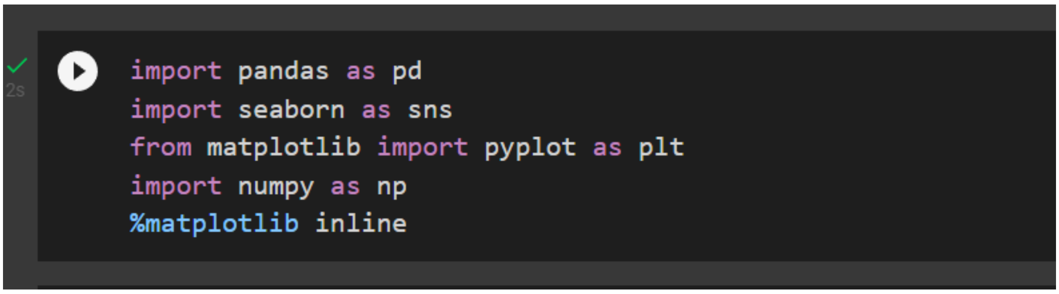
Assignment -1
Python Programming

Assignment Date	29 September 2022
Student Name	Vishal R
Student Roll Number	CITC1907058
Maximum Marks	2 Marks

Question 1. Download the dataset: Dataset

Importing the required libraries



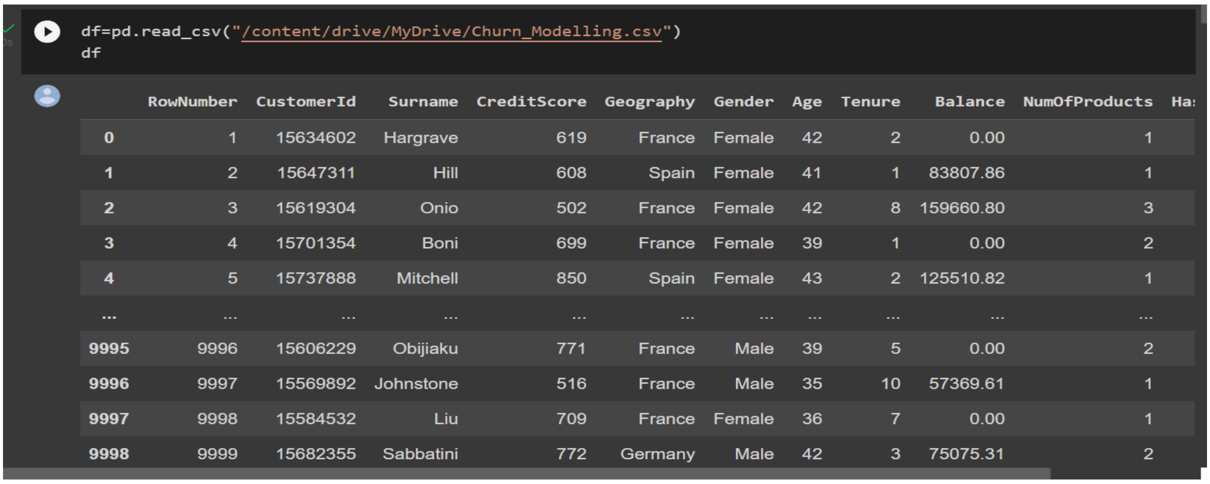
```
import pandas as pd
import seaborn as sns
from matplotlib import pyplot as plt
import numpy as np
%matplotlib inline
```

Question 2. Load the dataset.

# 2. Load the dataset

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

df



```
df=pd.read_csv("/content/drive/MyDrive/Churn_Modelling.csv")
df
```

```
      RowNumber  CustomerId    Surname  CreditScore  Geography  Gender  Age  Tenure    Balance  NumOfProducts  Ha:
0             1    15634602   Hargrave          619     France  Female   42       2       0.00              1
1             2    15647311       Hill          608      Spain  Female   41       1   83807.86              1
2             3    15619304       Onio          502     France  Female   42       8  159660.80              3
3             4    15701354       Boni          699     France  Female   39       1       0.00              2
4             5    15737888   Mitchell          850      Spain  Female   43       2  125510.82              1
...         ...         ...        ...          ...        ...     ...  ...     ...        ...            ...
9995       9996    15606229   Obijiaku          771     France    Male   39       5       0.00              2
9996       9997    15569892  Johnstone          516     France    Male   35      10   57369.61              1
9997       9998    15584532        Liu          709     France  Female   36       7       0.00              1
9998       9999    15682355  Sabbatini          772    Germany    Male   42       3   75075.31              2
```

Question 3. Perform Below Visualizations.

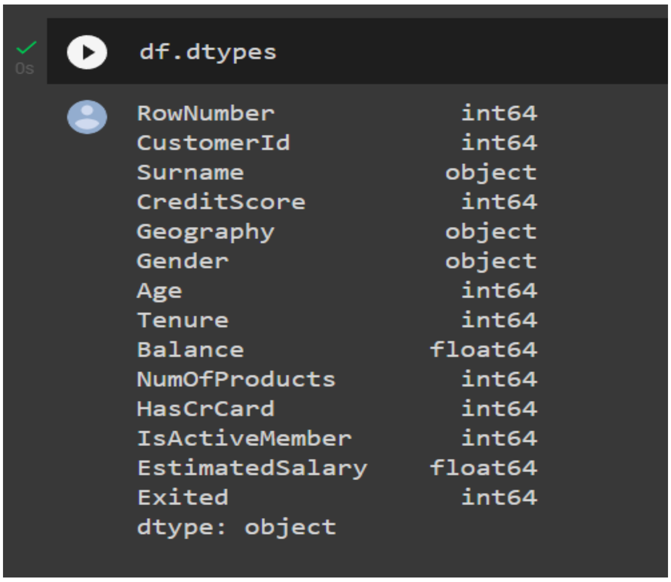
- **Univariate Analysis**

Code:

df.dtypes

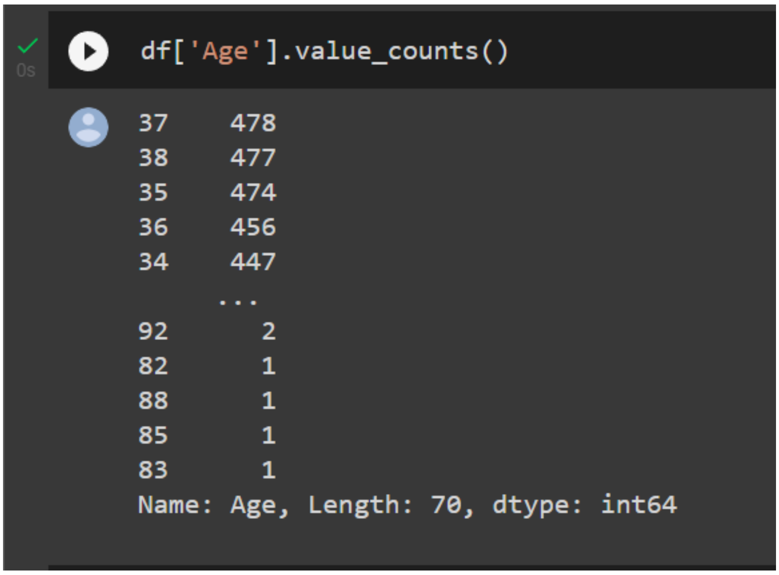
df['Age'].value_counts()

sns.kdeplot(df['Age'])



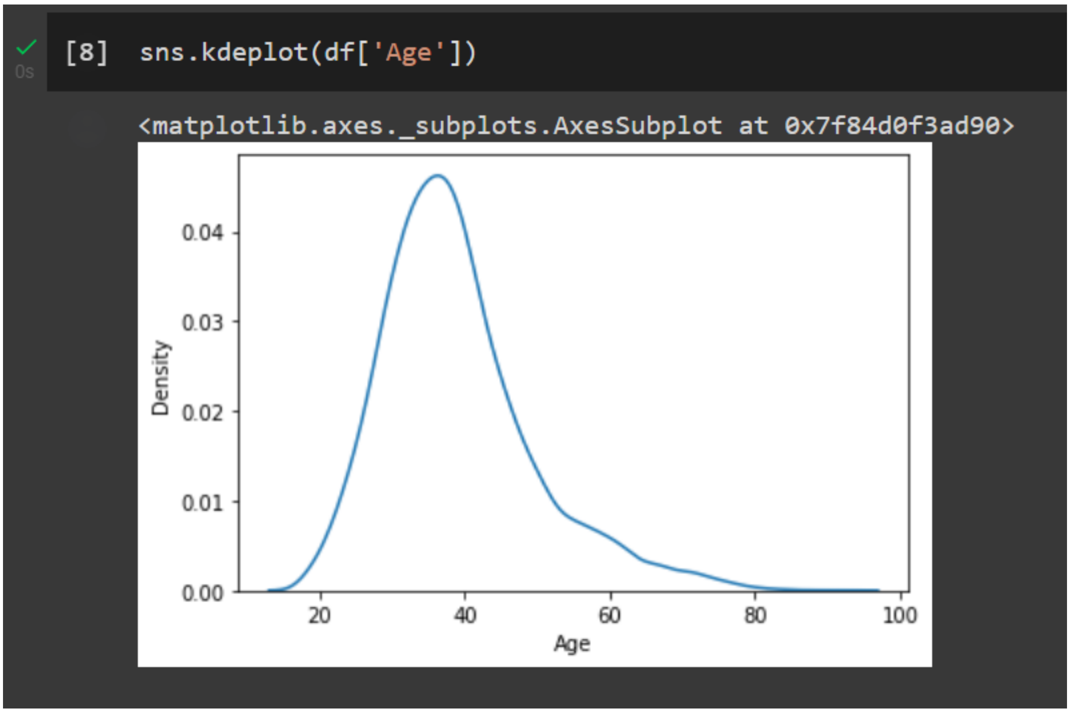
```
df.dtypes
```

```
RowNumber            int64
CustomerId           int64
Surname             object
CreditScore          int64
Geography           object
Gender              object
Age                  int64
Tenure               int64
Balance            float64
NumOfProducts        int64
HasCrCard            int64
IsActiveMember       int64
EstimatedSalary    float64
Exited               int64
dtype: object
```



```
df['Age'].value_counts()
```

```
37    478
38    477
35    474
36    456
34    447
     ... 
92      2
82      1
88      1
85      1
83      1
Name: Age, Length: 70, dtype: int64
```



```
[8] sns.kdeplot(df['Age'])

<matplotlib.axes._subplots.AxesSubplot at 0x7f84d0f3ad90>
```

- ## Bi - Variate Analysis

Code:

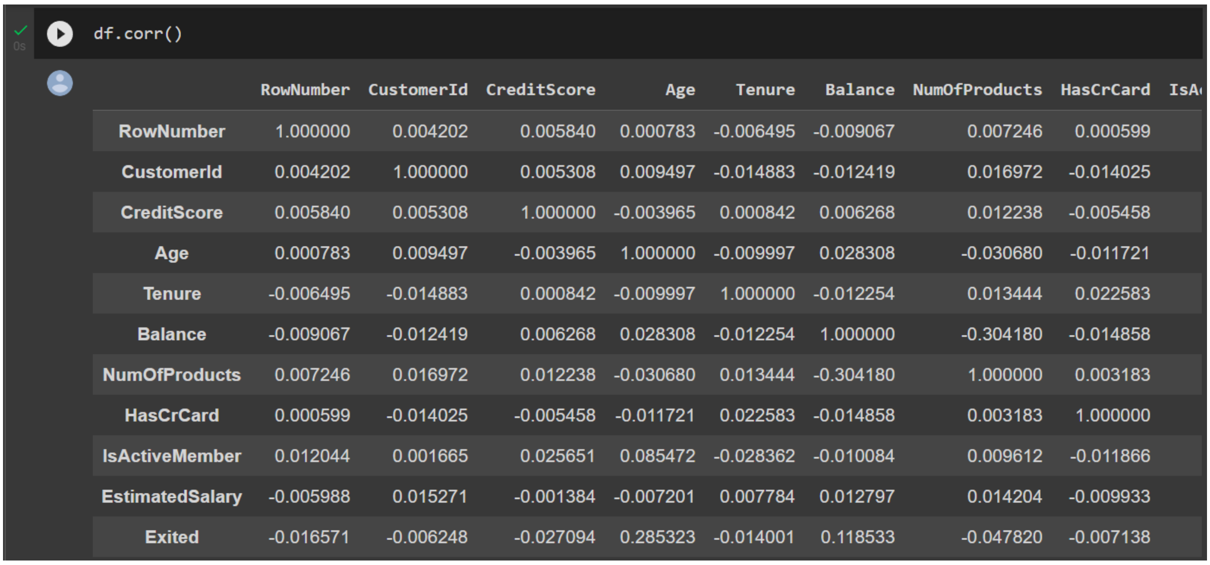
```
#1.
df.corr()
#2.
import seaborn as sns
sns.heatmap(df.corr())
#3.
import statsmodels.api as sm
#define response variable
y = df['Age']
#define explanatory variable
x = df[['Exited']]
#add constant to predictor variables
x = sm.add_constant(x)
```

#fit linear regression model

model = sm.OLS(y, x).fit()

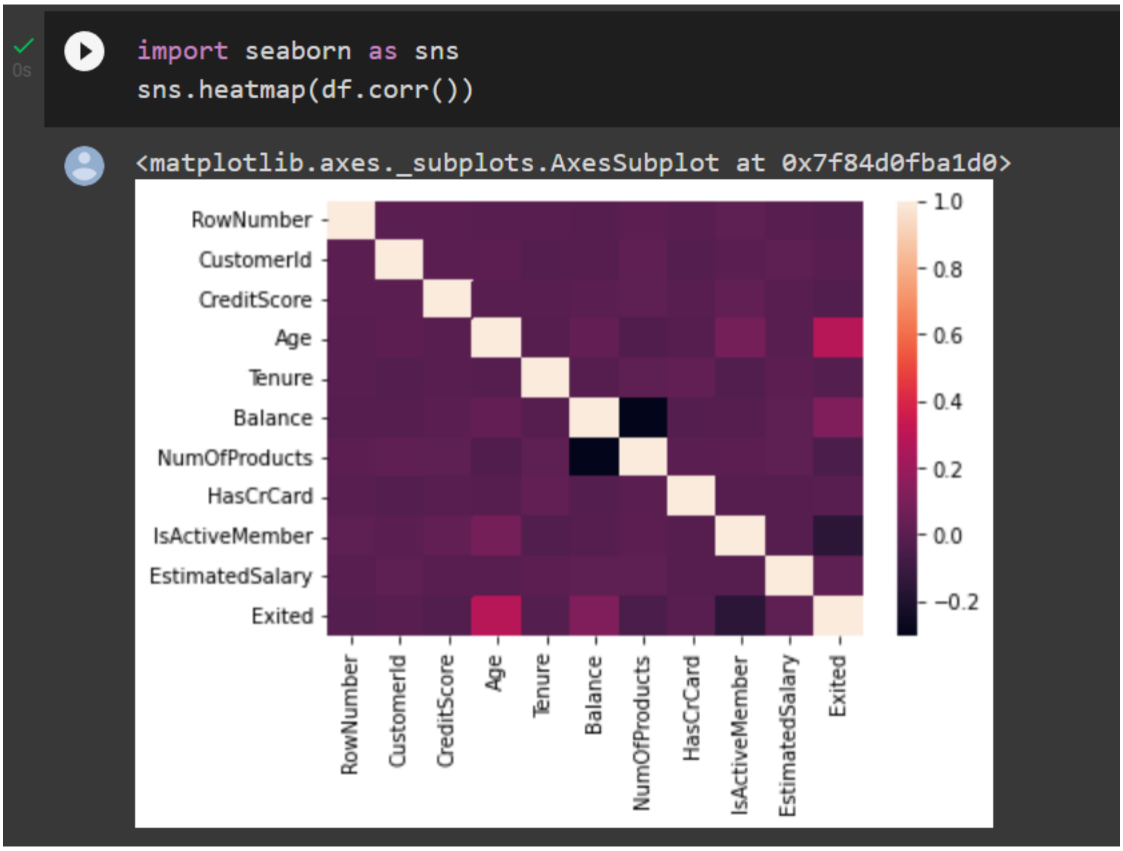
#view model summary

print(model.summary())



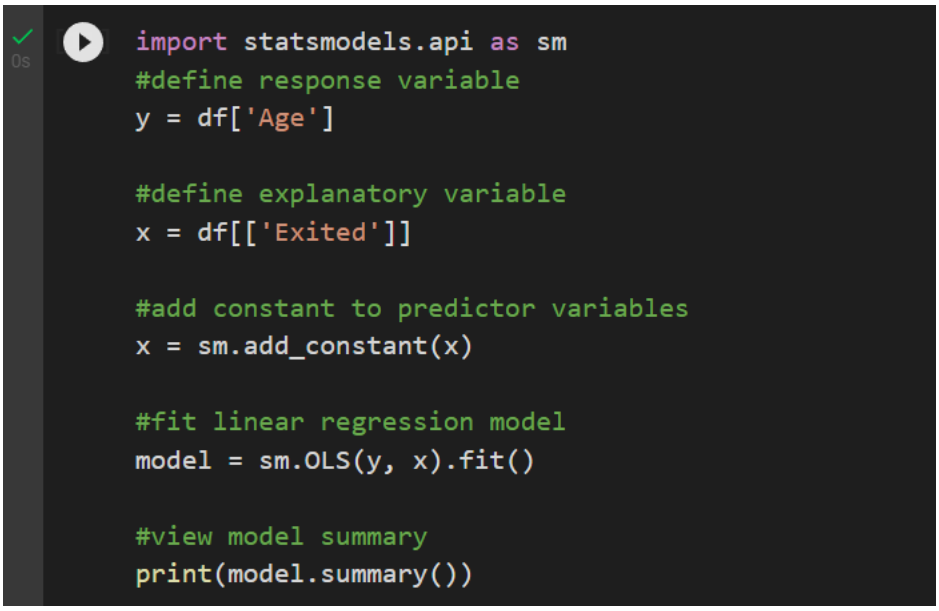
```
df.corr()
```

	RowNumber	CustomerId	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsA
RowNumber	1.000000	0.004202	0.005840	0.000783	-0.006495	-0.009067	0.007246	0.000599	
CustomerId	0.004202	1.000000	0.005308	0.009497	-0.014883	-0.012419	0.016972	-0.014025	
CreditScore	0.005840	0.005308	1.000000	-0.003965	0.000842	0.006268	0.012238	-0.005458	
Age	0.000783	0.009497	-0.003965	1.000000	-0.009997	0.028308	-0.030680	-0.011721	
Tenure	-0.006495	-0.014883	0.000842	-0.009997	1.000000	-0.012254	0.013444	0.022583	
Balance	-0.009067	-0.012419	0.006268	0.028308	-0.012254	1.000000	-0.304180	-0.014858	
NumOfProducts	0.007246	0.016972	0.012238	-0.030680	0.013444	-0.304180	1.000000	0.003183	
HasCrCard	0.000599	-0.014025	-0.005458	-0.011721	0.022583	-0.014858	0.003183	1.000000	
IsActiveMember	0.012044	0.001665	0.025651	0.085472	-0.028362	-0.010084	0.009612	-0.011866	
EstimatedSalary	-0.005988	0.015271	-0.001384	-0.007201	0.007784	0.012797	0.014204	-0.009933	
Exited	-0.016571	-0.006248	-0.027094	0.285323	-0.014001	0.118533	-0.047820	-0.007138	

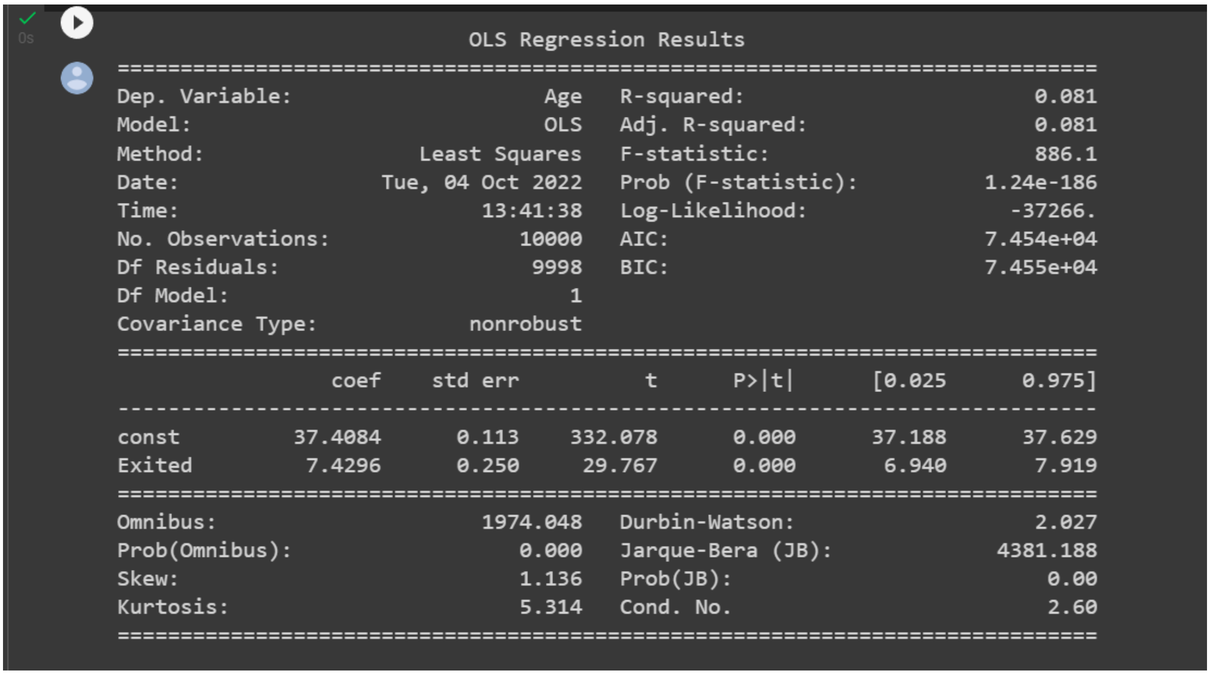


```
import seaborn as sns
sns.heatmap(df.corr())
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f84d0fba1d0>
```



```
import statsmodels.api as sm
#define response variable
y = df['Age']

#define explanatory variable
x = df[['Exited']]

#add constant to predictor variables
x = sm.add_constant(x)

#fit linear regression model
model = sm.OLS(y, x).fit()

#view model summary
print(model.summary())
```

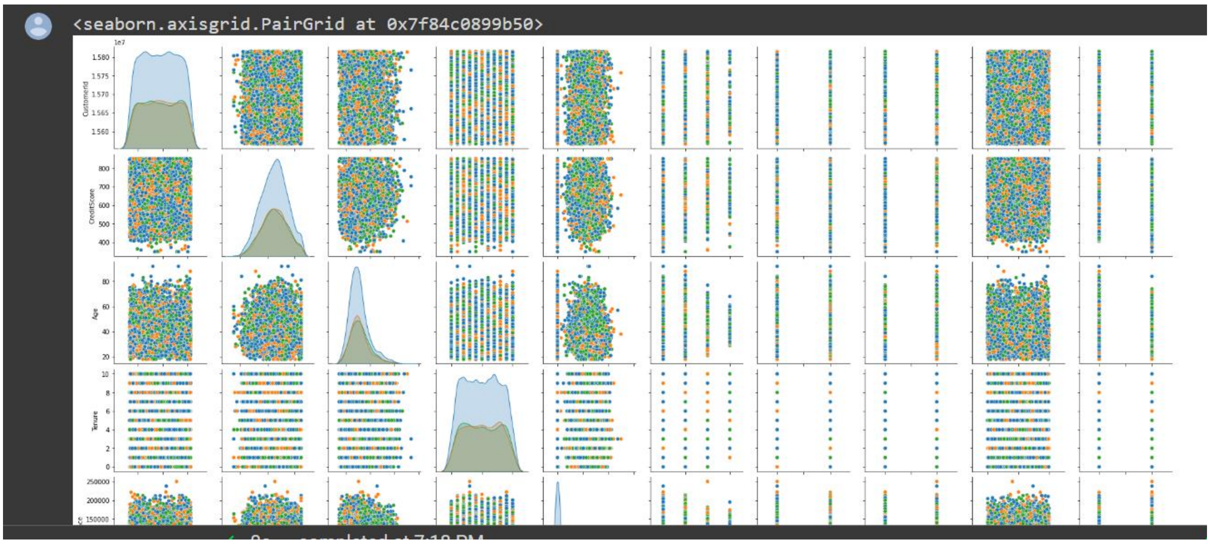


```
                            OLS Regression Results
==============================================================================
Dep. Variable:                    Age   R-squared:                       0.081
Model:                            OLS   Adj. R-squared:                  0.081
Method:                 Least Squares   F-statistic:                     886.1
Date:                Tue, 04 Oct 2022   Prob (F-statistic):          1.24e-186
Time:                        13:41:38   Log-Likelihood:                -37266.
No. Observations:               10000   AIC:                         7.454e+04
Df Residuals:                    9998   BIC:                         7.455e+04
Df Model:                           1
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const         37.4084      0.113    332.078      0.000      37.188      37.629
Exited         7.4296      0.250     29.767      0.000       6.940       7.919
==============================================================================
Omnibus:                     1974.048   Durbin-Watson:                   2.027
Prob(Omnibus):                  0.000   Jarque-Bera (JB):             4381.188
Skew:                           1.136   Prob(JB):                         0.00
Kurtosis:                       5.314   Cond. No.                         2.60
==============================================================================
```

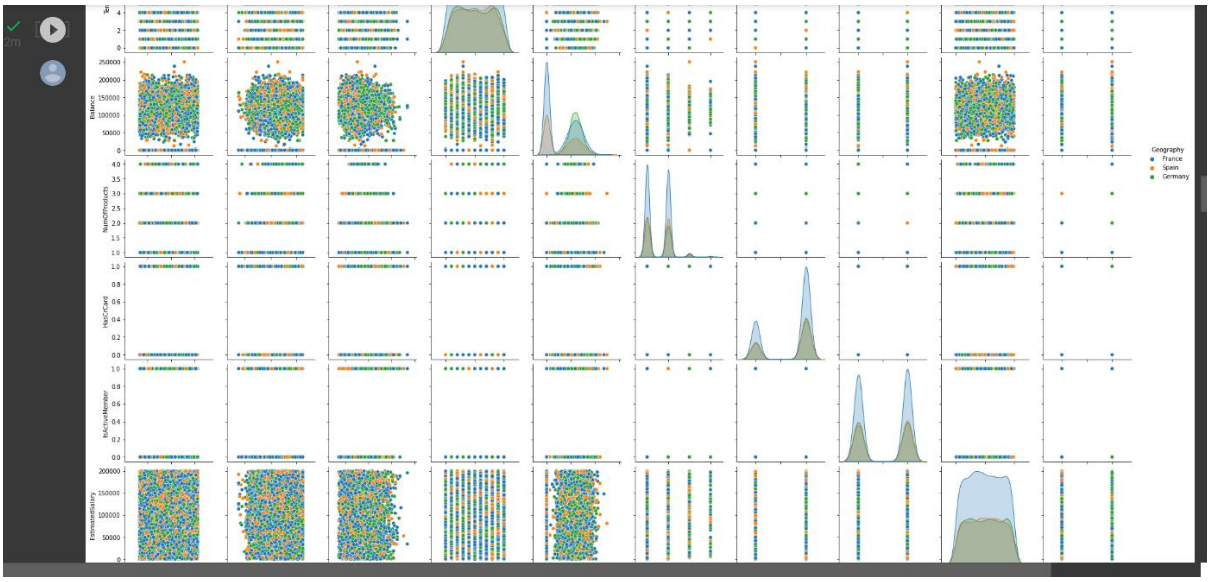
- **Multi - Variate Analysis**

Code

sns.pairplot(data=df[['CustomerId', 'CreditScore','Gender', 'Age', 'Tenure', ‘Geography', 'Balance', 'NumOfProducts', 'HasCrCard', 'IsActiveMember' ,'EstimatedSalary', 'Exited']],hue='Geography')



```
<seaborn.axisgrid.PairGrid at 0x7f84c0899b50>
```

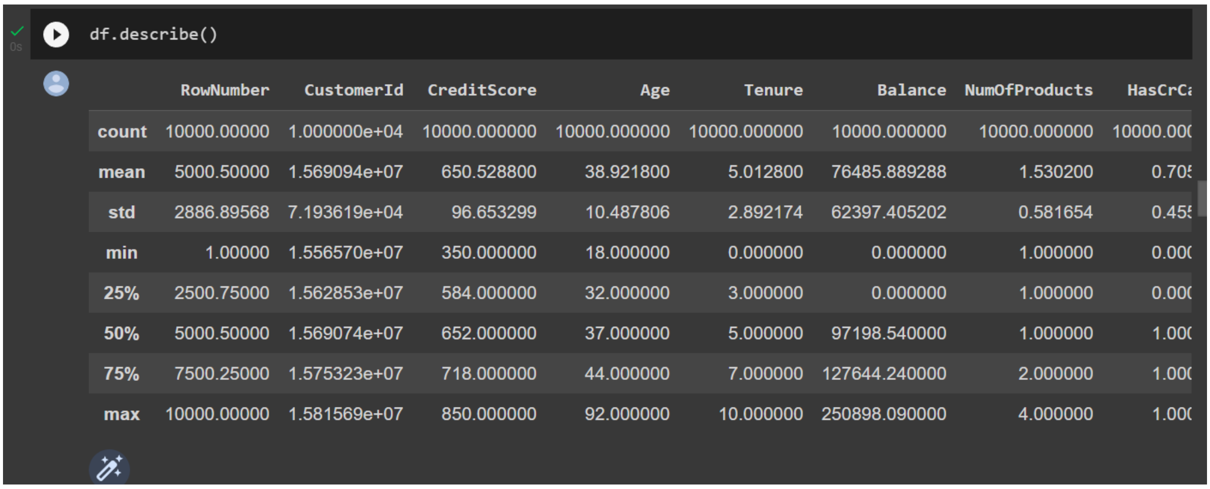


Question 4. Perform descriptive statistics on the dataset.

Code:

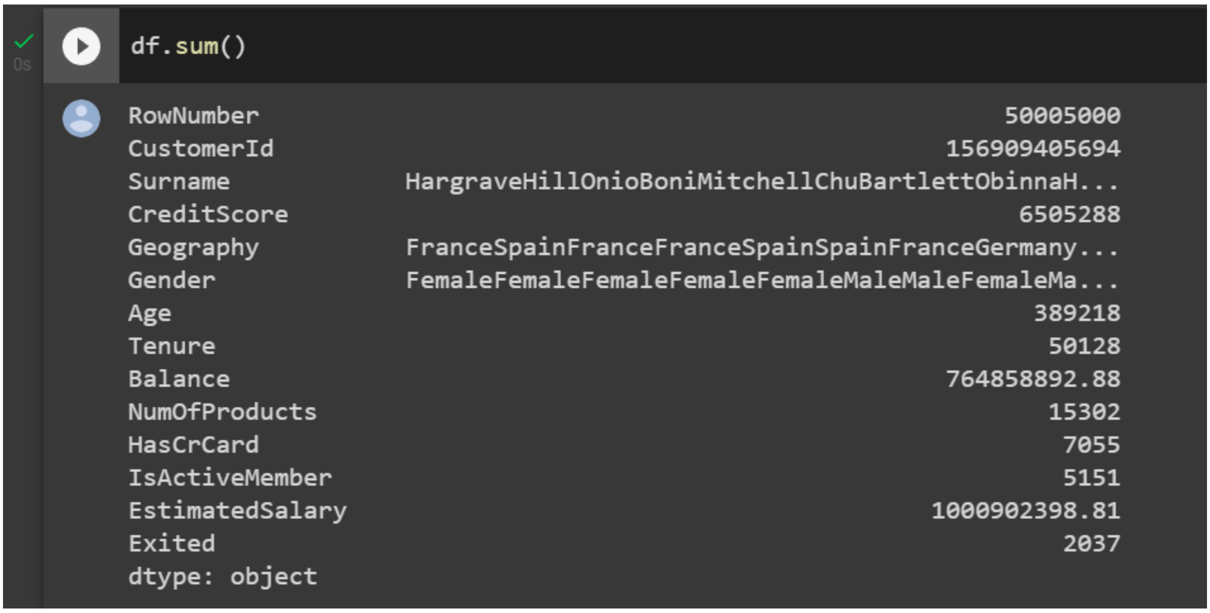
df.describe()

df.sum()



```
df.describe()
```

	RowNumber	CustomerId	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCa
count	10000.00000	1.000000e+04	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.000
mean	5000.50000	1.569094e+07	650.528800	38.921800	5.012800	76485.889288	1.530200	0.705
std	2886.89568	7.193619e+04	96.653299	10.487806	2.892174	62397.405202	0.581654	0.455
min	1.00000	1.556570e+07	350.000000	18.000000	0.000000	0.000000	1.000000	0.000
25%	2500.75000	1.562853e+07	584.000000	32.000000	3.000000	0.000000	1.000000	0.000
50%	5000.50000	1.569074e+07	652.000000	37.000000	5.000000	97198.540000	1.000000	1.000
75%	7500.25000	1.575323e+07	718.000000	44.000000	7.000000	127644.240000	2.000000	1.000
max	10000.00000	1.581569e+07	850.000000	92.000000	10.000000	250898.090000	4.000000	1.000

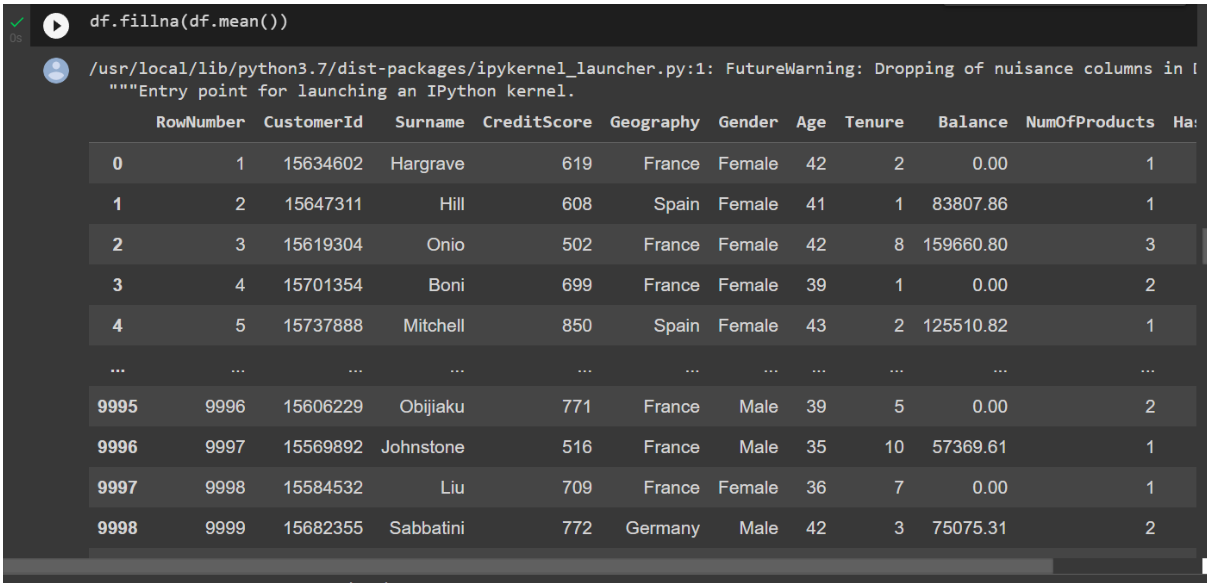


```
df.sum()
```

```
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
```

Question 5. Handle the Missing values.

Code:
df.fillna(df.mean())



```
df.fillna(df.mean())
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: FutureWarning: Dropping of nuisance columns in [
  """Entry point for launching an IPython kernel.
```

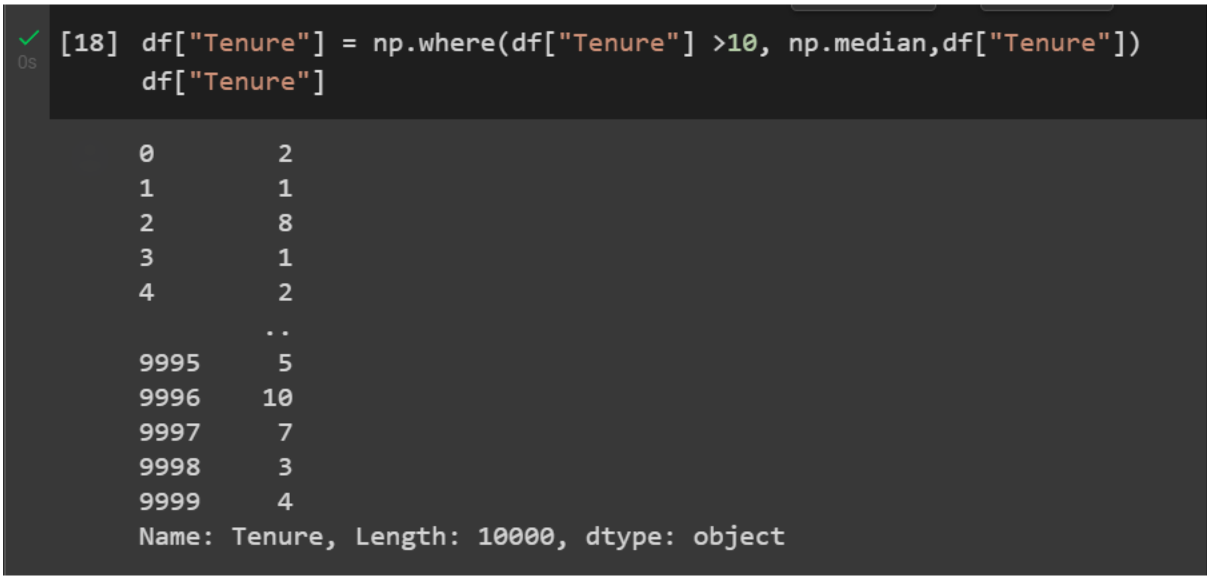
	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	Ha
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	
2	3	15619304	Onio	502	France	Female	42	8	159660.80	3	
3	4	15701354	Boni	699	France	Female	39	1	0.00	2	
4	5	15737888	Mitchell	850	Spain	Female	43	2	125510.82	1	
...	...	...	...	...	...	...	...	...	...	...	
9995	9996	15606229	Obijiaku	771	France	Male	39	5	0.00	2	
9996	9997	15569892	Johnstone	516	France	Male	35	10	57369.61	1	
9997	9998	15584532	Liu	709	France	Female	36	7	0.00	1	
9998	9999	15682355	Sabbatini	772	Germany	Male	42	3	75075.31	2	

Question 6. Find the outliers and replace the outliers

Code:

df["Tenure"] = np.where(df["Tenure"] >10, np.median,df["Tenure"])

df["Tenure"]



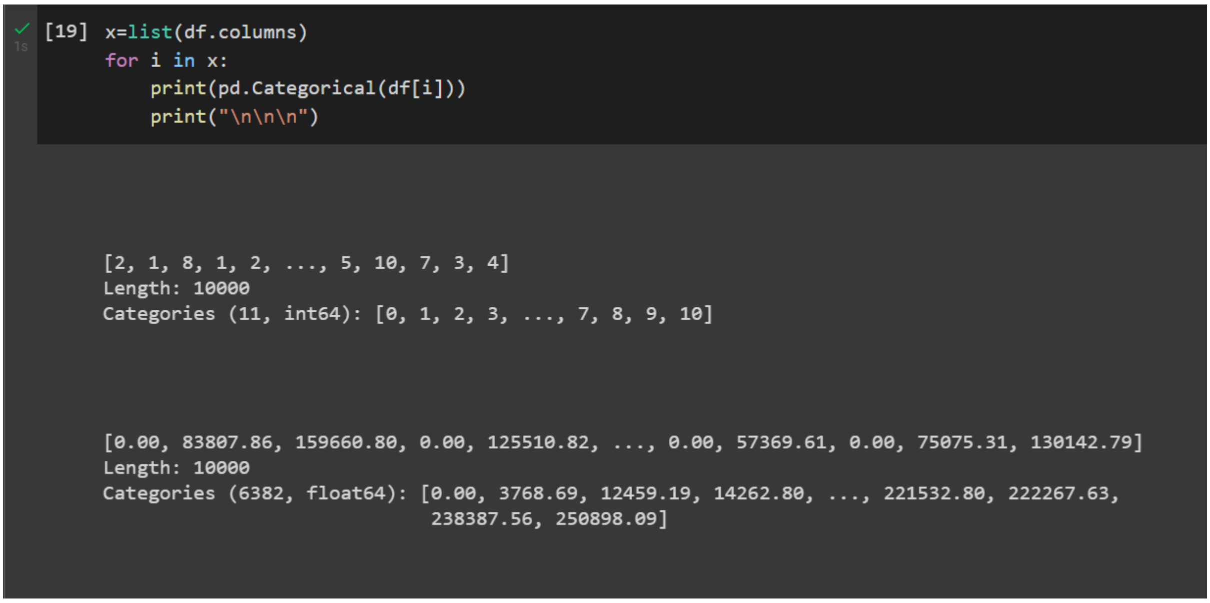
```
[18] df["Tenure"] = np.where(df["Tenure"] >10, np.median,df["Tenure"])
     df["Tenure"]
```

```
0        2
1        1
2        8
3        1
4        2
        ..
9995     5
9996    10
9997     7
9998     3
9999     4
Name: Tenure, Length: 10000, dtype: object
```

Question 7. Check for Categorical columns and perform encoding.

Code:

```
x=list(df.columns)
for i in x:
   print(pd.Categorical(df[i]))
   print("\n\n\n")
```



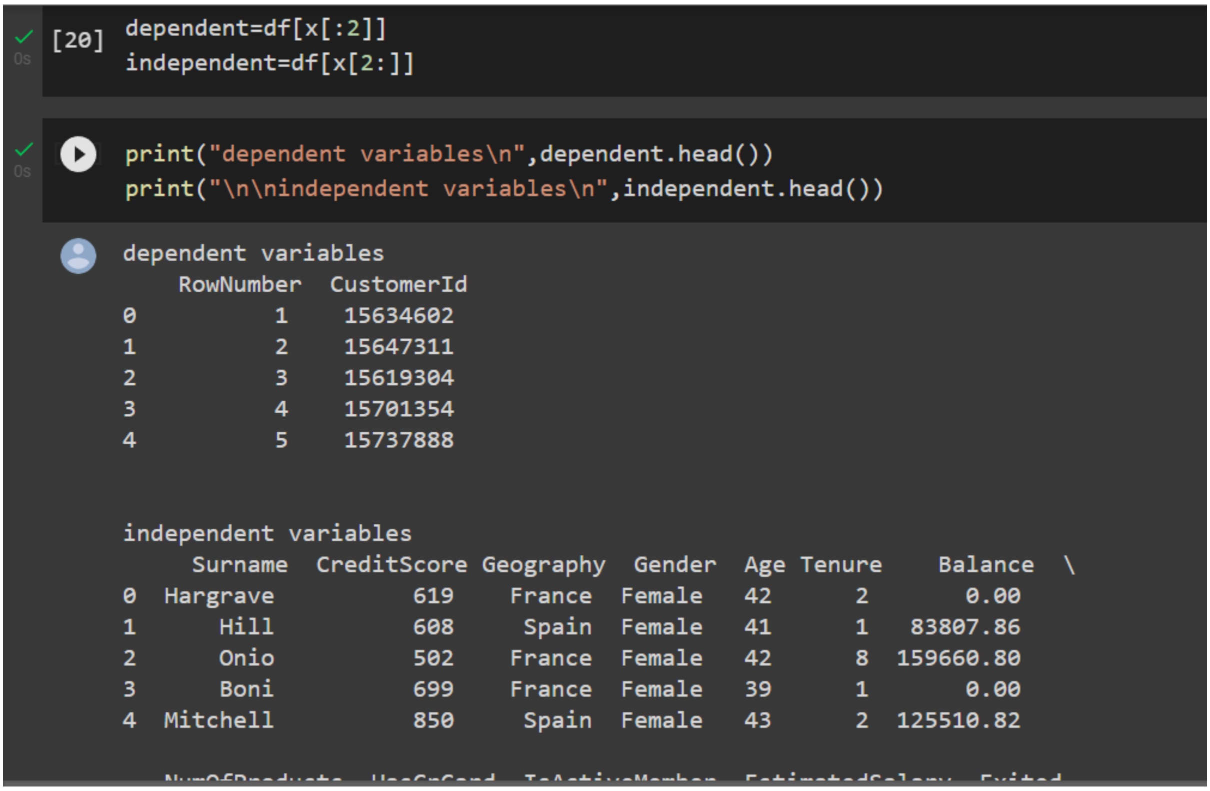
```
[19] x=list(df.columns)
     for i in x:
         print(pd.Categorical(df[i]))
         print("\n\n\n")
```

```
[2, 1, 8, 1, 2, ..., 5, 10, 7, 3, 4]
Length: 10000
Categories (11, int64): [0, 1, 2, 3, ..., 7, 8, 9, 10]




[0.00, 83807.86, 159660.80, 0.00, 125510.82, ..., 0.00, 57369.61, 0.00, 75075.31, 130142.79]
Length: 10000
Categories (6382, float64): [0.00, 3768.69, 12459.19, 14262.80, ..., 221532.80, 222267.63,
                             238387.56, 250898.09]
```

Question 8. Split the data into dependent and independent variables.

Code:

```
dependent=df[x[:2]]
independent=df[x[2:]]
print("dependent variables\n",dependent.head())
print("\n\nindependent variables\n",independent.head())
```



```
[20] dependent=df[x[:2]]
     independent=df[x[2:]]
```

```
print("dependent variables\n",dependent.head())
print("\n\nindependent variables\n",independent.head())
```

```
dependent variables
    RowNumber  CustomerId
0          1    15634602
1          2    15647311
2          3    15619304
3          4    15701354
4          5    15737888


independent variables
     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

   NumOfProducts  HasCrCard  IsActiveMember  EstimatedSalary  Exited
```

Question 9. Scale the independent variables

Code:

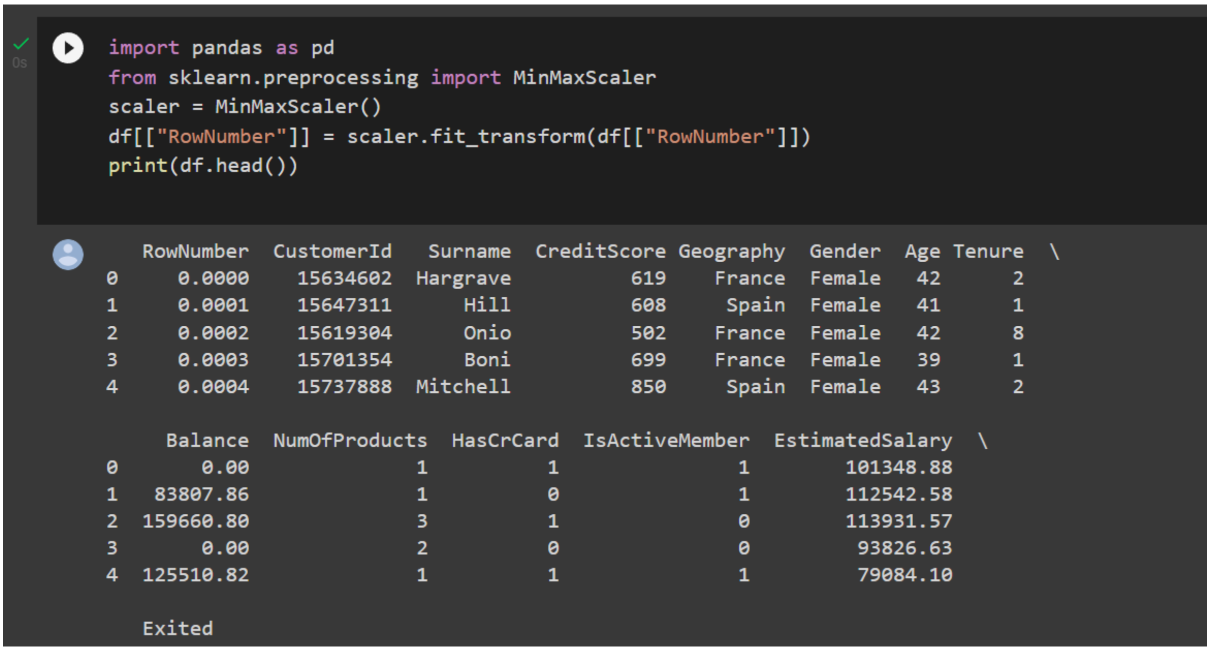
import pandas as pd

from sklearn.preprocessing import MinMaxScaler

scaler = MinMaxScaler()

df[["RowNumber"]] = scaler.fit_transform(df[["RowNumber"]])

print(df.head())



```
import pandas as pd
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()
df[["RowNumber"]] = scaler.fit_transform(df[["RowNumber"]])
print(df.head())
```

```
   RowNumber  CustomerId   Surname  CreditScore Geography  Gender  Age Tenure  \
0     0.0000    15634602  Hargrave          619    France  Female   42      2
1     0.0001    15647311      Hill          608     Spain  Female   41      1
2     0.0002    15619304      Onio          502    France  Female   42      8
3     0.0003    15701354      Boni          699    France  Female   39      1
4     0.0004    15737888  Mitchell          850     Spain  Female   43      2

       Balance  NumOfProducts  HasCrCard  IsActiveMember  EstimatedSalary  \
0         0.00              1          1               1        101348.88
1     83807.86              1          0               1        112542.58
2    159660.80              3          1               0        113931.57
3         0.00              2          0               0         93826.63
4    125510.82              1          1               1         79084.10

   Exited
```

Question 10. Split the data into training and testing

Code:

from sklearn.model_selection import train_test_split

train_size=0.8

X = df.drop(columns = ['Tenure']).copy()

y = df['Tenure']

X_train, X_rem, y_train, y_rem = train_test_split(X,y, train_size=0.8)

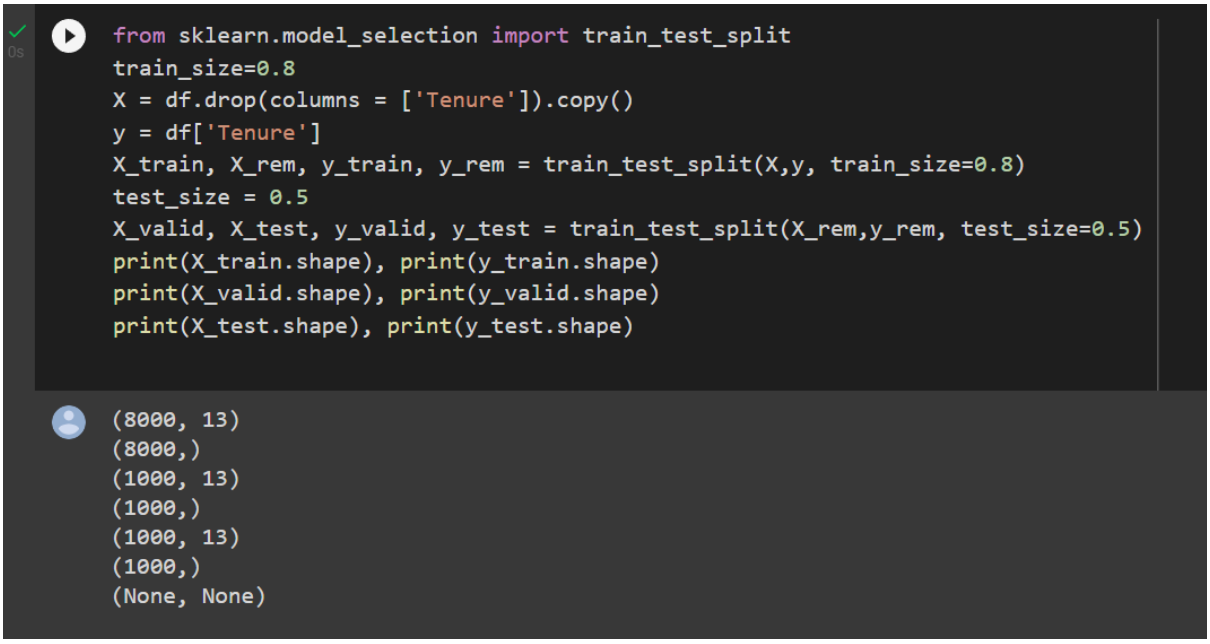
test_size = 0.5

X_valid, X_test, y_valid, y_test = train_test_split(X_rem,y_rem, test_size=0.5)

print(X_train.shape), print(y_train.shape)

print(X_valid.shape), print(y_valid.shape)

print(X_test.shape), print(y_test.shape)



```
from sklearn.model_selection import train_test_split
train_size=0.8
X = df.drop(columns = ['Tenure']).copy()
y = df['Tenure']
X_train, X_rem, y_train, y_rem = train_test_split(X,y, train_size=0.8)
test_size = 0.5
X_valid, X_test, y_valid, y_test = train_test_split(X_rem,y_rem, test_size=0.5)
print(X_train.shape), print(y_train.shape)
print(X_valid.shape), print(y_valid.shape)
print(X_test.shape), print(y_test.shape)
```

```
(8000, 13)
(8000,)
(1000, 13)
(1000,)
(1000, 13)
(1000,)
(None, None)
```