1. importing package

```
import pandas as pd
import seaborn as sns
import numpy as np
from matplotlib import pyplot as plt
%matplotlib inline
```

1. Loading dataset

```
df = pd.read_csv("Churn_Modelling.csv")
```

```
df
```

```
      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   Obijiaku          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
```

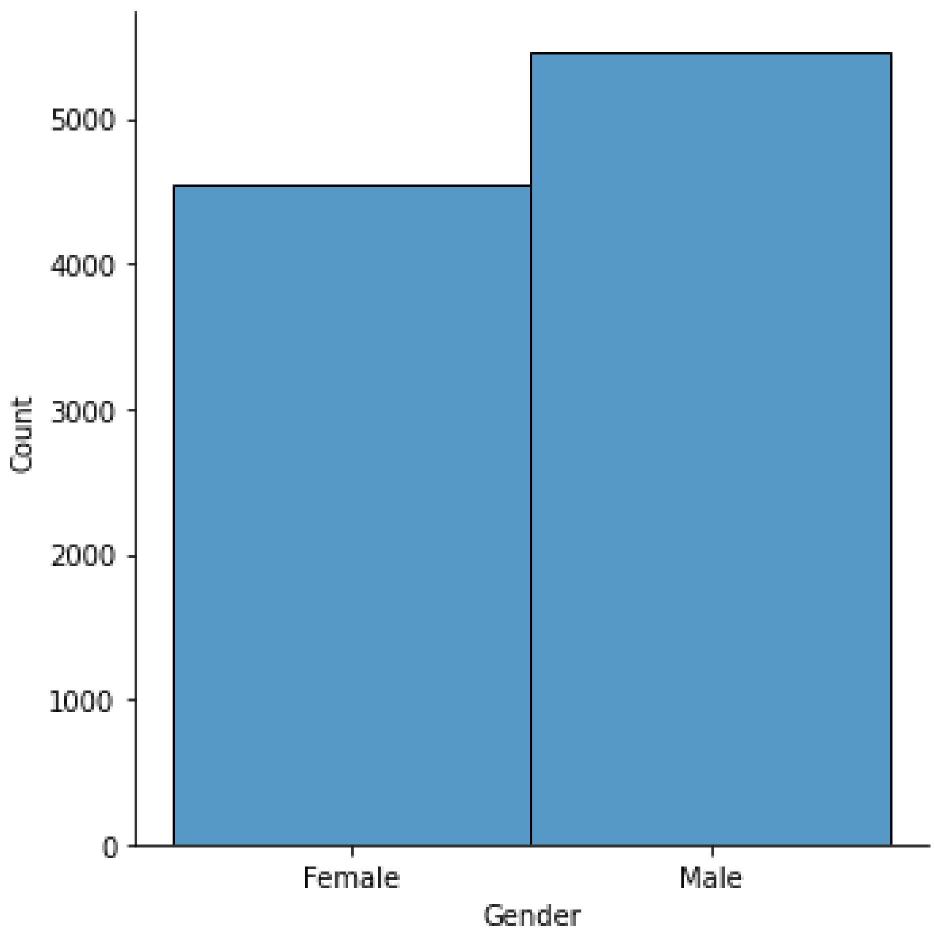
```
      EstimatedSalary  Exited
0           101348.88       1
1           112542.58       0
2           113931.57       1
3            93826.63       0
4            79084.10       0
...               ...     ...
9995         96270.64       0
9996        101699.77       0
9997         42085.58     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

[10000 rows x 14 columns]
```

1. Visualizations

a) Univariate Analysis

```
sns.displot(df.Gender)
```

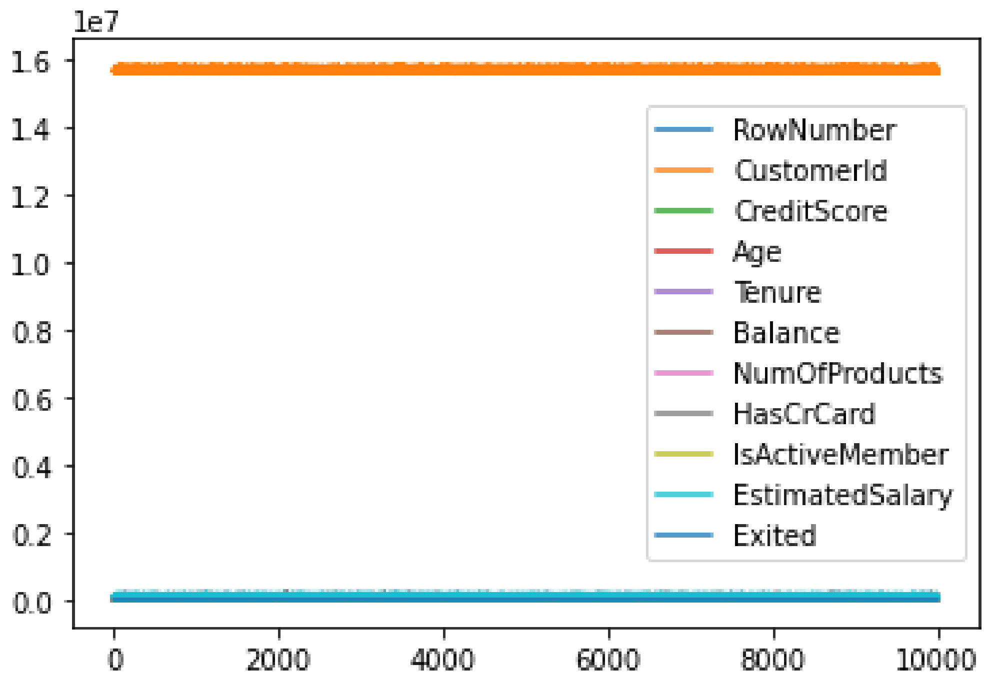
```
<seaborn.axisgrid.FacetGrid at 0x7f2935aae790>
```



b) Bi-Variate Analysis

```
df.plot.line()
```

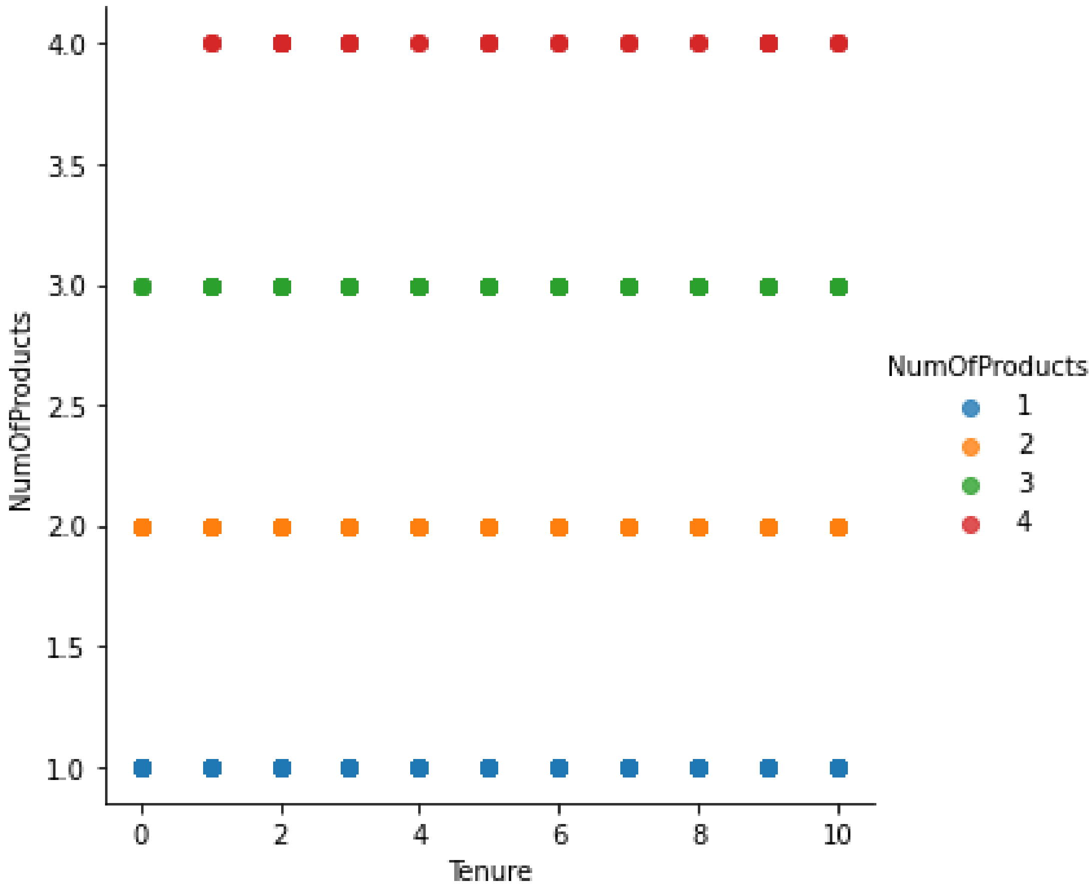
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f2932d2df50>
```



c) Multi - Variate Analysis

```
sns.lmplot("Tenure","NumOfProducts",df,hue="NumOfProducts",
fit_reg=False);
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43:
FutureWarning: Pass the following variables as keyword args: x, y,
data. 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
```



1. Perform descriptive statistics on the dataset.

```
df.describe()

          RowNumber    CustomerId   CreditScore           Age
Tenure  \
count  10000.00000  1.000000e+04  10000.000000  10000.000000
10000.000000
mean    5000.50000  1.569094e+07    650.528800     38.921800
5.012800
std     2886.89568  7.193619e+04     96.653299     10.487806
2.892174
min        1.00000  1.556570e+07    350.000000     18.000000
0.000000
25%     2500.75000  1.562853e+07    584.000000     32.000000
3.000000
50%     5000.50000  1.569074e+07    652.000000     37.000000
5.000000
75%     7500.25000  1.575323e+07    718.000000     44.000000
7.000000
max    10000.00000  1.581569e+07    850.000000     92.000000
10.000000

             Balance  NumOfProducts    HasCrCard  IsActiveMember  \
```

```
count   10000.000000   10000.000000  10000.00000    10000.000000
mean    76485.889288       1.530200      0.70550        0.515100
std     62397.405202       0.581654      0.45584        0.499797
min         0.000000       1.000000      0.00000        0.000000
25%         0.000000       1.000000      0.00000        0.000000
50%     97198.540000       1.000000      1.00000        1.000000
75%    127644.240000       2.000000      1.00000        1.000000
max    250898.090000       4.000000      1.00000        1.000000

       EstimatedSalary        Exited
count     10000.000000  10000.000000
mean     100090.239881      0.203700
std       57510.492818      0.402769
min          11.580000      0.000000
25%       51002.110000      0.000000
50%      100193.915000      0.000000
75%      149388.247500      0.000000
max      199992.480000      1.000000
```

1. Handle the Missing values.

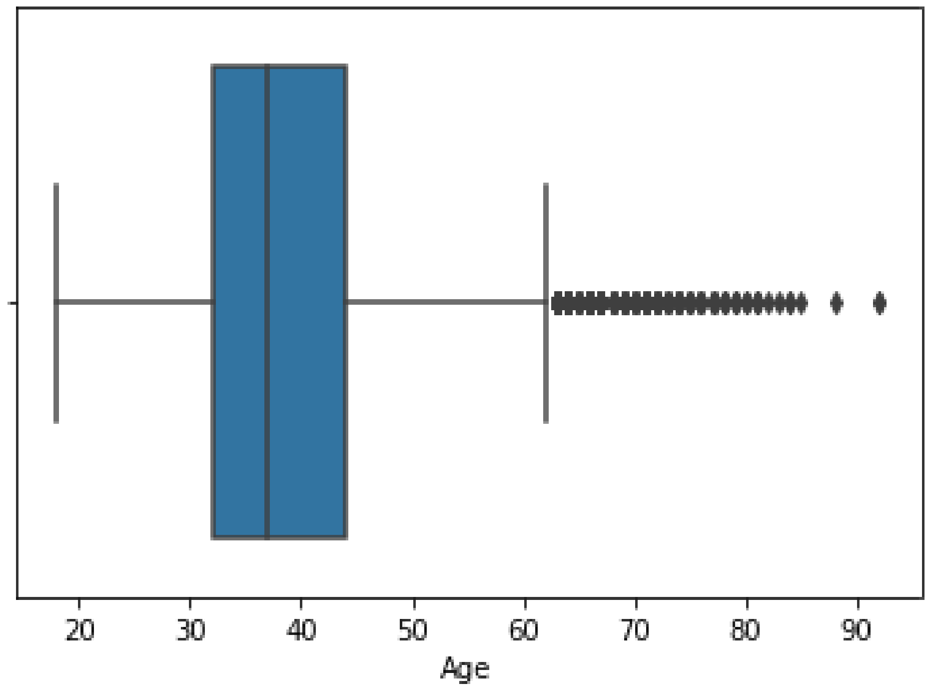
```
data = pd.read_csv("Churn_Modelling.csv")
pd.isnull(data["Gender"])
```

```
0       False
1       False
2       False
3       False
4       False
        ...
9995    False
9996    False
9997    False
9998    False
9999    False
Name: Gender, Length: 10000, dtype: bool
```

1. Find the outliers and replace the outliers.

```
sns.boxplot(df['Age'])
```

```
/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

<matplotlib.axes._subplots.AxesSubplot at 0x7f2932b8c650>
```



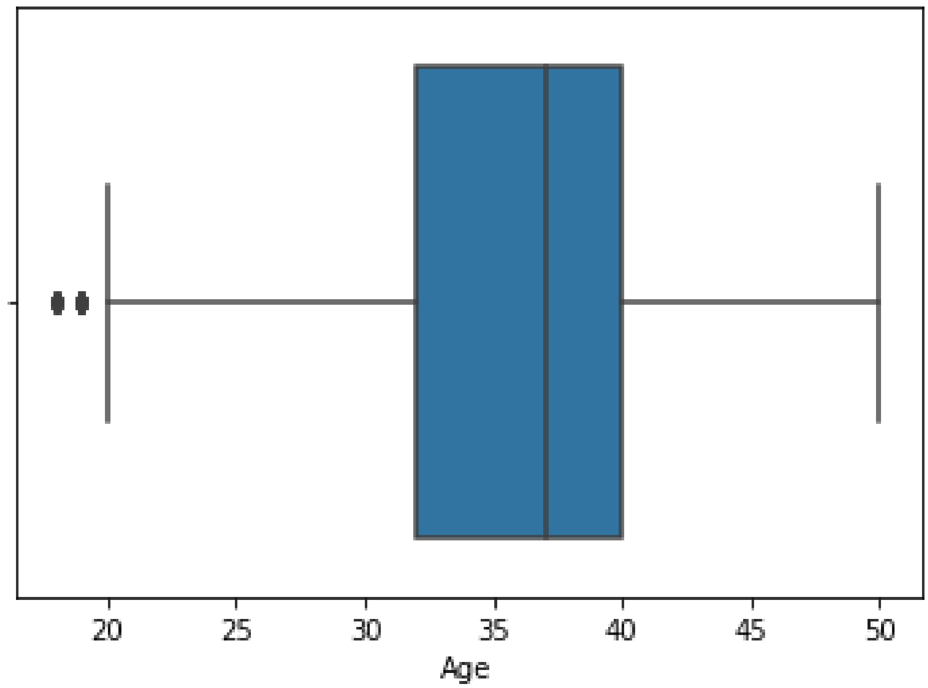

```
df['Age']=np.where(df['Age']>50,40,df['Age'])
df['Age']
```

```
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
```

```
sns.boxplot(df['Age'])
```

```
/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
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f2932a9a450>
```




```
df['Age']=np.where(df['Age']<20,35,df['Age'])
df['Age']
```

```
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
```

1. Check for Categorical columns and perform encoding.

```
pd.get_dummies(df, columns=["Gender", "Age"], prefix=["Age",
"Gender"]).head()
```

```
   RowNumber  CustomerId   Surname  CreditScore Geography  Tenure
Balance  \
0          1    15634602  Hargrave          619    France       2
0.00
1          2    15647311      Hill          608     Spain       1
83807.86
2          3    15619304      Onio          502    France       8
159660.80
3          4    15701354      Boni          699    France       1
```

```
0.00
4          5    15737888  Mitchell          850     Spain       2
125510.82

   NumOfProducts  HasCrCard  IsActiveMember  ...  Gender_41  Gender_42
\
0              1          1               1  ...          0          1

1              1          0               1  ...          1          0

2              3          1               0  ...          0          1

3              2          0               0  ...          0          0

4              1          1               1  ...          0          0


   Gender_43  Gender_44  Gender_45  Gender_46  Gender_47  Gender_48  \
0          0          0          0          0          0          0
1          0          0          0          0          0          0
2          0          0          0          0          0          0
3          0          0          0          0          0          0
4          1          0          0          0          0          0

   Gender_49  Gender_50
0          0          0
1          0          0
2          0          0
3          0          0
4          0          0

[5 rows x 45 columns]
```

1. Split the data into dependent and independent variables.

a) Split the data into Independent variables.

```
X = df.iloc[:, :-1].values
print(X)
```

```
[[1 15634602 'Hargrave' ... 1 1 101348.88]
 [2 15647311 'Hill' ... 0 1 112542.58]
 [3 15619304 'Onio' ... 1 0 113931.57]
 ...
 [9998 15584532 'Liu' ... 0 1 42085.58]
 [9999 15682355 'Sabbatini' ... 1 0 92888.52]
 [10000 15628319 'Walker' ... 1 0 38190.78]]
```

b) Split the data into Dependent variables.

```
Y = df.iloc[:, -1].values
print(Y)
```

```
[1 0 1 ... 1 1 0]
```

1. Scale the independent variables

```
import pandas as pd
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()
df[["CustomerId"]] = scaler.fit_transform(df[["CustomerId"]])

print(df)
```

```
      RowNumber  CustomerId    Surname  CreditScore Geography  Gender
Age  \
0             1    0.275616   Hargrave          619    France  Female
42
1             2    0.326454       Hill          608     Spain  Female
41
2             3    0.214421       Onio          502    France  Female
42
3             4    0.542636       Boni          699    France  Female
39
4             5    0.688778   Mitchell          850     Spain  Female
43
...         ...         ...        ...          ...       ...     ...
...
9995       9996    0.162119   Obijiaku          771    France    Male
39
9996       9997    0.016765  Johnstone          516    France    Male
35
9997       9998    0.075327        Liu          709    France  Female
36
9998       9999    0.466637  Sabbatini          772   Germany    Male
42
9999      10000    0.250483     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  Exited
0           101348.88       1
1           112542.58       0
2           113931.57       1
3            93826.63       0
4            79084.10       0
...               ...     ...
9995         96270.64       0
9996        101699.77       0
9997         42085.58       1
9998         92888.52       1
9999         38190.78       0

[10000 rows x 14 columns]
```

1. Split the data into training and testing

```
from sklearn.model_selection import train_test_split
train_size=0.8
X = df.drop(columns = ['Tenure']).copy()
y = df['Tenure']
X_train, X_rem, y_train, y_rem = train_test_split(X,y, train_size=0.8)
test_size = 0.5
X_valid, X_test, y_valid, y_test = train_test_split(X_rem,y_rem,
test_size=0.5)
print(X_train.shape), print(y_train.shape)
print(X_valid.shape), print(y_valid.shape)
print(X_test.shape), print(y_test.shape)
```

```
(8000, 13)
(8000,)
(1000, 13)
(1000,)
(1000, 13)
(1000,)

(None, None)
```