

## Assignment -II

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1) Importing

In [ ]:

```
import pandas as pd
```

```
import numpy as np
```

```
import seaborn as sns
```

```
from matplotlib import pyplot as plt
```

```
import warnings
```

```
warnings.filterwarnings('ignore')
```

2.Load the Dataset

In [ ]:

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

In [43]:

```
data
```

Out[43]:

	<b>Row Num</b>	<b>Cust omer</b>	<b>Sur nam</b>	<b>Credi tScor</b>	<b>Geog raph</b>	<b>Ge nd</b>	<b>A g</b>	<b>Te nu</b>	<b>Bala nce</b>	<b>NumOf Produc</b>	<b>HasC rCar</b>	<b>IsActiv eMemb</b>	<b>Estimat edSalar</b>	<b>Ex ite</b>
--	--------------------	----------------------	--------------------	------------------------	----------------------	------------------	----------------	------------------	---------------------	-------------------------	----------------------	--------------------------	----------------------------	-------------------

	ber	Id	e	e	y	er	e	re		ts	d	er	y	d
0	1	0.275 616	Har grav e	619	Franc e	Fe mal e	4 2	2	0.00	1	1	1	101348. 88	1
1	2	0.326 454	Hill	608	Spain	Fe mal e	4 1	1	8380 7.86	1	0	1	112542. 58	0
2	3	0.214 421	Oni o	502	Franc e	Fe mal e	4 2	8	1596 60.8 0	3	1	0	113931. 57	1
3	4	0.542 636	Bon i	699	Franc e	Fe mal e	3 9	1	0.00	2	0	0	93826.6 3	0
4	5	0.688 778	Mitc hell	850	Spain	Fe mal e	4 3	2	1255 10.8 2	1	1	1	79084.1 0	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9 9 9 5	9996	0.162 119	Obij iaku	771	Franc e	Ma le	3 9	5	0.00	2	1	0	96270.6 4	0
9 9 9 6	9997	0.016 765	John ston e	516	Franc e	Ma le	3 5	10	5736 9.61	1	1	1	101699. 77	0

9997	9998	0.075327	Liu	709	France	Female	36	7	0.00	1	0	1	42085.58	1
9998	9999	0.466637	Sab bati ni	772	Germany	Male	42	3	75075.31	2	1	0	92888.52	1
9999	10000	0.250483	Wal ker	792	France	Female	28	4	130142.79	1	1	0	38190.78	0

10000 rows × 14 columns

### 3. Visualizations

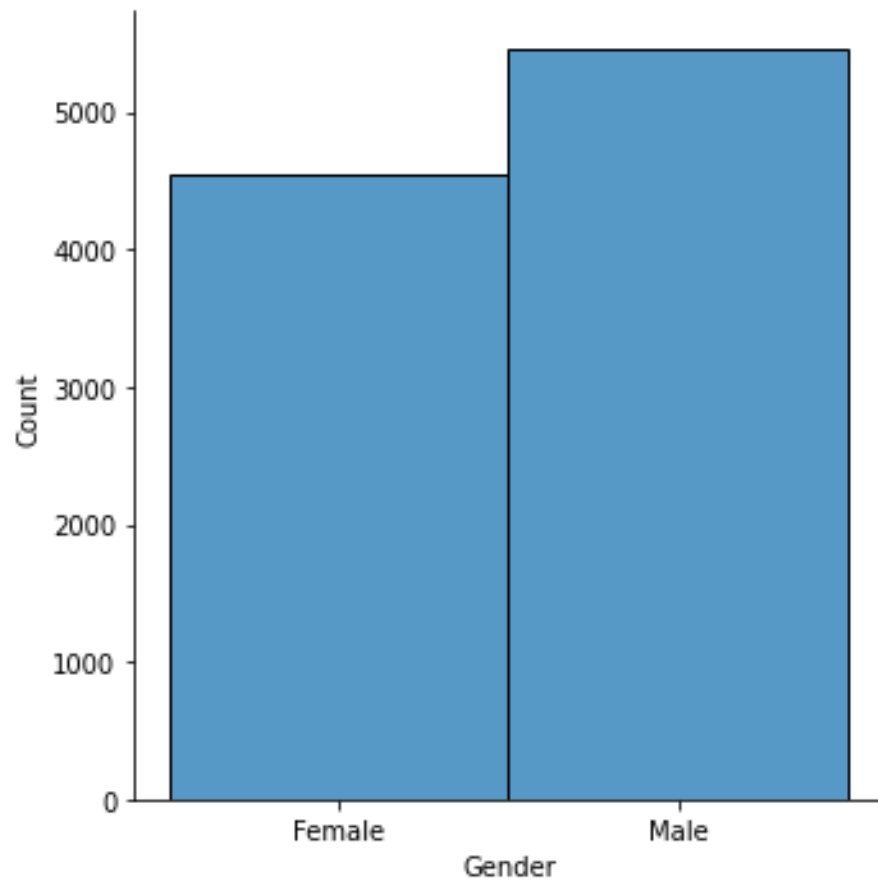
#### a) Univariate Analysis

In [44]:

```
sns.displot(data.Gender)
```

Out[44]:

<seaborn.axisgrid.FacetGrid at 0x7f80cb07c690>



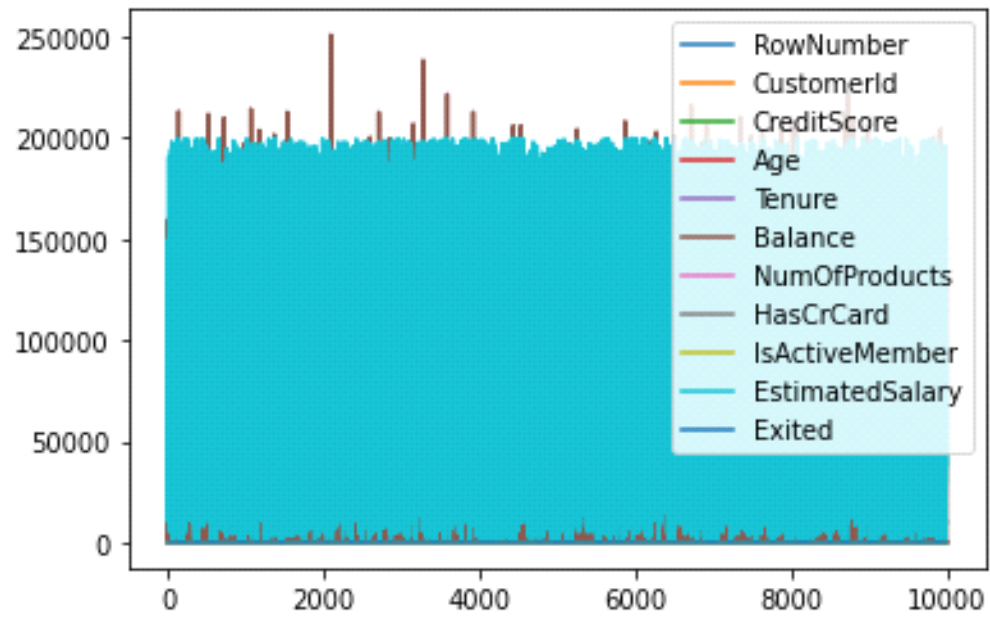
## B)Bi-Variate Analysis

In [45]:

```
data.plot.line()
```

Out[45]:

<matplotlib.axes.\_subplots.AxesSubplot at 0x7f80cb9a8a50>



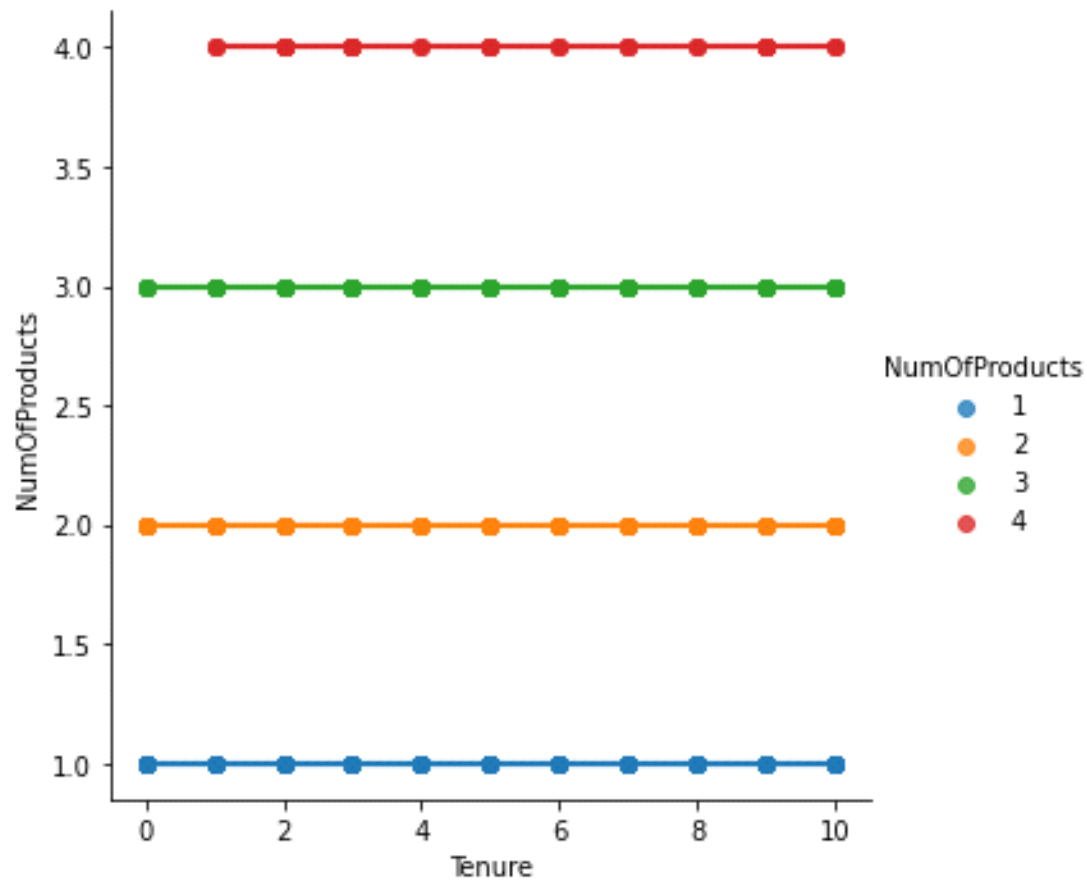
### C)Multi - Variate Analysis

In [46]:

```
sns.lmplot("Tenure","NumOfProducts",data,hue="NumOfProducts")
```

Out[46]:

<seaborn.axisgrid.FacetGrid at 0x7f80cb95fe10>



4)Perform descriptive statistics on the dataset.

In [47]:

```
data.describe()
```

Out[47]:

	RowN umber	Custo merId	Credit Score	Age	Tenur e	Balanc e	NumOf Product s	HasC rCard	IsActive Member	Estimat edSalar y	Exited
co un t	10000. 00000	10000. 000000	10000. 000000	10000. 000000	10000. 000000	10000.0 00000	10000.0 00000	10000. 00000	10000.00 0000	10000.00 0000	10000. 000000
m ea	5000.5	0.5009	650.52	36.533	5.0128	76485.8	1.53020	0.7055	0.515100	100090.2	0.2037

<b>n</b>	0000	80	8800	900	00	89288	0	0		39881	00
<b>st</b>	2886.8	0.2877	96.653	6.4738	2.8921	62397.4	0.58165	0.4558	0.499797	57510.49	0.4027
<b>d</b>	9568	57	299	43	74	05202	4	4		2818	69
<b>mi</b>	1.0000	0.0000	350.00	20.000	0.0000	0.00000	1.00000	0.0000	0.000000	11.58000	0.0000
<b>n</b>	0	00	0000	000	00	0	0	0		0	00
<b>25</b>	2500.7	0.2513	584.00	32.000	3.0000	0.00000	1.00000	0.0000	0.000000	51002.11	0.0000
<b>%</b>	5000	20	0000	000	00	0	0	0		0000	00
<b>50</b>	5000.5	0.5001	652.00	37.000	5.0000	97198.5	1.00000	1.0000	1.000000	100193.9	0.0000
<b>%</b>	0000	70	0000	000	00	40000	0	0		15000	00
<b>75</b>	7500.2	0.7501	718.00	40.000	7.0000	127644.	2.00000	1.0000	1.000000	149388.2	0.0000
<b>%</b>	5000	64	0000	000	00	240000	0	0		47500	00
<b>m</b>	10000.	1.0000	850.00	50.000	10.000	250898.	4.00000	1.0000	1.000000	199992.4	1.0000
<b>ax</b>	00000	00	0000	000	000	090000	0	0		80000	00

5)Handle the Missing values.

In [ ]:

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

```
pd.isnull(data["Gender"])
```

Out[ ]:

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

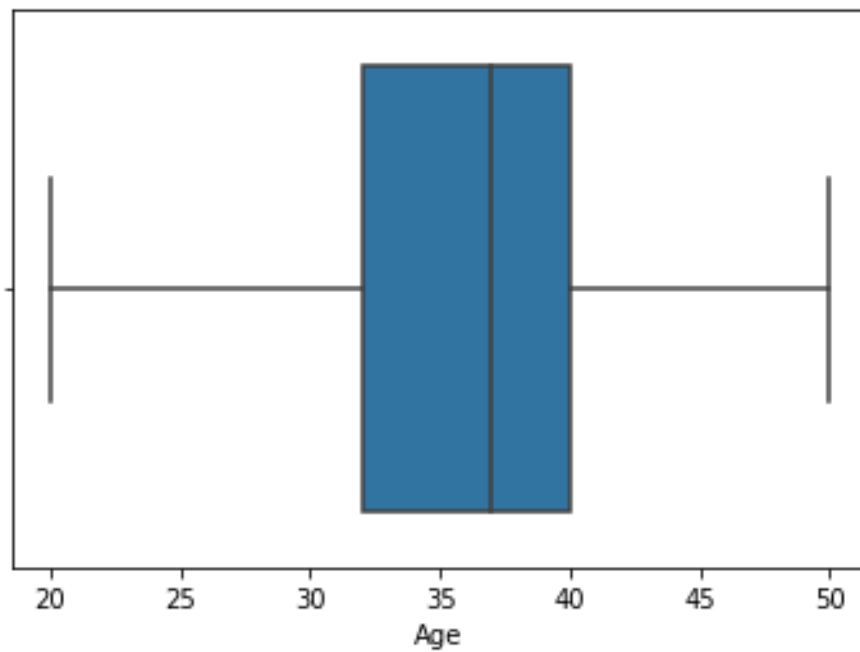
6) Find the outliers and replace the outliers

In [48]:

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

Out[48]:

<matplotlib.axes.\_subplots.AxesSubplot at 0x7f80caeafc50>



In [28]:

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

```
data['Age']
```

Out[28]:

0 42

1 41



```
2    42
3    39
4    43
..
9995  39
9996  35
9997  36
9998  42
9999  28
```

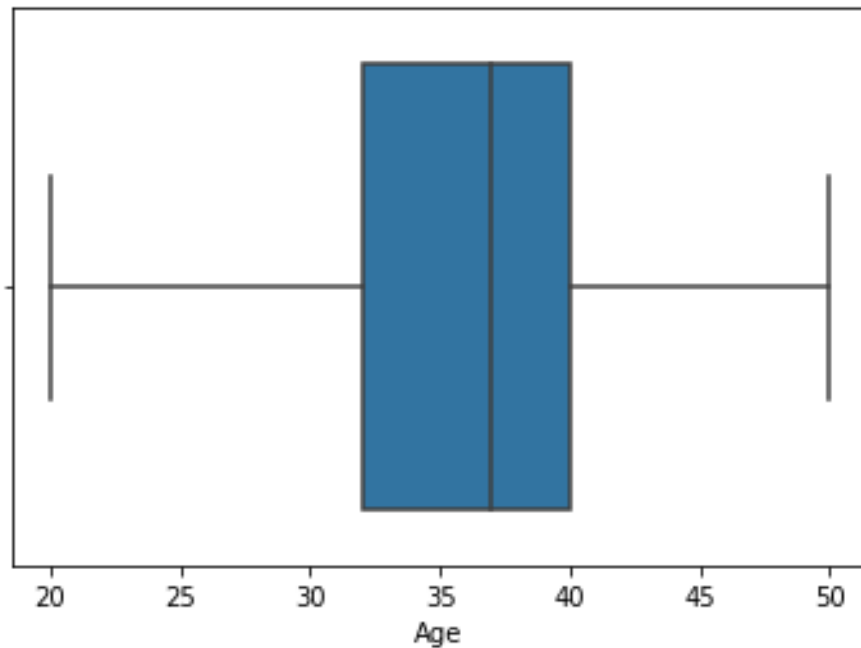
Name: Age, Length: 10000, dtype: int64

In [49]:

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

Out[49]:

<matplotlib.axes.\_subplots.AxesSubplot at 0x7f80cb95fc10>



In [34]:

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

```
data['Age']
```

```
Out[34]:
```

```
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

7) Check for Categorical columns and perform encoding.

```
In [50]:
```

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

```
Out[50]:
```

	Row Number	Customer Id	Survived	Credit Score	Gender	Tenure	Balance	Num of Products	Has Credit Card	IsActive Member	.	Age_41	Age_42	Age_43	Age_44	Age_45	Age_46	Age_47	Age_48	Age_49	Age_50
0	1	0.27	Har	619	Female	2	0.0	1	1	1	.	0	1	0	0	0	0	0	0	0	0

		56 16	gr a v e		ce		0				.										
1	2	0. 32 64 54	H ill	60 8	Sp ai n	1	8 3 8 0 7. 8 6	1	0	1	.	1	0	0	0	0	0	0	0	0	0
2	3	0. 21 44 21	O ni o	50 2	Fr an ce	8	1 5 9 6 6 0. 8 0	3	1	0	.	0	1	0	0	0	0	0	0	0	0
3	4	0. 54 26 36	B o ni	69 9	Fr an ce	1	0. 0 0	2	0	0	.	0	0	0	0	0	0	0	0	0	0
4	5	0. 68 87 78	M it c h el	85 0	Sp ai n	2	1 2 5 5 1	1	1	1	.	0	0	1	0	0	0	0	0	0	0

[illegible]

8) Split the data into dependent and independent variables.

A) Split the data into Independent variables.

In [37]:

```
X = data.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.

In [38]:

```
Y = data.iloc[:, -1].values
```

```
print(Y)
```

$$[1 \ 0 \ 1 \ \dots \ 1 \ 1 \ 0]$$

9) Scale the independent variables

In [39]:

```
import pandas as pd
```

```
from sklearn.preprocessing import MinMaxScaler
```

```
scaler = MinMaxScaler()
```

```
data[["CustomerId"]] = scaler.fit_transform(data[["CustomerId"]])
```

In [40]:

```
print(data)
```

	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]

10) Split the data into training and testing

In [42]:

```

from sklearn.model_selection import train_test_split

train_size=0.8

X = data.drop(columns = ["Tenure"]).copy()
y = data["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,)

Out[42]:

(None, None)