**Assignment-2**

VirtualEye -
Life Guard for
Swimming Pools
to Detect Active Drowning

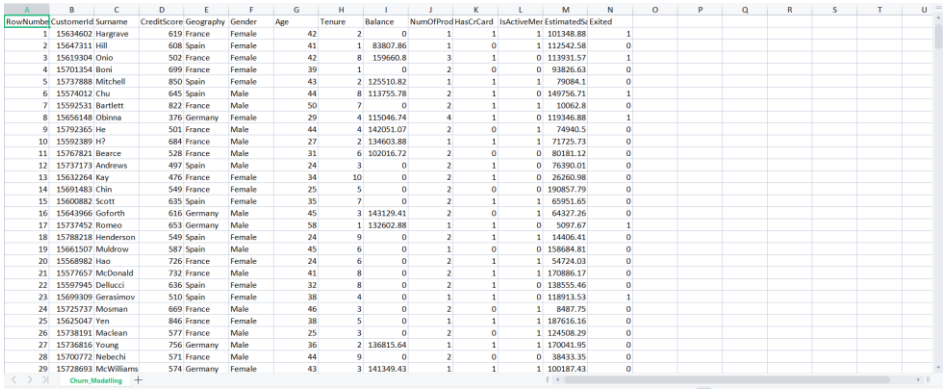
| | |
|---|---|
| Assignment Date | November 14, 2022 |
| Student Name | S.Santhosh |
| Student Roll Number | 2127190801072 |
| Maximum Marks | 2 Marks |

## Question-1:

Download the dataset

## Solution:

**Download the given dataset in the given attached link.**



| RowNumber | CustomerId | Surname | CreditScore | Geography | Gender | Age | Tenure | Balance | NumOfProd | HasCrCard | IsActiveMer | EstimatedSa | Exited |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15634602 | Hargrave | 619 | France | Female | 42 | 2 | 0 | 1 | 1 | 1 | 101348.88 | 1 |
| 2 | 15647311 | Hill | 608 | Spain | Female | 41 | 1 | 83807.86 | 1 | 0 | 1 | 112542.58 | 0 |
| 3 | 15619304 | Onio | 502 | France | Female | 42 | 8 | 159660.8 | 3 | 1 | 0 | 113931.57 | 1 |
| 4 | 15701354 | Boni | 699 | France | Female | 39 | 1 | 0 | 2 | 0 | 0 | 93826.63 | 0 |
| 5 | 15737888 | Mitchell | 850 | Spain | Female | 43 | 2 | 125510.82 | 1 | 1 | 1 | 79084.1 | 0 |
| 6 | 15574012 | Chu | 645 | Spain | Male | 44 | 8 | 113755.78 | 2 | 1 | 0 | 149756.71 | 1 |
| 7 | 15592531 | Bartlett | 822 | France | Male | 50 | 7 | 0 | 2 | 1 | 1 | 10062.8 | 0 |
| 8 | 15656148 | Obinna | 376 | Germany | Female | 29 | 4 | 115046.74 | 4 | 1 | 0 | 119346.88 | 1 |
| 9 | 15792365 | He | 501 | France | Male | 44 | 4 | 142051.07 | 2 | 0 | 1 | 74940.5 | 0 |
| 10 | 15592389 | H? | 684 | France | Male | 27 | 2 | 134603.88 | 1 | 1 | 1 | 71725.73 | 0 |
| 11 | 15767821 | Bearce | 528 | France | Male | 31 | 6 | 102016.72 | 2 | 0 | 0 | 80181.12 | 0 |
| 12 | 15737173 | Andrews | 497 | Spain | Male | 24 | 3 | 0 | 2 | 1 | 0 | 76390.01 | 0 |
| 13 | 15632264 | Kay | 476 | France | Female | 34 | 10 | 0 | 2 | 1 | 0 | 26260.98 | 0 |
| 14 | 15691483 | Chin | 549 | France | Female | 25 | 5 | 0 | 2 | 0 | 0 | 190857.79 | 0 |
| 15 | 15600882 | Scott | 635 | Spain | Female | 35 | 7 | 0 | 2 | 1 | 1 | 65951.65 | 0 |
| 16 | 15643966 | Goforth | 616 | Germany | Male | 45 | 3 | 143129.41 | 2 | 0 | 1 | 64327.26 | 0 |
| 17 | 15737452 | Romeo | 653 | Germany | Male | 58 | 1 | 132602.88 | 1 | 1 | 0 | 5097.67 | 1 |
| 18 | 15788218 | Henderson | 549 | Spain | Female | 24 | 9 | 0 | 2 | 1 | 1 | 14406.41 | 0 |
| 19 | 15661507 | Muldrow | 587 | Spain | Male | 45 | 6 | 0 | 1 | 0 | 0 | 158684.81 | 0 |
| 20 | 15568982 | Hao | 726 | France | Female | 24 | 6 | 0 | 2 | 1 | 1 | 54724.03 | 0 |
| 21 | 15577657 | McDonald | 732 | France | Male | 41 | 8 | 0 | 2 | 1 | 1 | 170886.17 | 0 |
| 22 | 15597945 | Dellucci | 636 | Spain | Female | 32 | 8 | 0 | 2 | 1 | 0 | 138555.46 | 0 |
| 23 | 15699309 | Gerasimov | 510 | Spain | Female | 38 | 4 | 0 | 1 | 1 | 0 | 118913.53 | 1 |
| 24 | 15725737 | Mosman | 669 | France | Male | 46 | 3 | 0 | 2 | 0 | 1 | 8487.75 | 0 |
| 25 | 15625047 | Yen | 846 | France | Female | 38 | 5 | 0 | 1 | 1 | 1 | 187616.16 | 0 |
| 26 | 15738191 | Maclean | 577 | France | Male | 25 | 3 | 0 | 2 | 0 | 1 | 124508.29 | 0 |
| 27 | 15736816 | Young | 756 | Germany | Male | 36 | 2 | 136815.64 | 1 | 1 | 1 | 170041.95 | 0 |
| 28 | 15700772 | Nebechi | 571 | France | Male | 44 | 9 | 0 | 2 | 0 | 0 | 38433.35 | 0 |
| 29 | 15728693 | McWilliams | 574 | Germany | Female | 43 | 3 | 141349.43 | 1 | 1 | 1 | 100187.43 | 0 |

Churn_Modelling

## Question-2:

Load the dataset

## Solution:

**df=pd.read_csv('Churn_Modelling.csv')**

**df.head()**

IMPORT THE DATA SET INTO DATAFRAME

In [2]:
```
df=pd.read_csv('Churn_Modelling.csv')
```

In [3]:
```
df.head()
```

Out[3]:

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

**Question 3:**

**Perform Below Visualizations:**

- **Univariate analysis**
- **Bi-variate analysis**
- **Multi-variate analysis**

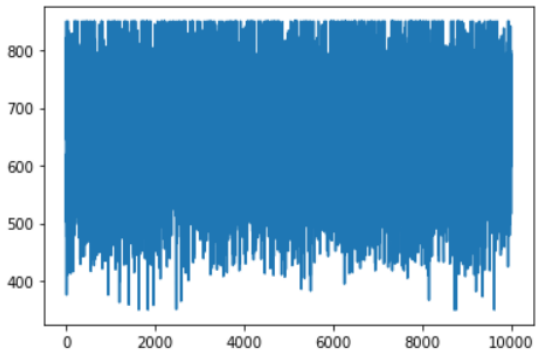
## Solution:

## Univariate analysis:

### df.CreditScore.plot()

```
#univariate analysis
df.CreditScore.plot()
```

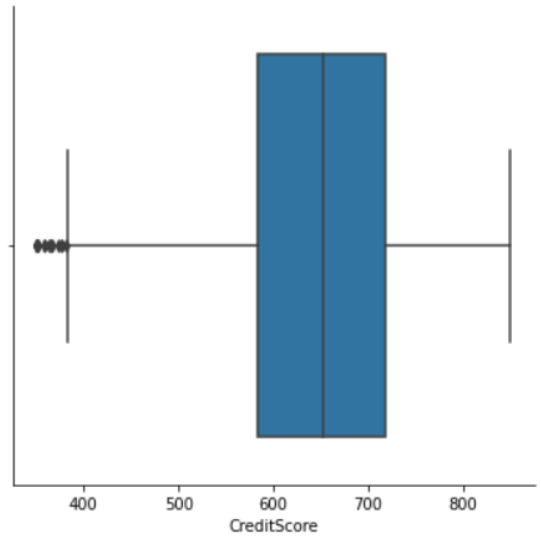
```
<AxesSubplot:>
```




### sns.catplot(x='CreditScore',kind='box',data=df)

```
sns.catplot(x='CreditScore',kind='box',data=df)
```

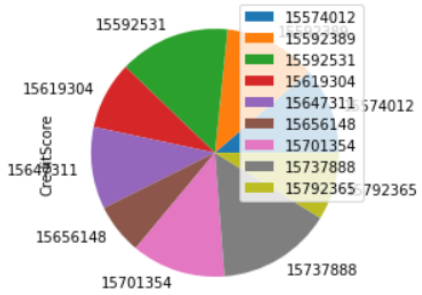
```
<seaborn.axisgrid.FacetGrid at 0x2ca156c06a0>
```



## df[1:10].groupby(['CustomerId']).sum().plot(kind='pie', y='CreditScore')

```
df[1:10].groupby(['CustomerId']).sum().plot(kind='pie', y='CreditScore')
```

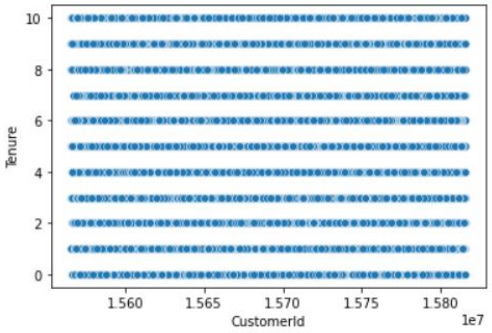
```
<AxesSubplot:ylabel='CreditScore'>
```




## sns.scatterplot(df.CustomerId,df.Tenure)
## plt.show()

```
sns.scatterplot(df.CustomerId,df.Tenure)
plt.show()
```

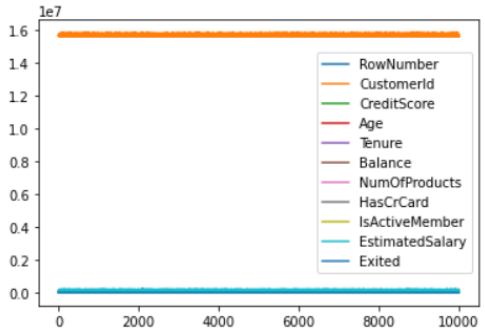
```
C:\Users\darat\AppData\Local\Programs\Python\Python36\lib\site-packages\seaborn\_decorate
rd args: x, y. From version 0.12, the only valid positional argument will be `data`, and
t in an error or misinterpretation.
  FutureWarning
```




## Multivariate Analysis:
## df.plot()

```
#multivariate analysis
df.plot()
```

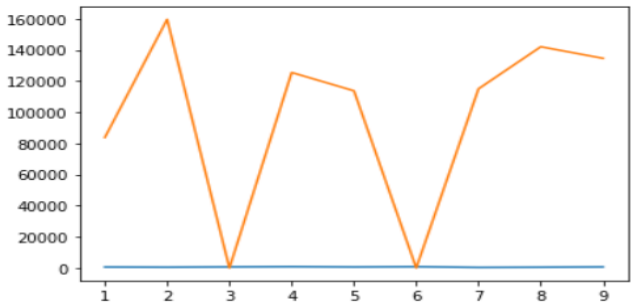
```
<AxesSubplot:>
```



## Bivariate Analysis:
## df.CreditScore[1:10].plot()
## df.Balance[1:10].plot()

```
#bivariate analysis
df.CreditScore[1:10].plot()
df.Balance[1:10].plot()
```

```
<AxesSubplot:>
```




## Question 4:

## Perform descriptive statistics on the dataset.

## Solution:

## df.describe()

```
df.describe()
```

| | RowNumber | CustomerId | CreditScore | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveMember | EstimatedSalary | Exited |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **count** | 10000.00000 | 1.000000e+04 | 10000.000000 | 10000.000000 | 10000.000000 | 10000.000000 | 10000.000000 | 10000.00000 | 10000.000000 | 10000.000000 | 10000.000000 |
| **mean** | 5000.50000 | 1.569094e+07 | 650.528800 | 38.921800 | 5.012800 | 76485.889288 | 1.530200 | 0.70550 | 0.515100 | 100090.239881 | 0.203700 |
| **std** | 2886.89568 | 7.193619e+04 | 96.653299 | 10.487806 | 2.892174 | 62397.405202 | 0.581654 | 0.45584 | 0.499797 | 57510.492818 | 0.402769 |
| **min** | 1.00000 | 1.556570e+07 | 350.000000 | 18.000000 | 0.000000 | 0.000000 | 1.000000 | 0.00000 | 0.000000 | 11.580000 | 0.000000 |
| **25%** | 2500.75000 | 1.562853e+07 | 584.000000 | 32.000000 | 3.000000 | 0.000000 | 1.000000 | 0.00000 | 0.000000 | 51002.110000 | 0.000000 |
| **50%** | 5000.50000 | 1.569074e+07 | 652.000000 | 37.000000 | 5.000000 | 97198.540000 | 1.000000 | 1.00000 | 1.000000 | 100193.915000 | 0.000000 |
| **75%** | 7500.25000 | 1.575323e+07 | 718.000000 | 44.000000 | 7.000000 | 127644.240000 | 2.000000 | 1.00000 | 1.000000 | 149388.247500 | 0.000000 |
| **max** | 10000.00000 | 1.581569e+07 | 850.000000 | 92.000000 | 10.000000 | 250898.090000 | 4.000000 | 1.00000 | 1.000000 | 199992.480000 | 1.000000 |

**Question 5:**

**Handle the missing values**

## Solution:

## df.isnull().any()

```
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.isnull().sum()

```
df.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
```

**Question 6:**

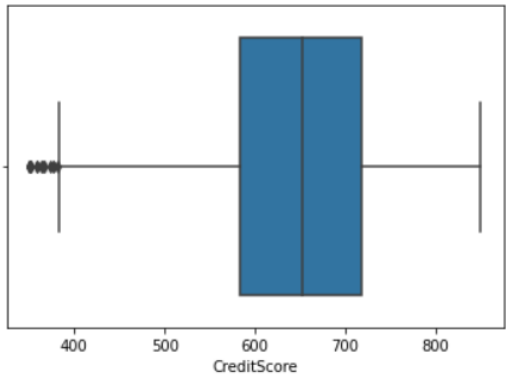
**Find the outliers and replace the outliers.**

**Solution:**

**#occurence of outliers**
**sns.boxplot(df.CreditScore)**

```
#occurence of outliers
sns.boxplot(df.CreditScore)
```

```
C:\Users\darat\AppData\Local\Programs\Python\Python36\lib\site-packa
ord arg: x. From version 0.12, the only valid positional argument w
n an error or misinterpretation.
  FutureWarning
<AxesSubplot:xlabel='CreditScore'>
```




**Q1= df.CreditScore.quantile(0.25)**
**Q3=df.CreditScore.quantile(0.75)**

**IQR=Q3-Q1**

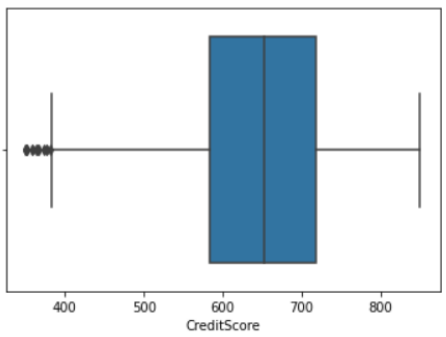
**upper_limit =Q3 + 1.5*IQR**
**lower_limit =Q1 - 1.5*IQR**

**df['CreditScore'] = np.where(df['CreditScore']>upper_limit,30,df['CreditScore'])**

**sns.boxplot(df.CreditScore)**

```
sns.boxplot(df.CreditScore)
```

```
C:\Users\darat\AppData\Local\Programs\Python\Python36\lib\site-packages\
ord arg: x. From version 0.12, the only valid positional argument will b
n an error or misinterpretation.
  FutureWarning
<AxesSubplot:xlabel='CreditScore'>
```



**Question 7:**

**Check for Categorical columns and perform encoding.**

## Solution:

```
#label encoder
from sklearn.preprocessing import LabelEncoder

le=LabelEncoder()

df.Gender= le.fit_transform(df.Gender)

df.head(5)
```

```
df.head(5)
```

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

```
#one hot encoding
df_main=pd.get_dummies(df,columns=['Geography'])
df_main.head()
```

```
#one hot encoding
df_main=pd.get_dummies(df,columns=['Geography'])
df_main.head()
```

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

**Question 8:**

**Split the data into dependent and independent variables.**

**Solution:**

**X=df_main.drop(columns=['EstimatedSalary'],axis=1)**

**X.head()**

**X_scaled=pd.DataFrame(scale(X),columns=X.columns)**

**X_scaled.head()**

```
X=df_main.drop(columns=['EstimatedSalary'],axis=1)
X.head()
X_scaled=pd.DataFrame(scale(X),columns=X.columns)
X_scaled.head()
```

| | RowNumber | CustomerId | CreditScore | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveMember | Exited | Geography_France | Geography_Germar |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | -1.731878 | -0.783213 | -0.326221 | -1.095988 | 0.293517 | -1.041760 | -1.225848 | -0.911583 | 0.646092 | 0.970243 | 1.977165 | 0.997204 | -0.5787 |
| 1 | -1.731531 | -0.606534 | -0.440036 | -1.095988 | 0.198164 | -1.387538 | 0.117350 | -0.911583 | -1.547768 | 0.970243 | -0.505775 | -1.002804 | -0.5787 |
| 2 | -1.731185 | -0.995885 | -1.536794 | -1.095988 | 0.293517 | 1.032908 | 1.333053 | 2.527057 | 0.646092 | -1.030670 | 1.977165 | 0.997204 | -0.5787 |
| 3 | -1.730838 | 0.144767 | 0.501521 | -1.095988 | 0.007457 | -1.387538 | -1.225848 | 0.807737 | -1.547768 | -1.030670 | -0.505775 | 0.997204 | -0.5787 |
| 4 | -1.730492 | 0.652659 | 2.063884 | -1.095988 | 0.388871 | -1.041760 | 0.785728 | -0.911583 | 0.646092 | 0.970243 | -0.505775 | -1.002804 | -0.5787 |

**y=df_main.EstimatedSalary**
**y**

```
y=df_main.EstimatedSalary
y
```

```
0       101348.88
1       112542.58
2       113931.57
3        93826.63
4        79084.10
          ...
9995     96270.64
9996    101699.77
9997     42085.58
9998     92888.52
9999     38190.78
Name: EstimatedSalary, Length: 10000, dtype: float64
```

**Question 9:**

**Scale the independent variables.**

**Solution:**

**from sklearn.preprocessing import scale**

**X_scaled=pd.DataFrame(scale(X),columns=X.columns)**

**X_scaled.head()**

```
X_scaled=pd.DataFrame(scale(X),columns=X.columns)
X_scaled.head()
```

| | RowNumber | CustomerId | CreditScore | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveMember | Exited | Geography_France | Geography_Germar |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | -1.731878 | -0.783213 | -0.326221 | -1.095988 | 0.293517 | -1.041760 | -1.225848 | -0.911583 | 0.646092 | 0.970243 | 1.977165 | 0.997204 | -0.5787 |
| 1 | -1.731531 | -0.606534 | -0.440036 | -1.095988 | 0.198164 | -1.387538 | 0.117350 | -0.911583 | -1.547768 | 0.970243 | -0.505775 | -1.002804 | -0.5787 |
| 2 | -1.731185 | -0.995885 | -1.536794 | -1.095988 | 0.293517 | 1.032908 | 1.333053 | 2.527057 | 0.646092 | -1.030670 | 1.977165 | 0.997204 | -0.5787 |
| 3 | -1.730838 | 0.144767 | 0.501521 | -1.095988 | 0.007457 | -1.387538 | -1.225848 | 0.807737 | -1.547768 | -1.030670 | -0.505775 | 0.997204 | -0.5787 |
| 4 | -1.730492 | 0.652659 | 2.063884 | -1.095988 | 0.388871 | -1.041760 | 0.785728 | -0.911583 | 0.646092 | 0.970243 | -0.505775 | -1.002804 | -0.5787 |

**Question 10:**

**Split the data into training and testing.**

**Solution:**

**from sklearn.model_selection import train_test_split**

**X_train,X_test,y_train,y_test =train_test_split(X_scaled,y, test_size=0.3,random_state=0)**

```
X_train.shape
```

```
(7000, 14)
```

```
X_test.shape
```

```
(3000, 14)
```

```
y_train.shape
```

```
(7000,)
```

```
y_test.shape
```

```
(3000,)
```