## LOADING THE DATASET

```
file=("Churn_Modelling.csv")

import pandas as pd

dataset=pd.read_csv(file)

dataset
```

```
      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]
```

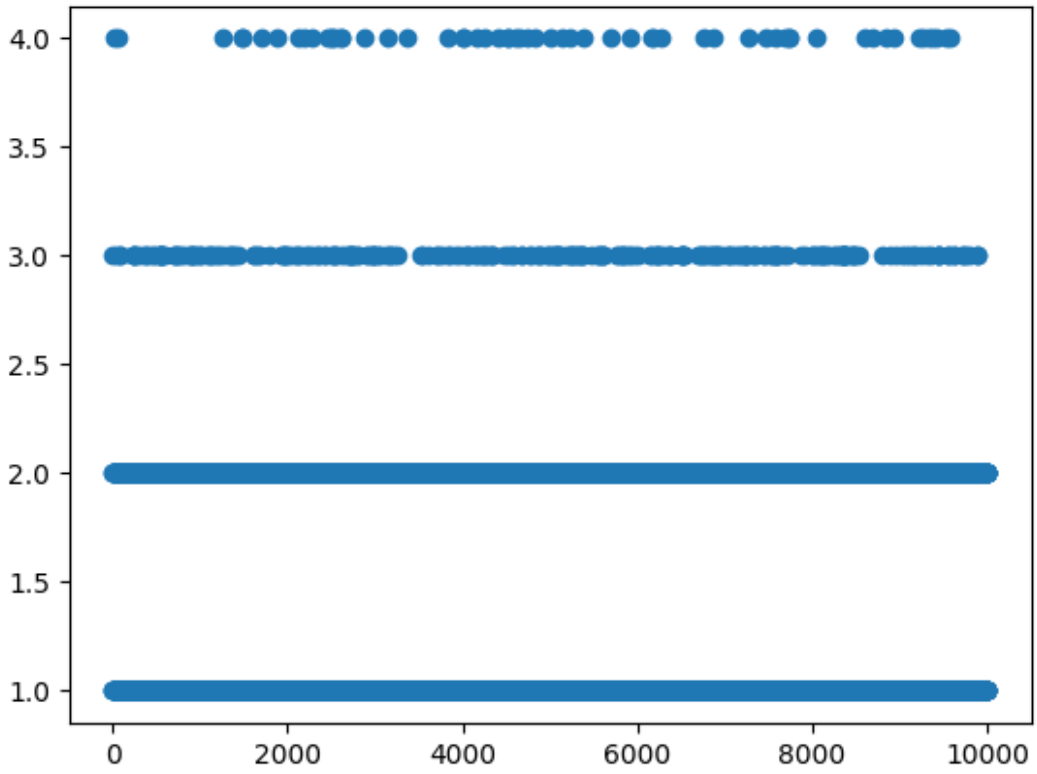
```
dataset.dtypes
```

```
RowNumber            int64
CustomerId           int64
Surname             object
CreditScore          int64
Geography           object
Gender              object
Age                  int64
Tenure               int64
Balance            float64
NumOfProducts        int64
HasCrCard            int64
IsActiveMember       int64
EstimatedSalary    float64
Exited               int64
dtype: object
```

```
import matplotlib.pyplot as plt
import seaborn as sns
```

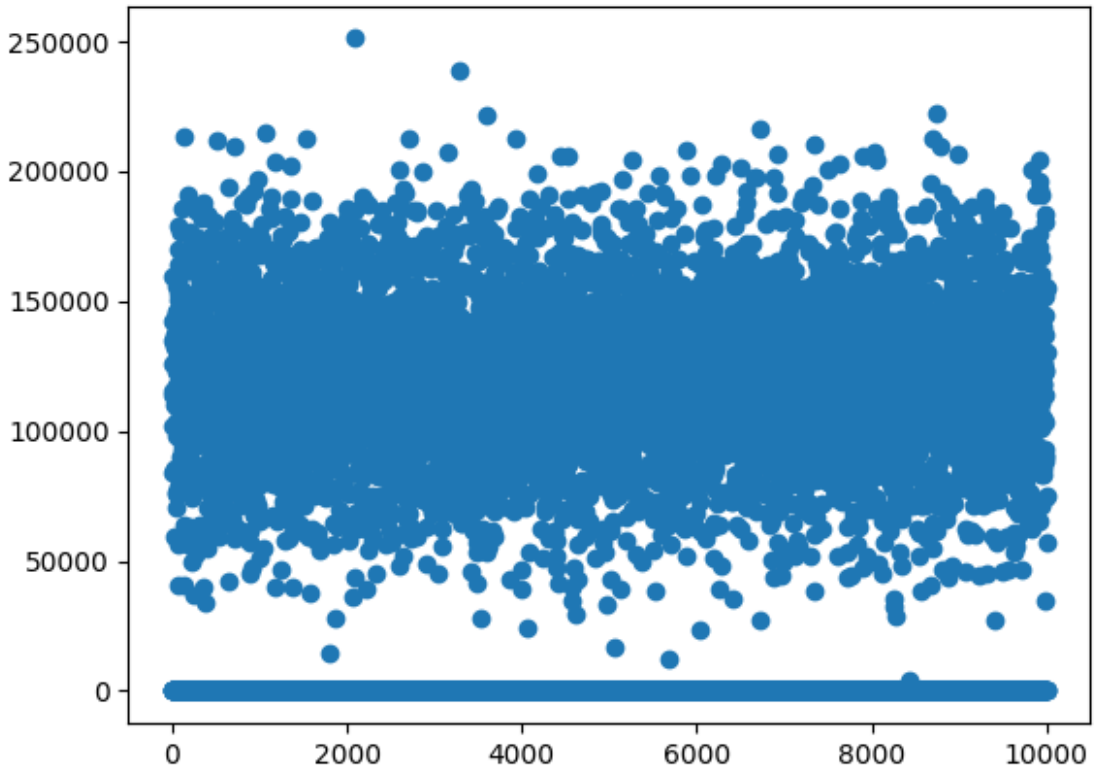
```
plt.scatter(dataset.index,dataset['NumOfProducts'])
```

```
<matplotlib.collections.PathCollection at 0x13a2831f0>
```



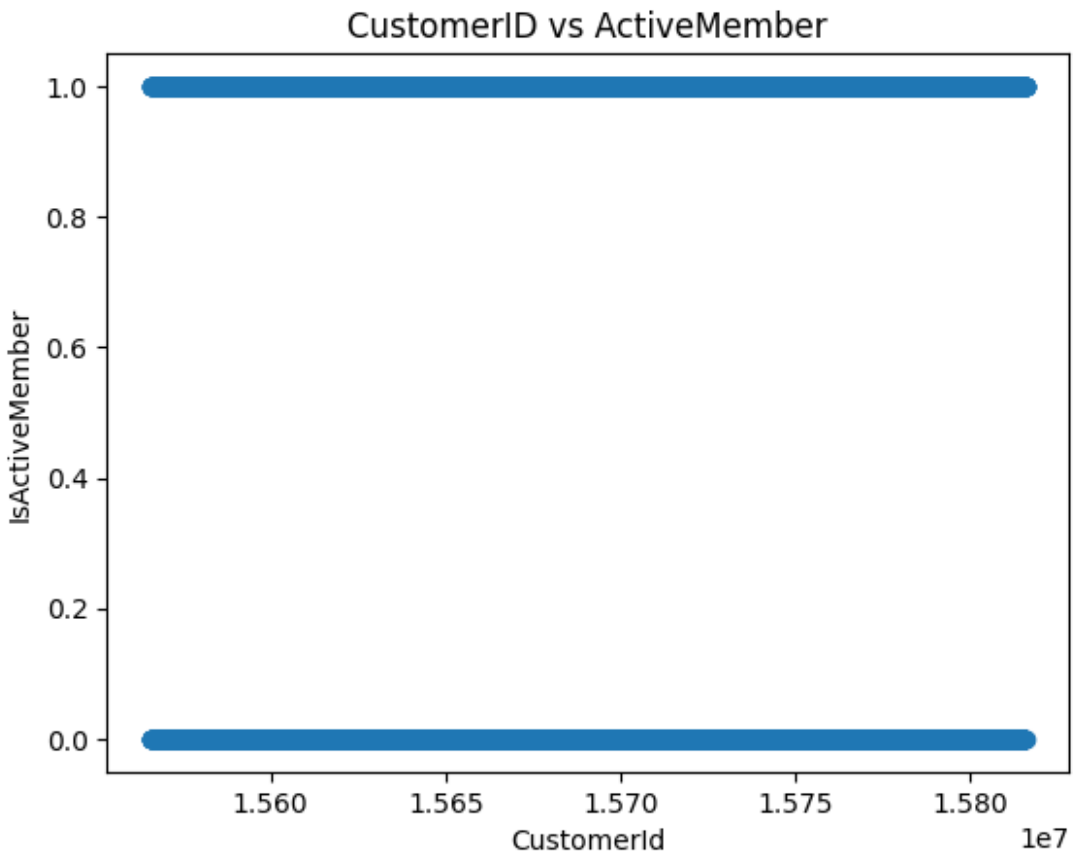

```
plt.scatter(dataset.index,dataset['Balance'])
```

```
<matplotlib.collections.PathCollection at 0x13a3a8550>
```



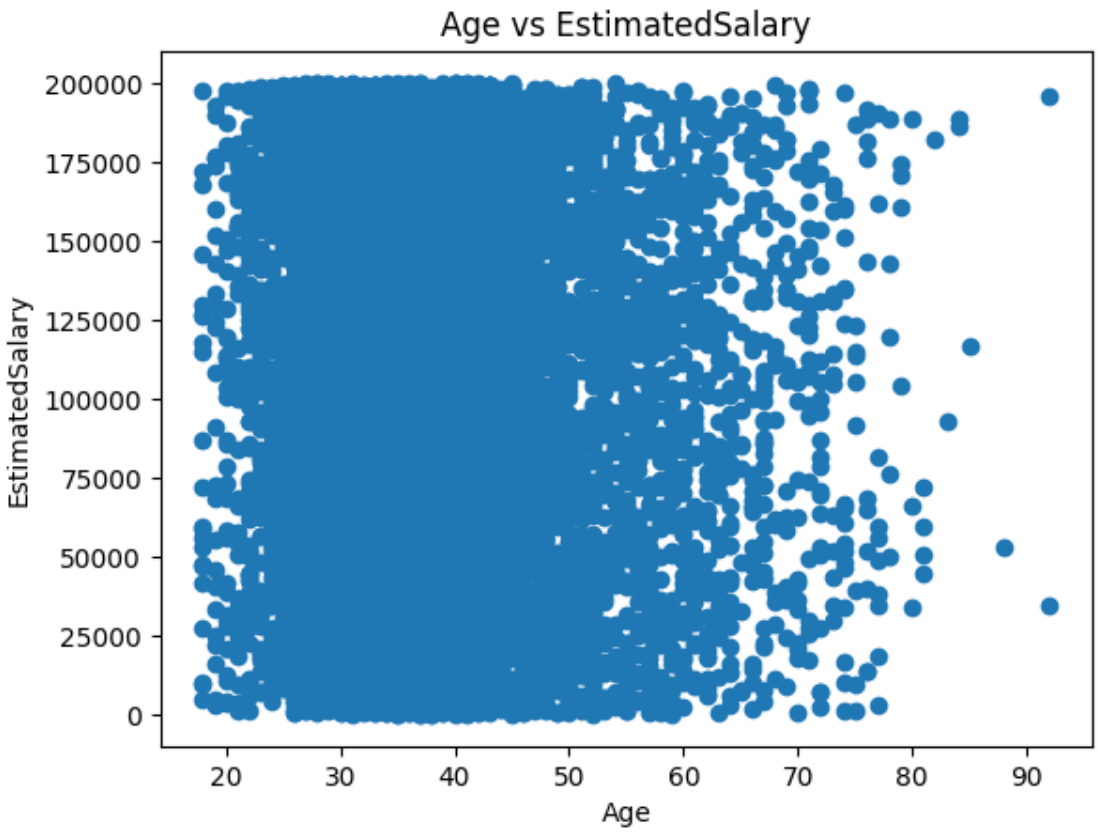

```
plt.scatter(dataset.CustomerId,dataset.IsActiveMember)
plt.title("CustomerID vs ActiveMember")
plt.xlabel("CustomerId")
plt.ylabel("IsActiveMember")
```

```
Text(0, 0.5, 'IsActiveMember')
```




```
plt.scatter(dataset.Age,dataset.EstimatedSalary)
plt.title("Age vs EstimatedSalary")
plt.xlabel("Age")
plt.ylabel("EstimatedSalary")
```

```
Text(0, 0.5, 'EstimatedSalary')
```




## PERFORMING DESCRIPTIVE ANALYSIS ON THE DATASET

```
dataset.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
```

## HANDLING THE MISSING VALUES

```
dataset.isnull().sum()
```

```
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
```

```
dataset[dataset.isnull().any(axis=1)]
```

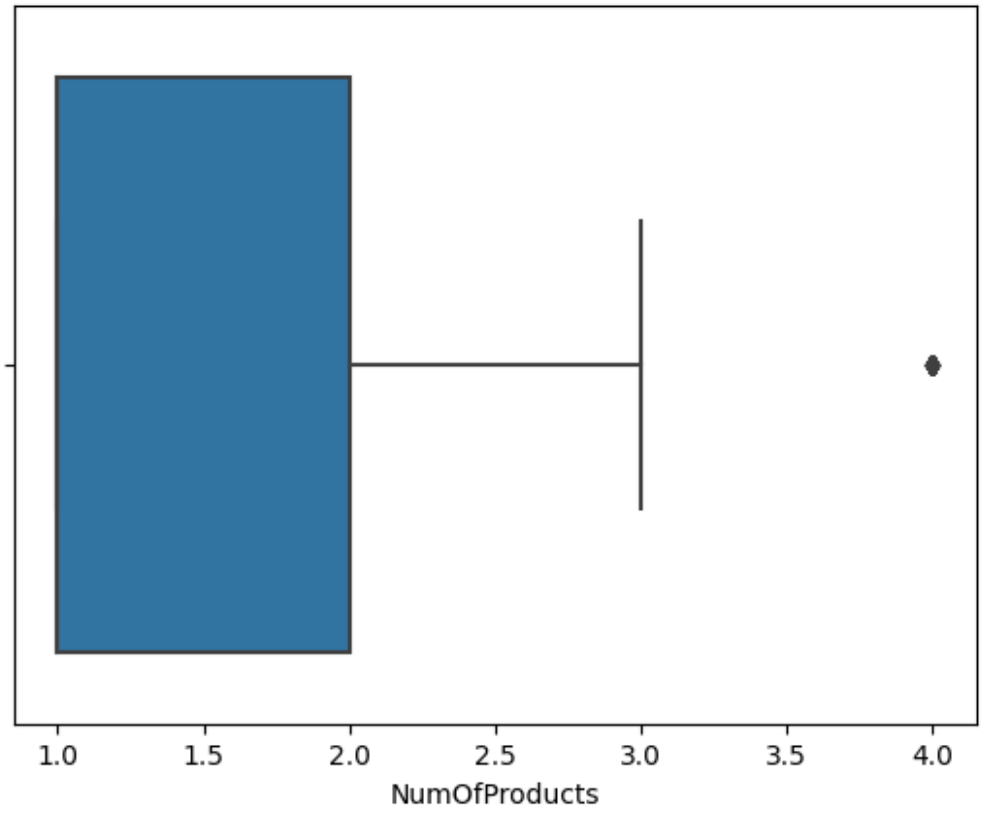
```
Empty DataFrame
Columns: [RowNumber, CustomerId, Surname, CreditScore, Geography,
Gender, Age, Tenure, Balance, NumOfProducts, HasCrCard,
IsActiveMember, EstimatedSalary, Exited]
Index: []
```

## FIND THE OUTLIERS AND REPLACE IT

```
sns.boxplot(dataset['NumOfProducts'],data=dataset)
```

```
/Library/Frameworks/Python.framework/Versions/3.10/lib/python3.10/
site-packages/seaborn/_decorators.py:36: 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.
  warnings.warn(

<AxesSubplot:xlabel='NumOfProducts'>
```




```
Q1=dataset['NumOfProducts'].quantile(0.25)
Q3=dataset['NumOfProducts'].quantile(0.75)
IQR=Q3-Q1
IQR

1.0

P_mean = dataset['NumOfProducts'].mean()
p_std = dataset['NumOfProducts'].std()
low= P_mean -(3 * p_std)
high= P_mean + (3 * p_std)
p_outliers = dataset[(dataset['NumOfProducts'] < low) |
(dataset['NumOfProducts'] > high)]
p_outliers.head()
```

```
      RowNumber  CustomerId     Surname  CreditScore Geography  Gender
Age  \
7             8    15656148      Obinna          376   Germany  Female
29
70           71    15703793  Konovalova          738   Germany    Male
58
1254       1255    15610383  Dumetolisa          628    France  Female
46
1469       1470    15670374      Wright          819   Germany  Female
49
1488       1489    15625824   Kornilova          596     Spain    Male
30

      Tenure    Balance  NumOfProducts  HasCrCard  IsActiveMember  \
7          4  115046.74              4          1               0
70         2  133745.44              4          1               0
1254       1   46870.43              4          1               0
1469       1  120656.86              4          0               0
1488       6  121345.88              4          1               0

      EstimatedSalary  Exited
7           119346.88       1
70           28373.86       1
1254         31272.14       1
1469        166164.30       1
1488         41921.75       1
```

## Label encoding

```
dataset["Gender"] = dataset["Gender"].astype('category')
dataset.dtypes
```

```
RowNumber             int64
CustomerId            int64
Surname              object
CreditScore           int64
Geography            object
Gender             category
Age                   int64
Tenure                int64
Balance             float64
NumOfProducts         int64
HasCrCard             int64
IsActiveMember        int64
EstimatedSalary     float64
Exited                int64
dtype: object
```

```
dataset["gender_cat"] = dataset["Gender"].cat.codes
dataset
```

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

```
[10000 rows x 15 columns]
```

## Split the data into dependent and independent variables.

```
X = dataset.iloc[:, :-1].values
X
```

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

```
Y = dataset.iloc[:, -2].values
Y
```

```
array([1, 0, 1, ..., 1, 1, 0])
```

## Scale the independent variables

```
from sklearn import preprocessing
```

```
x=dataset.iloc[:,12:14]
x
```

```
      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 2 columns]
```

```
min_max_scaler = preprocessing.MinMaxScaler(feature_range =(0, 1))
new_x= min_max_scaler.fit_transform(x)
new_x
```

```
array([[0.50673489, 1.        ],
       [0.56270874, 0.        ],
       [0.56965435, 1.        ],
```

```
       ...,
       [0.21039009, 1.        ],
       [0.46442905, 1.        ],
       [0.19091423, 0.        ]])
```

## Split the data into training and testing

```
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, random_state=1)

dataset.shape

(10000, 15)

X_train.shape

(6700, 14)

X_test.shape

(3300, 14)
```