Assignment -2

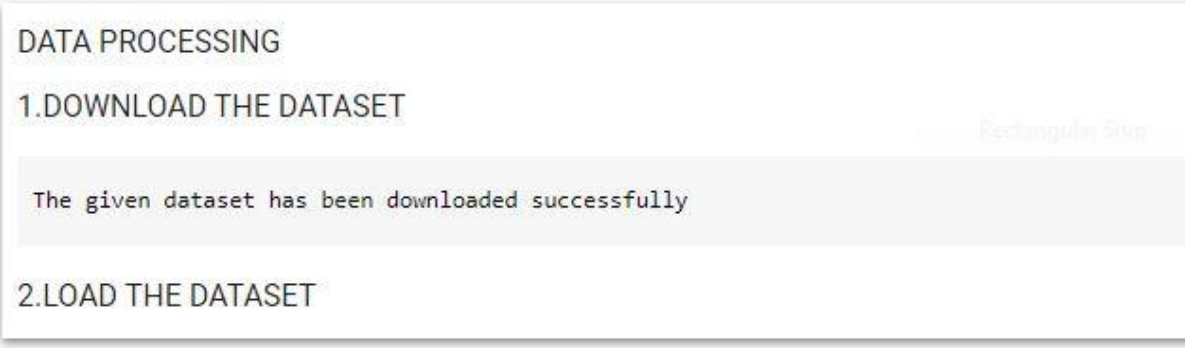
PYTHON PROGRAM

Assignment Date	21 September 2022
Student Name	M.ANNAPOORANI
Student Roll Number	912619104001
Maximum Marks	2 Marks

Question-1:

Download the dataset: Dataset

Solution:



DATA PROCESSING

1.DOWNLOAD THE DATASET

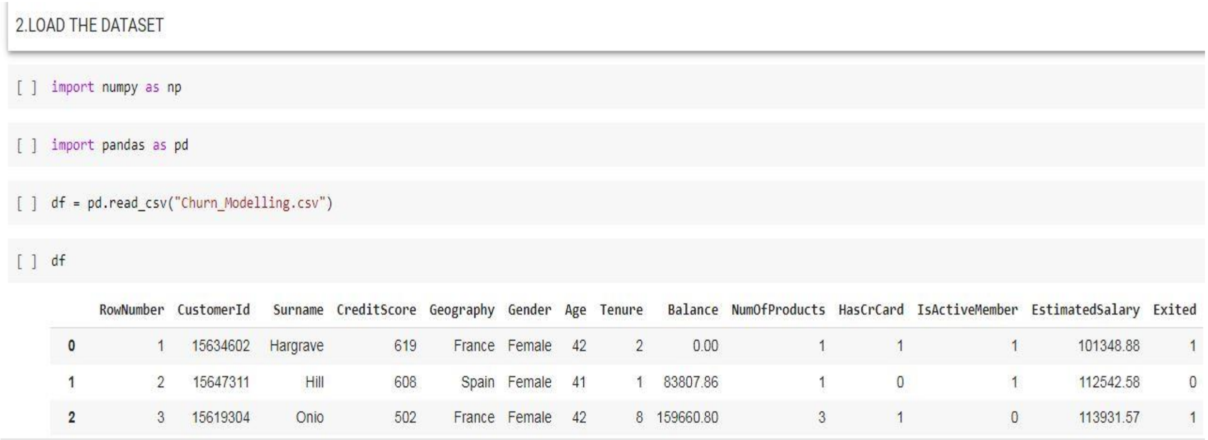
```
The given dataset has been downloaded successfully
```

2.LOAD THE DATASET

Question-2:

Load the dataset.

Solution:



2.LOAD THE DATASET

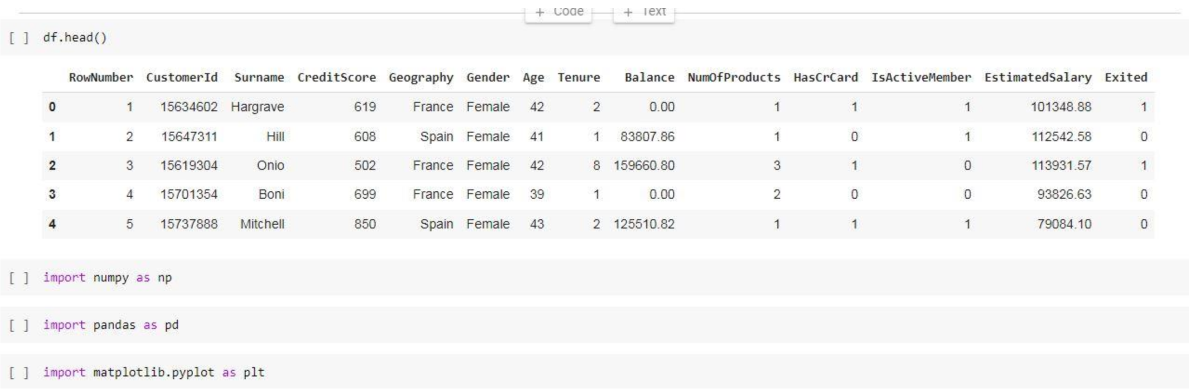
```
[ ] import numpy as np
```

```
[ ] import pandas as pd
```

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

```
[ ] df
```

	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



```
[ ] df.head()
```

	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

```
[ ] import numpy as np
```

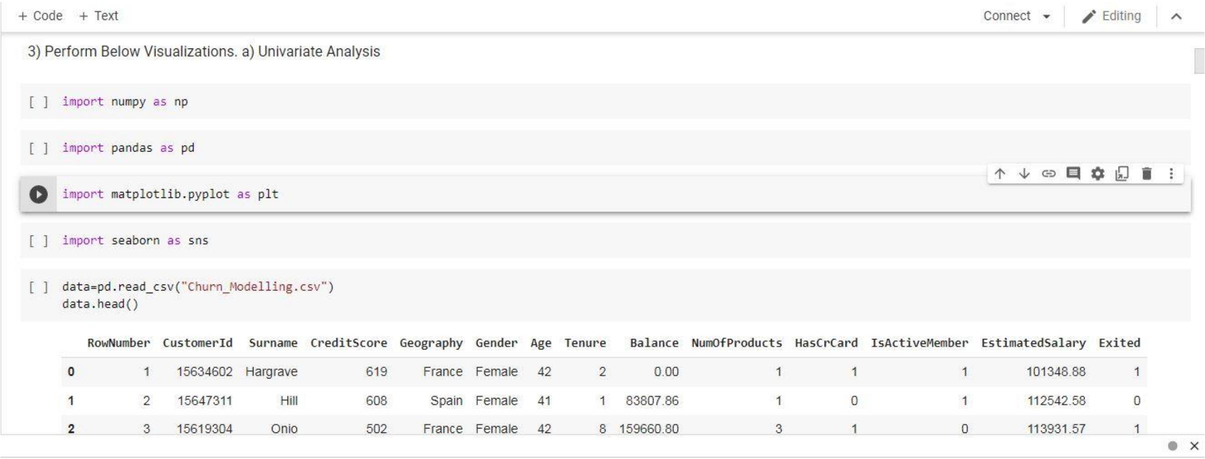
```
[ ] import pandas as pd
```

```
[ ] import matplotlib.pyplot as plt
```

Question-3:

Perform Below Visualizations.

3 a) Univariate Analysis



3) Perform Below Visualizations. a) Univariate Analysis

```
[ ] import numpy as np
```

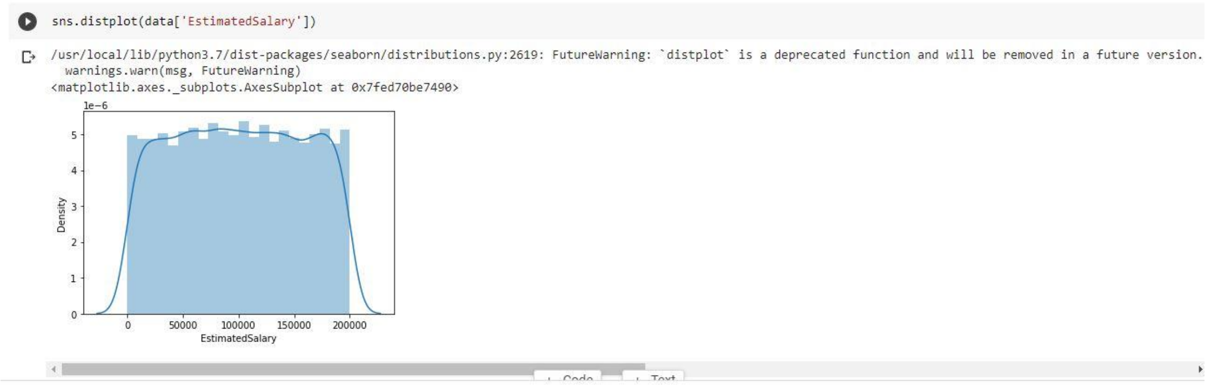
```
[ ] import pandas as pd
```

```
import matplotlib.pyplot as plt
```

```
[ ] import seaborn as sns
```

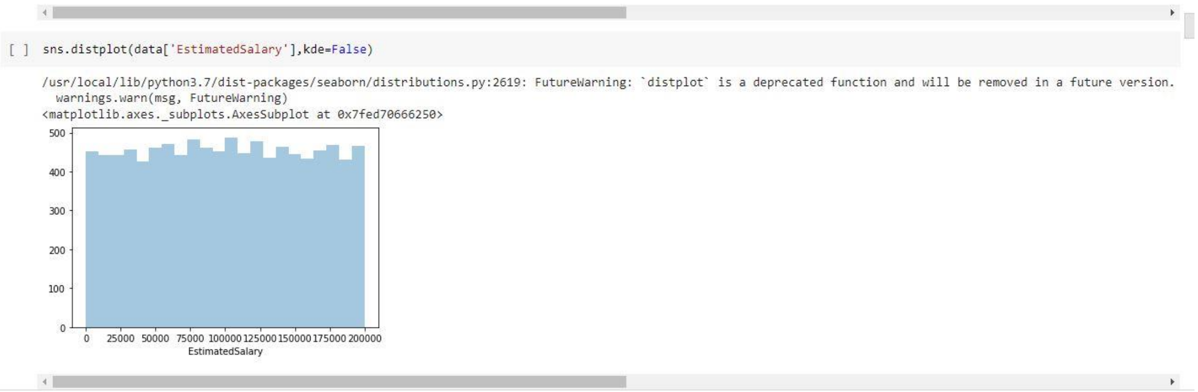
```
[ ] data=pd.read_csv("Churn_Modelling.csv")
    data.head()
```

	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

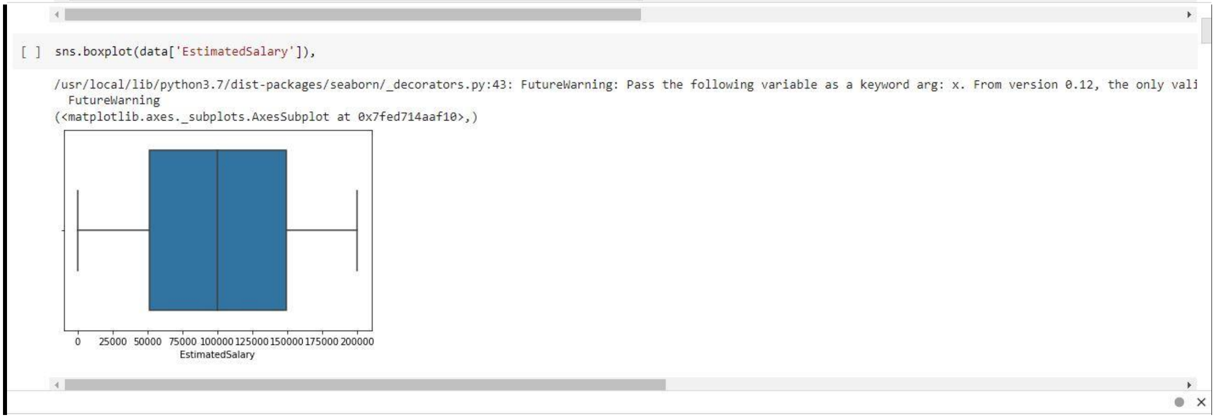


```
sns.distplot(data['EstimatedSalary'])
```

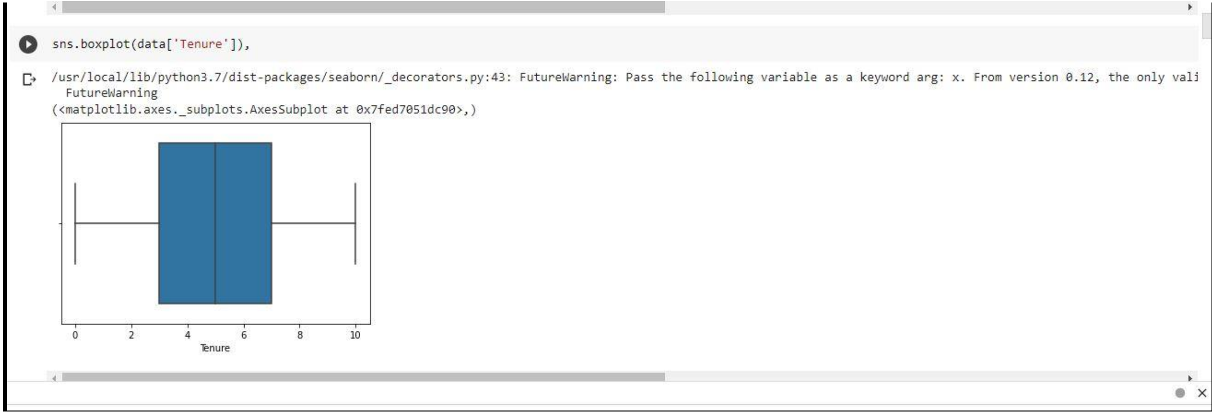
```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2619: FutureWarning: `distplot` is a deprecated function and will be removed in a future version.
  warnings.warn(msg, FutureWarning)
<matplotlib.axes._subplots.AxesSubplot at 0x7fed70be7490>
```



```
[ ] sns.distplot(data['EstimatedSalary'],kde=False)

/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2619: FutureWarning: `distplot` is a deprecated function and will be removed in a future version.
  warnings.warn(msg, FutureWarning)
<matplotlib.axes._subplots.AxesSubplot at 0x7fed70666250>
```

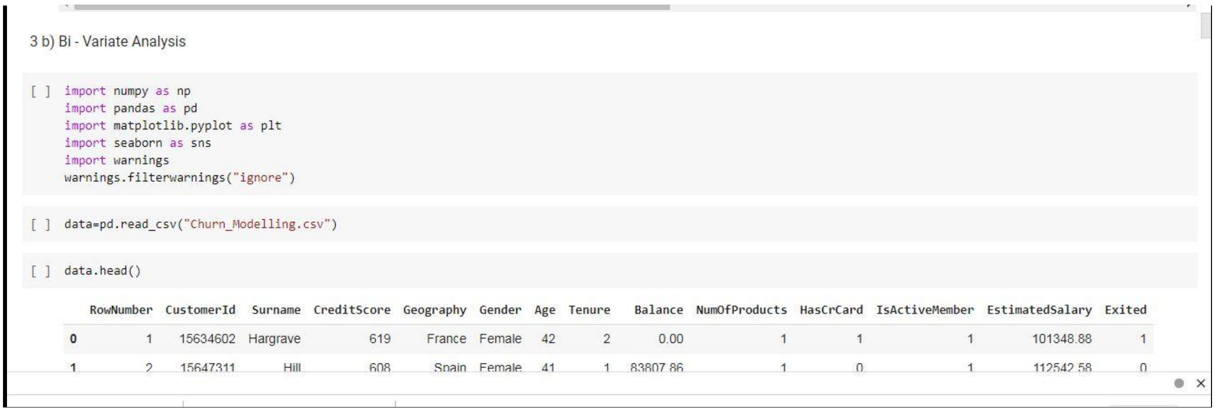


```
[ ] sns.boxplot(data['EstimatedSalary']),

/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 only vali
  FutureWarning
(<matplotlib.axes._subplots.AxesSubplot at 0x7fed714aaf10>,)
```



```
sns.boxplot(data['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 only vali
  FutureWarning
(<matplotlib.axes._subplots.AxesSubplot at 0x7fed7051dc90>,)
```

3 b)Bi - Variate Analysis



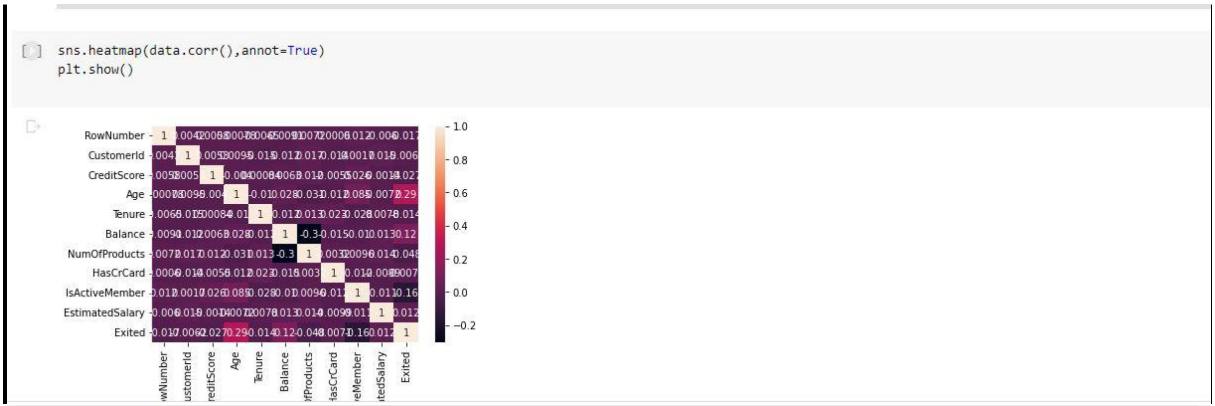
3 b) Bi - Variate Analysis

```
[ ] import numpy as np
    import pandas as pd
    import matplotlib.pyplot as plt
    import seaborn as sns
    import warnings
    warnings.filterwarnings("ignore")
```

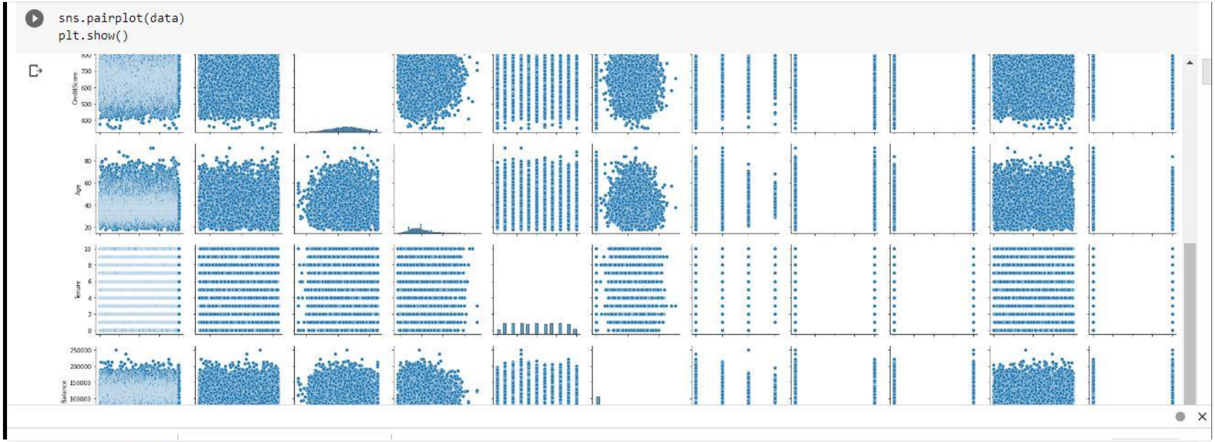
```
[ ] data=pd.read_csv("Churn_Modelling.csv")
```

```
[ ] data.head()
```

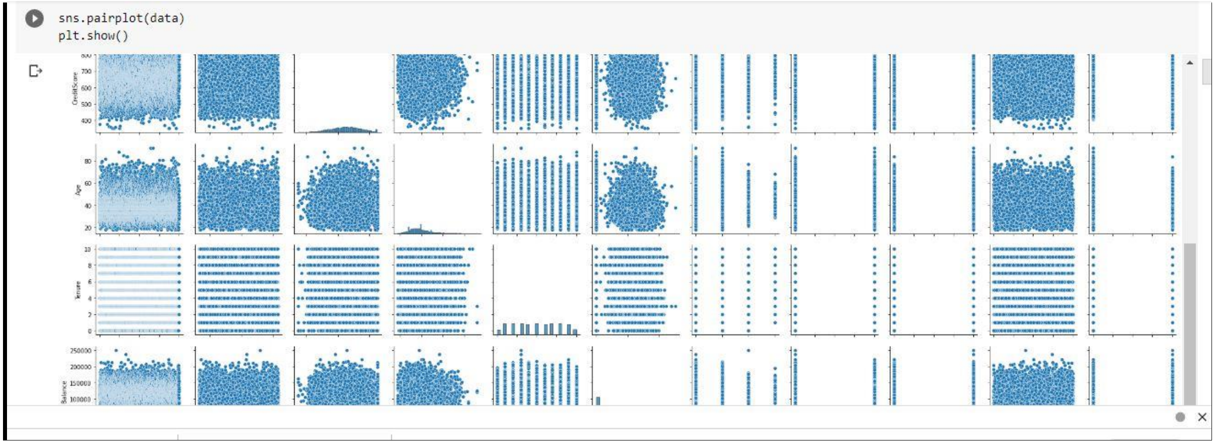
	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	1	1	101348.88	1
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0



```
sns.heatmap(data.corr(),annot=True)
plt.show()
```

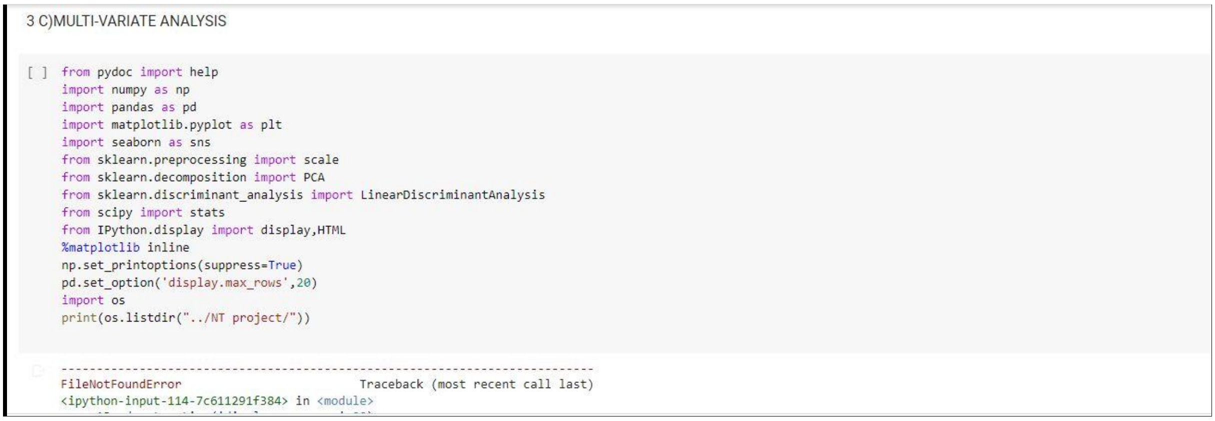


```
sns.pairplot(data)
plt.show()
```



```
sns.pairplot(data)
plt.show()
```

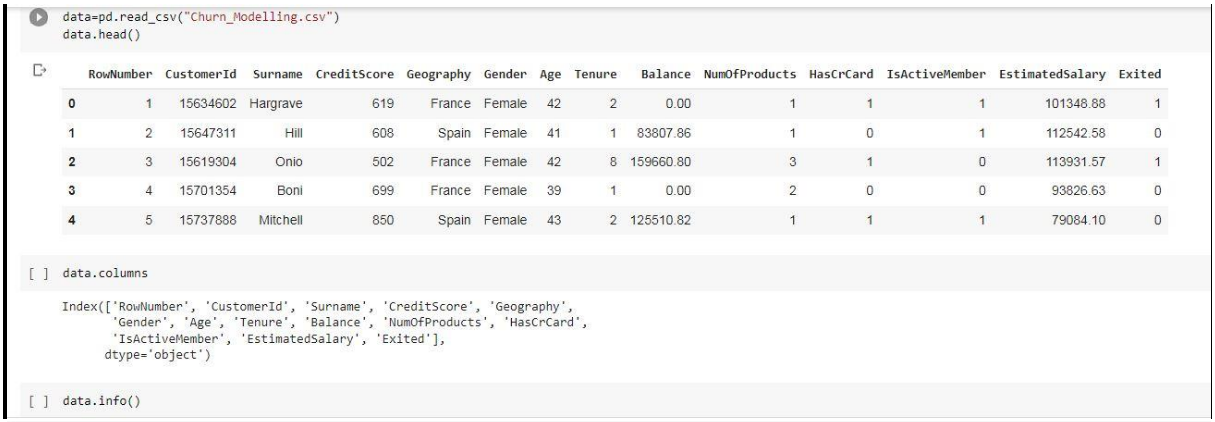
3 c) Multi - Variate Analysis



3 C)MULTI-VARIATE ANALYSIS

```
from pydoc import help
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import scale
from sklearn.decomposition import PCA
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis
from scipy import stats
from IPython.display import display,HTML
%matplotlib inline
np.set_printoptions(suppress=True)
pd.set_option('display.max_rows',20)
import os
print(os.listdir("../NT project/"))
```

```
---------------------------------------------------------------------------
FileNotFoundError                         Traceback (most recent call last)
<ipython-input-114-7c611291f384> in <module>
```



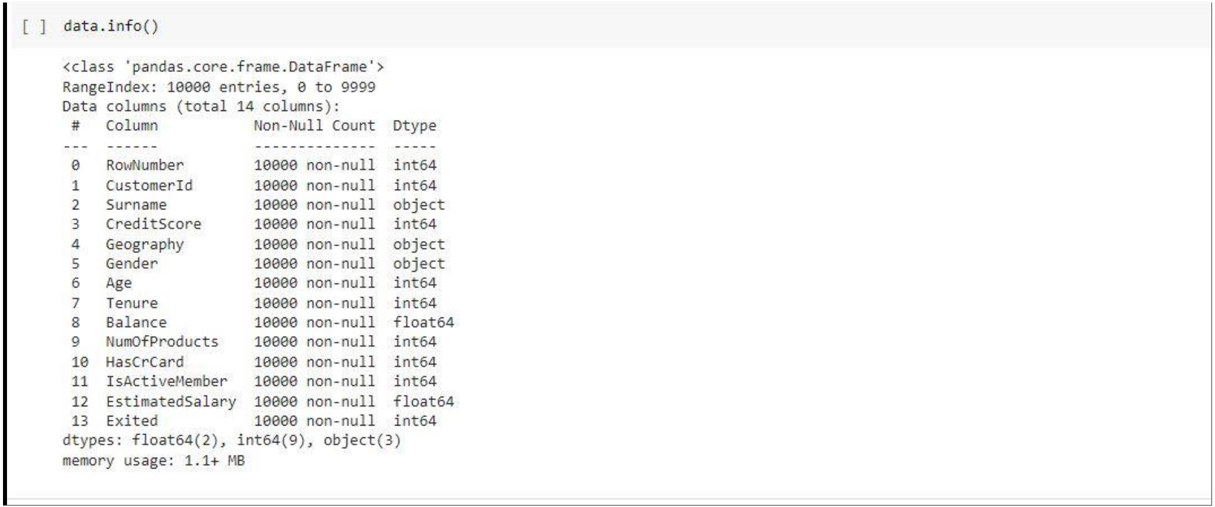
```
data=pd.read_csv("Churn_Modelling.csv")
data.head()
```

	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

```
[ ] data.columns
```

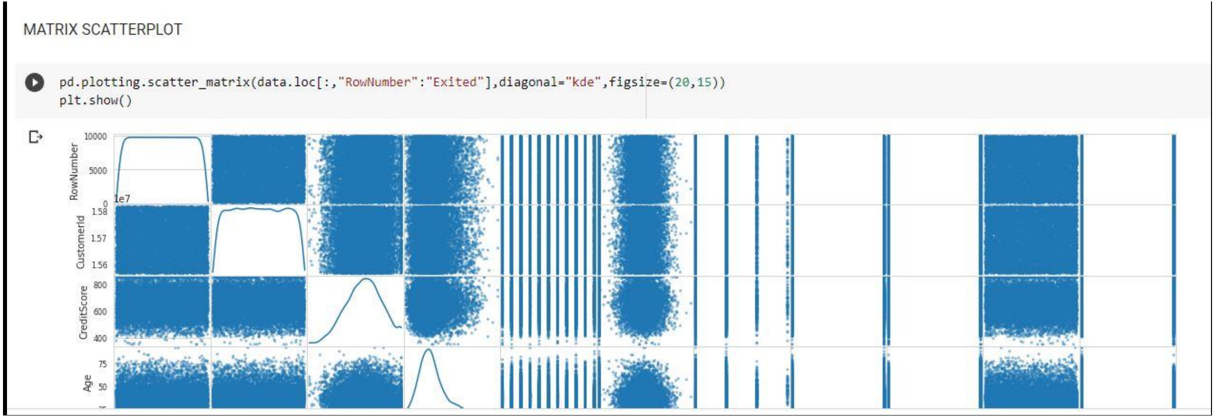
```
Index(['RowNumber', 'CustomerId', 'Surname', 'CreditScore', 'Geography',
       'Gender', 'Age', 'Tenure', 'Balance', 'NumOfProducts', 'HasCrCard',
       'IsActiveMember', 'EstimatedSalary', 'Exited'],
      dtype='object')
```

```
[ ] data.info()
```



```
[ ] data.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  object
 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(9), object(3)
memory usage: 1.1+ MB
```

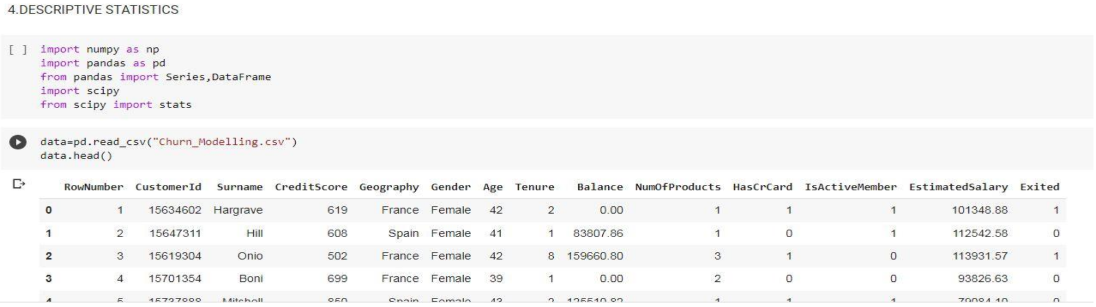


MATRIX SCATTERPLOT

```
pd.plotting.scatter_matrix(data.loc[:,"RowNumber":"Exited"],diagonal="kde",figsize=(20,15))
plt.show()
```

Question-4:

Perform descriptive statistics on the datase



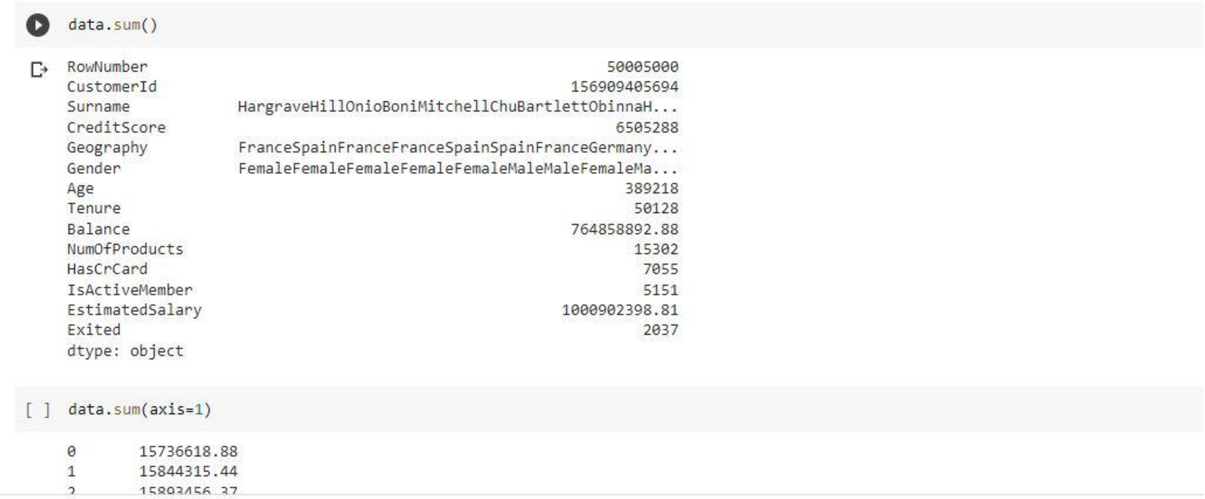
4.DESCRIPTIVE STATISTICS

```
[ ] import numpy as np
    import pandas as pd
    from pandas import Series,DataFrame
    import scipy
    from scipy import stats
```

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

	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

t.

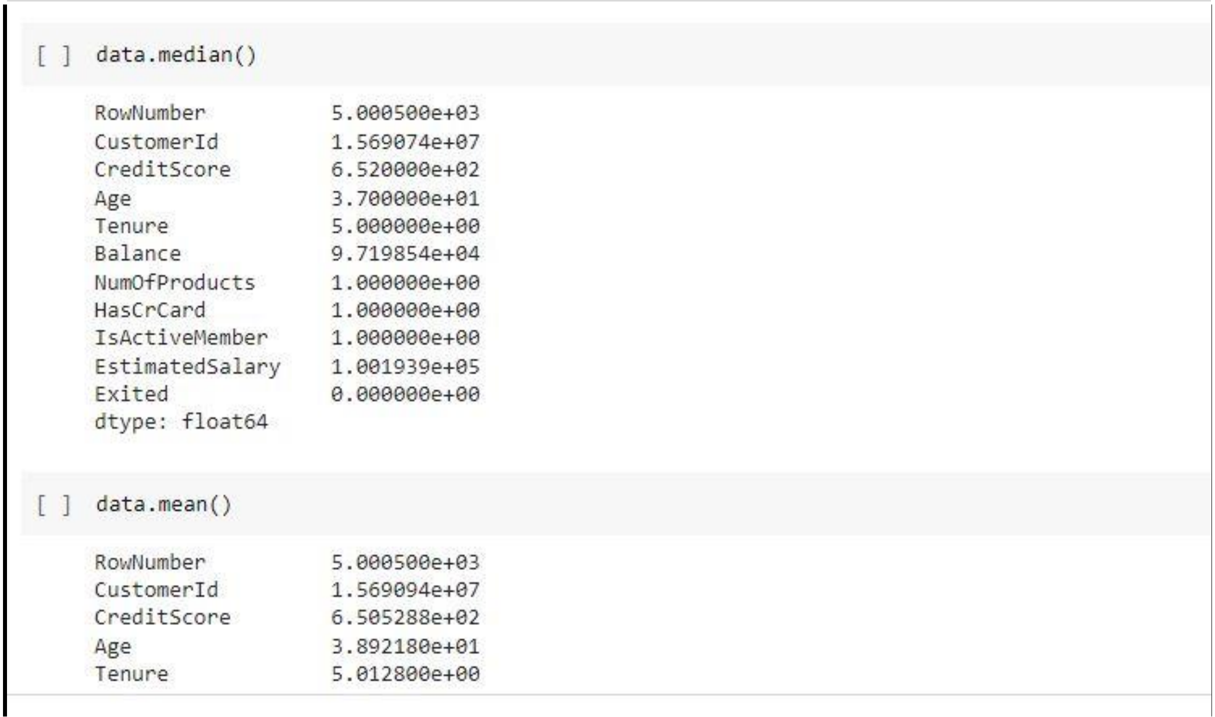


```
data.sum()
```

```
RowNumber                                                   50005000
CustomerId                                              156909405694
Surname            HargraveHillOnioBoniMitchellChuBartlettObinnaH...
CreditScore                                                  6505288
Geography          FranceSpainFranceFranceSpainSpainFranceGermany...
Gender             FemaleFemaleFemaleFemaleFemaleMaleMaleFemaleMa...
Age                                                           389218
Tenure                                                         50128
Balance                                                 764858892.88
NumOfProducts                                                  15302
HasCrCard                                                       7055
IsActiveMember                                                  5151
EstimatedSalary                                        1000902398.81
Exited                                                          2037
dtype: object
```

```
[ ] data.sum(axis=1)
```

```
0        15736618.88
1        15844315.44
2        15893456.37
```

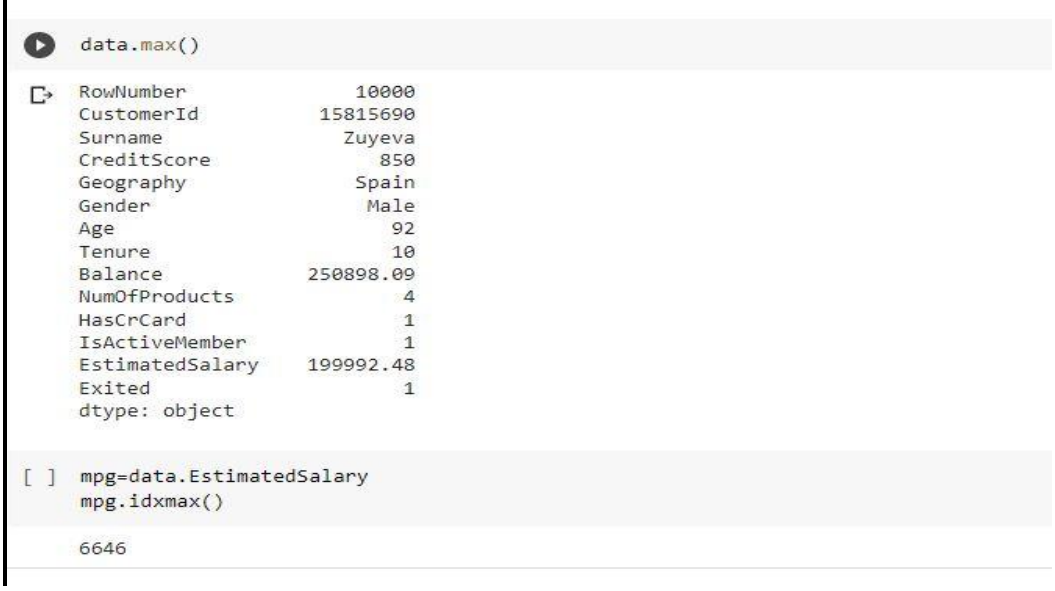


```
[ ] data.median()
```

```
RowNumber          5.000500e+03
CustomerId         1.569074e+07
CreditScore        6.520000e+02
Age                3.700000e+01
Tenure             5.000000e+00
Balance            9.719854e+04
NumOfProducts      1.000000e+00
HasCrCard          1.000000e+00
IsActiveMember     1.000000e+00
EstimatedSalary    1.001939e+05
Exited             0.000000e+00
dtype: float64
```

```
[ ] data.mean()
```

```
RowNumber          5.000500e+03
CustomerId         1.569094e+07
CreditScore        6.505288e+02
Age                3.892180e+01
Tenure             5.012800e+00
```

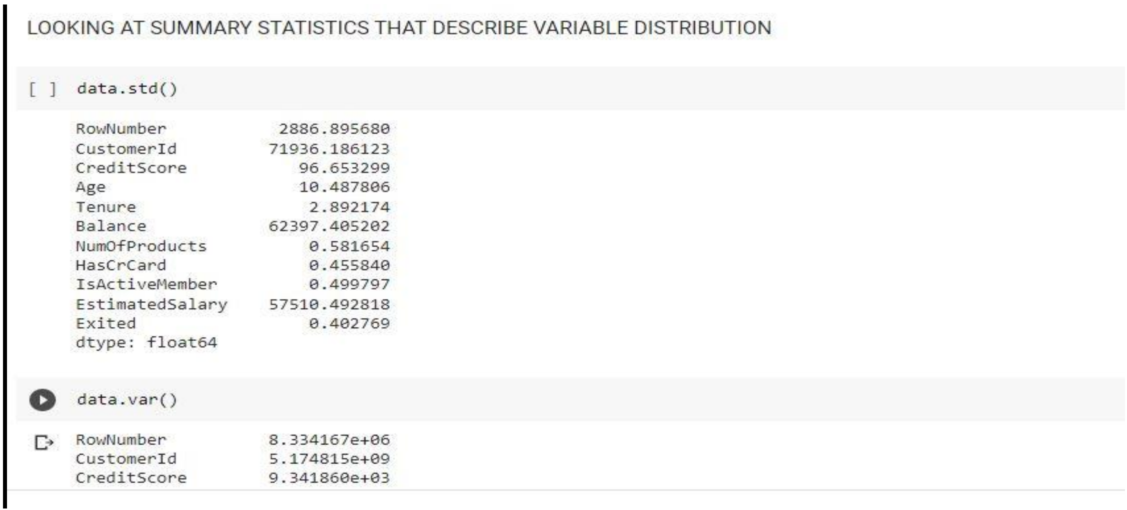


```
data.max()
```

```
RowNumber              10000
CustomerId          15815690
Surname               Zuyeva
CreditScore              850
Geography              Spain
Gender                  Male
Age                       92
Tenure                    10
Balance            250898.09
NumOfProducts              4
HasCrCard                  1
IsActiveMember             1
EstimatedSalary    199992.48
Exited                     1
dtype: object
```

```
[ ] mpg=data.EstimatedSalary
    mpg.idxmax()
```

```
6646
```



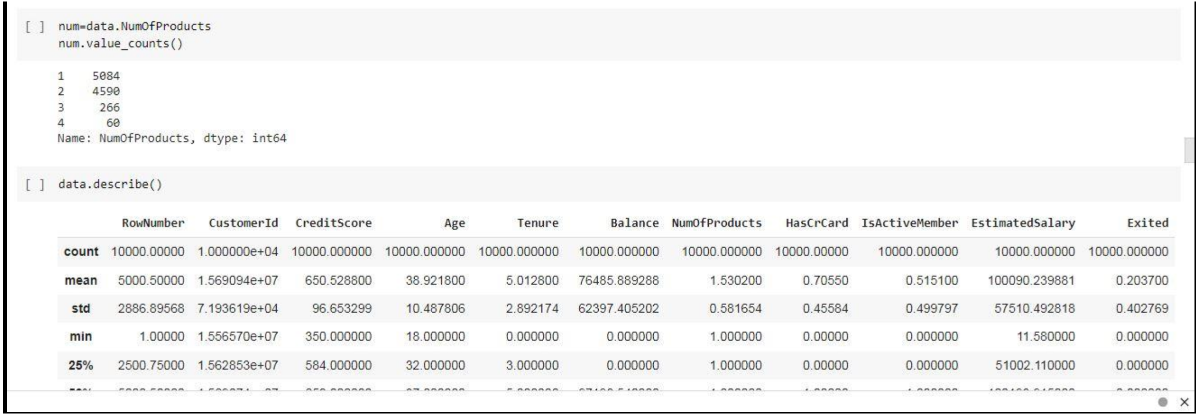
LOOKING AT SUMMARY STATISTICS THAT DESCRIBE VARIABLE DISTRIBUTION

```
[ ] data.std()
```

```
RowNumber           2886.895680
CustomerId         71936.186123
CreditScore           96.653299
Age                   10.487806
Tenure                 2.892174
Balance            62397.405202
NumOfProducts          0.581654
HasCrCard              0.455840
IsActiveMember         0.499797
EstimatedSalary    57510.492818
Exited                 0.402769
dtype: float64
```

```
data.var()
```

```
RowNumber          8.334167e+06
CustomerId         5.174815e+09
CreditScore        9.341860e+03
```



```
[ ] num=data.NumOfProducts
    num.value_counts()
```

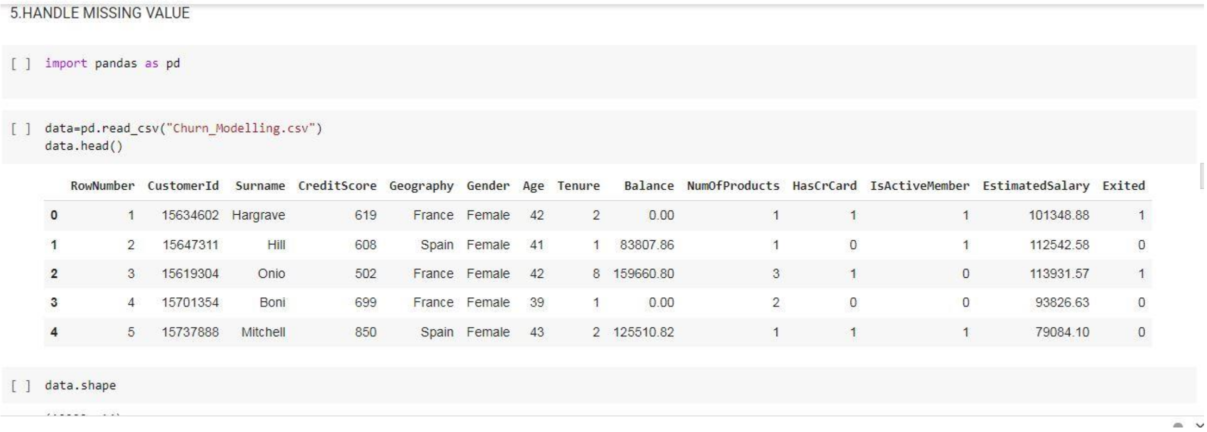
```
1    5084
2    4590
3     266
4      60
Name: NumOfProducts, dtype: int64
```

```
[ ] data.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

Question-5:

Handle the Missing values



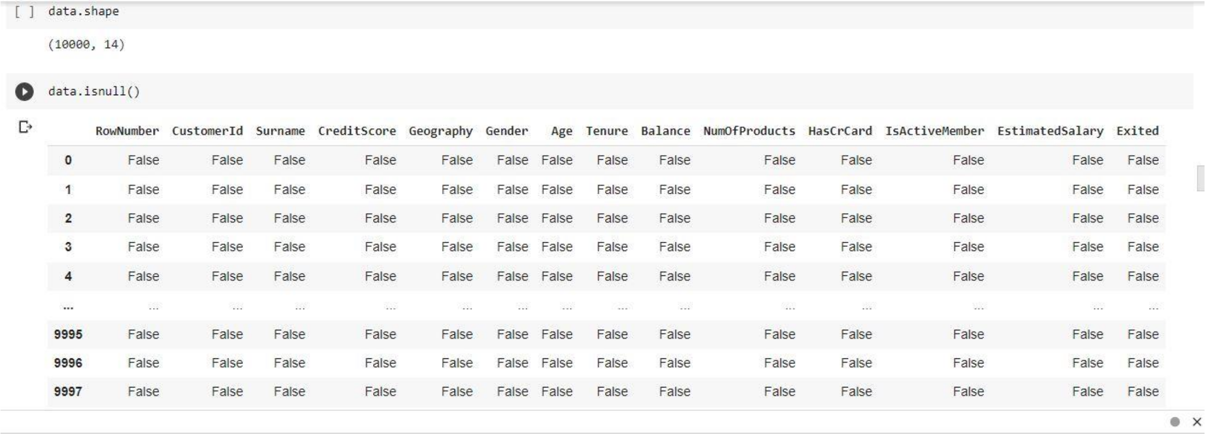
5.HANDLE MISSING VALUE

```
[ ] import pandas as pd
```

```
[ ] data=pd.read_csv("Churn_Modelling.csv")
    data.head()
```

	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

```
[ ] data.shape
```

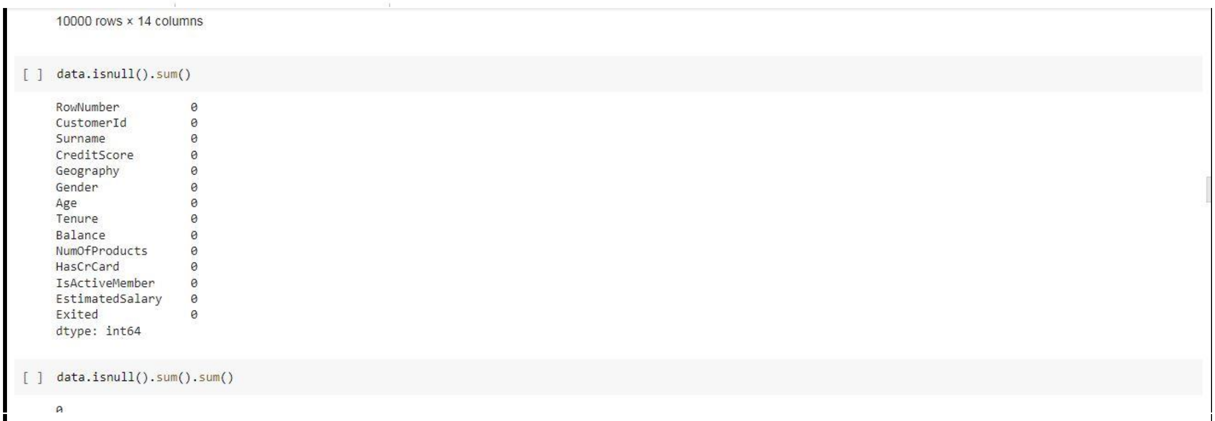


```
[ ] data.shape
```

```
(10000, 14)
```

```
data.isnull()
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	False	False	False	False	False	False	False	False	False	False	False	False	False	False
1	False	False	False	False	False	False	False	False	False	False	False	False	False	False
2	False	False	False	False	False	False	False	False	False	False	False	False	False	False
3	False	False	False	False	False	False	False	False	False	False	False	False	False	False
4	False	False	False	False	False	False	False	False	False	False	False	False	False	False
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9995	False	False	False	False	False	False	False	False	False	False	False	False	False	False
9996	False	False	False	False	False	False	False	False	False	False	False	False	False	False
9997	False	False	False	False	False	False	False	False	False	False	False	False	False	False



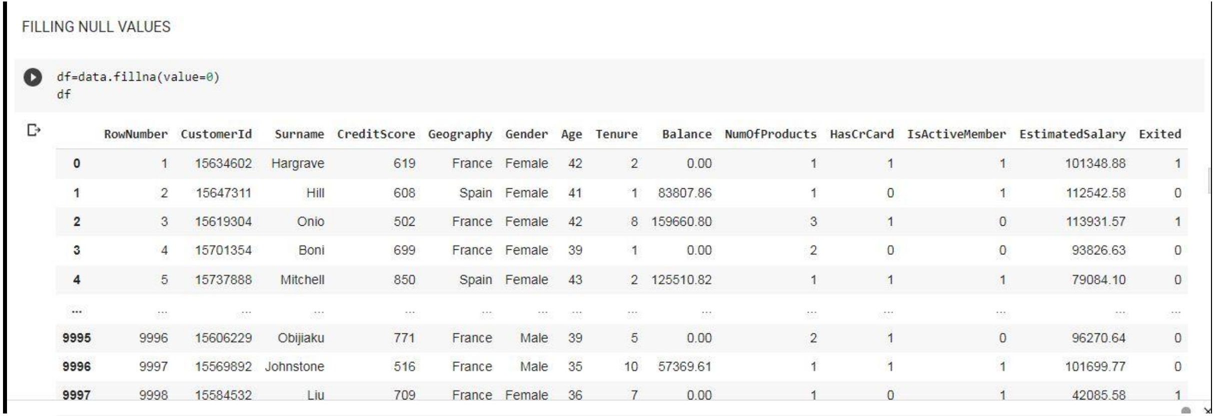
10000 rows × 14 columns

```
[ ] data.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
```

```
[ ] data.isnull().sum().sum()
```

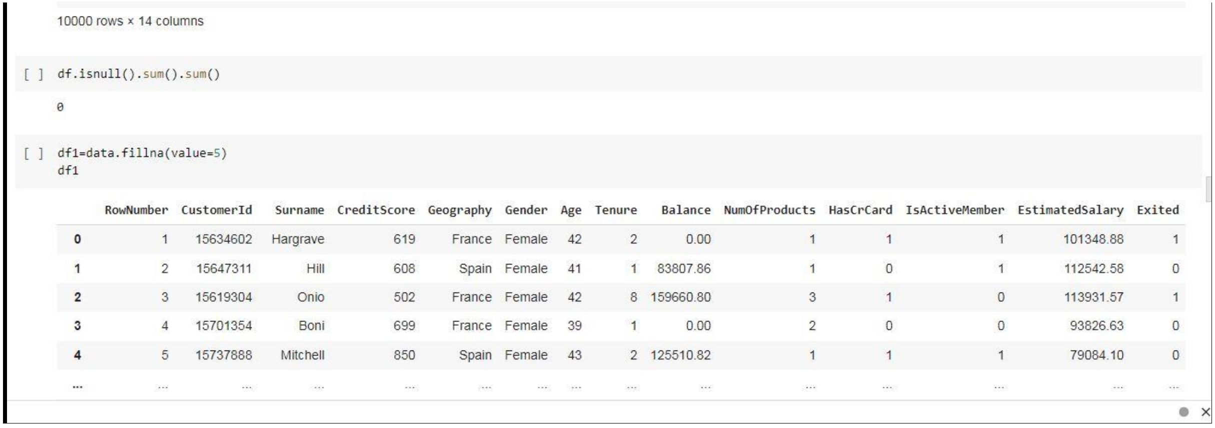
```
0
```



FILLING NULL VALUES

```
df=data.fillna(value=0)
df
```

	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
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9995	9996	15606229	Obijiaku	771	France	Male	39	5	0.00	2	1	0	96270.64	0
9996	9997	15569892	Johnstone	516	France	Male	35	10	57369.61	1	1	1	101699.77	0
9997	9998	15584532	Liu	709	France	Female	36	7	0.00	1	0	1	42085.58	1



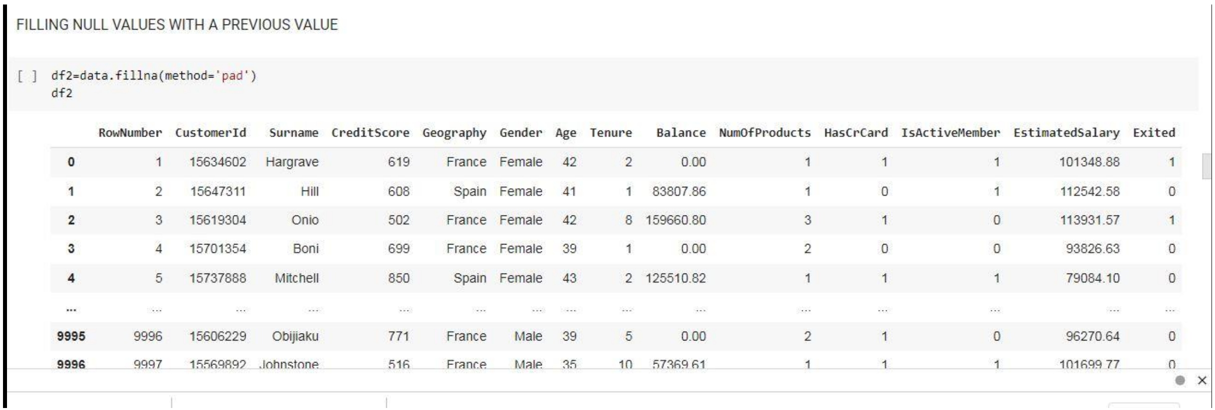
10000 rows × 14 columns

```
[ ] df.isnull().sum().sum()
```

```
0
```

```
[ ] df1=data.fillna(value=5)
df1
```

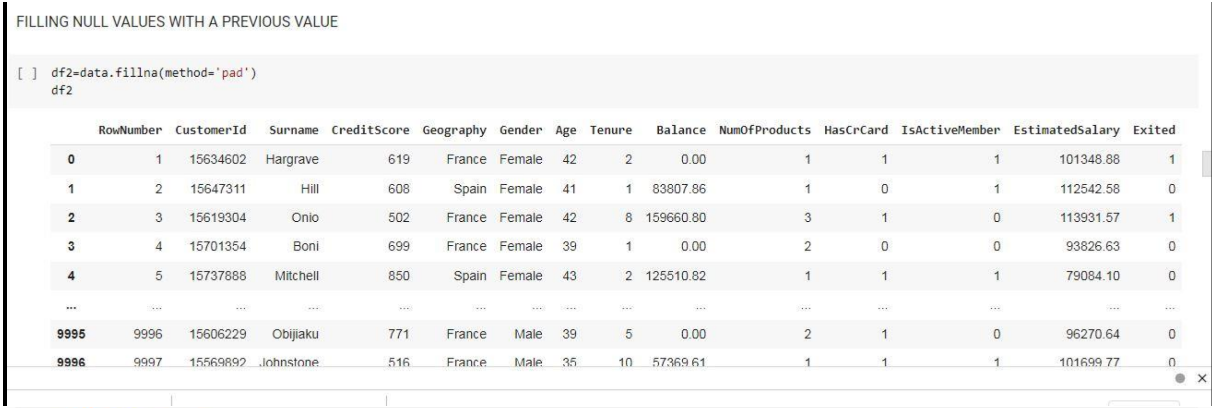
	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	1	1	101348.88	1
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0
2	3	15619304	Onio	502	France	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
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...



FILLING NULL VALUES WITH A PREVIOUS VALUE

```
[ ] df2=data.fillna(method='pad')
    df2
```

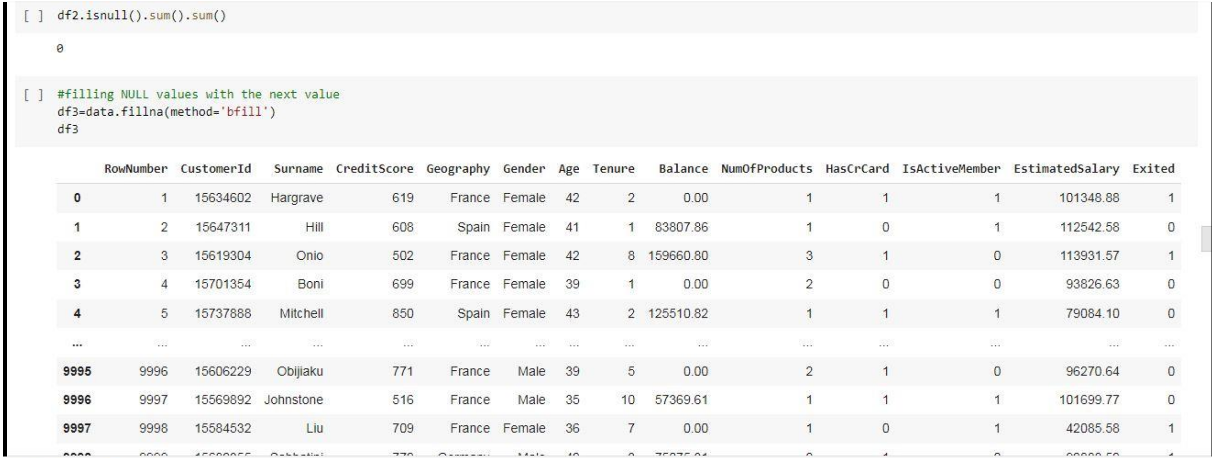
	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	1	1	101348.88	1
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0
2	3	15619304	Onio	502	France	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
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9995	9996	15606229	Obijiaku	771	France	Male	39	5	0.00	2	1	0	96270.64	0
9996	9997	15569892	Johnstone	516	France	Male	35	10	57369.61	1	1	1	101699.77	0



FILLING NULL VALUES WITH A PREVIOUS VALUE

```
[ ] df2=data.fillna(method='pad')
    df2
```

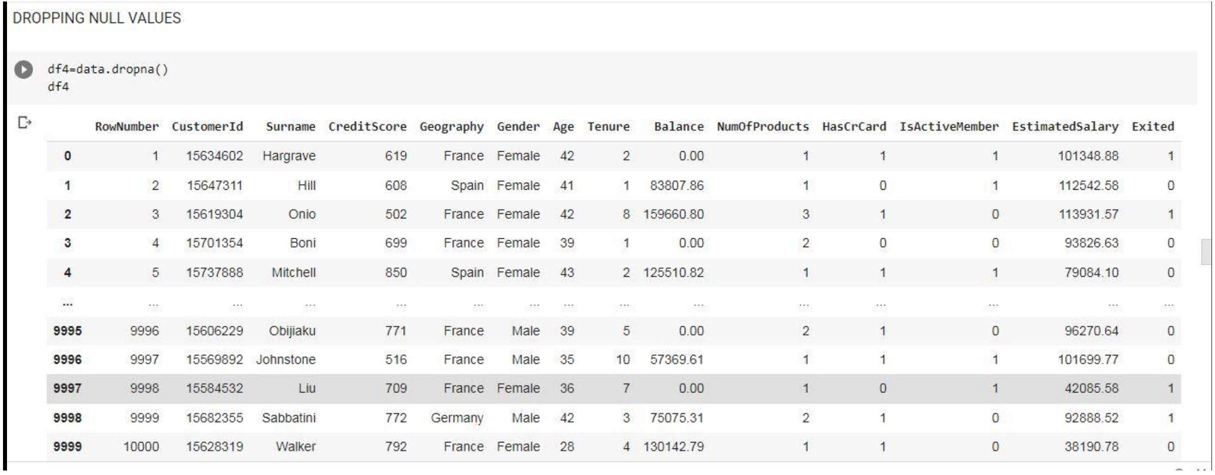
	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	1	1	101348.88	1
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0
2	3	15619304	Onio	502	France	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
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9995	9996	15606229	Obijiaku	771	France	Male	39	5	0.00	2	1	0	96270.64	0
9996	9997	15569892	Johnstone	516	France	Male	35	10	57369.61	1	1	1	101699.77	0



```
[ ] df2.isnull().sum().sum()

    0
```

```
[ ] #filling NULL values with the next value
    df3=data.fillna(method='bfill')
    df3
```

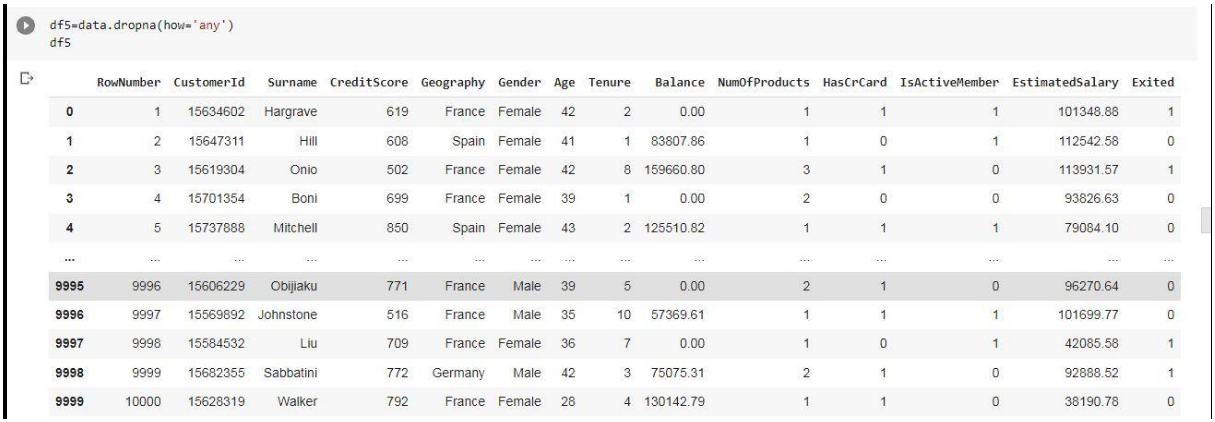
	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	1	1	101348.88	1
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0
2	3	15619304	Onio	502	France	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
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9995	9996	15606229	Obijiaku	771	France	Male	39	5	0.00	2	1	0	96270.64	0
9996	9997	15569892	Johnstone	516	France	Male	35	10	57369.61	1	1	1	101699.77	0
9997	9998	15584532	Liu	709	France	Female	36	7	0.00	1	0	1	42085.58	1



DROPPING NULL VALUES

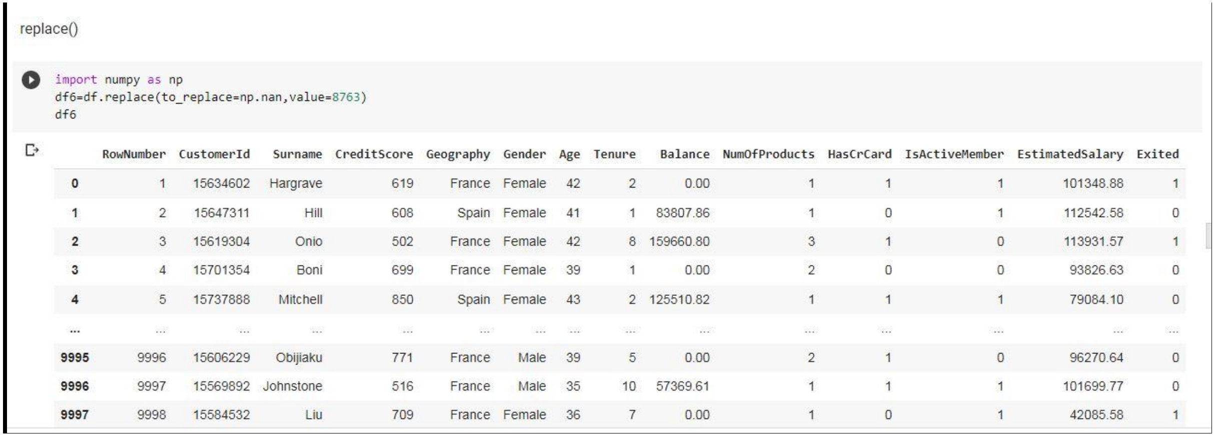
```
df4=data.dropna()
df4
```

	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
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9995	9996	15606229	Obijiaku	771	France	Male	39	5	0.00	2	1	0	96270.64	0
9996	9997	15569892	Johnstone	516	France	Male	35	10	57369.61	1	1	1	101699.77	0
9997	9998	15584532	Liu	709	France	Female	36	7	0.00	1	0	1	42085.58	1
9998	9999	15682355	Sabbatini	772	Germany	Male	42	3	75075.31	2	1	0	92888.52	1
9999	10000	15628319	Walker	792	France	Female	28	4	130142.79	1	1	0	38190.78	0



```
df5=data.dropna(how='any')
df5
```

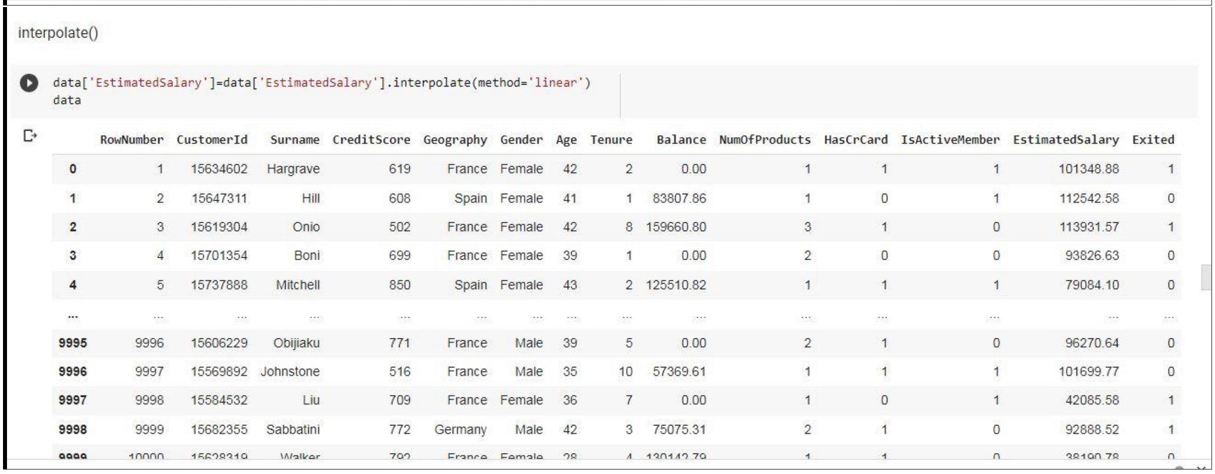
	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	1	1	101348.88	1
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0
2	3	15619304	Onio	502	France	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
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9995	9996	15606229	Obijiaku	771	France	Male	39	5	0.00	2	1	0	96270.64	0
9996	9997	15569892	Johnstone	516	France	Male	35	10	57369.61	1	1	1	101699.77	0
9997	9998	15584532	Liu	709	France	Female	36	7	0.00	1	0	1	42085.58	1
9998	9999	15682355	Sabbatini	772	Germany	Male	42	3	75075.31	2	1	0	92888.52	1
9999	10000	15628319	Walker	792	France	Female	28	4	130142.79	1	1	0	38190.78	0



replace()

```
import numpy as np
df6=df.replace(to_replace=np.nan,value=8763)
df6
```

	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
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9995	9996	15606229	Obijiaku	771	France	Male	39	5	0.00	2	1	0	96270.64	0
9996	9997	15569892	Johnstone	516	France	Male	35	10	57369.61	1	1	1	101699.77	0
9997	9998	15584532	Liu	709	France	Female	36	7	0.00	1	0	1	42085.58	1



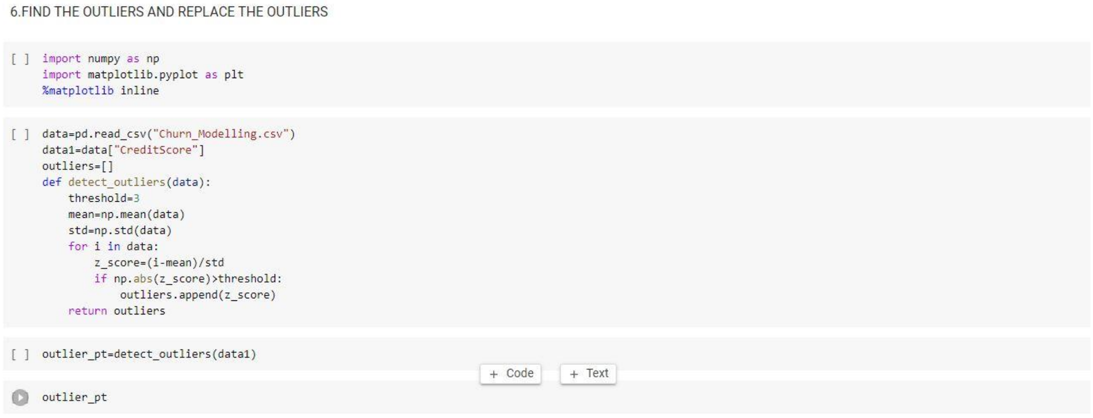
interpolate()

```
data['EstimatedSalary']=data['EstimatedSalary'].interpolate(method='linear')
data
```

	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
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9995	9996	15606229	Obijiaku	771	France	Male	39	5	0.00	2	1	0	96270.64	0
9996	9997	15569892	Johnstone	516	France	Male	35	10	57369.61	1	1	1	101699.77	0
9997	9998	15584532	Liu	709	France	Female	36	7	0.00	1	0	1	42085.58	1
9998	9999	15682355	Sabbatini	772	Germany	Male	42	3	75075.31	2	1	0	92888.52	1
9999	10000	15628319	Walker	792	France	Female	28	4	130142.79	1	1	0	38190.78	0

Question-6:

Find the outliers and replace the outliers



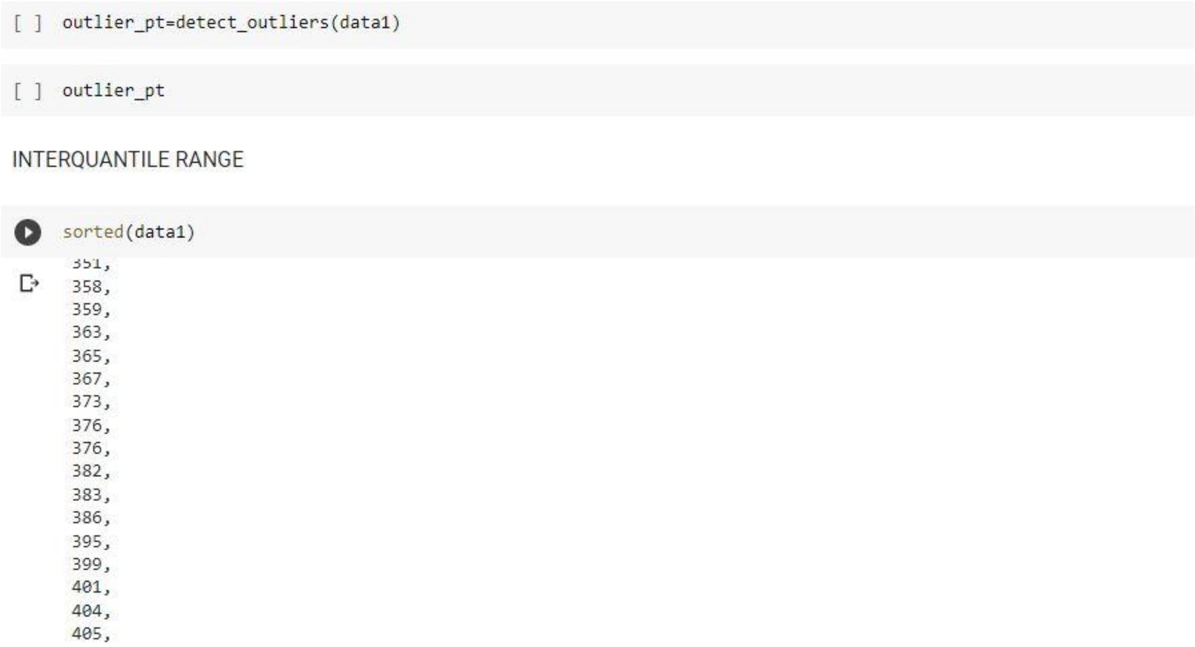
6.FIND THE OUTLIERS AND REPLACE THE OUTLIERS

```
[ ] import numpy as np
    import matplotlib.pyplot as plt
    %matplotlib inline
```

```
[ ] data=pd.read_csv("Churn_Modelling.csv")
    data1=data["CreditScore"]
    outliers=[]
    def detect_outliers(data):
        threshold=3
        mean=np.mean(data)
        std=np.std(data)
        for i in data:
            z_score=(i-mean)/std
            if np.abs(z_score)>threshold:
                outliers.append(z_score)
        return outliers
```

```
[ ] outlier_pt=detect_outliers(data1)
```

```
outlier_pt
```



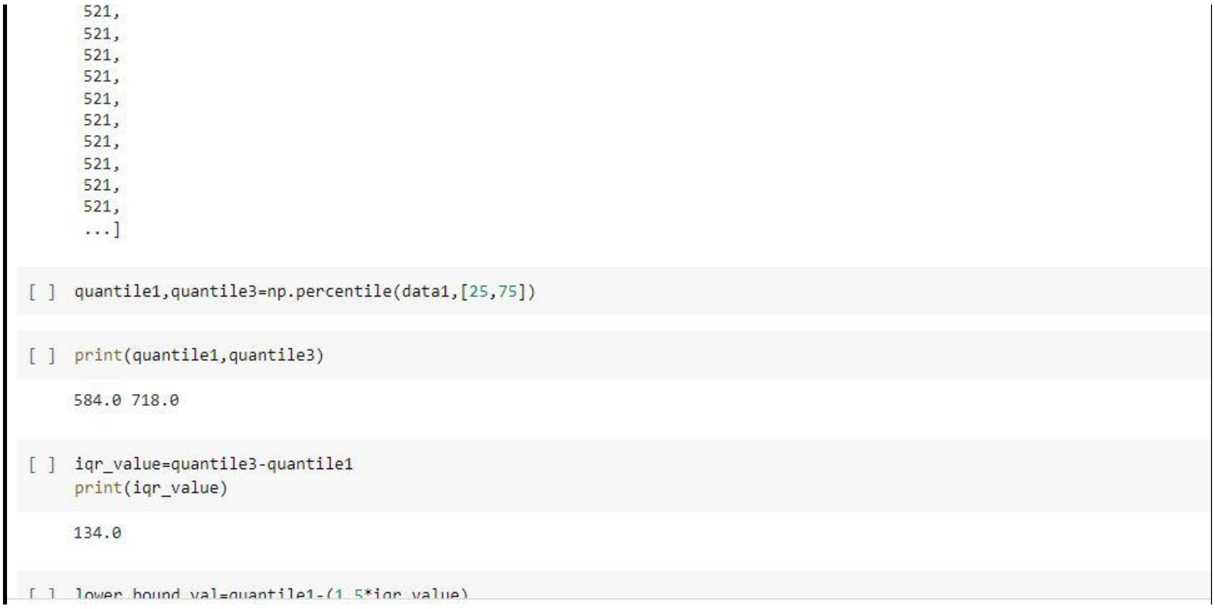
```
[ ] outlier_pt=detect_outliers(data1)
```

```
[ ] outlier_pt
```

INTERQUANTILE RANGE

```
sorted(data1)
```

```
 351,
 358,
 359,
 363,
 365,
 367,
 373,
 376,
 376,
 382,
 383,
 386,
 395,
 399,
 401,
 404,
 405,
```



```
 521,
 521,
 521,
 521,
 521,
 521,
 521,
 521,
 521,
 521,
 ...]
```

```
[ ] quantile1,quantile3=np.percentile(data1,[25,75])
```

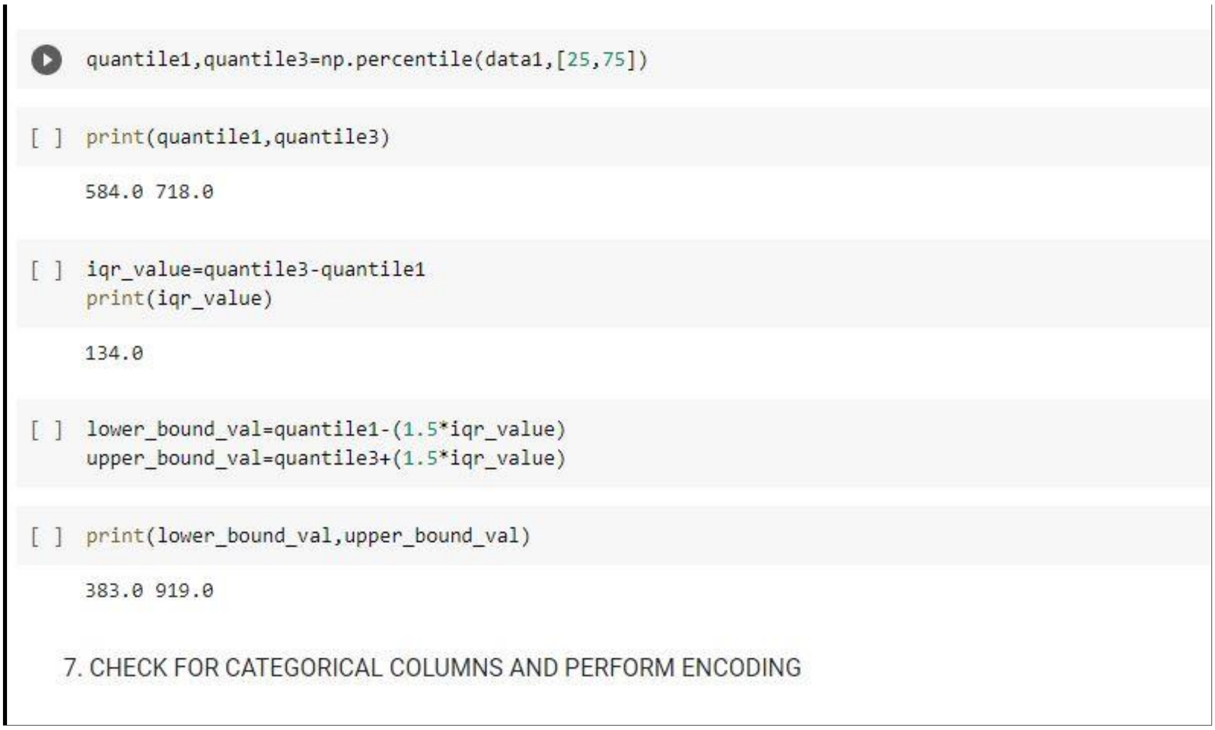
```
[ ] print(quantile1,quantile3)
```

```
584.0 718.0
```

```
[ ] iqr_value=quantile3-quantile1
    print(iqr_value)
```

```
134.0
```

```
[ ] lower_bound_val=quantile1-(1.5*iqr_value)
```



```
quantile1,quantile3=np.percentile(data1,[25,75])
```

```
print(quantile1,quantile3)
```

```
584.0 718.0
```

```
iqr_value=quantile3-quantile1
print(iqr_value)
```

```
134.0
```

```
lower_bound_val=quantile1-(1.5*iqr_value)
upper_bound_val=quantile3+(1.5*iqr_value)
```

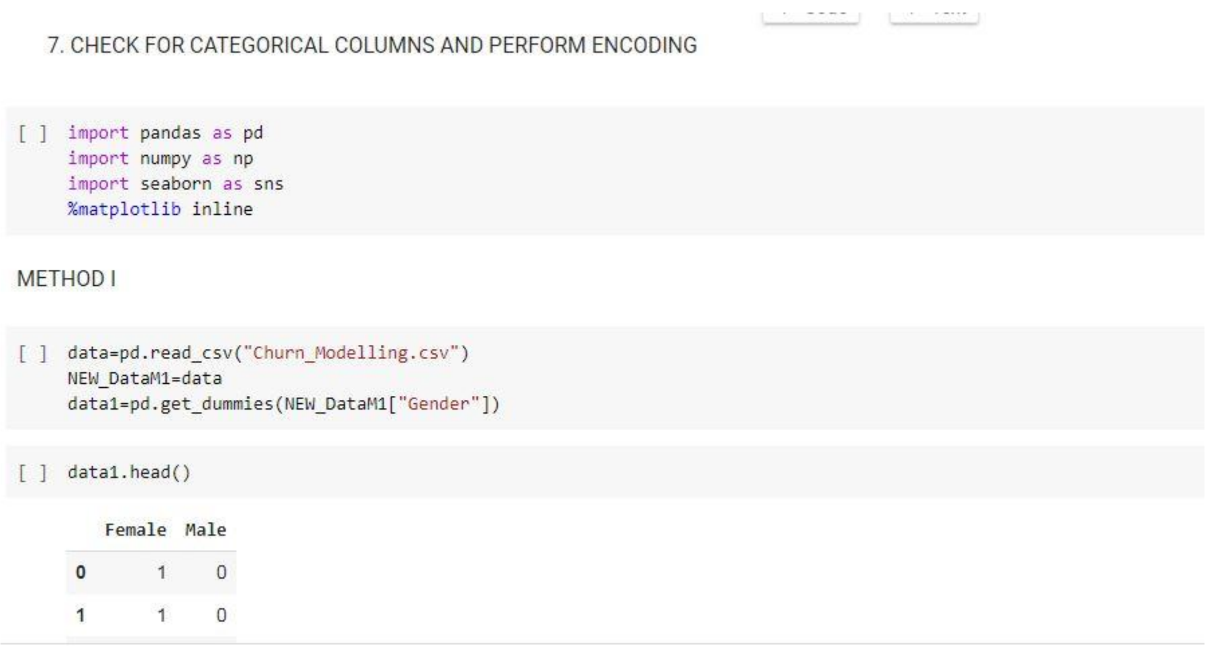
```
print(lower_bound_val,upper_bound_val)
```

```
383.0 919.0
```

7. CHECK FOR CATEGORICAL COLUMNS AND PERFORM ENCODING

Question-7:

Check for Categorical columns and perform encoding.



7. CHECK FOR CATEGORICAL COLUMNS AND PERFORM ENCODING

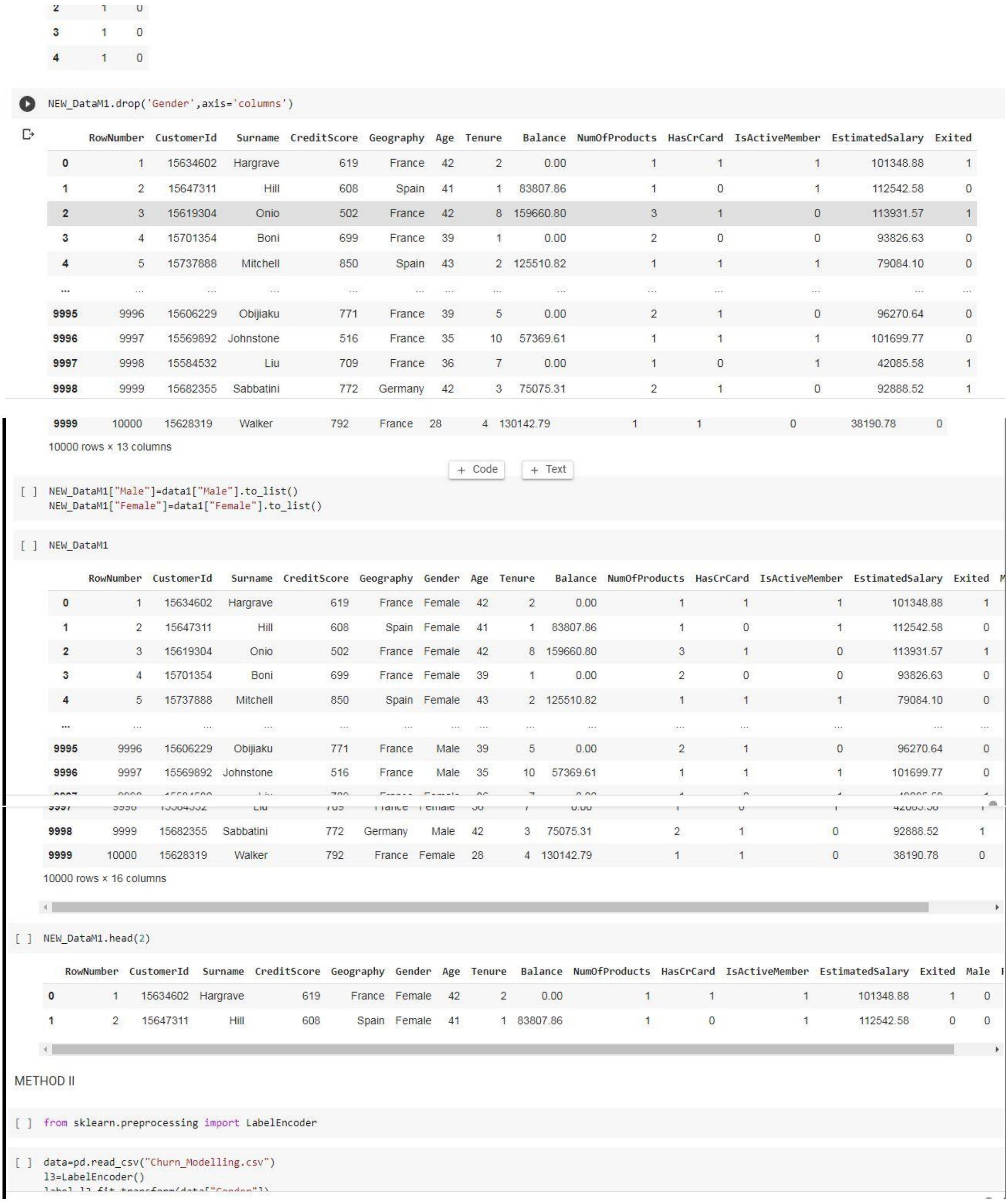
```
import pandas as pd
import numpy as np
import seaborn as sns
%matplotlib inline
```

METHOD I

```
data=pd.read_csv("Churn_Modelling.csv")
NEW_DataM1=data
data1=pd.get_dummies(NEW_DataM1["Gender"])
```

```
data1.head()
```

```
   Female  Male
0       1     0
1       1     0
```



2	1	0
3	1	0
4	1	0

```
NEW_DataM1.drop('Gender',axis='columns')
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	1	15634602	Hargrave	619	France	42	2	0.00	1	1	1	101348.88	1
1	2	15647311	Hill	608	Spain	41	1	83807.86	1	0	1	112542.58	0
2	3	15619304	Onio	502	France	42	8	159660.80	3	1	0	113931.57	1
3	4	15701354	Boni	699	France	39	1	0.00	2	0	0	93826.63	0
4	5	15737888	Mitchell	850	Spain	43	2	125510.82	1	1	1	79084.10	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...
9995	9996	15606229	Obijiaku	771	France	39	5	0.00	2	1	0	96270.64	0
9996	9997	15569892	Johnstone	516	France	35	10	57369.61	1	1	1	101699.77	0
9997	9998	15584532	Liu	709	France	36	7	0.00	1	0	1	42085.58	1
9998	9999	15682355	Sabbatini	772	Germany	42	3	75075.31	2	1	0	92888.52	1
9999	10000	15628319	Walker	792	France	28	4	130142.79	1	1	0	38190.78	0

10000 rows × 13 columns

```
NEW_DataM1["Male"]=data1["Male"].to_list()
NEW_DataM1["Female"]=data1["Female"].to_list()
```

```
NEW_DataM1
```

	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
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9995	9996	15606229	Obijiaku	771	France	Male	39	5	0.00	2	1	0	96270.64	0
9996	9997	15569892	Johnstone	516	France	Male	35	10	57369.61	1	1	1	101699.77	0
9997	9998	15584532	Liu	709	France	Female	36	7	0.00	1	0	1	42085.58	1
9998	9999	15682355	Sabbatini	772	Germany	Male	42	3	75075.31	2	1	0	92888.52	1
9999	10000	15628319	Walker	792	France	Female	28	4	130142.79	1	1	0	38190.78	0

10000 rows × 16 columns

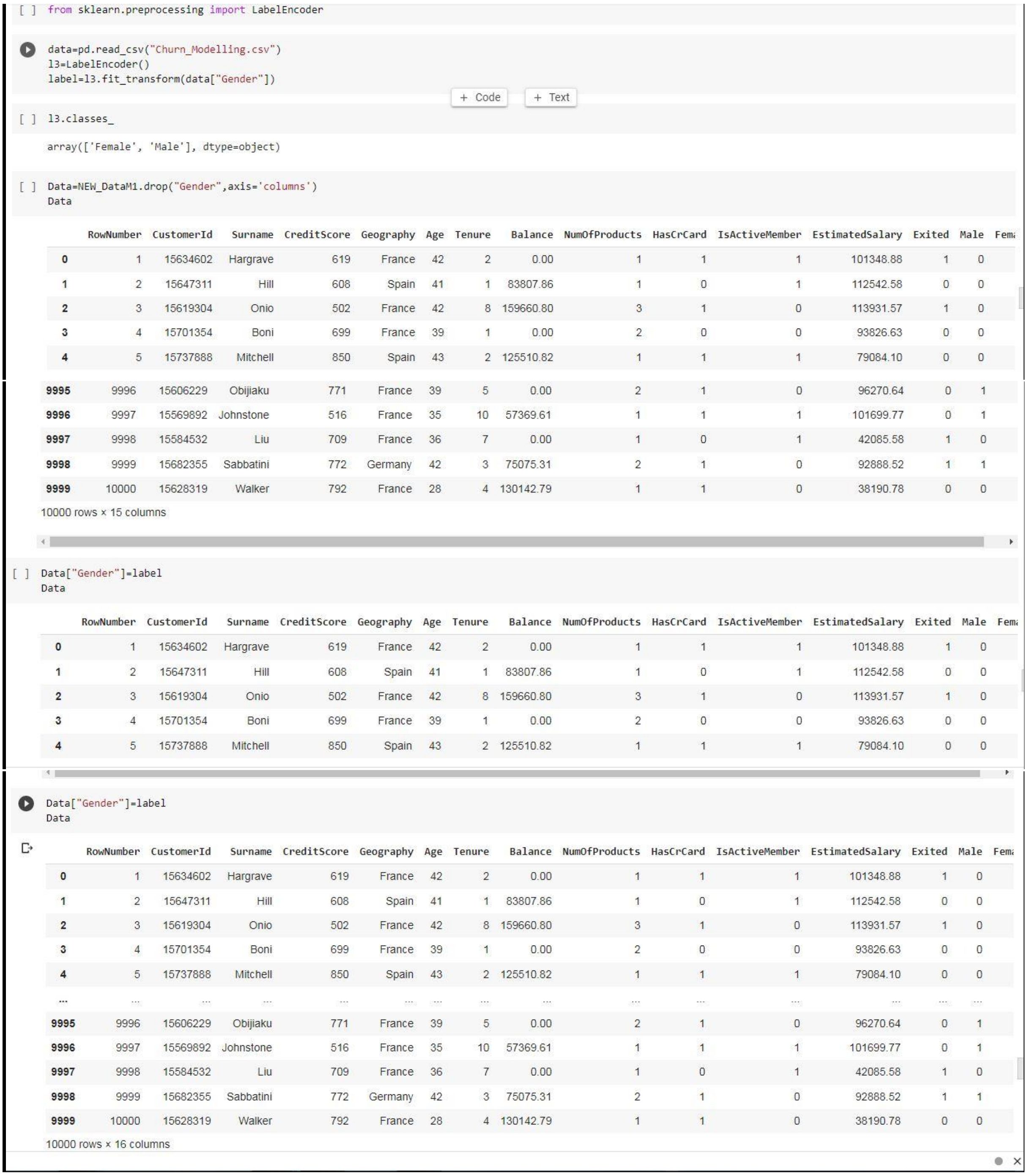
```
NEW_DataM1.head(2)
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited	Male
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	1	1	101348.88	1	0
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0	0

METHOD II

```
from sklearn.preprocessing import LabelEncoder
```

```
data=pd.read_csv("Churn_Modelling.csv")
l3=LabelEncoder()
label_l3.fit_transform(data["Gender"])
```



```
[ ] from sklearn.preprocessing import LabelEncoder
```

```
data=pd.read_csv("Churn_Modelling.csv")
l3=LabelEncoder()
label=l3.fit_transform(data["Gender"])
```

```
[ ] l3.classes_
```

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

```
[ ] Data=NEW_DataM1.drop("Gender",axis='columns')
    Data
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited	Male	Fema
0	1	15634602	Hargrave	619	France	42	2	0.00	1	1	1	101348.88	1	0	
1	2	15647311	Hill	608	Spain	41	1	83807.86	1	0	1	112542.58	0	0	
2	3	15619304	Onio	502	France	42	8	159660.80	3	1	0	113931.57	1	0	
3	4	15701354	Boni	699	France	39	1	0.00	2	0	0	93826.63	0	0	
4	5	15737888	Mitchell	850	Spain	43	2	125510.82	1	1	1	79084.10	0	0	
9995	9996	15606229	Obijiaku	771	France	39	5	0.00	2	1	0	96270.64	0	1	
9996	9997	15569892	Johnstone	516	France	35	10	57369.61	1	1	1	101699.77	0	1	
9997	9998	15584532	Liu	709	France	36	7	0.00	1	0	1	42085.58	1	0	
9998	9999	15682355	Sabbatini	772	Germany	42	3	75075.31	2	1	0	92888.52	1	1	
9999	10000	15628319	Walker	792	France	28	4	130142.79	1	1	0	38190.78	0	0	

10000 rows × 15 columns

```
[ ] Data["Gender"]=label
    Data
```

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

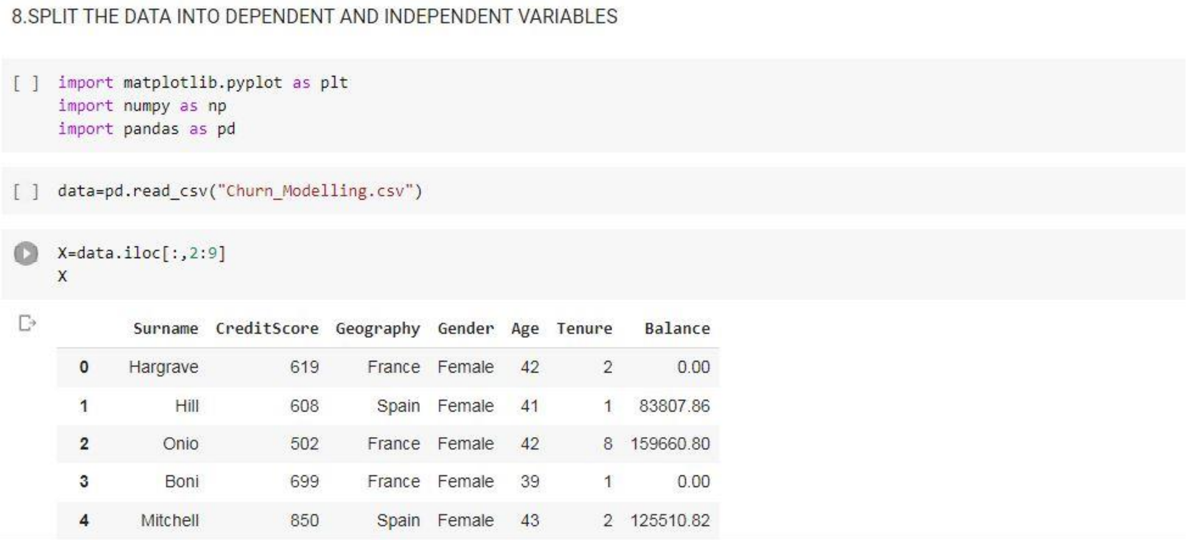
```
Data["Gender"]=label
Data
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited	Male	Fema
0	1	15634602	Hargrave	619	France	42	2	0.00	1	1	1	101348.88	1	0	
1	2	15647311	Hill	608	Spain	41	1	83807.86	1	0	1	112542.58	0	0	
2	3	15619304	Onio	502	France	42	8	159660.80	3	1	0	113931.57	1	0	
3	4	15701354	Boni	699	France	39	1	0.00	2	0	0	93826.63	0	0	
4	5	15737888	Mitchell	850	Spain	43	2	125510.82	1	1	1	79084.10	0	0	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9995	9996	15606229	Obijiaku	771	France	39	5	0.00	2	1	0	96270.64	0	1	
9996	9997	15569892	Johnstone	516	France	35	10	57369.61	1	1	1	101699.77	0	1	
9997	9998	15584532	Liu	709	France	36	7	0.00	1	0	1	42085.58	1	0	
9998	9999	15682355	Sabbatini	772	Germany	42	3	75075.31	2	1	0	92888.52	1	1	
9999	10000	15628319	Walker	792	France	28	4	130142.79	1	1	0	38190.78	0	0	

10000 rows × 16 columns

Question-8:

Split the data into dependent and independent variables.

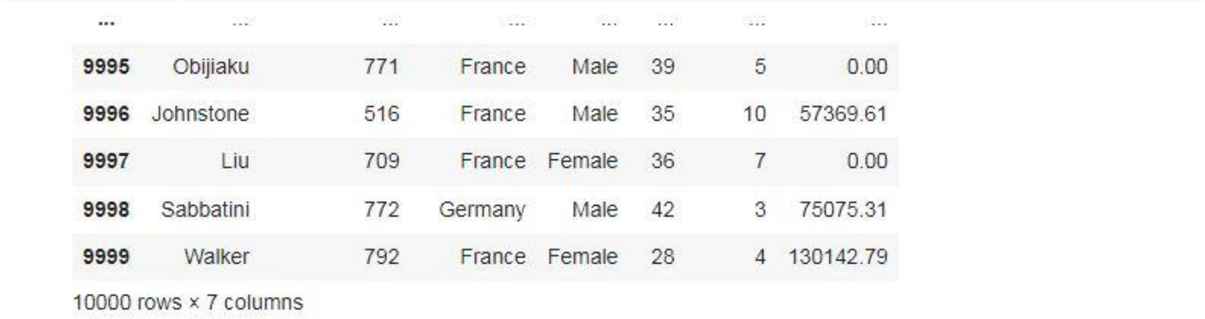


8.SPLIT THE DATA INTO DEPENDENT AND INDEPENDENT VARIABLES

```
[ ] import matplotlib.pyplot as plt
    import numpy as np
    import pandas as pd
```

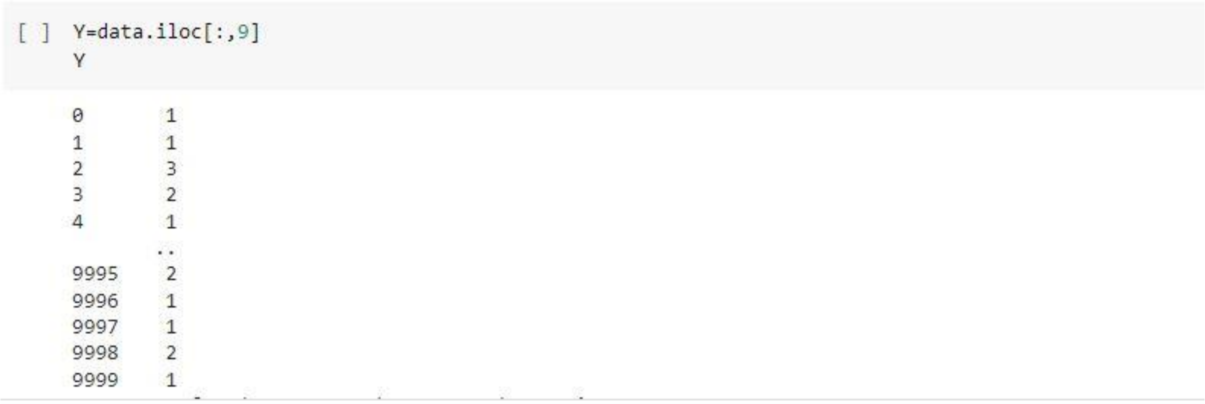
```
[ ] data=pd.read_csv("Churn_Modelling.csv")
```

```
X=data.iloc[:,2:9]
X
```



	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance
0	Hargrave	619	France	Female	42	2	0.00
1	Hill	608	Spain	Female	41	1	83807.86
2	Onio	502	France	Female	42	8	159660.80
3	Boni	699	France	Female	39	1	0.00
4	Mitchell	850	Spain	Female	43	2	125510.82
...	...	...	...	...	...	...	...
9995	Obijiaku	771	France	Male	39	5	0.00
9996	Johnstone	516	France	Male	35	10	57369.61
9997	Liu	709	France	Female	36	7	0.00
9998	Sabbatini	772	Germany	Male	42	3	75075.31
9999	Walker	792	France	Female	28	4	130142.79

10000 rows × 7 columns

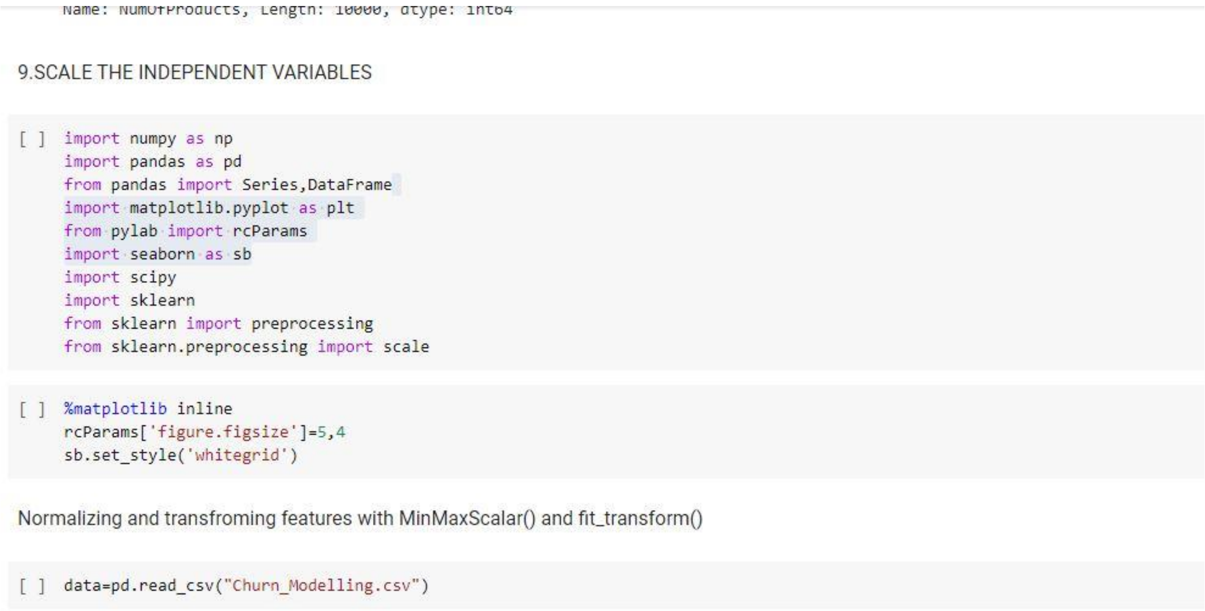


```
[ ] Y=data.iloc[:,9]
    Y
```

```
0       1
1       1
2       3
3       2
4       1
       ..
9995    2
9996    1
9997    1
9998    2
9999    1
```

Question-9:

Scale the independent variables



```
Name: NumOfProducts, Length: 10000, dtype: int64
```

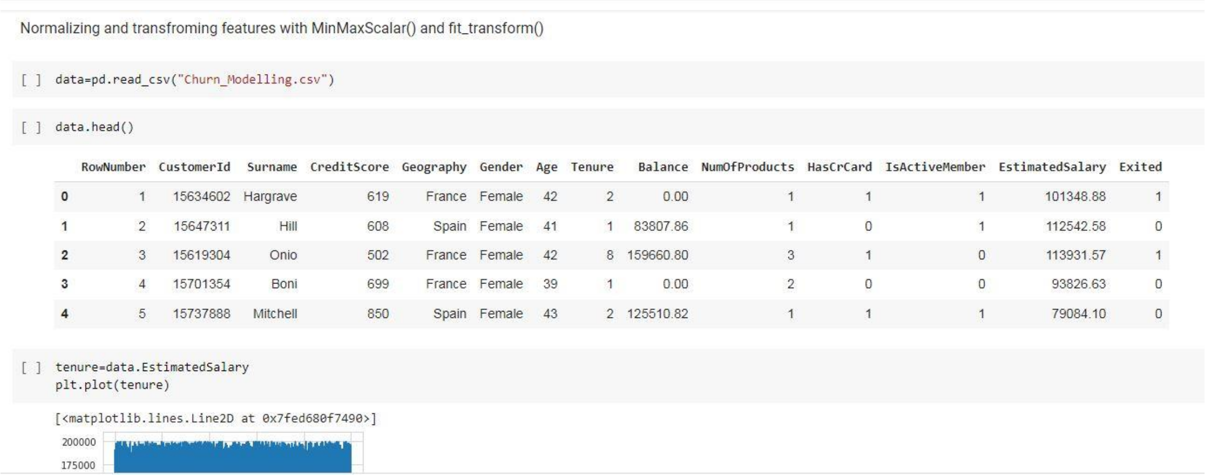
9.SCALE THE INDEPENDENT VARIABLES

```
[ ]  import numpy as np
     import pandas as pd
     from pandas import Series,DataFrame
     import matplotlib.pyplot as plt
     from pylab import rcParams
     import seaborn as sb
     import scipy
     import sklearn
     from sklearn import preprocessing
     from sklearn.preprocessing import scale
```

```
[ ]  %matplotlib inline
     rcParams['figure.figsize']=5,4
     sb.set_style('whitegrid')
```

Normalizing and transfroming features with MinMaxScalar() and fit_transform()

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



Normalizing and transfroming features with MinMaxScalar() and fit_transform()

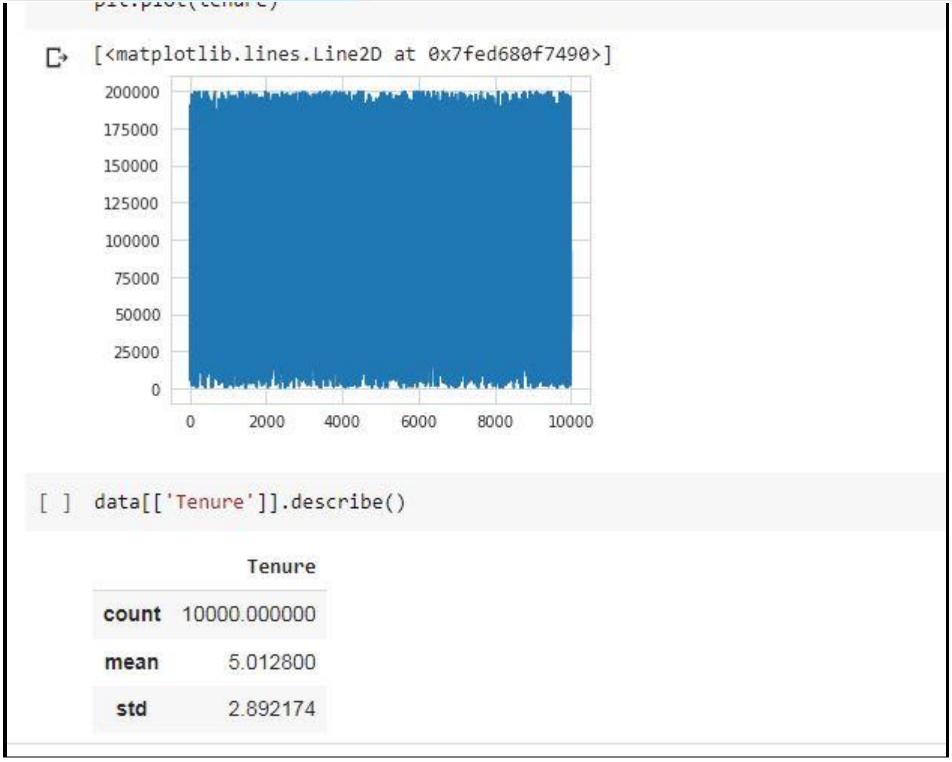
```
[ ]  data=pd.read_csv("Churn_Modelling.csv")
```

```
[ ]  data.head()
```

	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

```
[ ]  tenure=data.EstimatedSalary
     plt.plot(tenure)
```

```
[<matplotlib.lines.Line2D at 0x7fed680f7490>]
```

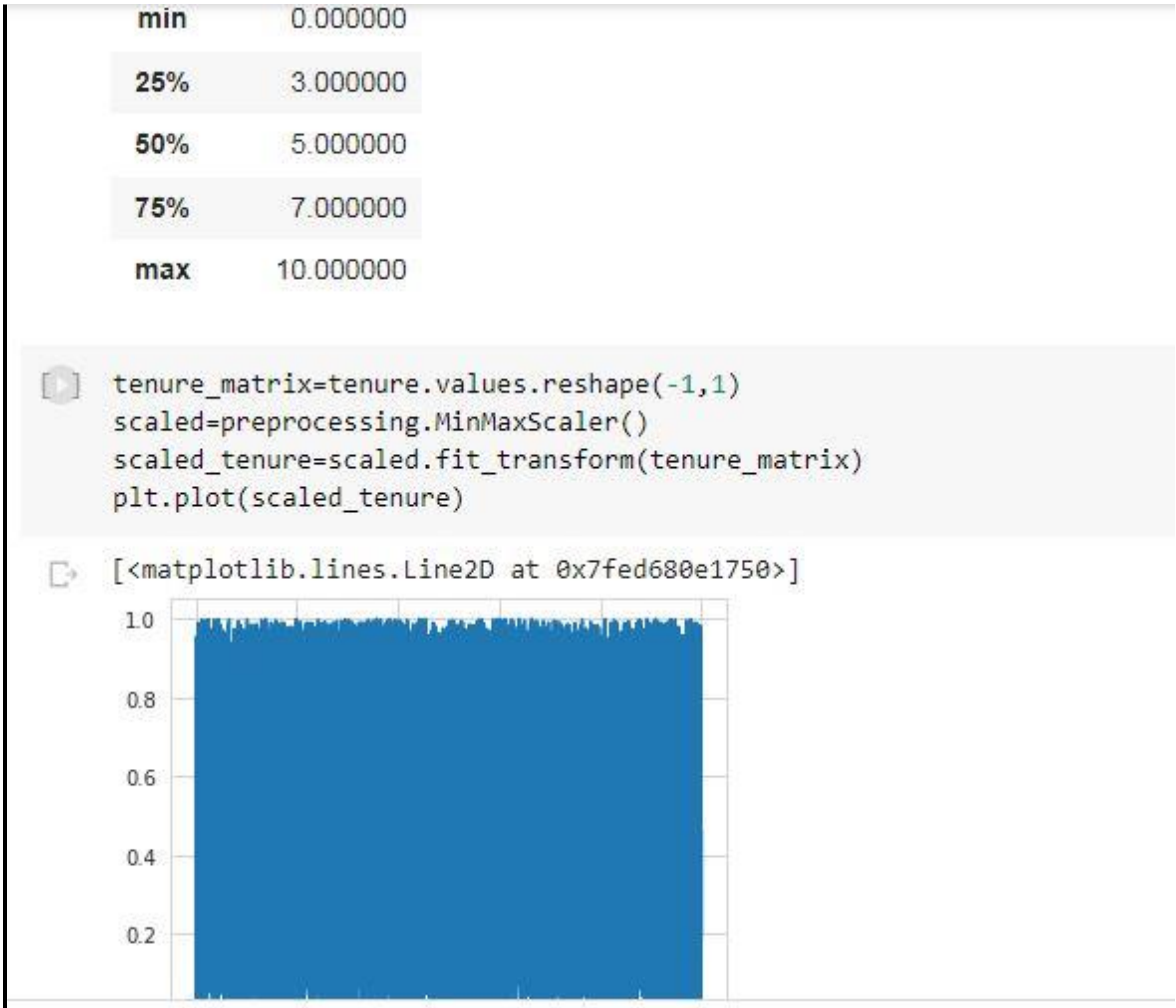


```
plt.plot(tenure)
```

```
[<matplotlib.lines.Line2D at 0x7fed680f7490>]
```

```
[ ]  data[['Tenure']].describe()
```

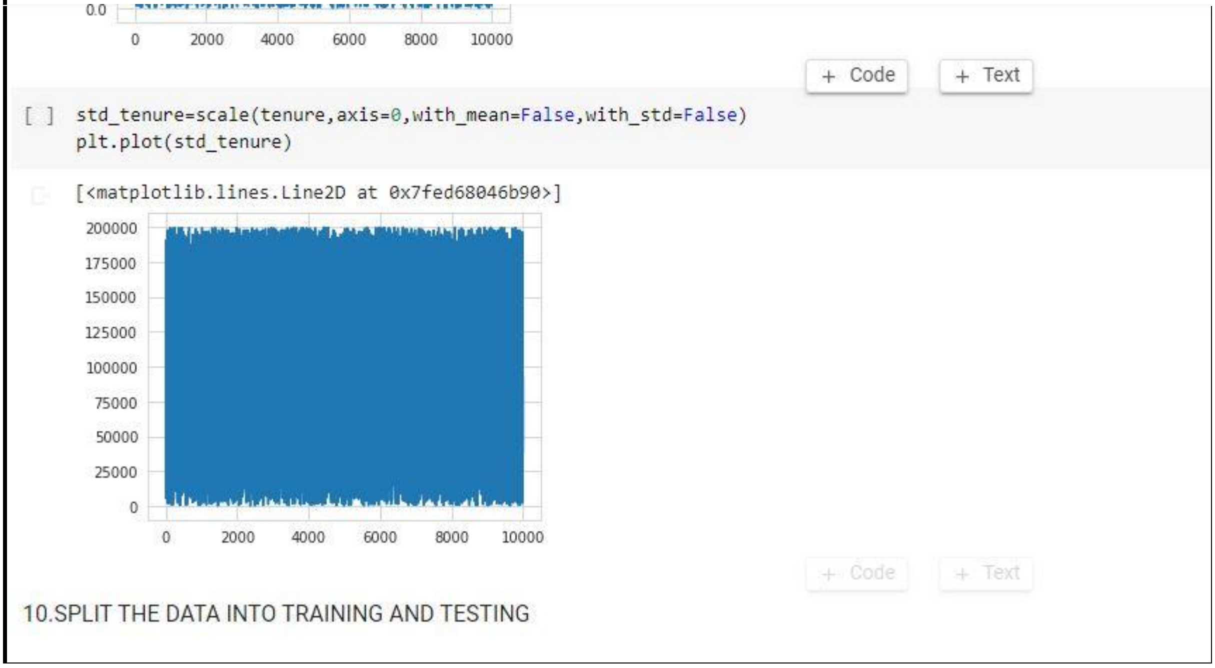
	Tenure
count	10000.000000
mean	5.012800
std	2.892174



min	0.000000
25%	3.000000
50%	5.000000
75%	7.000000
max	10.000000

```
tenure_matrix=tenure.values.reshape(-1,1)
scaled=preprocessing.MinMaxScaler()
scaled_tenure=scaled.fit_transform(tenure_matrix)
plt.plot(scaled_tenure)
```

```
[<matplotlib.lines.Line2D at 0x7fed680e1750>]
```



```
std_tenure=scale(tenure,axis=0,with_mean=False,with_std=False)
plt.plot(std_tenure)
```

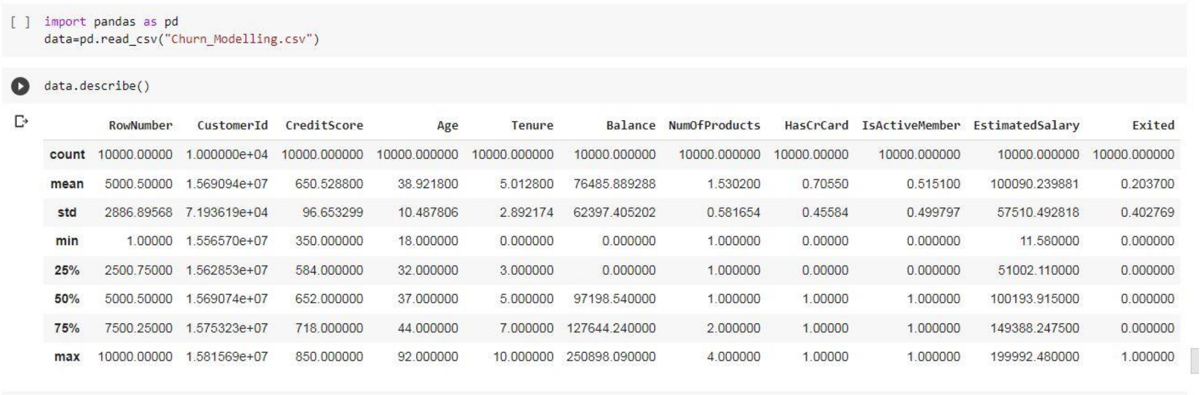
```
[<matplotlib.lines.Line2D at 0x7fed68046b90>]
```

10.SPLIT THE DATA INTO TRAINING AND TESTING

Question-10:

Split the data into training and testing

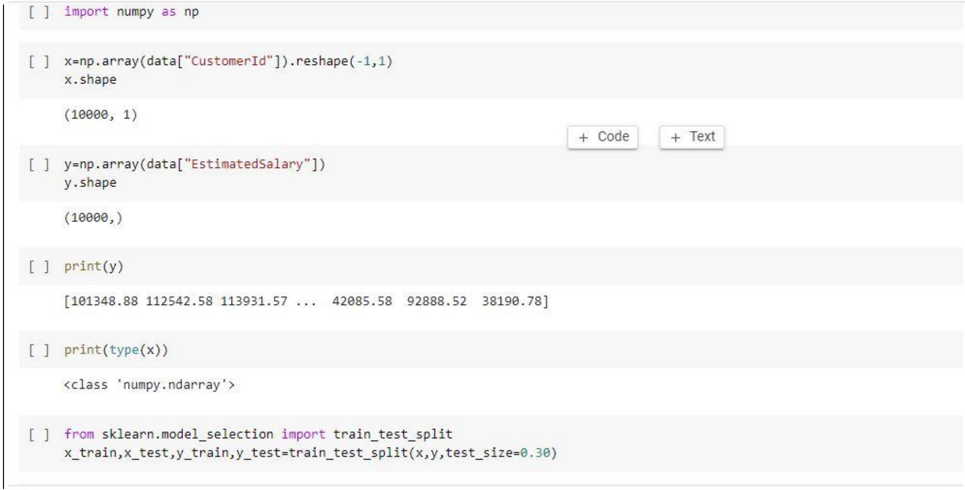
10.SPLIT THE DATA INTO TRAINING AND TESTING



```
[ ] import pandas as pd
    data=pd.read_csv("Churn_Modelling.csv")
```

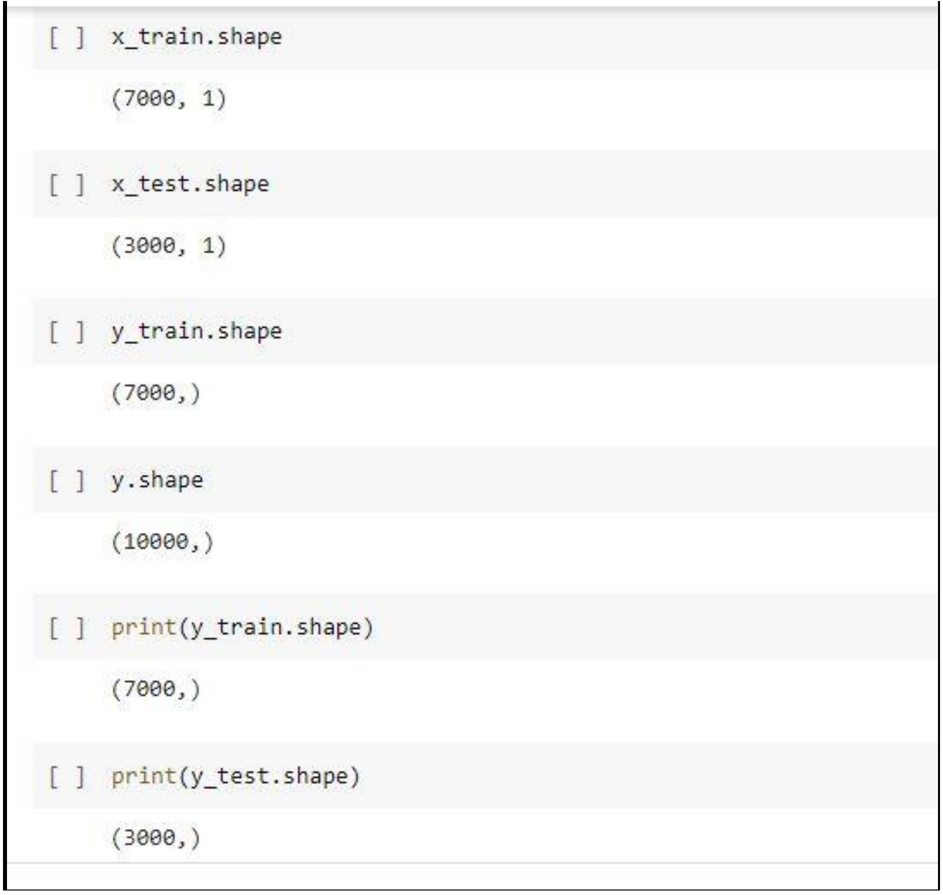
```
data.describe()
```

	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



```
[ ] import numpy as np

[ ] x=np.array(data["CustomerId"]).reshape(-1,1)
    x.shape

    (10000, 1)
```

```
[ ] y=np.array(data["EstimatedSalary"])
    y.shape

    (10000,)

[ ] print(y)

    [101348.88 112542.58 113931.57 ...  42085.58  92888.52  38190.78]

[ ] print(type(x))

    <class 'numpy.ndarray'>

[ ] from sklearn.model_selection import train_test_split
    x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.30)
```



```
[ ] x_train.shape

    (7000, 1)

[ ] x_test.shape

    (3000, 1)

[ ] y_train.shape

    (7000,)

[ ] y.shape

    (10000,)

[ ] print(y_train.shape)

    (7000,)

[ ] print(y_test.shape)

    (3000,)
```