**Assignment -2**

Python Programming

| | |
|---|---|
| Assignment Date | 18 OCTOBER 2022 |
| Student Name | JAGADEESH E |
| Student Roll Number | 19IT018 |
| Maximum Marks | 2 Marks |

**Question-1:**

1. Download the dataset: Dataset

**Solution:**

Downloaded succesfully

**Question-2:**

2. Load the dataset.

**Solution:**

```
import pandas as pd
import numpy as 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:**

3. Perform Below Visualizations:
Univariate Analysis, Bi - Variate Analysis, Multi - Variate Analysis

**Solution:**

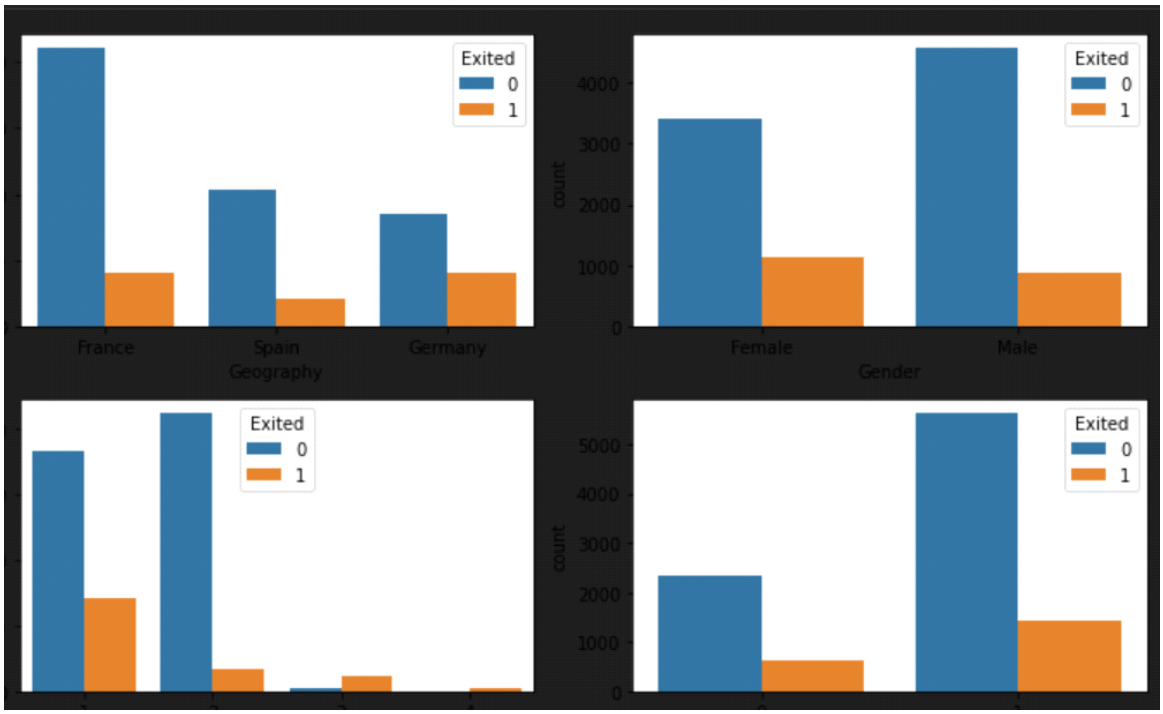
```
import seaborn as sns
density = df['Exited'].value_counts(normalize=True).reset_index()
sns.barplot(data=density, x='index', y='Exited', );
density
```

| | index | Exited |
|---|---|---|
| 0 | 0 | 0.7963 |
| 1 | 1 | 0.2037 |

The data is significantly imbalanced

```
import matplotlib.pyplot as plt

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 in range(rows):
    cols = min(2, categorical.shape[1] - row*2)
    for col in range(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:**

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:**

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

```
for i in df:
    if df[i].dtype=='object' or df[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:**

6. Find the outliers and replace the outliers.

**Solution:**

Checking for outliers

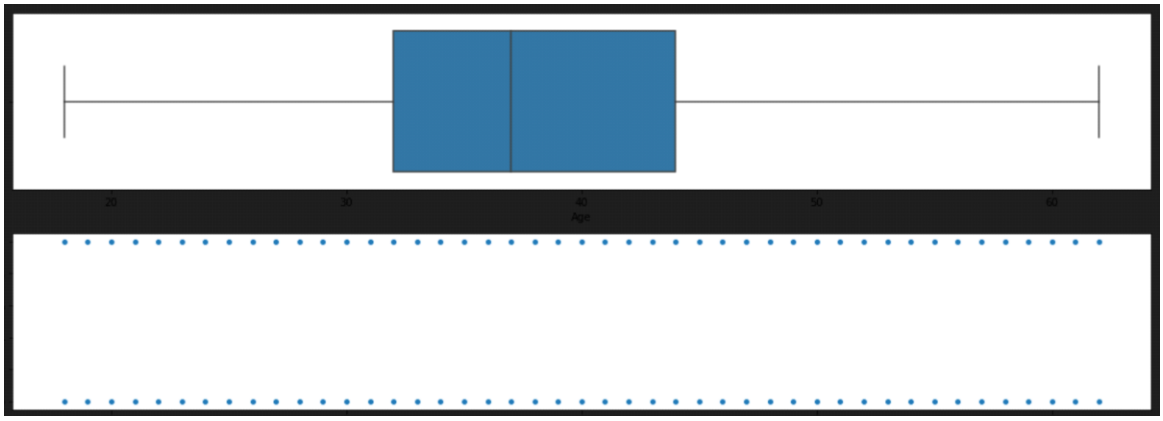
```
def box_scatter(data, x, y):
    fig, (ax1, ax2) = plt.subplots(nrows=2, ncols=1, figsize=(16,6))
    sns.boxplot(data=data, x=x, ax=ax1)
    sns.scatterplot(data=data, x=x,y=y,ax=ax2)
```

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

# of bivariate Outliers:19

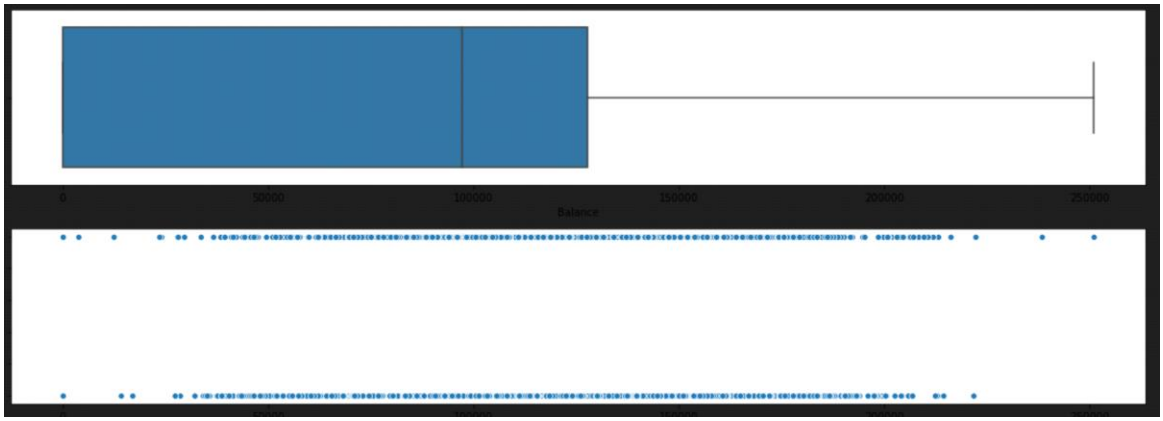
```
box_scatter(df,'Age','Exited');
plt.tight_layout()
print(f"# of Bivariate Outliers: {len(df.loc[df['Age'] > 87])}")
```

# 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

```
for i in df:
    if df[i].dtype=='int64' or df[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])
```

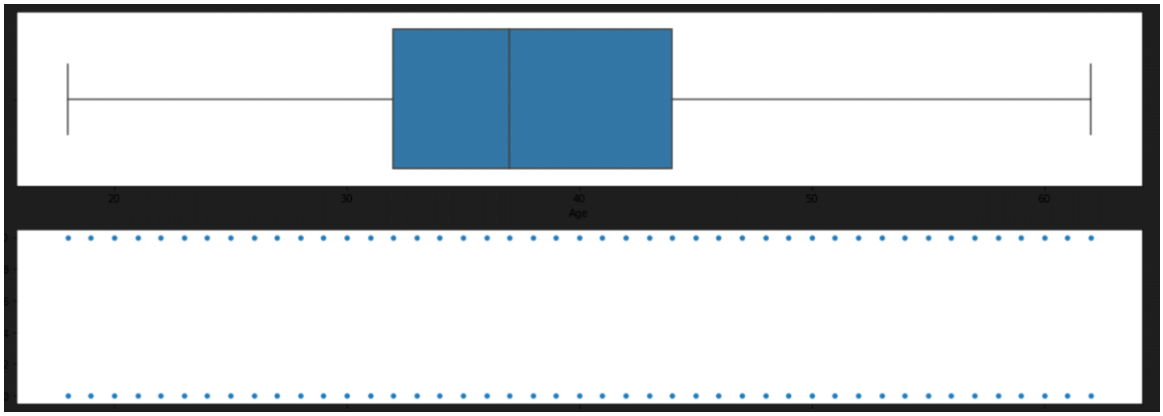
After removing outliers,boxplot will be like

```
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:**

7. Check for Categorical columns and perform encoding.

**Solution:**

```
from sklearn.preprocessing import LabelEncoder
encoder=LabelEncoder()
for i in df:
    if df[i].dtype=='object' or df[i].dtype=='category':
        df[i]=encoder.fit_transform(df[i])
```

**Question 8:**

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:**

9. Scale the independent variables

**Solution:**

```
from sklearn.preprocessing import StandardScaler
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:**

10. Split the data into training and testing

**Solution:**

```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.33)
```

```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,)
```