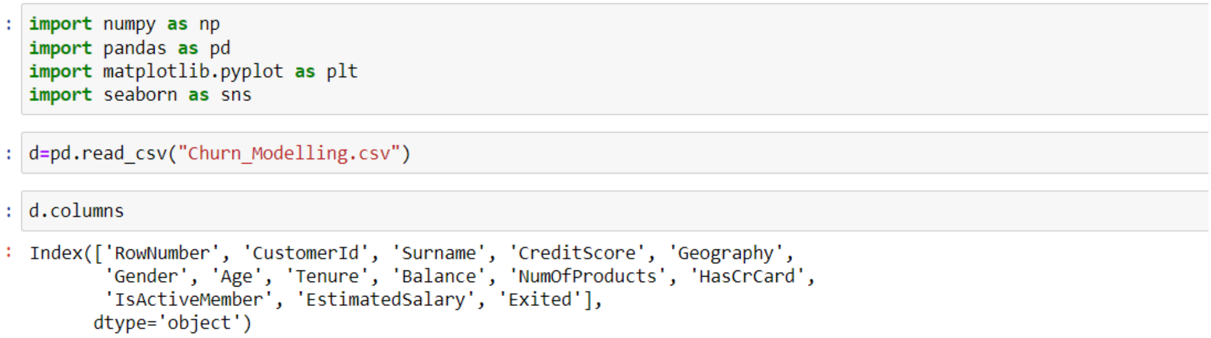
ASSIGNMENT 2

DATA VISUALIZATION AND PRE-PROCESSING

Assignment Date	24 September 2022
Student Name	Tejaswini S
Student Roll Number	2019105590
Maximum Marks	2 Marks

1)The dataset is downloaded.

2)The file dataset is loaded.



```
: import numpy as np
  import pandas as pd
  import matplotlib.pyplot as plt
  import seaborn as sns
```

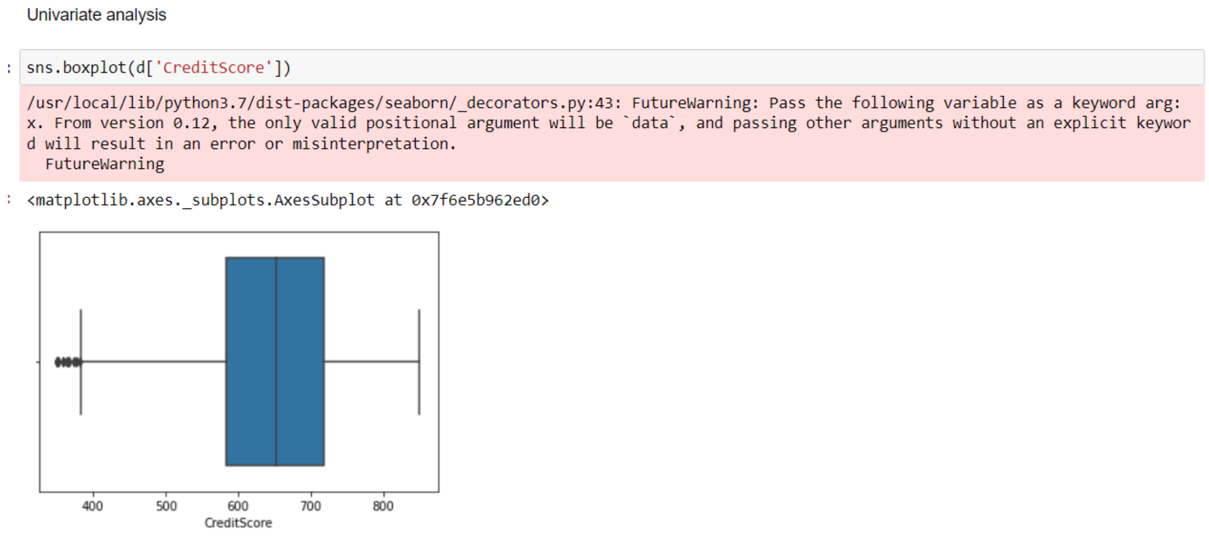
```
: d=pd.read_csv("Churn_Modelling.csv")
```

```
: d.columns
```

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

3)Performing Visualization:

a) Univariate Analysis:

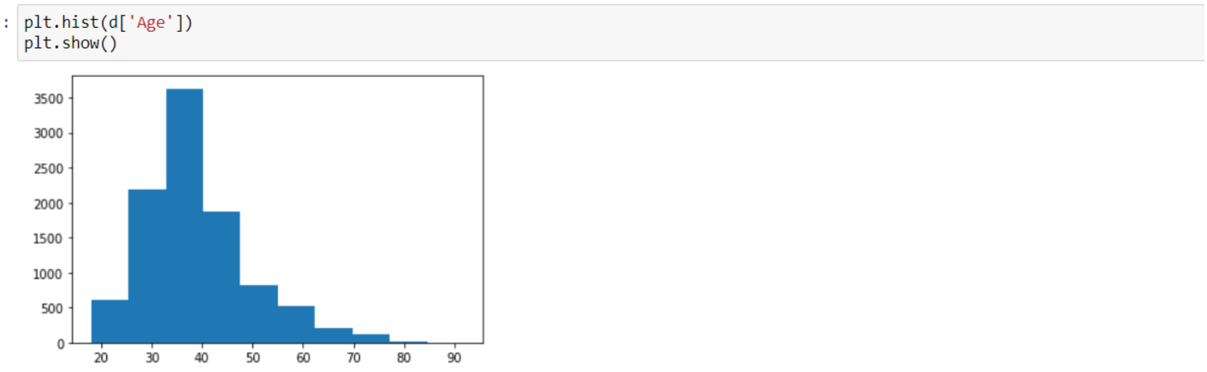


Univariate analysis

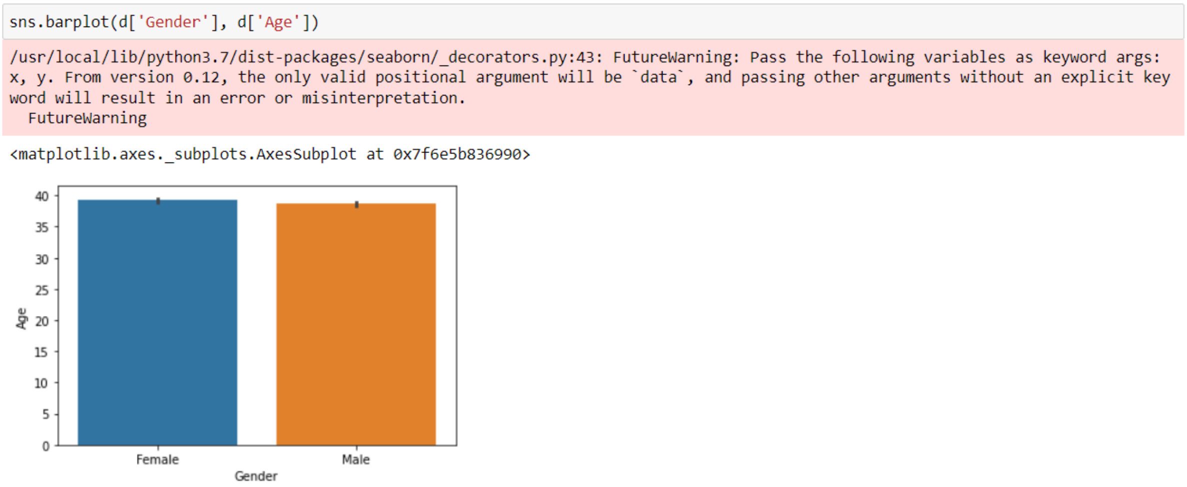
```
: sns.boxplot(d['CreditScore'])
```

```
/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 valid positional argument will be `data`, and passing other arguments without an explicit keywor
d will result in an error or misinterpretation.
  FutureWarning
```

```
: <matplotlib.axes._subplots.AxesSubplot at 0x7f6e5b962ed0>
```



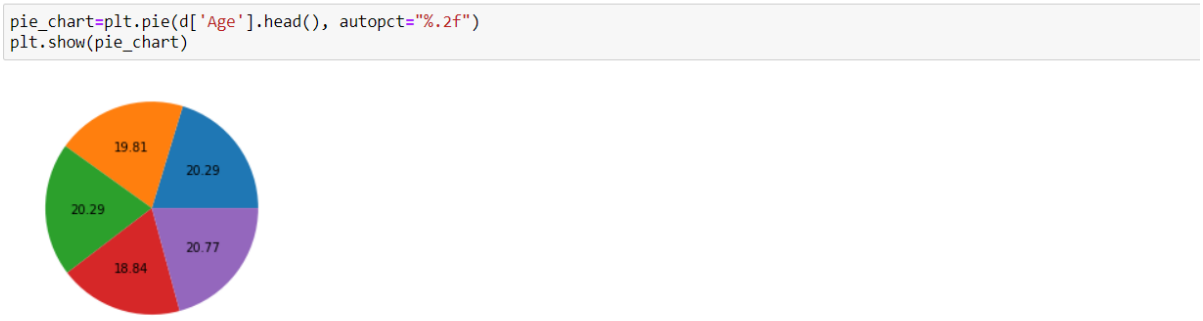
```
: plt.hist(d['Age'])
  plt.show()
```



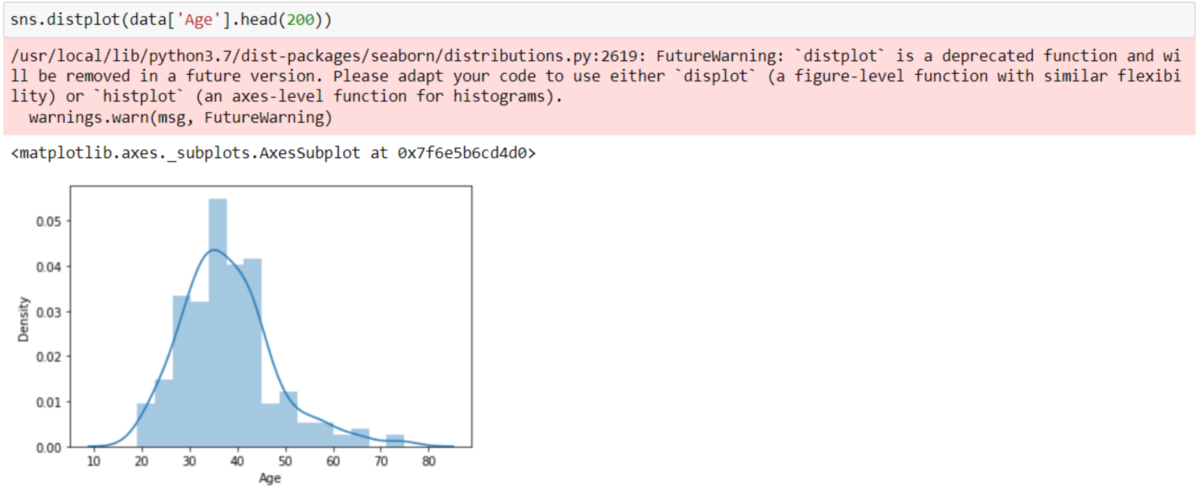
```
sns.barplot(d['Gender'], d['Age'])
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variables as keyword args:
x, y. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit key
word will result in an error or misinterpretation.
  FutureWarning
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f6e5b836990>
```



```
pie_chart=plt.pie(d['Age'].head(), autopct="%.2f")
plt.show(pie_chart)
```

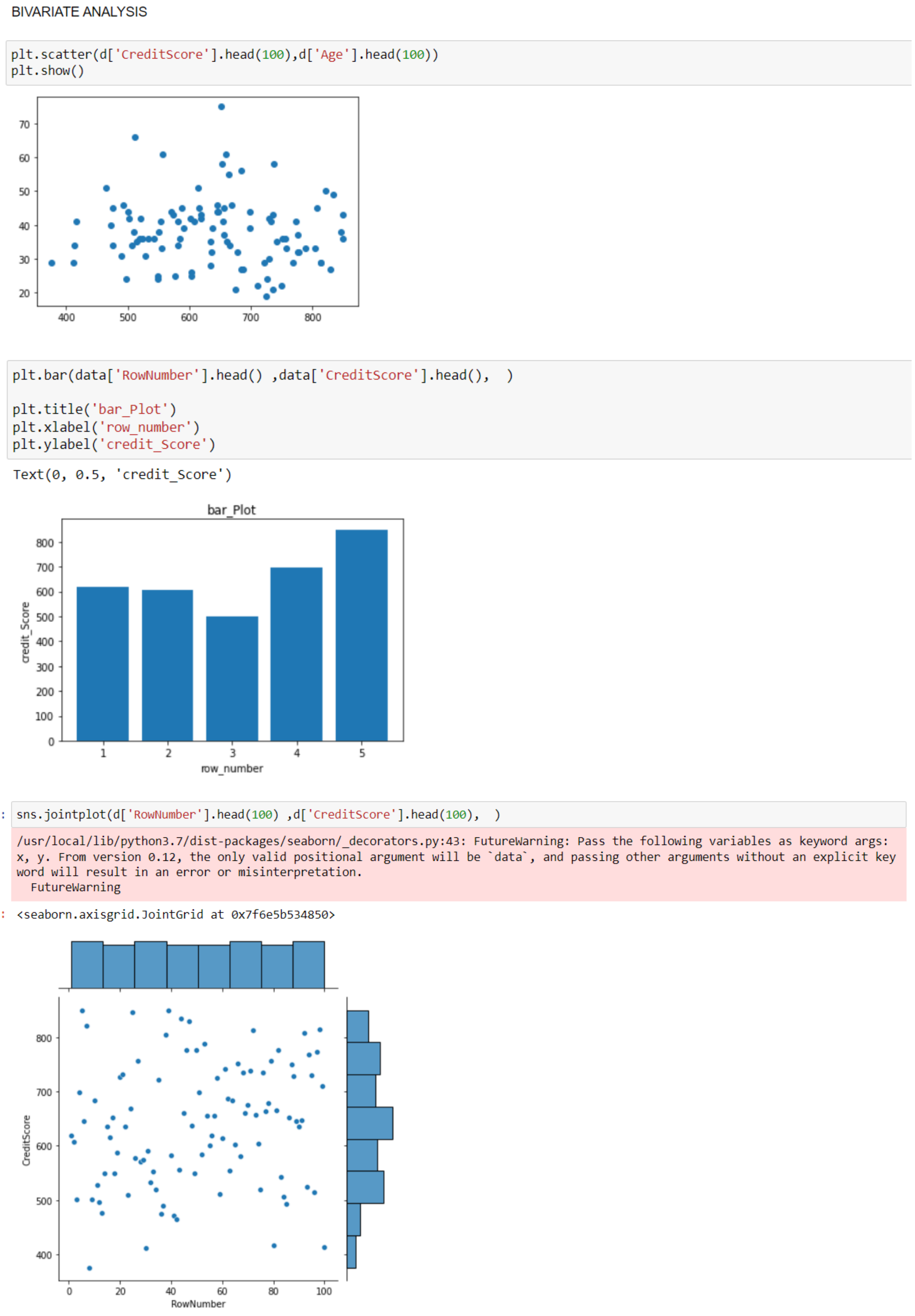


```
sns.distplot(data['Age'].head(200))
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2619: FutureWarning: `distplot` is a deprecated function and wi
ll be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibi
lity) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f6e5b6cd4d0>
```

b) Bi-variate Analysis:



BIVARIATE ANALYSIS

```
plt.scatter(d['CreditScore'].head(100),d['Age'].head(100))
plt.show()
```

```
plt.bar(data['RowNumber'].head() ,data['CreditScore'].head(),  )

plt.title('bar_Plot')
plt.xlabel('row_number')
plt.ylabel('credit_Score')
```

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

```
: sns.jointplot(d['RowNumber'].head(100) ,d['CreditScore'].head(100),  )
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variables as keyword args: 
x, y. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit key
word will result in an error or misinterpretation.
  FutureWarning
```

```
: <seaborn.axisgrid.JointGrid at 0x7f6e5b534850>
```

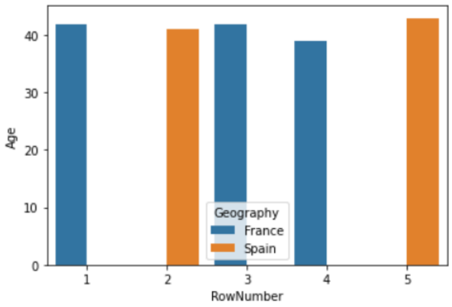
c) Multi-variate Analysis:

MULTIVARIATE ANALYSIS

```
sns.barplot('RowNumber','Age',hue='Geography', d=d.head())
```

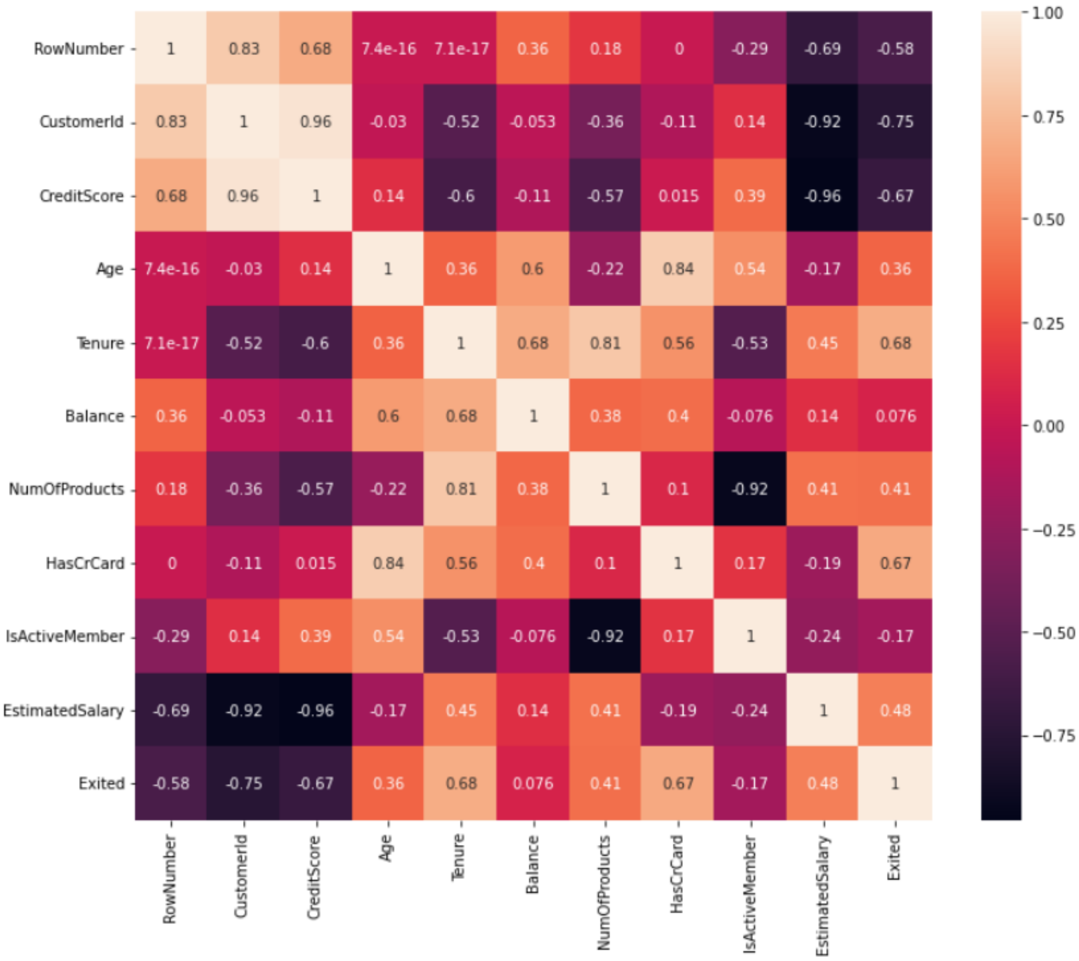
```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variables as keyword args:
x, y. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit key
word will result in an error or misinterpretation.
  FutureWarning
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f6e58b957d0>
```

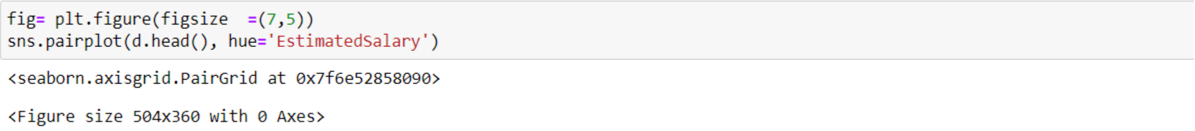


```
fig= plt.figure(figsize  =(12,10))
sns.heatmap(d.head().corr(), annot = True)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f6e58b1cad0>
```



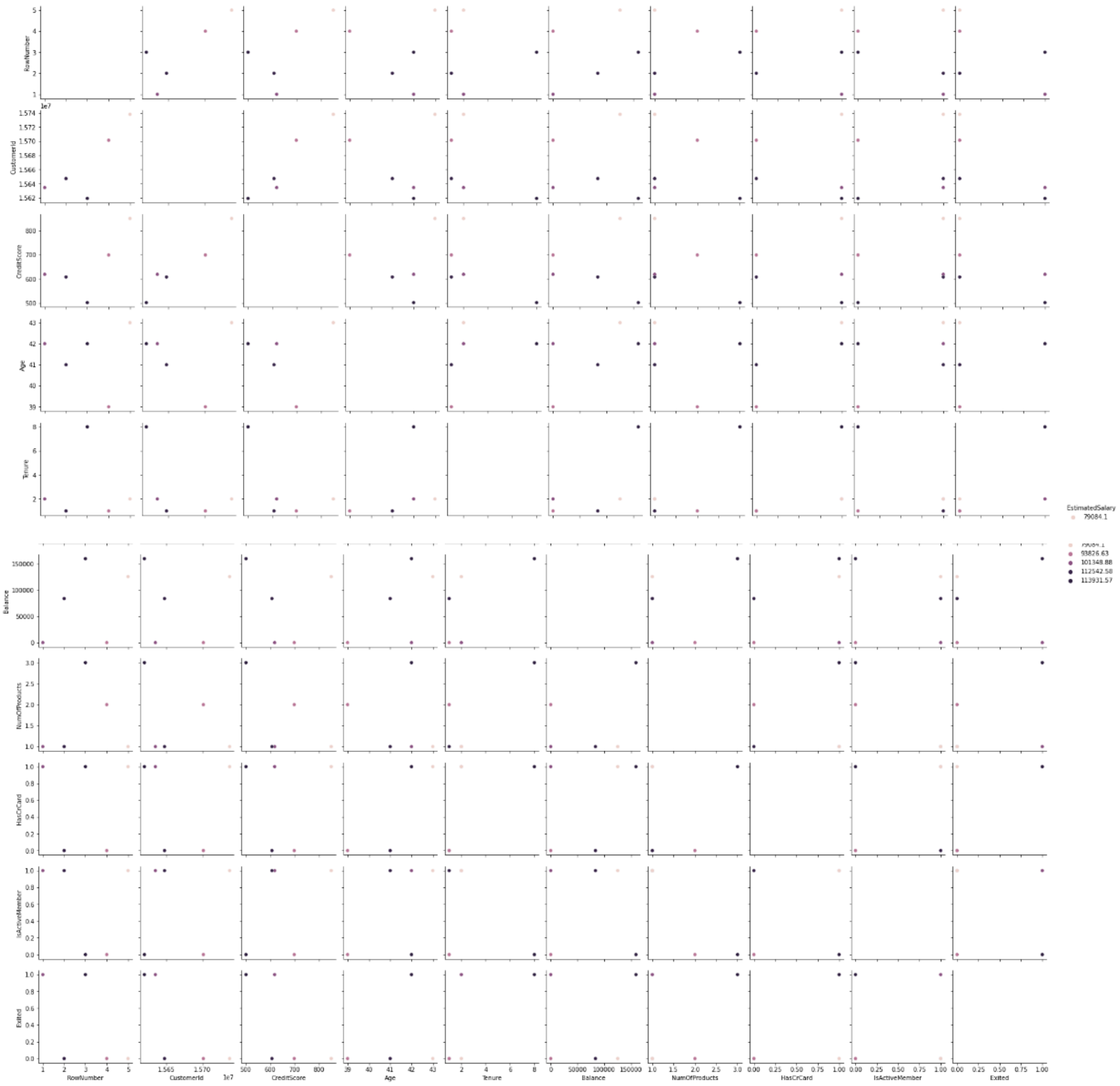
	RowNumber	CustomerId	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
RowNumber	1	0.83	0.68	7.4e-16	7.1e-17	0.36	0.18	0	-0.29	-0.69	-0.58
CustomerId	0.83	1	0.96	-0.03	-0.52	-0.053	-0.36	-0.11	0.14	-0.92	-0.75
CreditScore	0.68	0.96	1	0.14	-0.6	-0.11	-0.57	0.015	0.39	-0.96	-0.67
Age	7.4e-16	-0.03	0.14	1	0.36	0.6	-0.22	0.84	0.54	-0.17	0.36
Tenure	7.1e-17	-0.52	-0.6	0.36	1	0.68	0.81	0.56	-0.53	0.45	0.68
Balance	0.36	-0.053	-0.11	0.6	0.68	1	0.38	0.4	-0.076	0.14	0.076
NumOfProducts	0.18	-0.36	-0.57	-0.22	0.81	0.38	1	0.1	-0.92	0.41	0.41
HasCrCard	0	-0.11	0.015	0.84	0.56	0.4	0.1	1	0.17	-0.19	0.67
IsActiveMember	-0.29	0.14	0.39	0.54	-0.53	-0.076	-0.92	0.17	1	-0.24	-0.17
EstimatedSalary	-0.69	-0.92	-0.96	-0.17	0.45	0.14	0.41	-0.19	-0.24	1	0.48
Exited	-0.58	-0.75	-0.67	0.36	0.68	0.076	0.41	0.67	-0.17	0.48	1



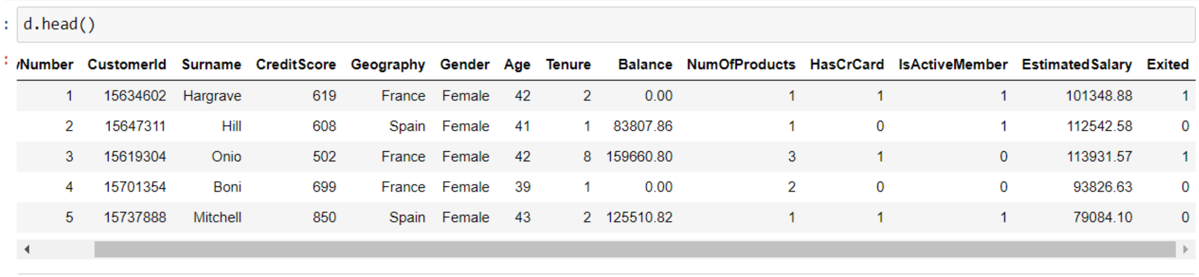
```
fig= plt.figure(figsize  =(7,5))
sns.pairplot(d.head(), hue='EstimatedSalary')
```

```
<seaborn.axisgrid.PairGrid at 0x7f6e52858090>

<Figure size 504x360 with 0 Axes>
```

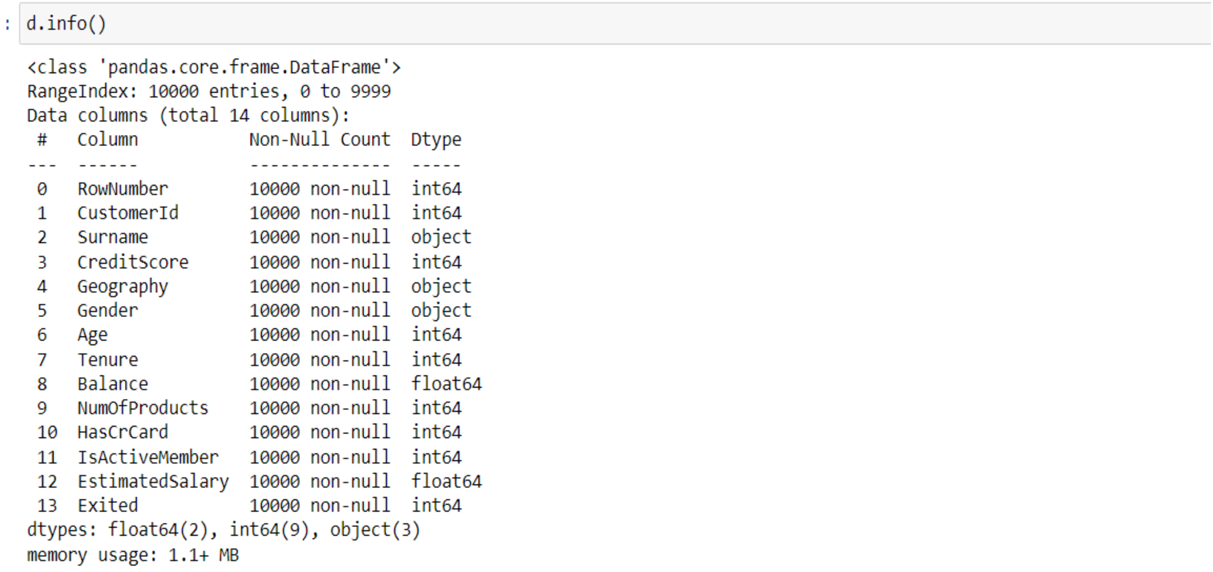


4) Descriptive statistics:



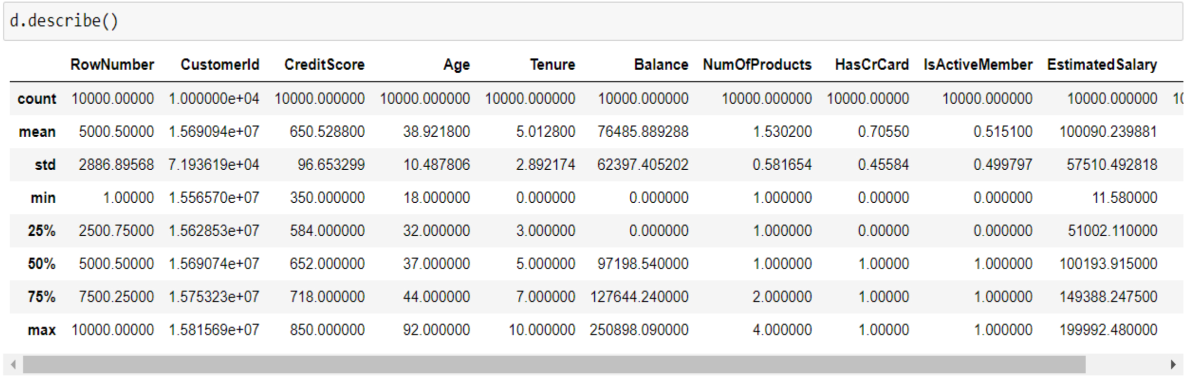
```
d.head()
```

/Number	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
1	15634602	Hargrave	619	France	Female	42	2	0.00	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	159660.80	3	1	0	113931.57	1
4	15701354	Boni	699	France	Female	39	1	0.00	2	0	0	93826.63	0
5	15737888	Mitchell	850	Spain	Female	43	2	125510.82	1	1	1	79084.10	0



```
: d.info()
```

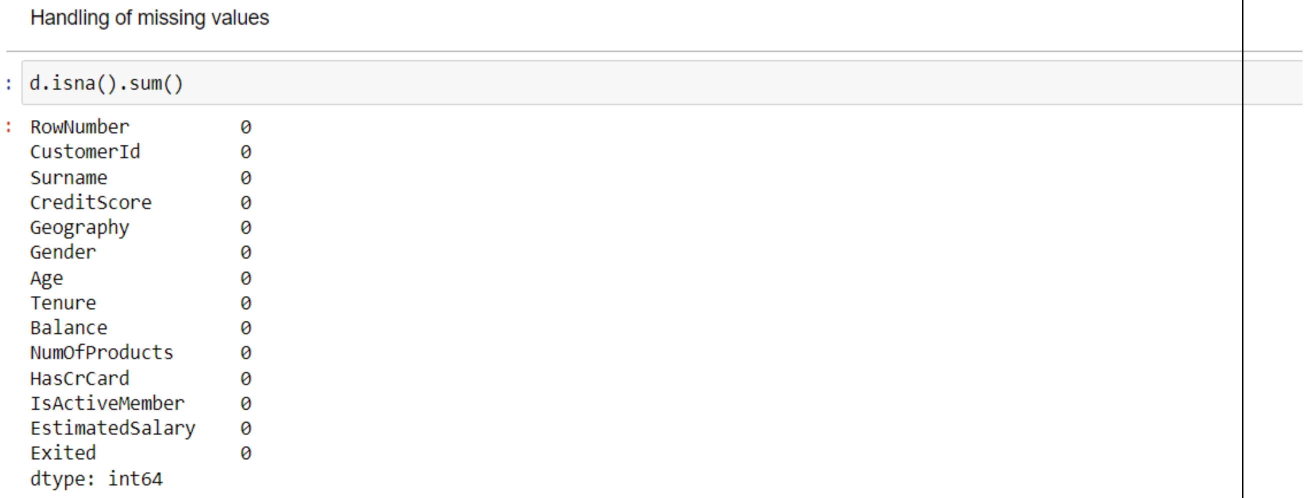
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 14 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   RowNumber        10000 non-null  int64  
 1   CustomerId       10000 non-null  int64  
 2   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
```



```
d.describe()
```

	RowNumber	CustomerId	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	
count	10000.00000	1.000000e+04	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.00000	10000.000000	10000.000000	1(
mean	5000.50000	1.569094e+07	650.528800	38.921800	5.012800	76485.889288	1.530200	0.70550	0.515100	100090.239881	
std	2886.89568	7.193619e+04	96.653299	10.487806	2.892174	62397.405202	0.581654	0.45584	0.499797	57510.492818	
min	1.00000	1.556570e+07	350.000000	18.000000	0.000000	0.000000	1.000000	0.00000	0.000000	11.580000	
25%	2500.75000	1.562853e+07	584.000000	32.000000	3.000000	0.000000	1.000000	0.00000	0.000000	51002.110000	
50%	5000.50000	1.569074e+07	652.000000	37.000000	5.000000	97198.540000	1.000000	1.00000	1.000000	100193.915000	
75%	7500.25000	1.575323e+07	718.000000	44.000000	7.000000	127644.240000	2.000000	1.00000	1.000000	149388.247500	
max	10000.00000	1.581569e+07	850.000000	92.000000	10.000000	250898.090000	4.000000	1.00000	1.000000	199992.480000	

5) Handling of missing values



Handling of missing values

```
: d.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
```

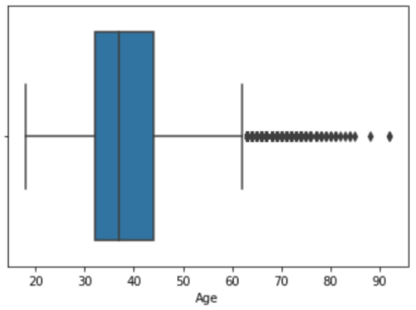
6) Checking for outliers and replacing them

Checking for outliers and replacing them

```
sns.boxplot(d['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 only valid positional argument will be `data`, and passing other arguments without an explicit keywor
d will result in an error or misinterpretation.
  FutureWarning
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f6e56c45ed0>
```



```
qt= d.quantile(q=[0.25,0.75])
qt
```

	RowNumber	CustomerId	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0.25	2500.75	15628528.25	584.0	32.0	3.0	0.00	1.0	0.0	0.0	51002.1100	0.0
0.75	7500.25	15753233.75	718.0	44.0	7.0	127644.24	2.0	1.0	1.0	149388.2475	0.0

```
irq=qt.loc[0.75]- qt.loc[0.25] # q3 and q1
irq
```

```
RowNumber            4999.5000
CustomerId         124705.5000
CreditScore           134.0000
Age                    12.0000
Tenure                  4.0000
Balance            127644.2400
NumOfProducts           1.0000
HasCrCard               1.0000
IsActiveMember          1.0000
EstimatedSalary     98386.1375
Exited                  0.0000
dtype: float64
```

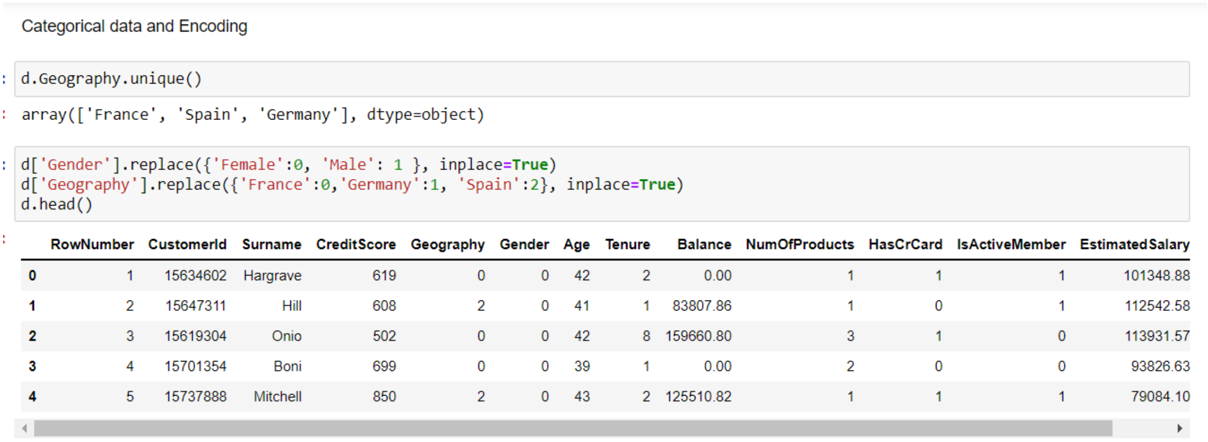
```
upper= qt.loc[0.75]+(1.5*irq)
upper
```

```
RowNumber          1.499950e+04
CustomerId         1.594029e+07
CreditScore        9.190000e+02
Age                6.200000e+01
Tenure             1.300000e+01
Balance            3.191106e+05
NumOfProducts      3.500000e+00
HasCrCard          2.500000e+00
IsActiveMember     2.500000e+00
EstimatedSalary    2.969675e+05
Exited             0.000000e+00
dtype: float64
```

```
d['Age'].mean()
```

```
38.9218
```

7) Categorical data and Encoding:



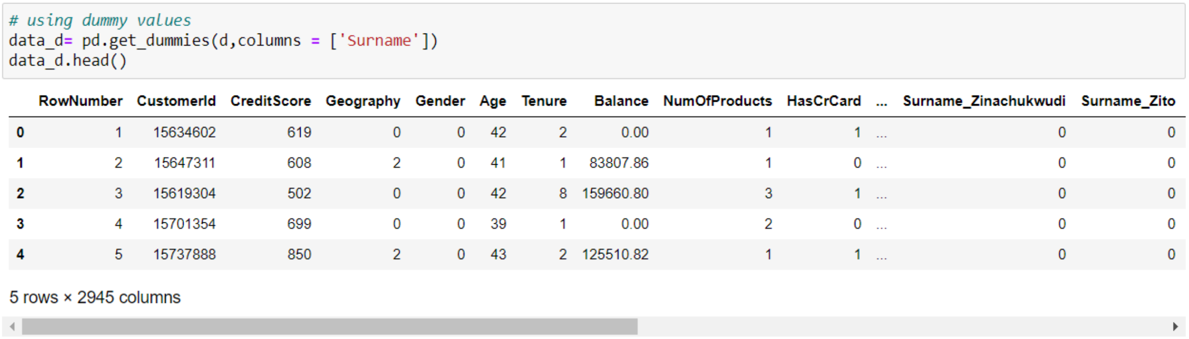
Categorical data and Encoding

```
d.Geography.unique()
```

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

```
d['Gender'].replace({'Female':0, 'Male': 1 }, inplace=True)
d['Geography'].replace({'France':0,'Germany':1, 'Spain':2}, inplace=True)
d.head()
```

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

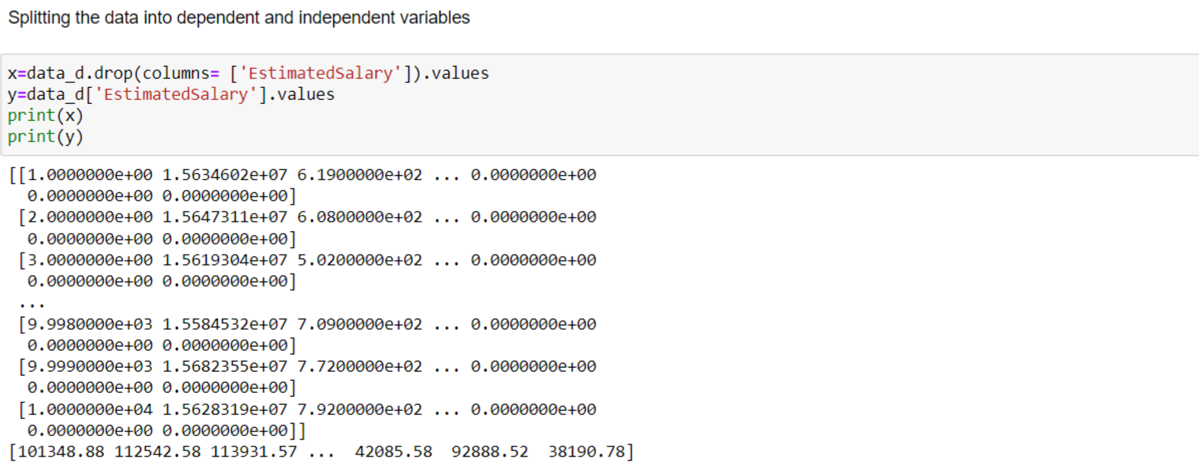


```
# using dummy values
data_d= pd.get_dummies(d,columns = ['Surname'])
data_d.head()
```

	RowNumber	CustomerId	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	...	Surname_Zinachukwudi	Surname_Zito
0	1	15634602	619	0	0	42	2	0.00	1	1	...	0	0
1	2	15647311	608	2	0	41	1	83807.86	1	0	...	0	0
2	3	15619304	502	0	0	42	8	159660.80	3	1	...	0	0
3	4	15701354	699	0	0	39	1	0.00	2	0	...	0	0
4	5	15737888	850	2	0	43	2	125510.82	1	1	...	0	0

5 rows × 2945 columns

8) Splitting the data into dependent and independent variables

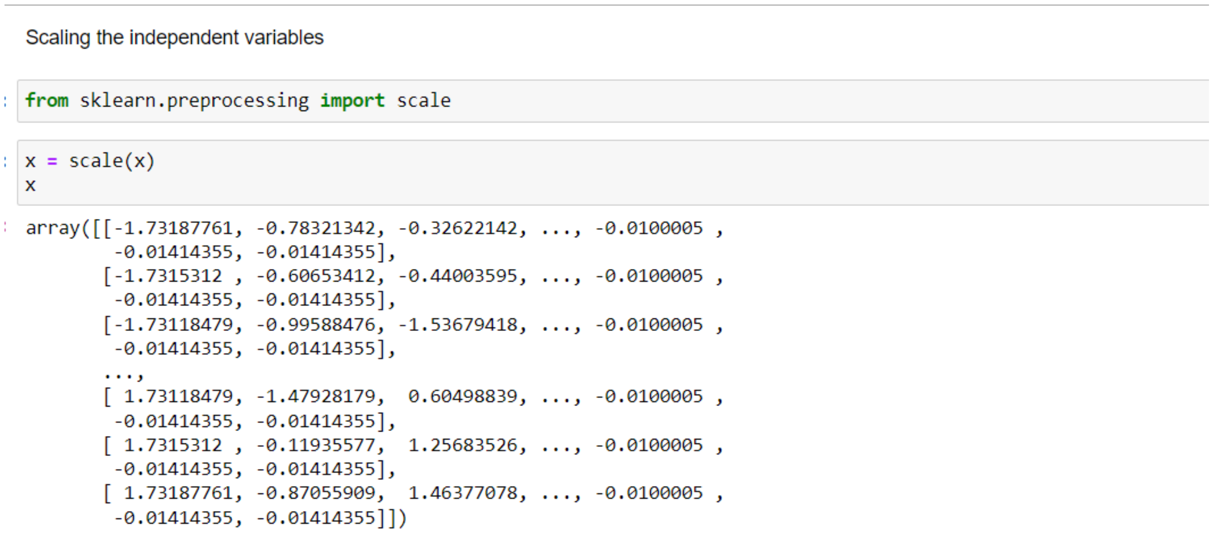


Splitting the data into dependent and independent variables

```
x=data_d.drop(columns= ['EstimatedSalary']).values
y=data_d['EstimatedSalary'].values
print(x)
print(y)
```

```
[[1.0000000e+00 1.5634602e+07 6.1900000e+02 ... 0.0000000e+00
  0.0000000e+00 0.0000000e+00]
 [2.0000000e+00 1.5647311e+07 6.0800000e+02 ... 0.0000000e+00
  0.0000000e+00 0.0000000e+00]
 [3.0000000e+00 1.5619304e+07 5.0200000e+02 ... 0.0000000e+00
  0.0000000e+00 0.0000000e+00]
 ...
 [9.9980000e+03 1.5584532e+07 7.0900000e+02 ... 0.0000000e+00
  0.0000000e+00 0.0000000e+00]
 [9.9990000e+03 1.5682355e+07 7.7200000e+02 ... 0.0000000e+00
  0.0000000e+00 0.0000000e+00]
 [1.0000000e+04 1.5628319e+07 7.9200000e+02 ... 0.0000000e+00
  0.0000000e+00 0.0000000e+00]]
[101348.88 112542.58 113931.57 ...  42085.58  92888.52  38190.78]
```

9) Scaling the independent variables



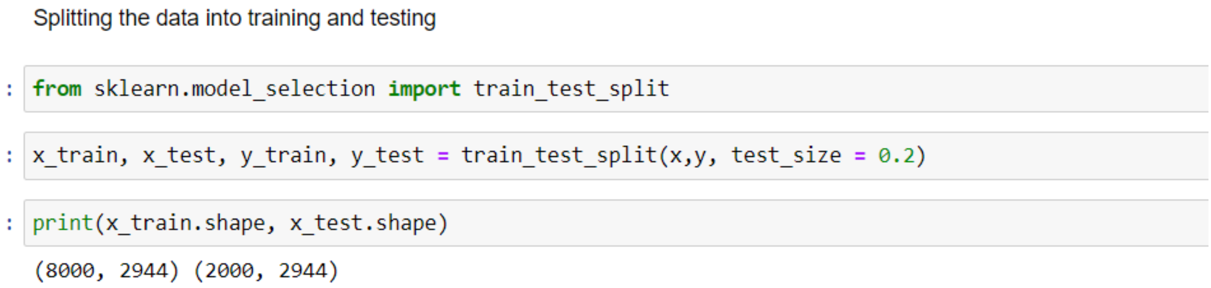
Scaling the independent variables

```
from sklearn.preprocessing import scale
```

```
x = scale(x)
x
```

```
array([[-1.73187761, -0.78321342, -0.32622142, ..., -0.0100005 ,
        -0.01414355, -0.01414355],
       [-1.7315312 , -0.60653412, -0.44003595, ..., -0.0100005 ,
        -0.01414355, -0.01414355],
       [-1.73118479, -0.99588476, -1.53679418, ..., -0.0100005 ,
        -0.01414355, -0.01414355],
       ...,
       [ 1.73118479, -1.47928179,  0.60498839, ..., -0.0100005 ,
        -0.01414355, -0.01414355],
       [ 1.7315312 , -0.11935577,  1.25683526, ..., -0.0100005 ,
        -0.01414355, -0.01414355],
       [ 1.73187761, -0.87055909,  1.46377078, ..., -0.0100005 ,
        -0.01414355, -0.01414355]])
```

10) Splitting the data into training and testing



Splitting 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 = 0.2)
```

```
print(x_train.shape, x_test.shape)
```

```
(8000, 2944) (2000, 2944)
```