Step 1

```
import pandas as pd
import seaborn as sns
```

```
from google.colab import files
uploaded = files.upload()
```

Choose Files No file chosen Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.

```
Saving Churn_Modelling.csv to Churn_Modelling.csv
```

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

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure
0	1	15634602	Hargrave	619	France	Female	42	2
1	2	15647311	Hill	608	Spain	Female	41	1
2	3	15619304	Onio	502	France	Female	42	8
3	4	15701354	Boni	699	France	Female	39	1
4	5	15737888	Mitchell	850	Spain	Female	43	2
...	...	...	...	...	...	...	...	...
9995	9996	15606229	Obijiaku	771	France	Male	39	5
9996	9997	15569892	Johnstone	516	France	Male	35	10
9997	9998	15584532	Liu	709	France	Female	36	7
9998	9999	15682355	Sabbatini	772	Germany	Male	42	3
9999	10000	15628319	Walker	792	France	Female	28	4

10000 rows × 14 columns

Step 2

```
df.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
```

```
df.describe()
```

	RowNumber	CustomerId	CreditScore	Age	Tenure	Bala
count	10000.00000	1.000000e+04	10000.000000	10000.000000	10000.000000	10000.0000
mean	5000.50000	1.569094e+07	650.528800	38.921800	5.012800	76485.889
std	2886.89568	7.193619e+04	96.653299	10.487806	2.892174	62397.405
min	1.00000	1.556570e+07	350.000000	18.000000	0.000000	0.000
25%	2500.75000	1.562853e+07	584.000000	32.000000	3.000000	0.000
50%	5000.50000	1.569074e+07	652.000000	37.000000	5.000000	97198.540
75%	7500.25000	1.575323e+07	718.000000	44.000000	7.000000	127644.240
max	10000.00000	1.581569e+07	850.000000	92.000000	10.000000	250898.090

```
df.isnull().any()
```

```
RowNumber          False
CustomerId         False
Surname            False
CreditScore        False
Geography          False
Gender             False
Age                False
Tenure             False
Balance            False
NumOfProducts      False
HasCrCard          False
IsActiveMember     False
EstimatedSalary    False
Exited             False
dtype: bool
```

```
df.isna().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
```

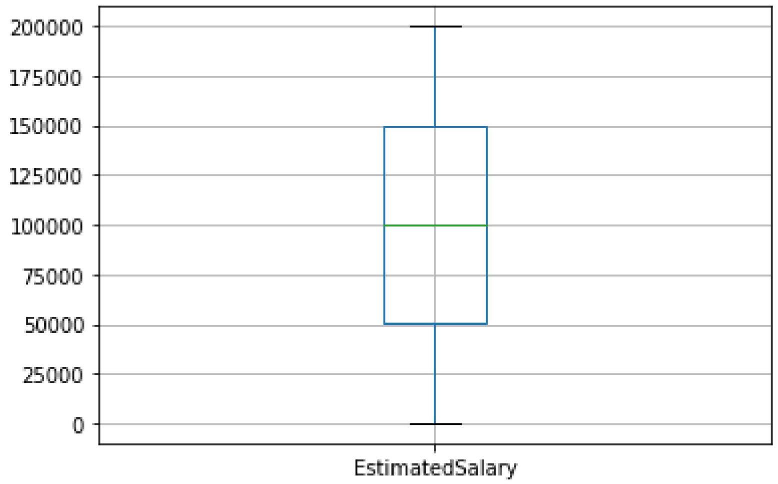
```
EstimatedSalary    0
Exited             0
dtype: int64
```

```
df.skew()
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: FutureWarning: Droppi
  """Entry point for launching an IPython kernel.
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
```

```
df.boxplot(column="EstimatedSalary")
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7ff3b18e8450>
```



```
df=df[(df.EstimatedSalary > 25000) & (df.EstimatedSalary<175000)]
df
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure
0	1	15634602	Hargrave	619	France	Female	42	2
1	2	15647311	Hill	608	Spain	Female	41	1
2	3	15619304	Onio	502	France	Female	42	8
3	4	15701354	Boni	699	France	Female	39	1
4	5	15737888	Mitchell	850	Spain	Female	43	2

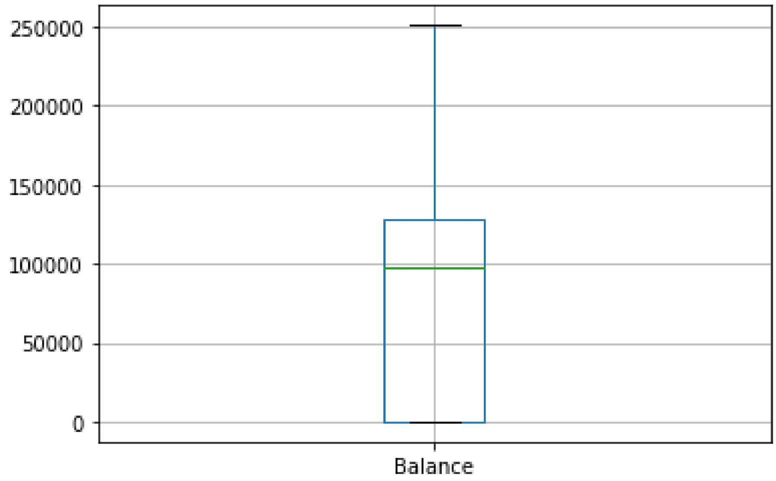
```
df.NumOfProducts.unique()
```

```
array([1, 3, 2, 4])
```

9996	9997	15569892	Johnstone	516	France	Male	35	10

```
df.boxplot(column="Balance")
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7ff3b17f9410>
```

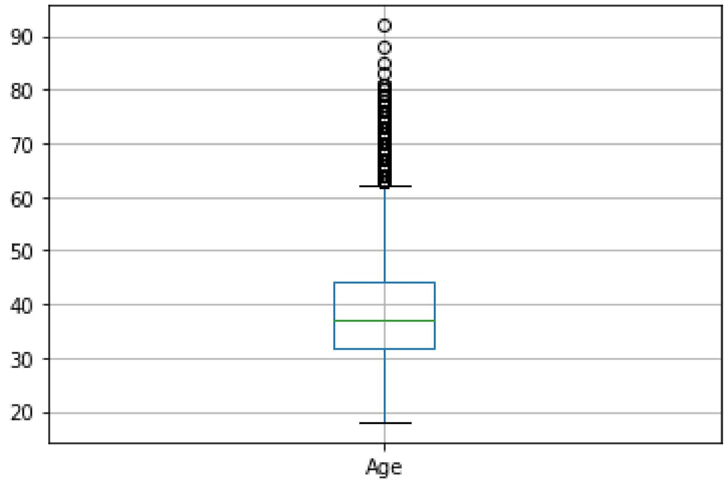


```
df=df[df.Balance < 150000]
df
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure
0	1	15634602	Hargrave	619	France	Female	42	2

```
df.boxplot(column="Age")
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7ff3b12f7210>
```



6782 rows × 14 columns

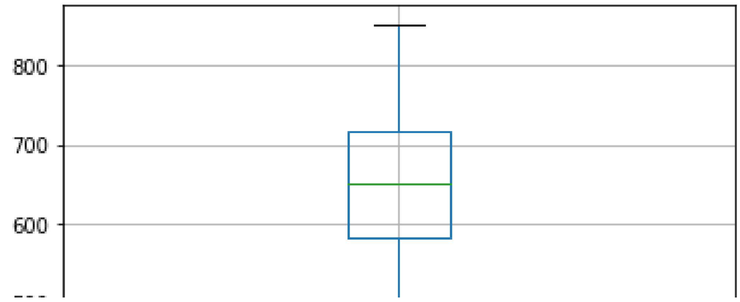
```
df=df[(df.Age <50) & (df.Age >20)]
df
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure
0	1	15634602	Hargrave	619	France	Female	42	2
1	2	15647311	Hill	608	Spain	Female	41	1
3	4	15701354	Boni	699	France	Female	39	1
4	5	15737888	Mitchell	850	Spain	Female	43	2
5	6	15574012	Chu	645	Spain	Male	44	8
...	...	...	...	...	...	...	...	...
9995	9996	15606229	Obijiaku	771	France	Male	39	5
9996	9997	15569892	Johnstone	516	France	Male	35	10
9997	9998	15584532	Liu	709	France	Female	36	7
9998	9999	15682355	Sabbatini	772	Germany	Male	42	3
9999	10000	15628319	Walker	792	France	Female	28	4

5783 rows × 14 columns

```
df.boxplot(column="CreditScore")
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7ff3b1295d10>
```



```
df=df[(df.CreditScore>500) & (df.CreditScore<790)]
df
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenur
0	1	15634602	Hargrave	619	France	Female	42	
1	2	15647311	Hill	608	Spain	Female	41	
3	4	15701354	Boni	699	France	Female	39	
5	6	15574012	Chu	645	Spain	Male	44	
8	9	15792365	He	501	France	Male	44	
...	...	...	...	...	...	...	...	.
9990	9991	15798964	Nkemakonam	714	Germany	Male	33	
9995	9996	15606229	Obijiaku	771	France	Male	39	
9996	9997	15569892	Johnstone	516	France	Male	35	1
9997	9998	15584532	Liu	709	France	Female	36	
9998	9999	15682355	Sabbatini	772	Germany	Male	42	

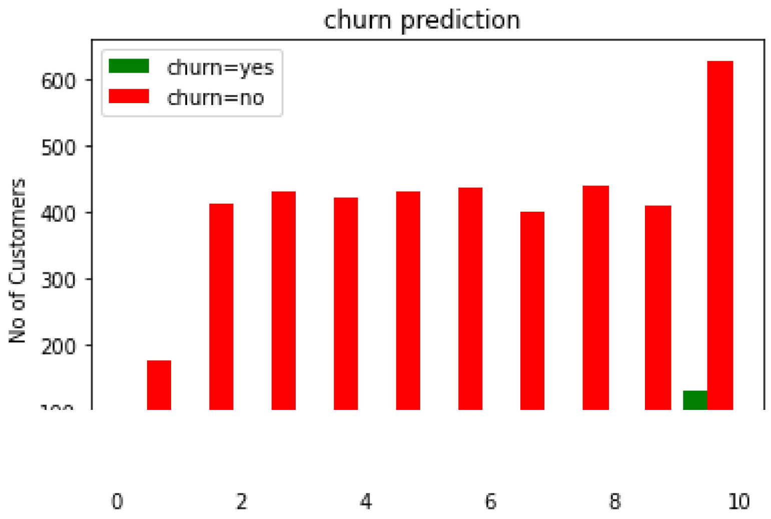
4993 rows × 14 columns

```
churn_yes=df['Tenure'][df.Exited == 1]
churn_no=df['Tenure'][df.Exited == 0]
```

```
import matplotlib.pyplot as plt

plt.xlabel("Tenure")
plt.ylabel("No of Customers")
plt.title("churn prediction ")
plt.hist([churn_yes,churn_no],color=["green","red"],label=["churn=yes","churn=no"])
plt.legend()
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/numpy/core/fromnumeric.py:3208: VisibleDepreca
  return asarray(a).size
/usr/local/lib/python3.7/dist-packages/matplotlib/cbook/__init__.py:1376: VisibleDepr
  X = np.atleast_1d(X.T if isinstance(X, np.ndarray) else np.asarray(X))
```

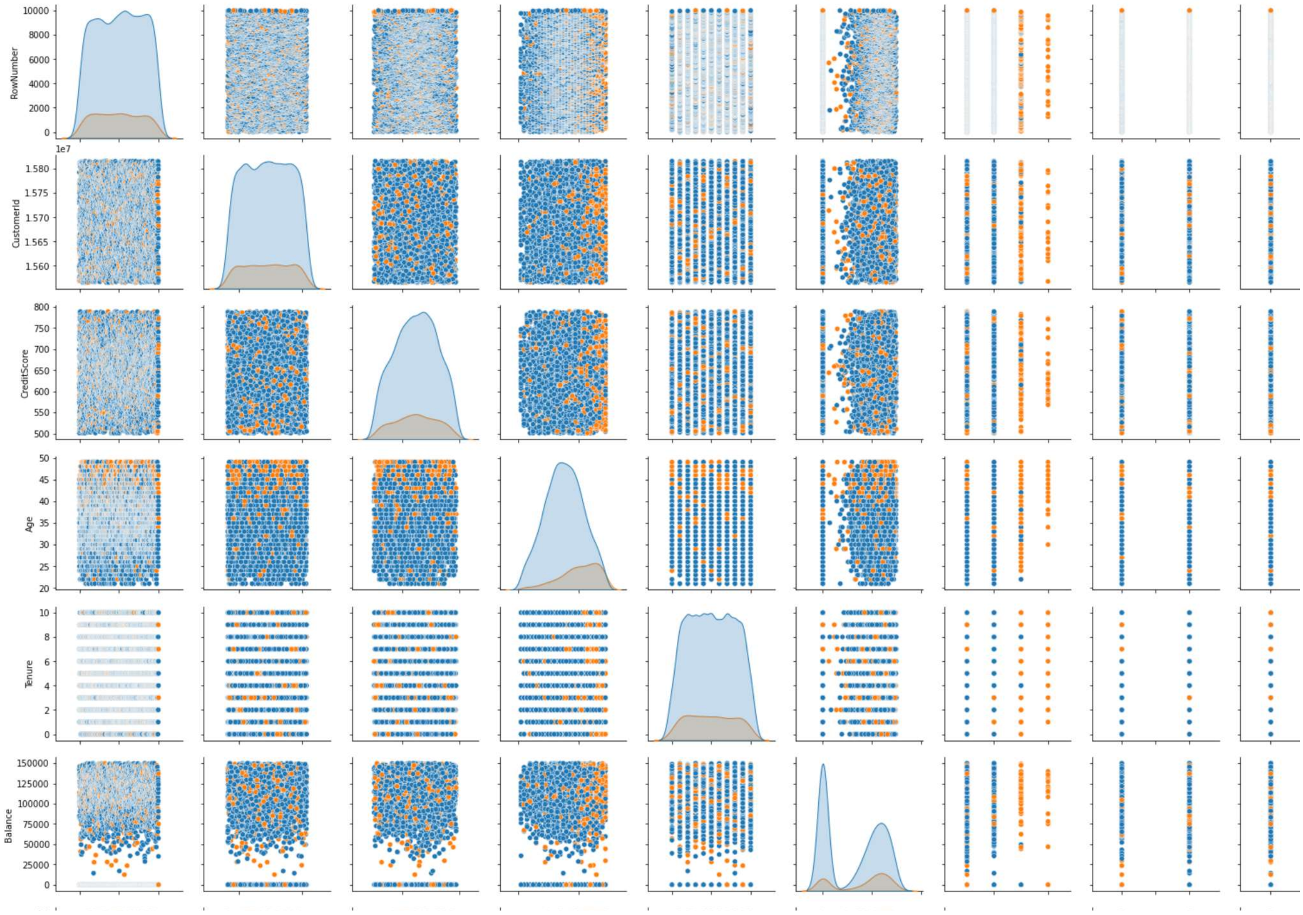


```
df.columns
```

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

```
sns.pairplot(data=df,hue='Exited')
```

```
<seaborn.axisgrid.PairGrid at 0x7ff3ac0c3110>
```



```
feature=df[['CreditScore','Geography',
       'Gender', 'Age', 'Tenure', 'Balance', 'NumOfProducts', 'HasCrCard',
       'IsActiveMember', 'EstimatedSalary']]
feature
```

	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCa
0	619	France	Female	42	2	0.00	1	
1	608	Spain	Female	41	1	83807.86	1	
3	699	France	Female	39	1	0.00	2	
5	645	Spain	Male	44	8	113755.78	2	
8	501	France	Male	44	4	142051.07	2	
...	...	...	...	...	...	...	...	
9990	714	Germany	Male	33	3	35016.60	1	
9995	771	France	Male	39	5	0.00	2	
9996	516	France	Male	35	10	57369.61	1	
9997	709	France	Female	36	7	0.00	1	
9998	772	Germany	Male	42	3	75075.31	2	

4993 rows × 10 columns

```
label=df['Exited']
```

```
label
```

```
0       1
1       0
3       0
5       1
8       0
       ..
9990    0
9995    0
9996    0
9997    1
9998    1
Name: Exited, Length: 4993, dtype: int64
```

```
from sklearn.compose import ColumnTransformer
from sklearn.preprocessing import OneHotEncoder

ct = ColumnTransformer([("oh",OneHotEncoder(),[1,2])],remainder="passthrough")
feature_onehot= ct.fit_transform(feature)
feature_onehot
```

```
array([[1.0000000e+00, 0.0000000e+00, 0.0000000e+00, ..., 1.0000000e+00,
        1.0000000e+00, 1.0134888e+05],
       [0.0000000e+00, 0.0000000e+00, 1.0000000e+00, ..., 0.0000000e+00,
        1.0000000e+00, 1.1254258e+05],
       [1.0000000e+00, 0.0000000e+00, 0.0000000e+00, ..., 0.0000000e+00,
        0.0000000e+00, 9.3826630e+04],
       ...,
       [1.0000000e+00, 0.0000000e+00, 0.0000000e+00, ..., 1.0000000e+00,
        1.0000000e+00, 1.0169977e+05],
       [1.0000000e+00, 0.0000000e+00, 0.0000000e+00, ..., 0.0000000e+00,
        1.0000000e+00, 4.2085580e+04],
       [0.0000000e+00, 1.0000000e+00, 0.0000000e+00, ..., 1.0000000e+00,
        0.0000000e+00, 9.2888520e+04]])
```

```
len(feature_onehot)
```

```
4993
```

```
feature_onehot[0]
```

```
array([1.0000000e+00, 0.0000000e+00, 0.0000000e+00, 1.0000000e+00,
       0.0000000e+00, 6.1900000e+02, 4.2000000e+01, 2.0000000e+00,
       0.0000000e+00, 1.0000000e+00, 1.0000000e+00, 1.0000000e+00,
       1.0134888e+05])
```

```
df["Geography"].unique()
```

```
array(['France', 'Spain', 'Germany'], dtype=object)
```

```
df["Gender"].unique()
```

```
array(['Female', 'Male'], dtype=object)
```

```
from sklearn.model_selection import train_test_split
trainX,testX,trainY,testY = train_test_split(feature_onehot,label,test_size=0.2,random_sta
```

```
trainX
```

```
array([[0.0000000e+00, 1.0000000e+00, 0.0000000e+00, ..., 1.0000000e+00,
        0.0000000e+00, 8.4300400e+04],
       [0.0000000e+00, 0.0000000e+00, 1.0000000e+00, ..., 1.0000000e+00,
        1.0000000e+00, 1.4203307e+05],
       [1.0000000e+00, 0.0000000e+00, 0.0000000e+00, ..., 1.0000000e+00,
        1.0000000e+00, 1.6737626e+05],
       ...,
       [0.0000000e+00, 1.0000000e+00, 0.0000000e+00, ..., 1.0000000e+00,
        0.0000000e+00, 3.8270470e+04],
       [1.0000000e+00, 0.0000000e+00, 0.0000000e+00, ..., 1.0000000e+00,
        0.0000000e+00, 1.1812088e+05],
       [1.0000000e+00, 0.0000000e+00, 0.0000000e+00, ..., 1.0000000e+00,
        1.0000000e+00, 9.7755290e+04]])
```

```
testX
```

```
array([[1.0000000e+00, 0.0000000e+00, 0.0000000e+00, ..., 1.0000000e+00,
        1.0000000e+00, 1.1045799e+05],
       [0.0000000e+00, 1.0000000e+00, 0.0000000e+00, ..., 1.0000000e+00,
        0.0000000e+00, 6.3981370e+04],
       [1.0000000e+00, 0.0000000e+00, 0.0000000e+00, ..., 1.0000000e+00,
        0.0000000e+00, 1.1343608e+05],
       ...,
       [1.0000000e+00, 0.0000000e+00, 0.0000000e+00, ..., 1.0000000e+00,
        0.0000000e+00, 2.6450570e+04],
       [0.0000000e+00, 0.0000000e+00, 1.0000000e+00, ..., 1.0000000e+00,
        0.0000000e+00, 5.4947510e+04],
       [0.0000000e+00, 1.0000000e+00, 0.0000000e+00, ..., 1.0000000e+00,
        0.0000000e+00, 1.6318162e+05]])
```

```
trainY
```

```
3935    1
34      0
4189    0
5100    0
5918    0
       ..
9864    0
6541    0
3333    0
5298    0
5530    0
Name: Exited, Length: 3994, dtype: int64
```

```
testY
```

```
2378    0
```

```
8392    1
8410    0
4970    0
7674    0
       ..
7618    0
5529    0
2262    1
7122    0
7061    0
Name: Exited, Length: 999, dtype: int64
```

```
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
```

```
trainX_scale = scaler.fit_transform(trainX)
testX_scale = scaler.transform(testX)
```

```
trainX_scale
```

```
array([[-1.0305103 ,  1.81765764, -0.58139784, ...,  0.64211021,
        -0.97918504, -0.37178651],
       [-1.0305103 , -0.55015861,  1.71999262, ...,  0.64211021,
         1.02125744,  0.97885865],
       [ 0.97039302, -0.55015861, -0.58139784, ...,  0.64211021,
         1.02125744,  1.57175791],
       ...,
       [-1.0305103 ,  1.81765764, -0.58139784, ...,  0.64211021,
        -0.97918504, -1.44864824],
       [ 0.97039302, -0.55015861, -0.58139784, ...,  0.64211021,
        -0.97918504,  0.41943738],
       [ 0.97039302, -0.55015861, -0.58139784, ...,  0.64211021,
         1.02125744, -0.05701184]])
```

```
testX_scale
```

```
array([[ 0.97039302, -0.55015861, -0.58139784, ...,  0.64211021,
         1.02125744,  0.24016548],
       [-1.0305103 ,  1.81765764, -0.58139784, ...,  0.64211021,
        -0.97918504, -0.84714647],
       [ 0.97039302, -0.55015861, -0.58139784, ...,  0.64211021,
        -0.97918504,  0.30983735],
       ...,
       [ 0.97039302, -0.55015861, -0.58139784, ...,  0.64211021,
        -0.97918504, -1.72517262],
       [-1.0305103 , -0.55015861,  1.71999262, ...,  0.64211021,
        -0.97918504, -1.05849196],
       [-1.0305103 ,  1.81765764, -0.58139784, ...,  0.64211021,
        -0.97918504,  1.47362508]])
```

```
trainY
```

```
3935    1
34      0
4189    0
```

```
5100    0
5918    0
        ..
9864    0
6541    0
3333    0
5298    0
5530    0
Name: Exited, Length: 3994, dtype: int64
```

```
testY
```

```
2378    0
8392    1
8410    0
4970    0
7674    0
        ..
7618    0
5529    0
2262    1
7122    0
7061    0
Name: Exited, Length: 999, dtype: int64
```