Assignment-2

Python Programming

Assignment Date	27 September 2022
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Maximum Mark	2 marks

1. Download the dataset

2. Load the dataset.

In [1]:
```
import pandas as pd
data = pd.read_csv("Churn_Modelling.csv")
data.head()
```

Out[1]:

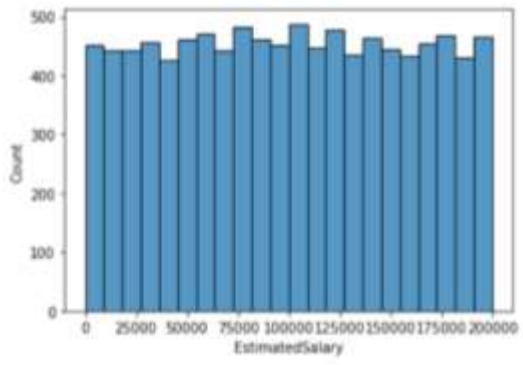
	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	1	1	101348.88
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112542.58
2	3	15619304	Onio	502	France	Female	42	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

3. Perform Below Visualizations.

- Univariate Analysis

In [4]:
```
import seaborn as sns
sns.histplot(data, x="EstimatedSalary")
```

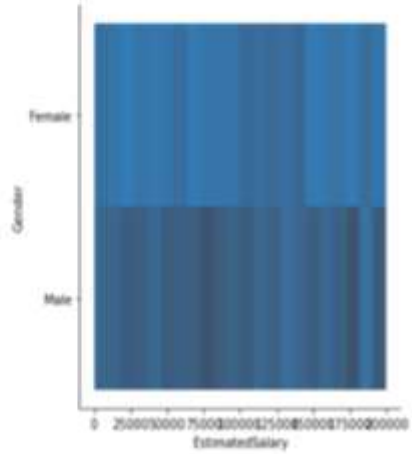
Out[4]: <AxesSubplot:xlabel='EstimatedSalary', ylabel='Count'>



In [ ]:
```
• Bi - Variate Analysis
```

In [5]:
```
sns.displot(data, x="EstimatedSalary" , y="Gender")
```

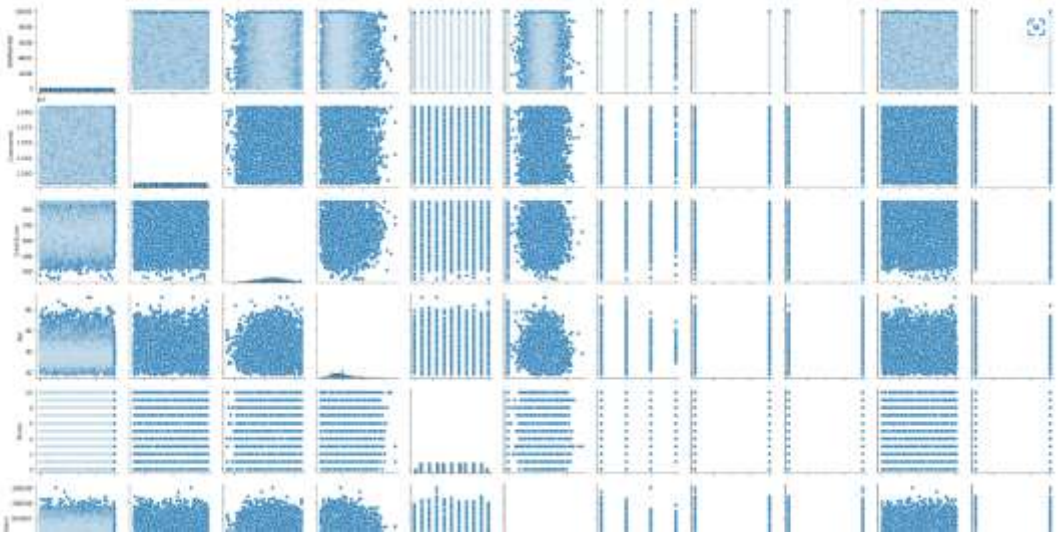
Out[5]: <seaborn.axisgrid.FacetGrid at 0x200f1b09e80>

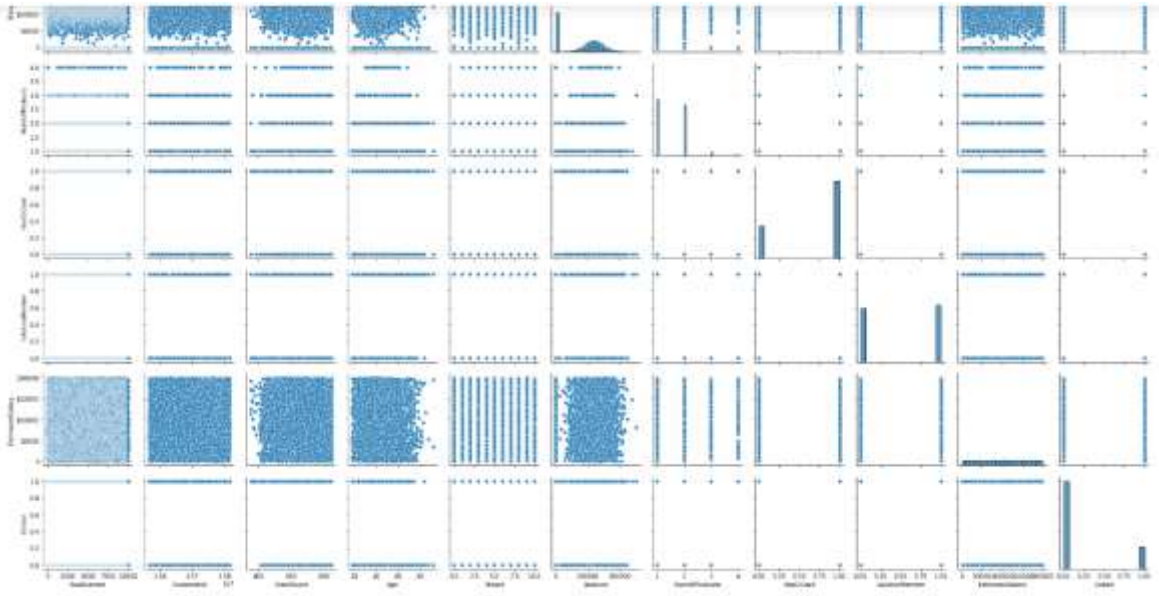


In [ ]:
```
• Multi - Variate Analysis
```

In [6]:
```
sns.pairplot(data)
```

Out[6]: <seaborn.axisgrid.PairGrid at 0x200f596c9d0>





4. Perform descriptive statistics on the dataset.

In [8]:
```
data.mean()
```

```
C:\Users\Raju\AppData\Local\Temp\ipykernel_912\531903386.py:1: FutureWarning: Dropping of nuisance columns in DataFrame reducti
ons (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError.  Select only valid columns before
calling the reduction.
  data.mean()
```

Out[8]:
```
RowNumber          5.000500e+03
CustomerId         1.569094e+07
CreditScore        6.505288e+02
Age                3.892180e+01
Tenure             5.012800e+00
Balance            7.648589e+04
NumOfProducts      1.530200e+00
HasCrCard          7.055000e-01
IsActiveMember     5.151000e-01
EstimatedSalary    1.000902e+05
Exited             2.037000e-01
dtype: float64
```

In [9]:
```
data.median()
```

```
C:\Users\Raju\AppData\Local\Temp\ipykernel_912\4184645713.py:1: FutureWarning: Dropping of nuisance columns in DataFrame reduct
ions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError.  Select only valid columns before
calling the reduction.
  data.median()
```

Out[9]:
```
RowNumber          5.000500e+03
CustomerId         1.569074e+07
CreditScore        6.520000e+02
Age                3.700000e+01
Tenure             5.000000e+00
Balance            9.719854e+04
NumOfProducts      1.000000e+00
HasCrCard          1.000000e+00
IsActiveMember     1.000000e+00
EstimatedSalary    1.001939e+05
Exited             0.000000e+00
dtype: float64
```

In [10]:
```
data.mode()
```

Out[10]:

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSala
0	1	15565701	Smith	850.0	France	Male	37.0	2.0	0.0	1.0	1.0	1.0	24924
1	2	15565706	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	Na
2	3	15565714	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	Na
3	4	15565779	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	Na
4	5	15565796	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	Na
...	...	...	...	...	...	...	...	...	...	...	...	...	...
9995	9996	15815628	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	Na
9996	9997	15815645	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	Na
9997	9998	15815656	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	Na
9998	9999	15815660	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	Na
9999	10000	15815690	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	Na

10000 rows × 14 columns

In [11]:
```
data.skew()
```

```
C:\Users\Raju\AppData\Local\Temp\ipykernel_912\1188251951.py:1: FutureWarning: Dropping of nuisance columns in DataFrame reduct
ions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError.  Select only valid columns before
calling the reduction.
  data.skew()
```

Out[11]:
```
RowNumber          0.000000
CustomerId         0.001149
CreditScore       -0.071607
Age                1.011320
Tenure             0.010991
Balance           -0.141109
NumOfProducts      0.745568
HasCrCard         -0.901812
IsActiveMember    -0.060437
EstimatedSalary    0.002085
Exited             1.471611
dtype: float64
```

In [12]:
```
data.kurt()
```

```
C:\Users\Raju\AppData\Local\Temp\ipykernel_912\2907027414.py:1: FutureWarning: Dropping of nuisance columns in DataFrame reduct
ions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError.  Select only valid columns before
calling the reduction.
  data.kurt()
```

Out[12]:
```
RowNumber         -1.200000
CustomerId        -1.196113
CreditScore       -0.425726
Age                1.395347
Tenure            -1.165225
Balance           -1.489412
NumOfProducts      0.582981
HasCrCard         -1.186973
IsActiveMember    -1.996747
EstimatedSalary   -1.181518
Exited             0.165671
dtype: float64
```

In [13]:
```
data.var()
```

```
C:\Users\Raju\AppData\Local\Temp\ipykernel_912\445316826.py:1: FutureWarning: Dropping of nuisance columns in DataFrame reducti
ons (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError.  Select only valid columns before
calling the reduction.
  data.var()
```

Out[13]:
```
RowNumber          8.334167e+06
CustomerId         5.174815e+09
CreditScore        9.341860e+03
Age                1.099941e+02
Tenure             8.364673e+00
Balance            3.893436e+09
NumOfProducts      3.383218e-01
HasCrCard          2.077905e-01
IsActiveMember     2.497970e-01
EstimatedSalary    3.307457e+09
Exited             1.622225e-01
dtype: float64
```

In [14]:
```
data.std()
```

```
C:\Users\Raju\AppData\Local\Temp\ipykernel_912\2723740006.py:1: FutureWarning: Dropping of nuisance columns in DataFrame reduct
ions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError.  Select only valid columns before
calling the reduction.
  data.std()
```

Out[14]:
```
RowNumber          2886.895680
CustomerId        71936.186123
CreditScore          96.653299
Age                  10.487806
Tenure                2.892174
Balance           62397.405202
NumOfProducts         0.581654
HasCrCard             0.455840
IsActiveMember        0.499797
EstimatedSalary   57510.492818
Exited                0.402769
dtype: float64
```

5. Handle the Missing values.

In [15]:
```
data.isna().sum()
```

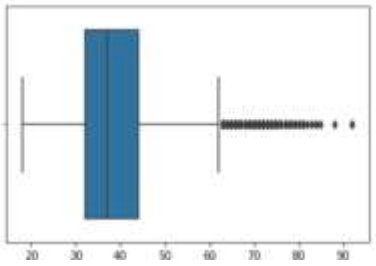
Out[15]:
```
RowNumber          0
CustomerId         0
Surname            0
CreditScore        0
Geography          0
Gender             0
Age                0
Tenure             0
Balance            0
NumOfProducts      0
HasCrCard          0
IsActiveMember     0
EstimatedSalary    0
Exited             0
dtype: int64
```

6. Find the outliers and replace the outliers

In [16]:
```
sns.boxplot(data['Age'])
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a keyword a
rg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit ke
yword will result in an error or misinterpretation.
  warnings.warn(
```

Out[16]:
```
<AxesSubplot:xlabel='Age'>
```

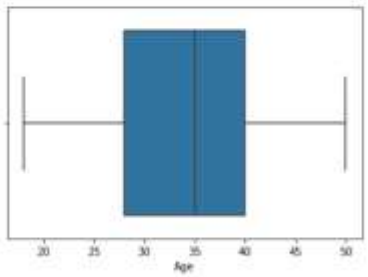


In [17]:
```
import numpy as np
data['Age']=np.where(data['Age']>50,20,data['Age']) #replacing
```

In [18]:
```
import seaborn as sns
sns.boxplot(data['Age'])
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a keyword a
rg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit ke
yword will result in an error or misinterpretation.
  warnings.warn(
```

Out[18]: <AxesSubplot:xlabel='Age'>



7. Check for Categorical columns and perform encoding.

In [19]:
```
data.tail() #Gender categorical column
```

Out[19]:

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSa
9995	9996	15606229	Obijaku	771	France	Male	39	5	0.00	2	1	0	9627
9996	9997	15569892	Johnstone	516	France	Male	35	10	57369.61	1	1	1	10169
9997	9998	15584532	Liu	709	France	Female	36	7	0.00	1	0	1	4208
9998	9999	15682355	Sabbatini	772	Germany	Male	42	3	75075.31	2	1	0	9288
9999	10000	15628319	Walker	792	France	Female	28	4	130142.79	1	1	0	3819

Encoding

In [21]:
```
data['Gender'].replace({'Female':1,'Male':0},inplace=True)
data.tail()
```

Out[21]:

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSa
9995	9996	15606229	Obijaku	771	France	0	39	5	0.00	2	1	0	9627
9996	9997	15569892	Johnstone	516	France	0	35	10	57369.61	1	1	1	10169
9997	9998	15584532	Liu	709	France	1	36	7	0.00	1	0	1	4208
9998	9999	15682355	Sabbatini	772	Germany	0	42	3	75075.31	2	1	0	9288
9999	10000	15628319	Walker	792	France	1	28	4	130142.79	1	1	0	3819

In [22]:
```
data_main=pd.get_dummies(data,columns=['Geography'])
data_main
```

Out[22]:

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

10000 rows × 16 columns

8. Split the data into dependent and independent variables.

In [23]:
```
y=data_main['Exited']
y.head()
```

Out[23]:
```
0    1
1    0
2    1
3    0
4    0
Name: Exited, dtype: int64
```

In [24]:
```
x=data_main.drop(columns=['Exited'],axis=1)
x.head()
```

Out[24]:

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

9. Scale the independent variables

In [25]:
```
x=data_main.drop(columns=['Surname',],axis=1)
x.head()
```

Out[25]:

	RowNumber	CustomerId	CreditScore	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited	Geography_F
0	1	15634602	619	1	42	2	0.00	1	1	1	101348.88	1	
1	2	15647311	608	1	41	1	83807.86	1	0	1	112542.58	0	
2	3	15619304	502	1	42	8	159660.80	3	1	0	113931.57	1	
3	4	15701354	699	1	39	1	0.00	2	0	0	93826.63	0	
4	5	15737888	850	1	43	2	125510.82	1	1	1	79084.10	0	

In [26]:
```
from sklearn.preprocessing import scale
x=scale(x)
x
```

Out[26]:
```
array([[-1.73187761, -0.78321342, -0.32622142, ...,  0.99720391,
        -0.57873591, -0.57380915],
       [-1.7315312 , -0.60653412, -0.44003595, ..., -1.00280393,
        -0.57873591,  1.74273971],
       [-1.73118479, -0.99588476, -1.53679418, ...,  0.99720391,
        -0.57873591, -0.57380915],
       ...,
       [ 1.73118479, -1.47928179,  0.60498839, ...,  0.99720391,
        -0.57873591, -0.57380915],
       [ 1.7315312 , -0.11935577,  1.25683526, ..., -1.00280393,
         1.72790383, -0.57380915],
       [ 1.73187761, -0.87055909,  1.46377078, ...,  0.99720391,
        -0.57873591, -0.57380915]])
```

10. Split the data into training and testing

In [28]:
```
from sklearn.model_selection import train_test_split
```

In [29]:
```
x_train,x_test,y_train,y_test = train_test_split(x,y,test_size=0.2,random_state=0)
```

In [30]:
```
x_train.shape
```

Out[30]:
```
(8000, 15)
```

In [31]:
```
x_test.shape
```

Out[31]:
```
(2000, 15)
```

In [32]:
```
y_train.shape
```

Out[32]:
```
(8000,)
```

In [33]:
```
y_test.shape
```

Out[33]:
```
(2000,)
```