

Assignment - 2

Python Programming

Assignment Date	21/09/2022
Student Name	Siva.R
Student Roll Number	110519106024
Maximum Mark	2 Mark

```
In [1]: import os
os.chdir('drive/MyDrive/Nalaiya Thiran')
```

1.Download dataset

2.Load dataset

```
In [130]: import pandas as pd
data = pd.read_csv("Churn_Modelling.csv")
data
```

```
Out[130]:
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	1	1	101348.88	1
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0
2	3	15619304	Onio	502	France	Female	42	8	159660.80	3	1	0	113931.57	1
3	4	15701354	Boni	699	France	Female	39	1	0.00	2	0	0	93826.63	0
4	5	15737888	Mitchell	850	Spain	Female	43	2	125510.82	1	1	1	79084.10	0
...
9995	9996	15606229	Obijaku	771	France	Male	39	5	0.00	2	1	0	96270.64	0
9996	9997	15569892	Johnstone	516	France	Male	35	10	57369.61	1	1	1	101699.77	0
9997	9998	15584532	Liu	709	France	Female	36	7	0.00	1	0	1	42085.58	1
9998	9999	15682355	Sabbatini	772	Germany	Male	42	3	75075.31	2	1	0	92888.52	1
9999	10000	15628319	Walker	792	France	Female	28	4	130142.79	1	1	0	38190.78	0

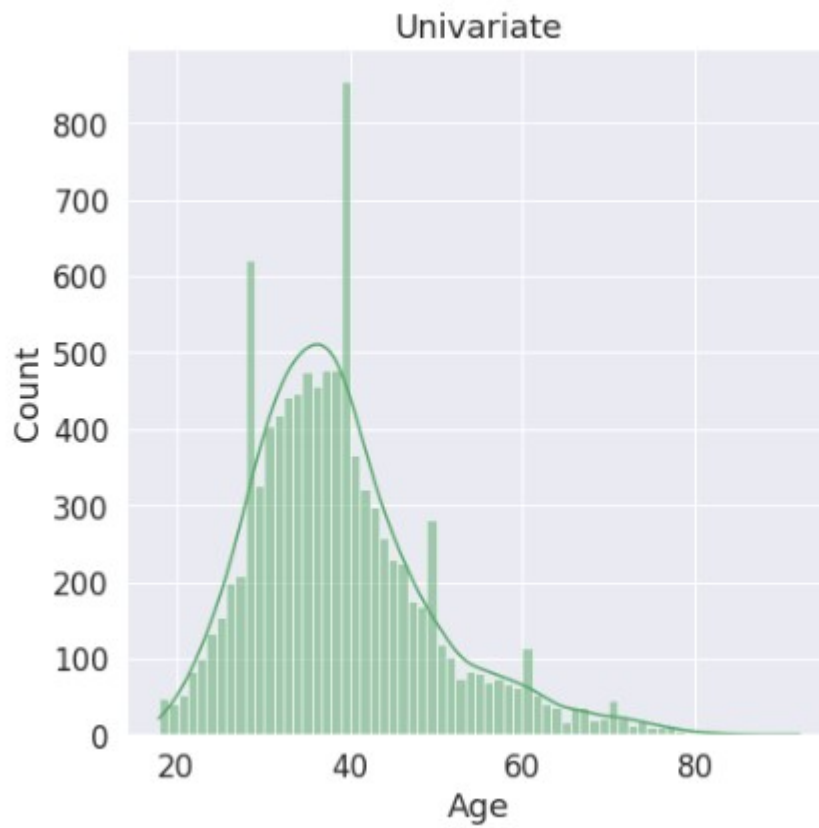
10000 rows × 14 columns

3.Perform Below Visualizations

1. Univariate Analysis
2. Bi-Variate Analysis
3. Multi-variate Analysis

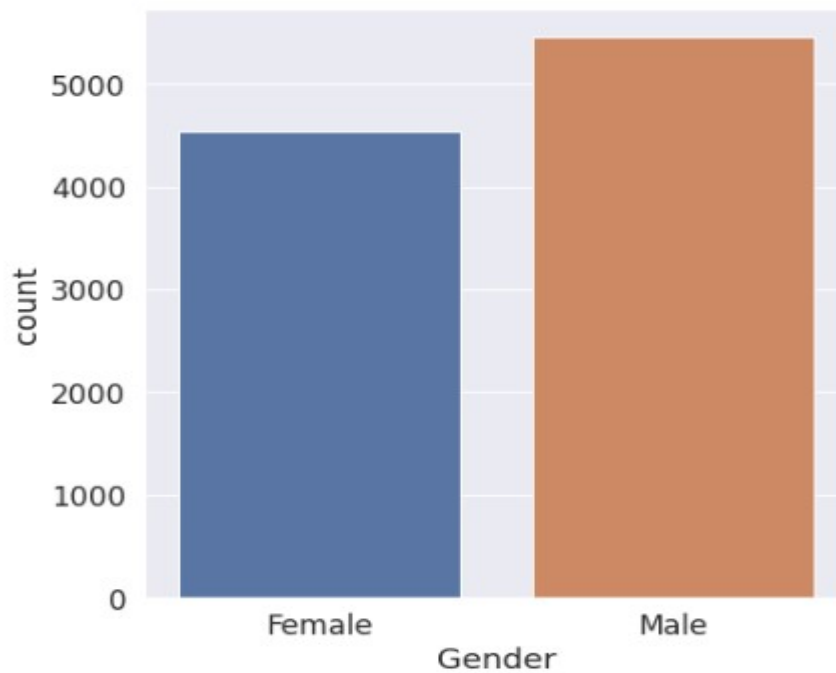
```
In [35]: #univariate analysis
import seaborn as sns
import matplotlib.pyplot as plt
#myplt = plt.hist(data["Age"])
sns.histplot(data["Age"],kde=True,color='g')
plt.title("Univariate")
```

```
Out[35]: Text(0.5, 1.0, 'Univariate')
```



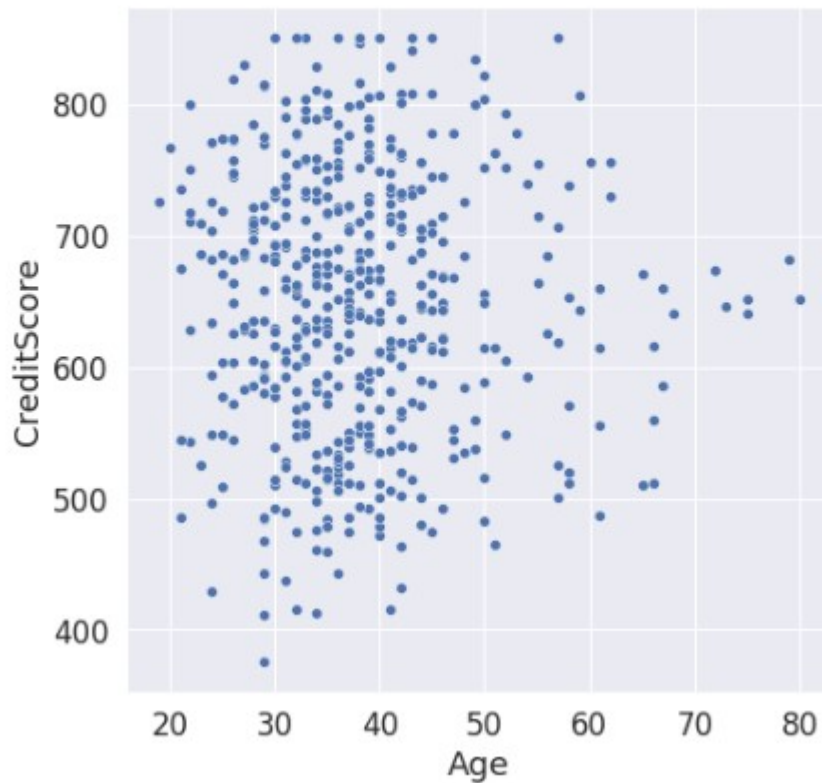
```
In [42]: #bivariate analysis 1  
sns.countplot(x='Gender', data = data)
```

```
Out[42]: <matplotlib.axes._subplots.AxesSubplot at 0x7f30022e0610>
```

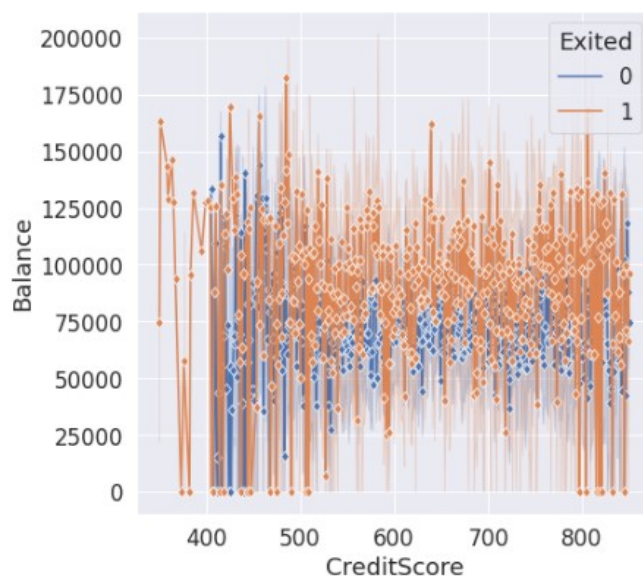


```
In [54]: #bivariate analysis 2
df = data.head(500)
sns.scatterplot(x='Age',y='CreditScore', data=df)
```

Out[54]: <matplotlib.axes._subplots.AxesSubplot at 0x7f2ffadce150>



```
In [ ]: #multivariate analysis
sns.set(rc={'figure.figsize':(7,7)})
sns.set(font_scale=1.5)
fig=sns.lineplot(x=data['CreditScore'], y=data['Balance'],markevery=1,marker='d',data=data, hue=data['Exited'] )
```



4.Perform descriptive statistics on the dataset.

```
In [6]: numeric_columns = data[['CreditScore', 'Age', 'Tenure', 'Balance', 'NumOfProducts', 'HasCrCard', 'IsActiveMember', 'EstimatedSalary', 'Exited']]
print("Numerical Data Descriptive Statistics")
numeric_columns.describe(include = 'all')
```

Numerical Data Descriptive Statistics

	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
count	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000
mean	650.528800	38.921800	5.012800	76485.889288	1.530200	0.70550	0.515100	100090.239881	0.203700
std	96.653299	10.487806	2.892174	62397.405202	0.581654	0.45584	0.499797	57510.492818	0.402769
min	350.000000	18.000000	0.000000	0.000000	1.000000	0.000000	0.000000	11.580000	0.000000
25%	584.000000	32.000000	3.000000	0.000000	1.000000	0.000000	0.000000	51002.110000	0.000000
50%	652.000000	37.000000	5.000000	97198.540000	1.000000	1.000000	1.000000	100193.915000	0.000000
75%	718.000000	44.000000	7.000000	127644.240000	2.000000	1.000000	1.000000	149388.247500	0.000000
max	850.000000	92.000000	10.000000	250898.090000	4.000000	1.000000	1.000000	199992.480000	1.000000

```
In [7]: print("String Columns Description")
data.describe(include=['object'])
```

String Columns Description

	Surname	Geography	Gender
count	10000	10000	10000
unique	2932	3	2
top	Smith	France	Male
freq	32	5014	5457

5.Handle the Missing values

```
In [57]: data.isnull().sum().sum()
```

Out[57]: 0

```
In [56]: data['Tenure'].isna().sum()
```

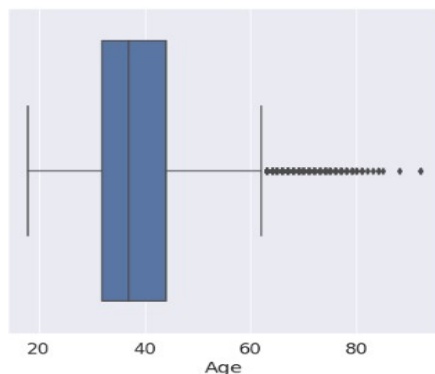
Out[56]: 0

6.Find the outliers and replace the outliers

```
In [115]: #use only the required column
df2 = pd.DataFrame(data['Age'], columns = ['Age'])
sns.boxplot(df2.Age, data = data)
```

/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be 'data', and passing other arguments without an explicit keyword will result in an error or misinterpretation.

FutureWarning
Out[115]: <matplotlib.axes._subplots.AxesSubplot at 0x7f2ff8938550>



In [104]

df2

Out[104]

	Age
0	42
1	41
2	42
3	39
4	43
...	...
9995	39
9996	35
9997	36
9998	42
9999	28

10000 rows × 1 columns

In [117]

```
#upper_extreme = q3+1.5*IQR
#lower_extreme = q1-1.5*IQR
#IQR = q3-q1

qnt = df2.quantile(q=[0.25,0.75])
qnt
```

Out[117]

	Age
0.25	32.0
0.75	44.0

In [106]

```
IQR = qnt.loc[0.75] - qnt.loc[0.25]
upper_extreme = qnt.loc[0.75]+1.5*IQR
lower_extreme = qnt.loc[0.25]-1.5*IQR
lower_extreme
```

Out[106]

Age 14.0
dtype: float64

In [84]:

```
upper_extreme
#now we got the upper extreme which is the outlier so replace it now
```

Out[84]:

Age 62.0
dtype: float64

In [191]

```
med = df2['Age'].median()
med
```

Out[191]

37.0

In [185]

upper_extreme

Out[185]

Age 62.0
dtype: float64

In [195]

```
#treating outliers using capping
#here 14 is lower_extreme
#62 is upper_extreme
import numpy as np

print(df2['Age'])
df2["New_Age"] = df2["Age"].map(
    lambda x: med
    if x < 14 else x)
df2["New_Age"] = df2["Age"].map(lambda x:med
                                if x > 62 else x)
df2
```

0	42
---	----

```

0      42
1      41
2      42
3      39
4      43
..
9995   39
9996   35
9997   36
9998   42
9999   28
Name: Age, Length: 10000, dtype: int64

```

```

Out[195_
  Age  New_Age
0    42    42.0
1    41    41.0
2    42    42.0
3    39    39.0
4    43    43.0
...    ...    ...
9995   39    39.0
9996   35    35.0
9997   36    36.0
9998   42    42.0
9999   28    28.0

```

10000 rows × 2 columns

7. Check for categorical columns and perform encoding

```

In [125_
#extracting categorical columns
print(data['Geography'].unique())
print(data['Gender'].unique())

```

```

['France' 'Spain' 'Germany']
['Female' 'Male']

```

```

In [122_
data2 = data.copy()
data2['Gender'].replace(['Female', 'Male'], [0, 1], inplace=True)
data2['Geography'].replace(['France', 'Spain', 'Germany'], [0, 1, 2], inplace=True)
data2

```

```

Out[122_
  RowNumber  CreditScore  Geography  Gender  Age  Tenure  Balance  EstimatedSalary
0          1          619           0       0   42       2      0.00      101348.88
1          2          608           1       0   41       1  83807.86      112542.58
2          3          502           0       0   42       8 159660.80      113931.57
3          4          699           0       0   39       1      0.00      93826.63
4          5          850           1       0   43       2 125510.82      79084.10
...        ...        ...        ...    ...    ...    ...      ...      ...
9995      9996          771           0       1   39       5      0.00      96270.64
9996      9997          516           0       1   35      10  57369.61      101699.77
9997      9998          709           0       0   36       7      0.00      42085.58
9998      9999          772           2       1   42       3  75075.31      92888.52
9999     10000          792           0       0   28       4 130142.79      38190.78

```

10000 rows × 8 columns

In [152_

```
d2 = pd.get_dummies(data, columns = ['Geography', 'Gender'])
d2
```

Out[152_

	RowNumber	CustomerId	Surname	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited	Geography_France	Geogra
0	1	15634602	Hargrave	619	42	2	0.00	1	1	1	101348.88	1	1	
1	2	15647311	Hill	608	41	1	83807.86	1	0	1	112542.58	0	0	
2	3	15619304	Onio	502	42	8	159660.80	3	1	0	113931.57	1	1	
3	4	15701354	Boni	699	39	1	0.00	2	0	0	93826.63	0	1	
4	5	15737888	Mitchell	850	43	2	125510.82	1	1	1	79084.10	0	0	
...
9995	9996	15606229	Obijaku	771	39	5	0.00	2	1	0	96270.64	0	1	
9996	9997	15569892	Johnstone	516	35	10	57369.61	1	1	1	101699.77	0	1	
9997	9998	15584532	Liu	709	36	7	0.00	1	0	1	42085.58	1	1	
9998	9999	15682355	Sabbatini	772	42	3	75075.31	2	1	0	92888.52	1	0	
9999	10000	15628319	Walker	792	28	4	130142.79	1	1	0	38190.78	0	1	

10000 rows × 17 columns



8. Split the data into dependent and independent variables.

In [138_

```
col= data.iloc[:, :-1].columns
print(col)

#dependant variable
y = data.iloc[:, -1:].columns
print(y)
```

```
Index(['RowNumber', 'CustomerId', 'Surname', 'CreditScore', 'Geography',
      'Gender', 'Age', 'Tenure', 'Balance', 'NumOfProducts', 'HasCrCard',
      'IsActiveMember', 'EstimatedSalary'],
      dtype='object')
Index(['Exited'], dtype='object')
```

In [139_

```
dep_data_var = data[col]
print(dep_data_var)

print(data[y])
```

	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	
...	
9995	9996	15606229	Obijaku	771	France	Male	39	
9996	9997	15569892	Johnstone	516	France	Male	35	
9997	9998	15584532	Liu	709	France	Female	36	
9998	9999	15682355	Sabbatini	772	Germany	Male	42	
9999	10000	15628319	Walker	792	France	Female	28	

	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	
...	
9995	5	0.00	2	1	0	
9996	10	57369.61	1	1	1	
9997	7	0.00	1	0	1	
9998	3	75075.31	2	1	0	
9999	4	130142.79	1	1	0	

	EstimatedSalary
0	101348.88
1	112542.58
2	113931.57
3	93826.63
4	79084.10
...	...
9995	96270.64
9996	101699.77
9997	42085.58
9998	92888.52
9999	38190.78

[10000 rows x 13 columns]

	Exited
0	1
1	0
2	1
3	0
4	0
...	...
9995	0
9996	0
9997	1
9998	1
9999	0

[10000 rows x 1 columns]

9. Scale the independent variables

In [157_

```
import pandas as pd
import matplotlib.pyplot as plt
# Import StandardScaler
from sklearn.preprocessing import StandardScaler

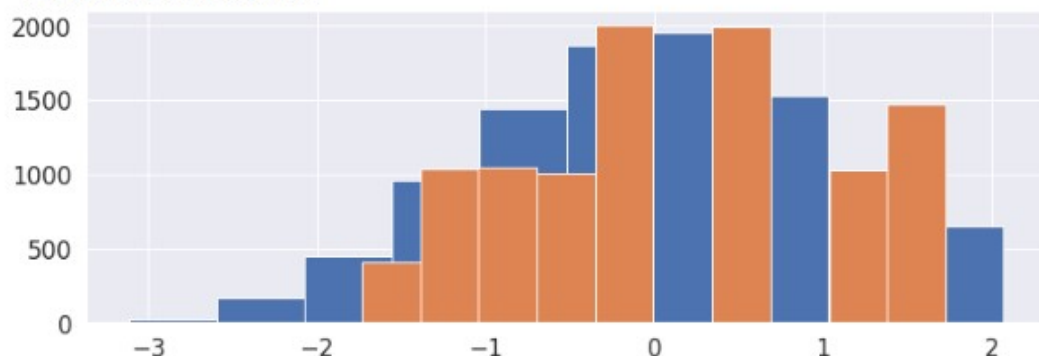
fig, ax = plt.subplots(figsize=(12, 4))
cols = ['CreditScore', 'Tenure', 'EstimatedSalary']

scaler = StandardScaler()
x_std = scaler.fit_transform(data[cols])

ax.hist(x_std[:,0])
ax.hist(x_std[:,1])
```

Out[157_

```
(array([ 413., 1035., 1048., 1009., 2001.,    0., 1995.,    0., 1025.,
        1474.]),
 array([-1.73331549, -1.38753759, -1.04175968, -0.69598177, -0.35020386,
        -0.00442596,  0.34135195,  0.68712986,  1.03290776,  1.37868567,
         1.72446358]),
 <a list of 10 Patch objects>)
```



10.Split the data into training and testing

In [173_

```
from sklearn.model_selection import train_test_split
x = data['Age'].values
print(x)
y = data.iloc[:, -1].values
print(y)
X_train, X_test, y_train, y_test = train_test_split(x, y, test_size=0.33, random_state=42)
print(X_train)
print("Total Training data ", len(X_train))
```

```
[42 41 42 ... 36 42 28]
[1 0 1 ... 1 1 0]
[29 37 49 ... 38 43 51]
Total Training data  6700
```