Assignment -2
Data Visualization and Pre-Processing

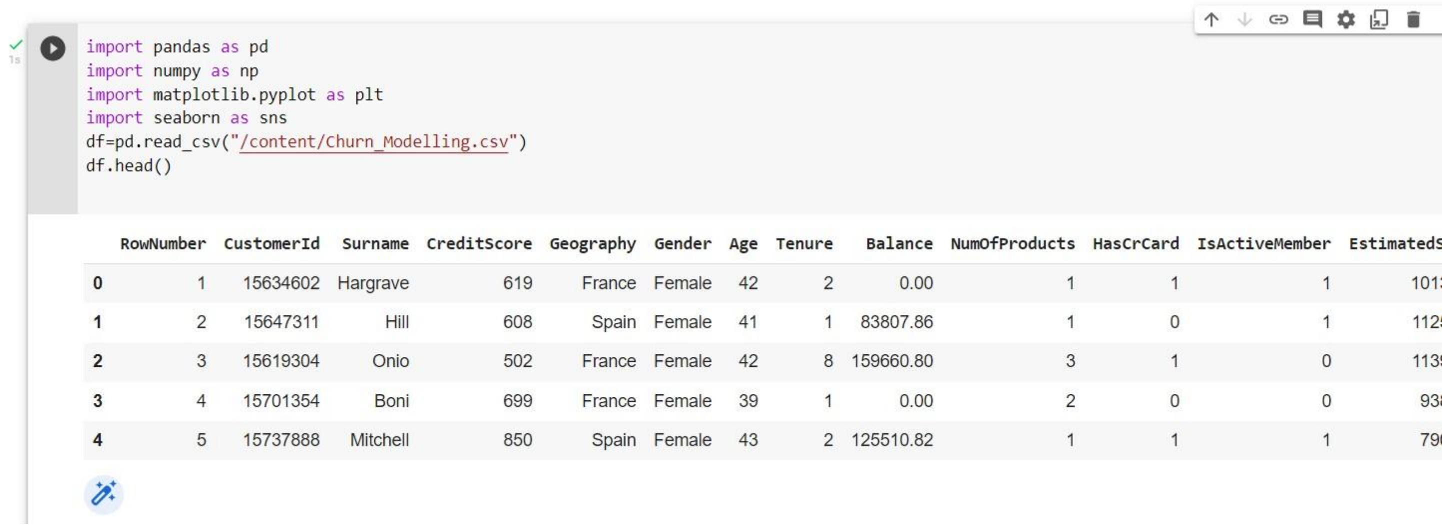
Question 1 - Load the dataset.

SOLUTION:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
df=pd.read_csv("/content/Churn_Modelling.csv")
df.head()
```

OUTPUT:

IMPORT LIBRARIES



```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
df=pd.read_csv("/content/Churn_Modelling.csv")
df.head()
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedS
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	1	1	101
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112
2	3	15619304	Onio	502	France	Female	42	8	159660.80	3	1	0	113
3	4	15701354	Boni	699	France	Female	39	1	0.00	2	0	0	93
4	5	15737888	Mitchell	850	Spain	Female	43	2	125510.82	1	1	1	79

Question 2 - Perform Univariate, Bivariate and Multivariate Analysis

SOLUTION:

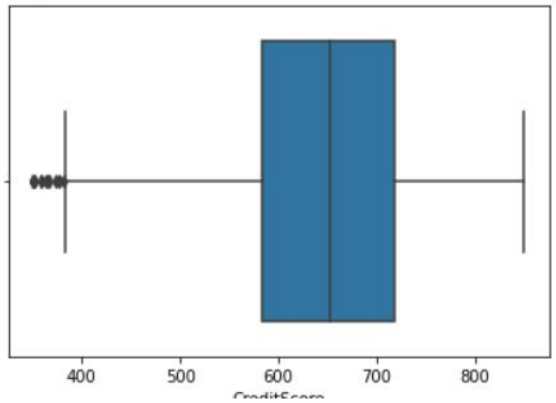
```
sns.boxplot(df['CreditScore'])
sns.boxplot(df['Age'])
sns.boxplot(df['Tenure'])
sns.boxplot(df['Balance'])
sns.boxplot(df['EstimatedSalary'])
sns.heatmap(df.corr(), annot=True)
```

OUTPUT:

```
[ ]  PERFORM UNIVARIATE, BIVARIATE, MULTIVARIATE ANALYSIS
```

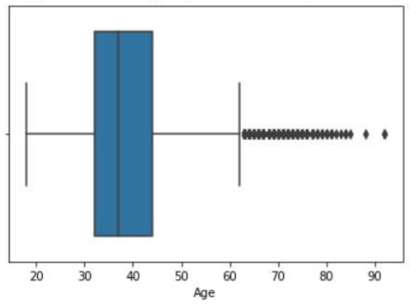
```
sns.boxplot(df['CreditScore'])
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f31539d5a10>
```



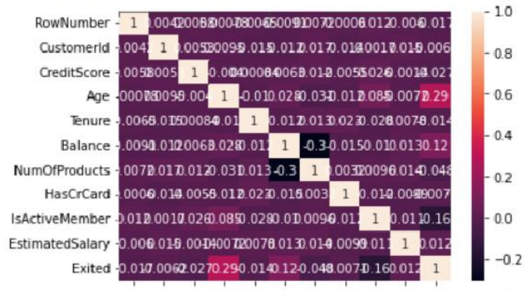
```
sns.boxplot(df['Age'])
```

```
/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 on
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f3152125950>
```



```python
sns.boxplot(df['CreditScore'])
sns.boxplot(df['Age'])
sns.boxplot(df['Tenure'])
sns.boxplot(df['Balance'])
sns.boxplot(df['EstimatedSalary'])
sns.heatmap(df.corr(), annot=True)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.
  FutureWarning
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.
  FutureWarning
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.
  FutureWarning
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.
  FutureWarning
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f3156965b50>
```



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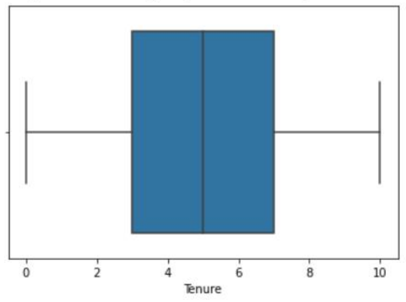
```python
sns.boxplot(df['Tenure'])
```

```
/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 on
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f3152199590>
```

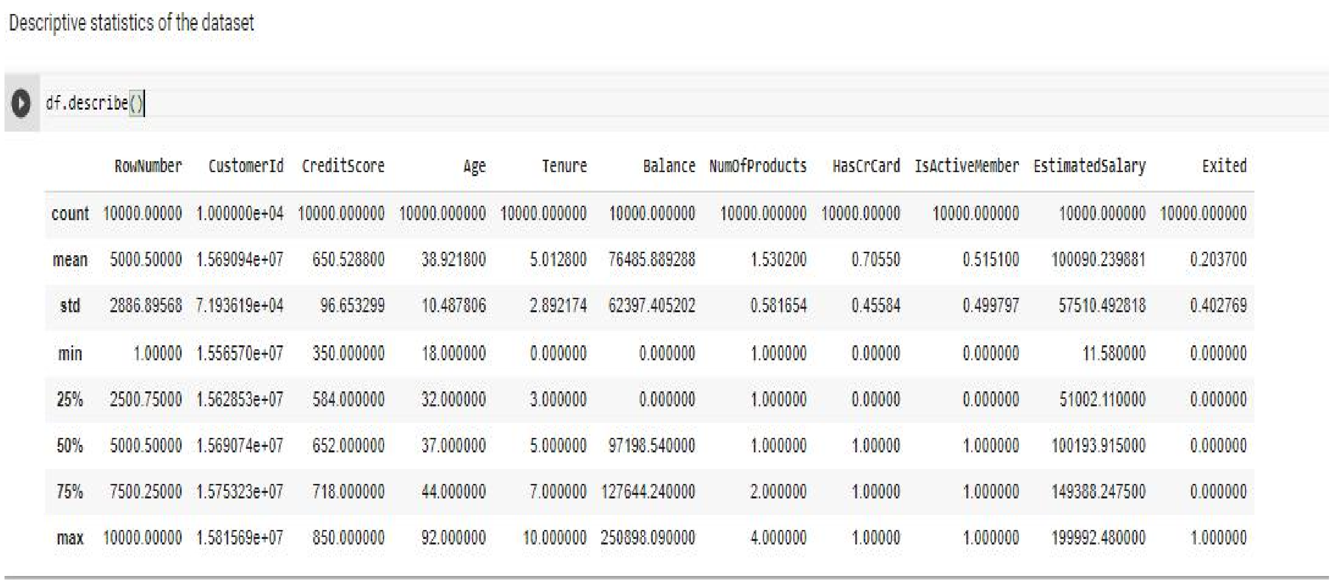


Question 3 - Perform descriptive statistics on the dataset.

SOLUTION:

```
df.describe()
```

OUTPUT:



Descriptive statistics of the dataset

```
df.describe()
```

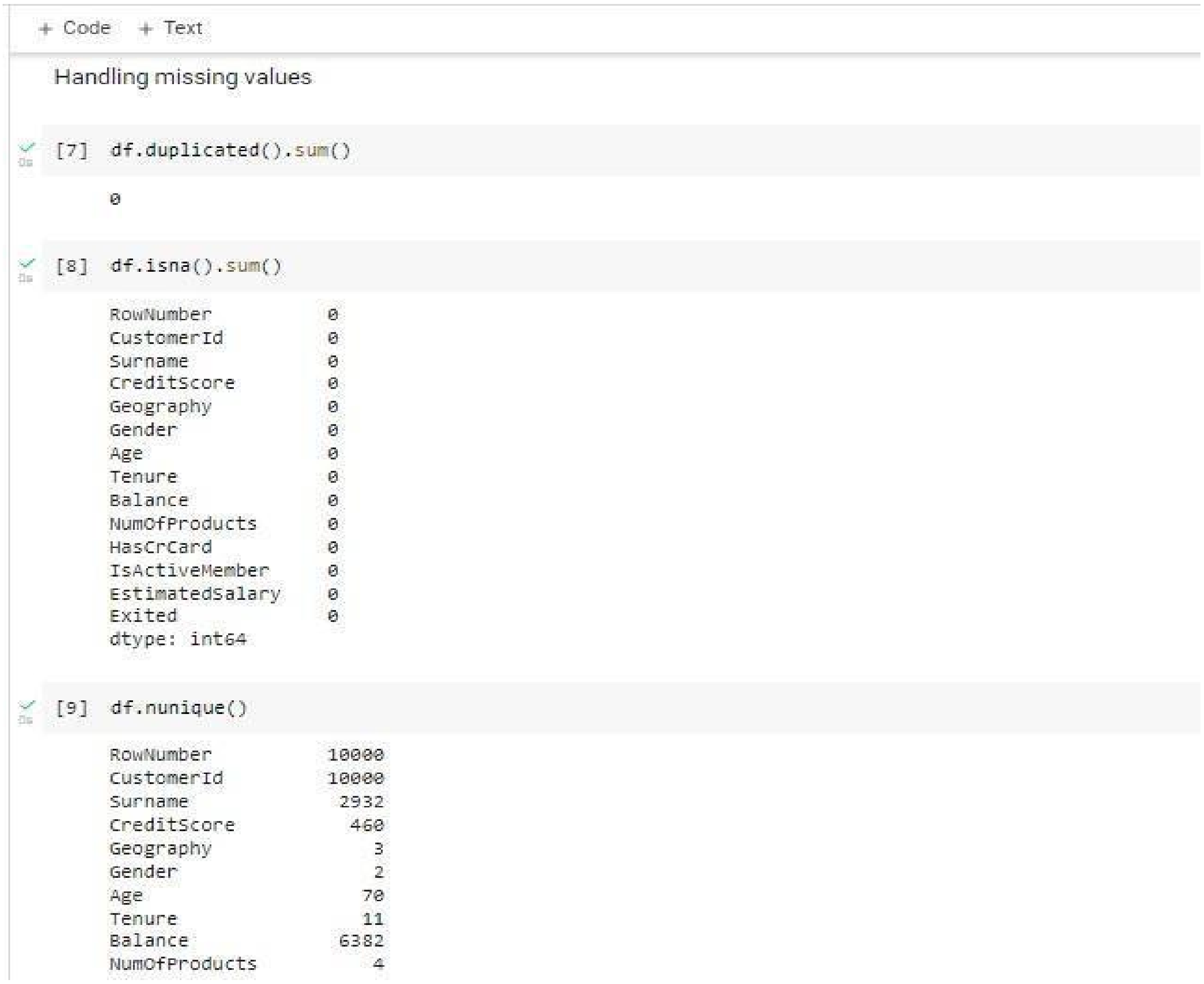
```
       RowNumber   CustomerId   CreditScore  Age           Tenure        Balance        NumOfProducts HasCrCard   IsActiveMember EstimatedSalary Exited
count  10000.00000 1.000000e+04 10000.000000 10000.000000  10000.000000  10000.000000   10000.000000  10000.00000 10000.000000   10000.000000    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 4 – Handle the missing values

SOLUTION:

```
df.duplicated().sum()
df.nunique()
df.info()
```

OUTPUT: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Handling missing values

```
[7] df.duplicated().sum()
```

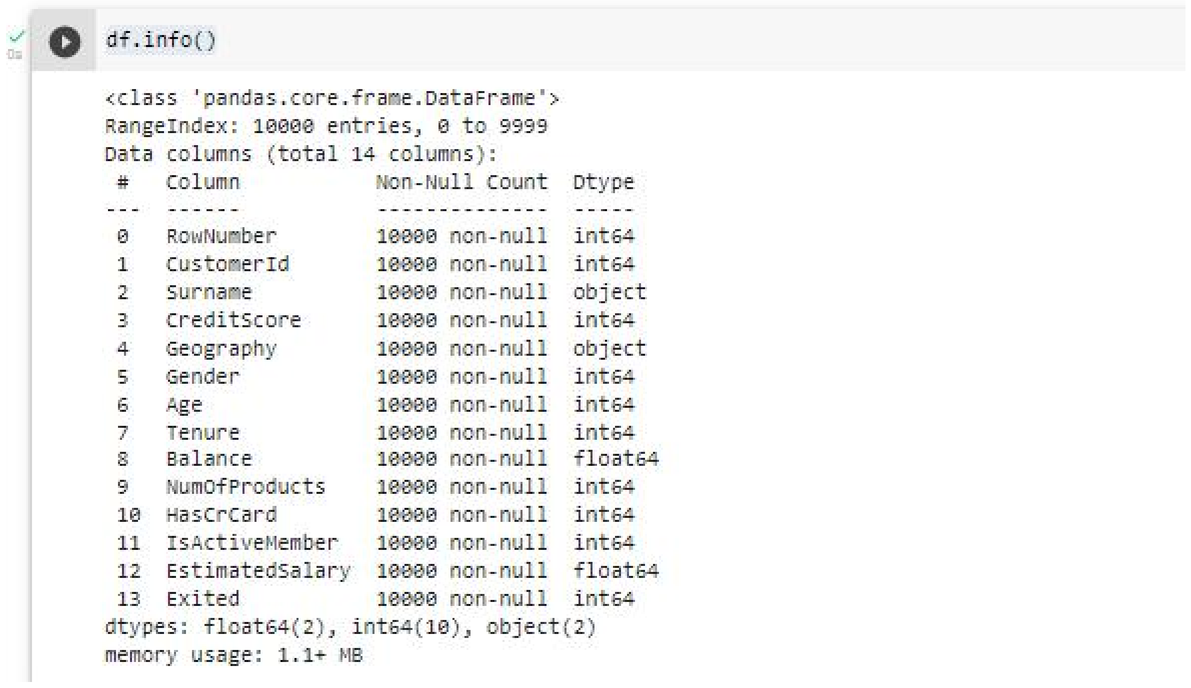
```
0
```

```
[8] 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
```

```
[9] df.nunique()
```

```
RowNumber          10000
CustomerId         10000
Surname             2932
CreditScore          460
Geography              3
Gender                 2
Age                   70
Tenure                11
Balance             6382
NumOfProducts          4
```

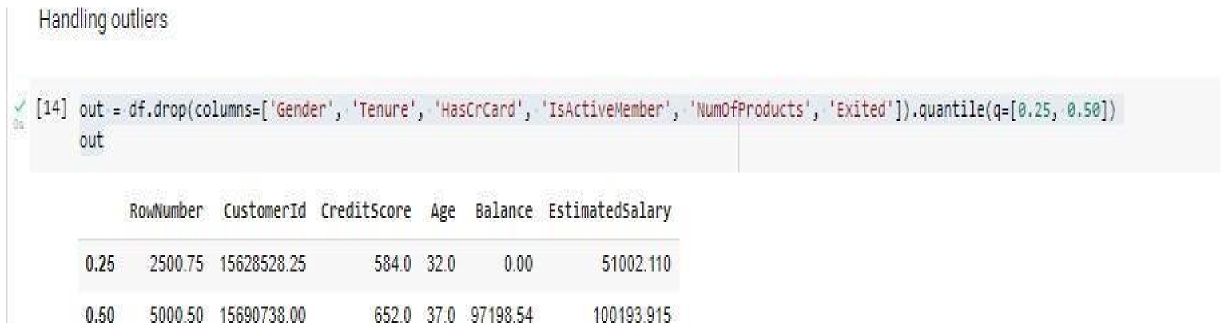


```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 14 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   RowNumber        10000 non-null  int64  
 1   CustomerId       10000 non-null  int64  
 2   Surname          10000 non-null  object 
 3   CreditScore      10000 non-null  int64  
 4   Geography        10000 non-null  object 
 5   Gender           10000 non-null  int64  
 6   Age              10000 non-null  int64  
 7   Tenure           10000 non-null  int64  
 8   Balance          10000 non-null  float64
 9   NumOfProducts    10000 non-null  int64  
 10  HasCrCard        10000 non-null  int64  
 11  IsActiveMember   10000 non-null  int64  
 12  EstimatedSalary  10000 non-null  float64
 13  Exited           10000 non-null  int64  
dtypes: float64(2), int64(10), object(2)
memory usage: 1.1+ MB
```

Question 5 - Find and replace outliers

```
       out = df.drop(columns=['Gender', 'Tenure', 'HasCrCard', 'IsActiveMember','NumOfProducts',
'Exi ted']).quantile(q=[0.25, 0.50])
```

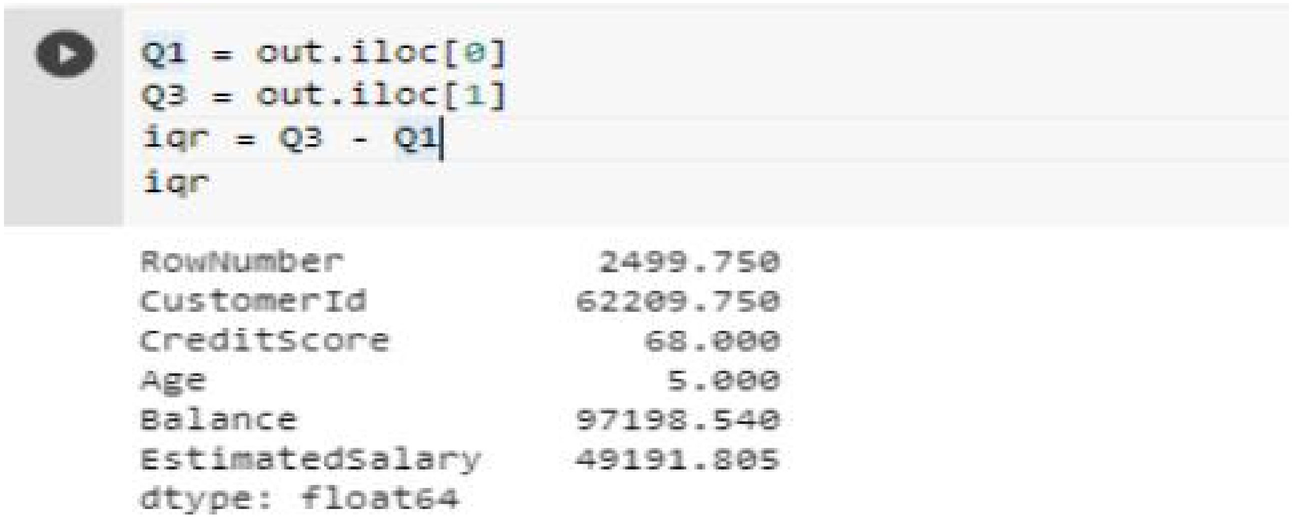


Handling outliers

```
[14] out = df.drop(columns=['Gender', 'Tenure', 'HasCrCard', 'IsActiveMember', 'NumOfProducts', 'Exited']).quantile(q=[0.25, 0.50])
     out
```

	RowNumber	CustomerId	CreditScore	Age	Balance	EstimatedSalary
0.25	2500.75	15628528.25	584.0	32.0	0.00	51002.110
0.50	5000.50	15690738.00	652.0	37.0	97198.54	100193.915

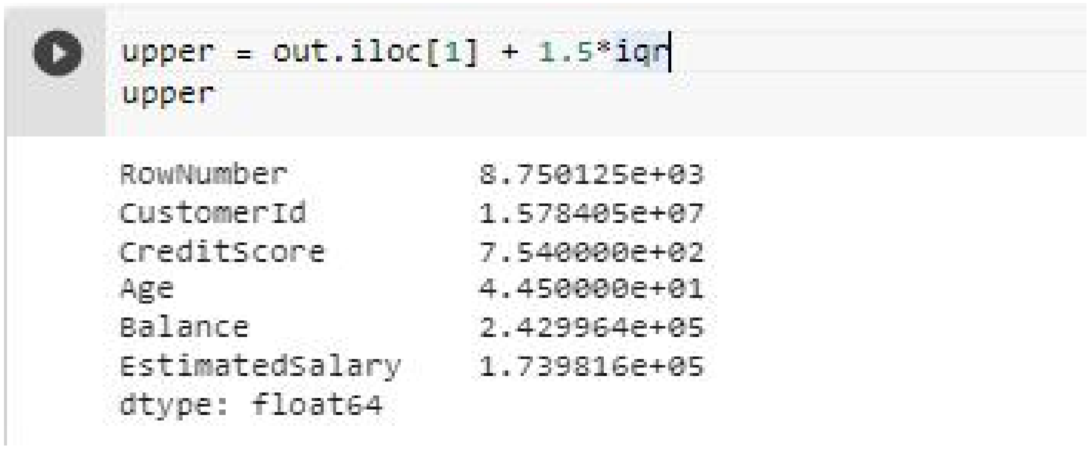
```
Q1 =
out.iloc[0]
Q3 =
out.iloc[1]
iqr = Q3 - Q1
iqr
```



```
Q1 = out.iloc[0]
Q3 = out.iloc[1]
iqr = Q3 - Q1
iqr
```

```
RowNumber            2499.750
CustomerId          62209.750
CreditScore            68.000
Age                     5.000
Balance             97198.540
EstimatedSalary     49191.805
dtype: float64
```

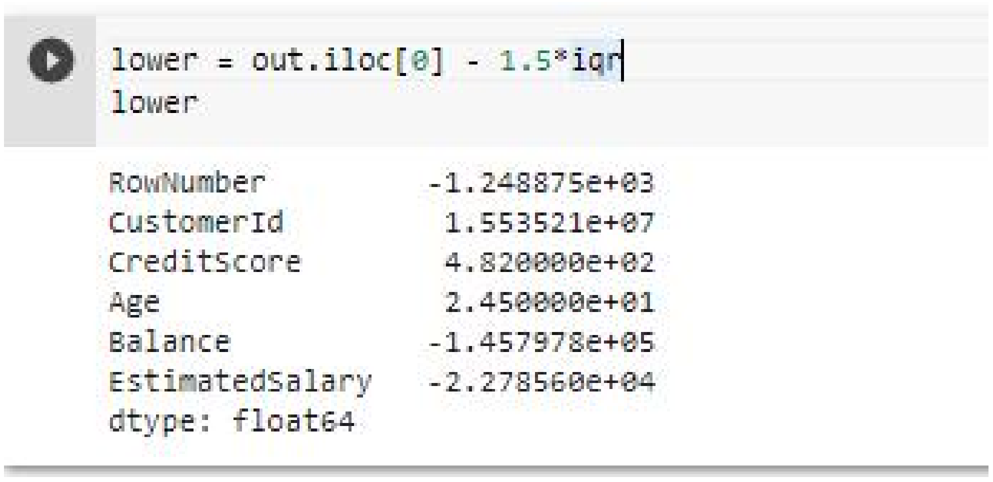
```
upper = out.iloc[1] +
1.5*iqr upper
```



```
upper = out.iloc[1] + 1.5*iqr
upper
```

```
RowNumber          8.750125e+03
CustomerId         1.578405e+07
CreditScore        7.540000e+02
Age                4.450000e+01
Balance            2.429964e+05
EstimatedSalary    1.739816e+05
dtype: float64
```

lower = out.iloc[0] - 1.5*iqr lower



```
lower = out.iloc[0] - 1.5*iqr
lower
```

```
RowNumber         -1.248875e+03
CustomerId         1.553521e+07
CreditScore        4.820000e+02
Age                2.450000e+01
Balance           -1.457978e+05
EstimatedSalary   -2.278560e+04
dtype: float64
```

Replace outliers

SOLUTION:

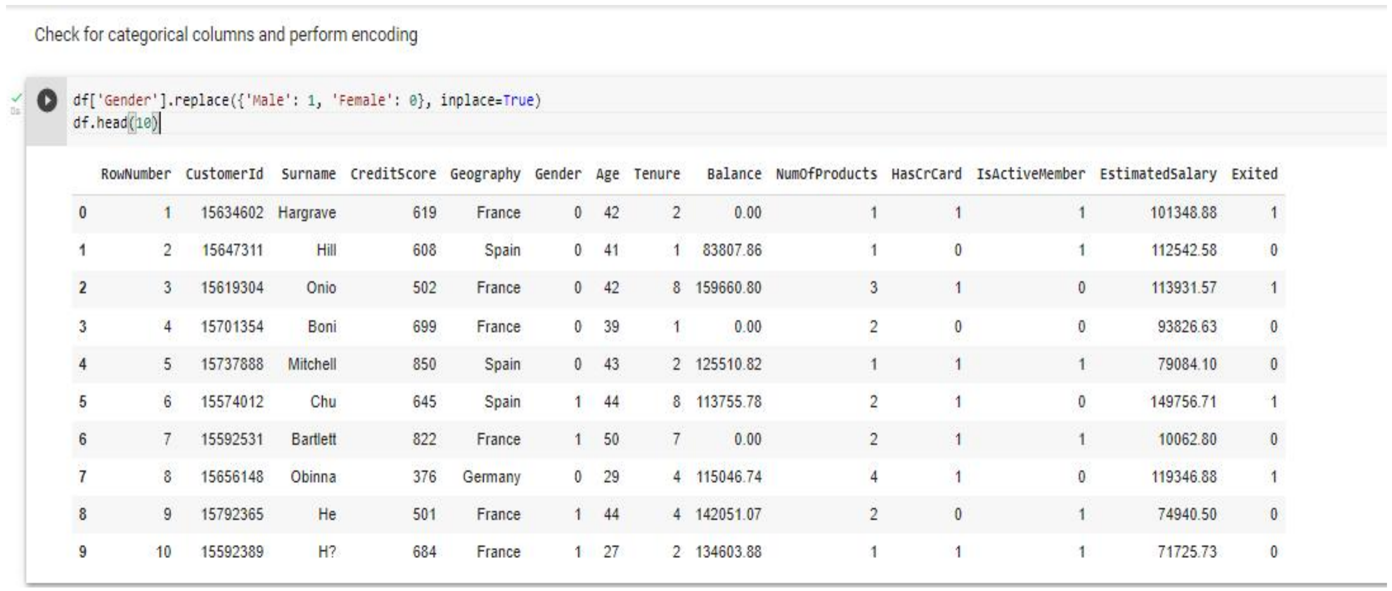
```
df['CreditScore'] = np.where(df['CreditScore']>756, 650.5288,
df['CreditScore']) df['Age'] = np.where(df['Age']>62, 38.9218,
df['Age'])
```

Question 6 - Check for Categorical columns and perform encoding.

SOLUTION:

```
df['Gender'].replace({'Male': 1,

'Female': 0}, inplace=True) df.head(10)
```

OUTPUT:



Check for categorical columns and perform encoding

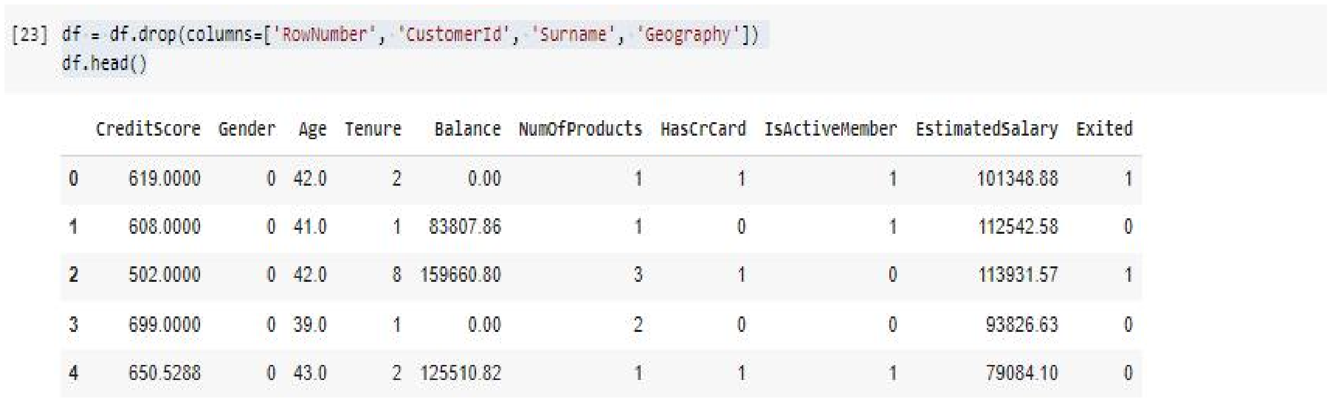
```
df['Gender'].replace({'Male': 1, 'Female': 0}, inplace=True)
df.head(10)
```

	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
5	6	15574012	Chu	645	Spain	1	44	8	113755.78	2	1	0	149756.71	1
6	7	15592531	Bartlett	822	France	1	50	7	0.00	2	1	1	10062.80	0
7	8	15656148	Obinna	376	Germany	0	29	4	115046.74	4	1	0	119346.88	1
8	9	15792365	He	501	France	1	44	4	142051.07	2	0	1	74940.50	0
9	10	15592389	H?	684	France	1	27	2	134603.88	1	1	1	71725.73	0

Question 7 – Split the data into dependent and independent variables.

SOLUTION:

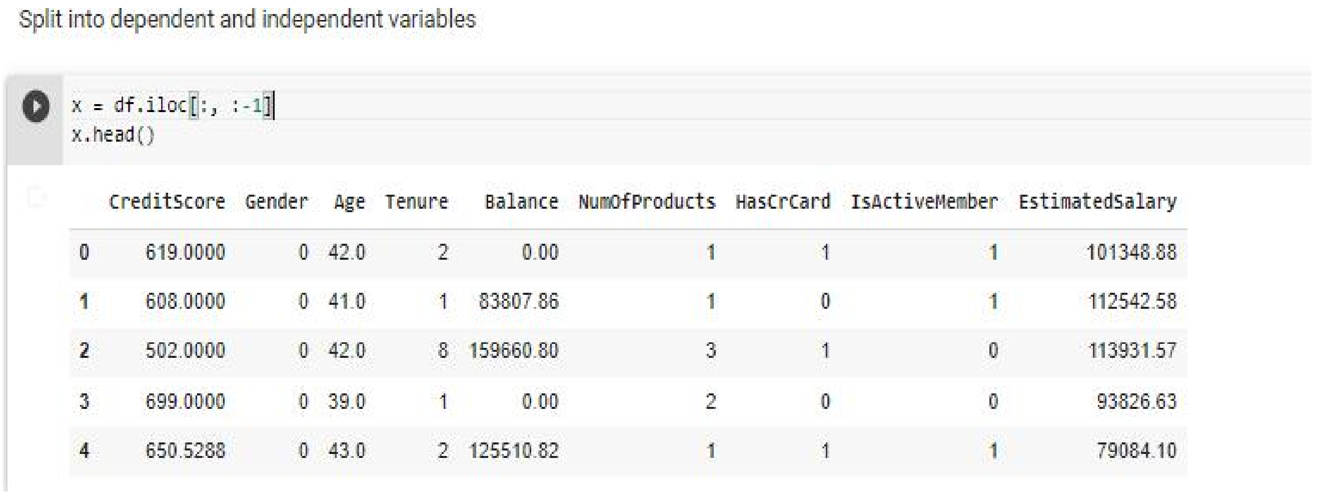
```
      df = df.drop(columns=['RowNumber', 'CustomerId',
'Surname', 'Geography']) df.head()
```



```
[23] df = df.drop(columns=['RowNumber', 'CustomerId', 'Surname', 'Geography'])
     df.head()
```

```
   CreditScore  Gender   Age  Tenure    Balance  NumOfProducts  HasCrCard  IsActiveMember  EstimatedSalary  Exited
0     619.0000       0  42.0       2       0.00              1          1               1        101348.88       1
1     608.0000       0  41.0       1   83807.86              1          0               1        112542.58       0
2     502.0000       0  42.0       8  159660.80              3          1               0        113931.57       1
3     699.0000       0  39.0       1       0.00              2          0               0         93826.63       0
4     650.5288       0  43.0       2  125510.82              1          1               1         79084.10       0
```

```
x =
df.iloc[:, :-
1] x.head()
```

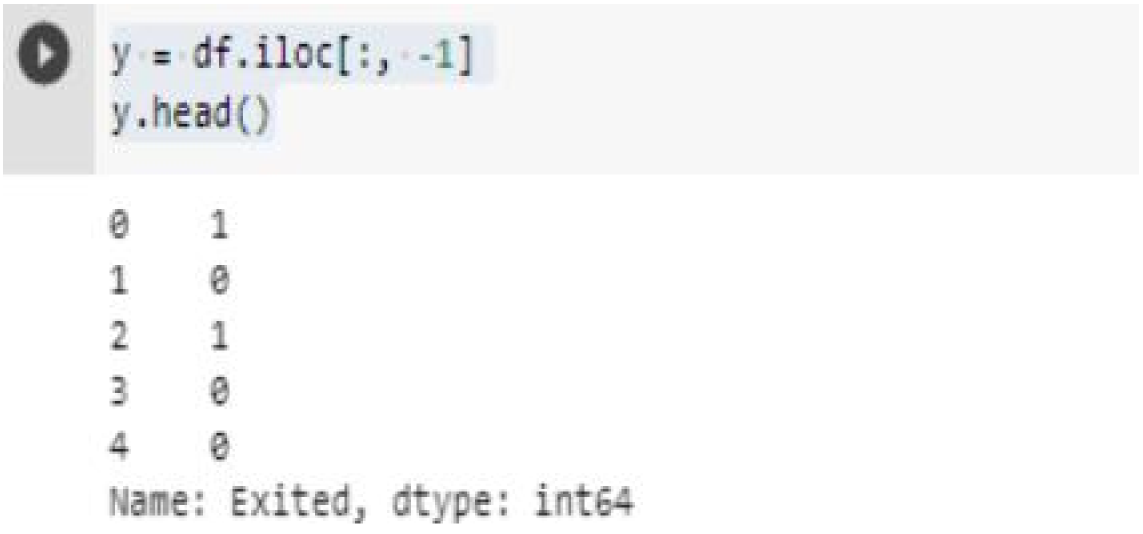


Split into dependent and independent variables

```
x = df.iloc[:, :-1]
x.head()
```

```
   CreditScore  Gender   Age  Tenure    Balance  NumOfProducts  HasCrCard  IsActiveMember  EstimatedSalary
0     619.0000       0  42.0       2       0.00              1          1               1        101348.88
1     608.0000       0  41.0       1   83807.86              1          0               1        112542.58
2     502.0000       0  42.0       8  159660.80              3          1               0        113931.57
3     699.0000       0  39.0       1       0.00              2          0               0         93826.63
4     650.5288       0  43.0       2  125510.82              1          1               1         79084.10
```

```
y =
df.iloc[:, -
1] y.head()
```



```
y = df.iloc[:, -1]
y.head()
```

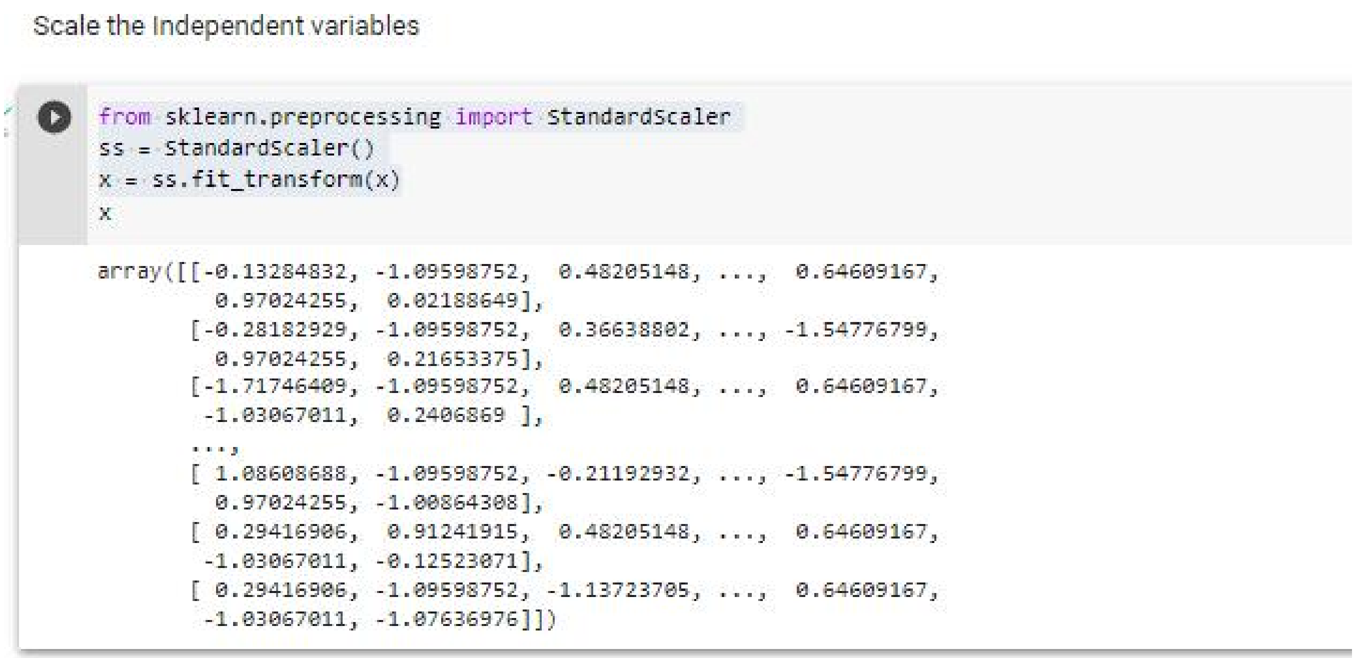
```
0    1
1    0
2    1
3    0
4    0
Name: Exited, dtype: int64
```

Question 8 – Scale the independent variables

SOLUTION:

from sklearn.preprocessing import
StandardScaler ss = StandardScaler()
x =
ss.fit_transform(x) x

OUTPUT:



Scale the Independent variables

```
from sklearn.preprocessing import StandardScaler
ss = StandardScaler()
x = ss.fit_transform(x)
x
```

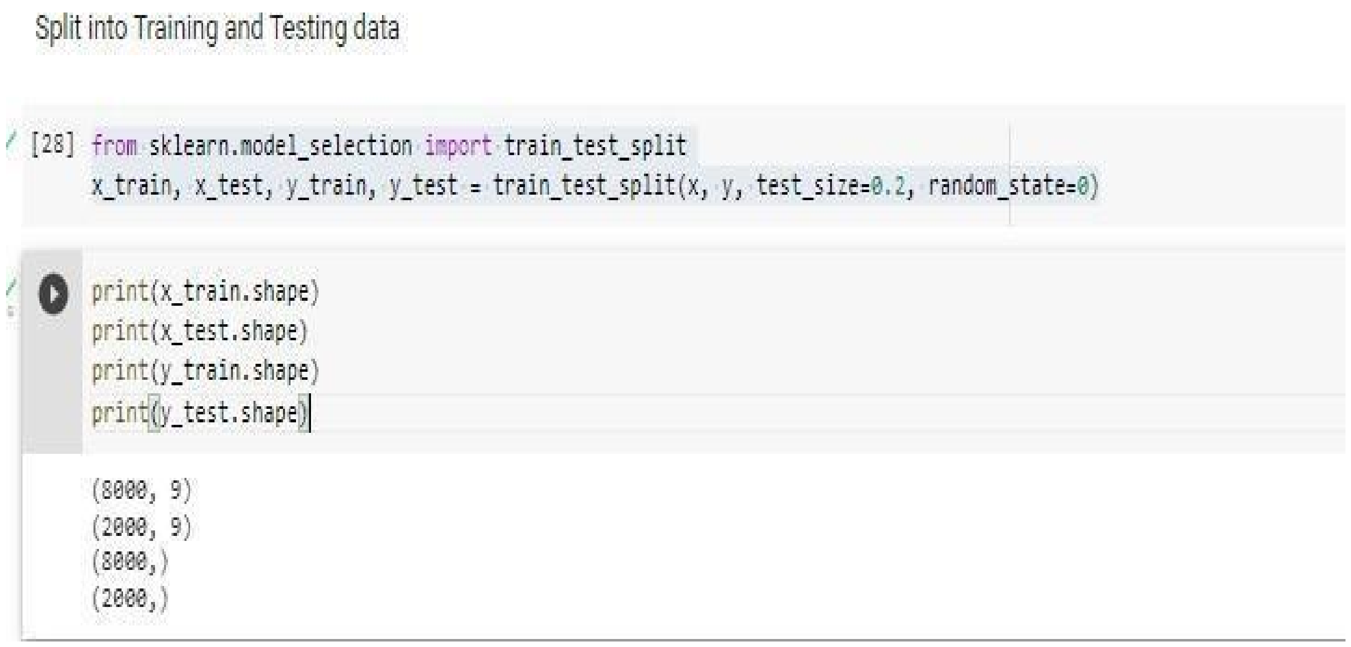
```
array([[-0.13284832, -1.09598752,  0.48205148, ...,  0.64609167,
         0.97024255,  0.02188649],
       [-0.28182929, -1.09598752,  0.36638802, ..., -1.54776799,
         0.97024255,  0.21653375],
       [-1.71746409, -1.09598752,  0.48205148, ...,  0.64609167,
        -1.03067011,  0.2406869 ],
       ...,
       [ 1.08608688, -1.09598752, -0.21192932, ..., -1.54776799,
         0.97024255, -1.00864308],
       [ 0.29416906,  0.91241915,  0.48205148, ...,  0.64609167,
        -1.03067011, -0.12523071],
       [ 0.29416906, -1.09598752, -1.13723705, ...,  0.64609167,
        -1.03067011, -1.07636976]])
```

Question 9 - Split the data into training and testing

SOLUTION:

```
from sklearn.model_selection import train_test_split

x_train, y_test = train_test_split(x, y, test_size=0.2,

random_state=0) print(x_train.shape)

print(x_test.shape

)

print(y_train.shape)

print(y_test.shape

)
```

OUTPUT:



Split into Training and Testing data

```
[28] from sklearn.model_selection import train_test_split
     x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2, random_state=0)
```

```
print(x_train.shape)
print(x_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(8000, 9)
(2000, 9)
(8000,)
(2000,)
```