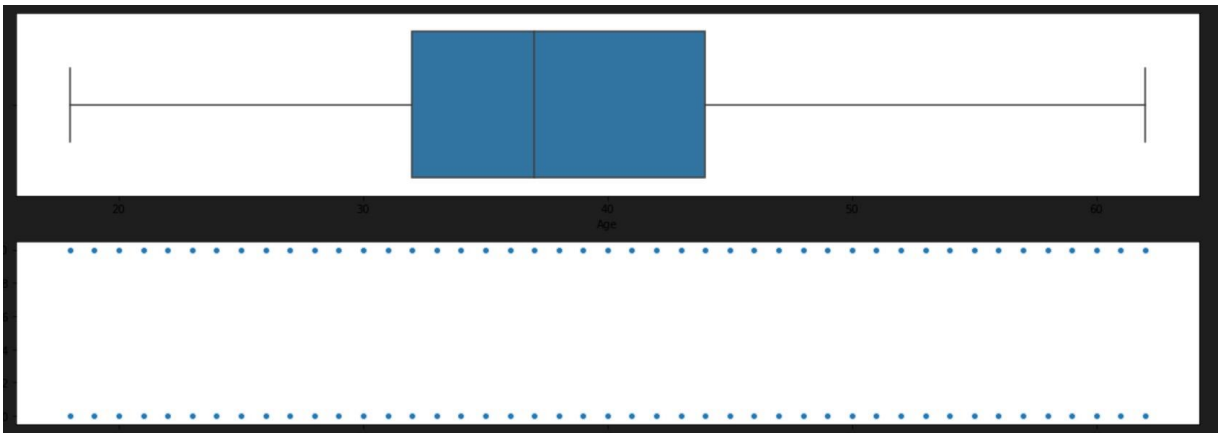
After removing outliers,boxplot will be like

# of bivariate Outliers:19

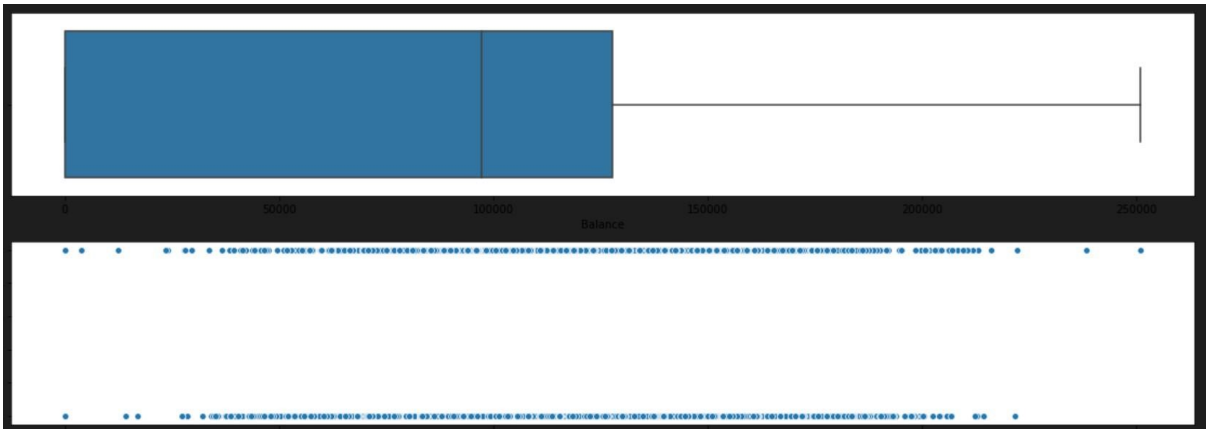



```
box_scatter(df,'Age','Exited'); plt.tight_layout()
print(f"# of Bivariate Outliers: {len(df.loc[df['Age'] >87])}")
```

# of bivariate Outliers:0



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



# of bivariate Outliers:4

Question 7:

Check for Categorical columns and perform encoding.

Solution:

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()
```

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

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

Question 9:

Scale the independent variables

Solution:

```
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:

```python
x_train.shape
```

Python

```
(6700, 10)
```

```python
x_test.shape
```

Python

```
(3300, 10)
```

```python
y_train.shape
```

Python

```
(6700,)
```

```python
y_test.shape
```

Python

```
(3300,)
```