ASSIGNMENT-2
DATA VISUALIZATION AND
PREPROCESSING

Assignment Date	24/09/2022
Student Name	PAVITHRA K
Student Roll Number	61772021T306
Maximum Marks	2 Marks

Task-1

Download the Dataset:

Churn_Modelling.csv

Task-2:

Load the Dataset:

Solution:

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

```
df=pd.read_csv('Churn_Modelling.csv')
df.head()
```

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

```
[5] df.shape
```

```
(10000, 14)
```

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```
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  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
```

```
[7] df.isnull().any()
```

```
RowNumber          False
CustomerId         False
Surname            False
CreditScore        False
Geography          False
Gender             False
Age                False
Tenure             False
Balance            False
NumOfProducts      False
HasCrCard          False
IsActiveMember     False
EstimatedSalary    False
Exited             False
dtype: bool
```

```
df.Geography.unique()
```

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

```
df.Age.unique()
```

```
array([42, 41, 39, 43, 44, 50, 29, 27, 31, 24, 34, 25, 35, 45, 58, 32, 38,
       46, 36, 33, 40, 51, 61, 49, 37, 19, 66, 56, 26, 21, 55, 75, 22, 30,
       28, 65, 48, 52, 57, 73, 47, 54, 72, 20, 67, 79, 62, 53, 80, 59, 68,
       23, 60, 70, 63, 64, 18, 82, 69, 74, 71, 76, 77, 88, 85, 84, 78, 81,
       92, 83])
```

```
[10] df.Tenure.value_counts()
```

```
2     1048
1     1035
7     1028
8     1025
5     1012
3     1009
4      989
9      984
6      967
10     490
0      413
Name: Tenure, dtype: int64
```

```
df.Gender.value_counts()
```

```
Male      5457
Female    4543
Name: Gender, dtype: int64
```

Task-3:

3. Perform Below Visualizations.

Univariate Analysis

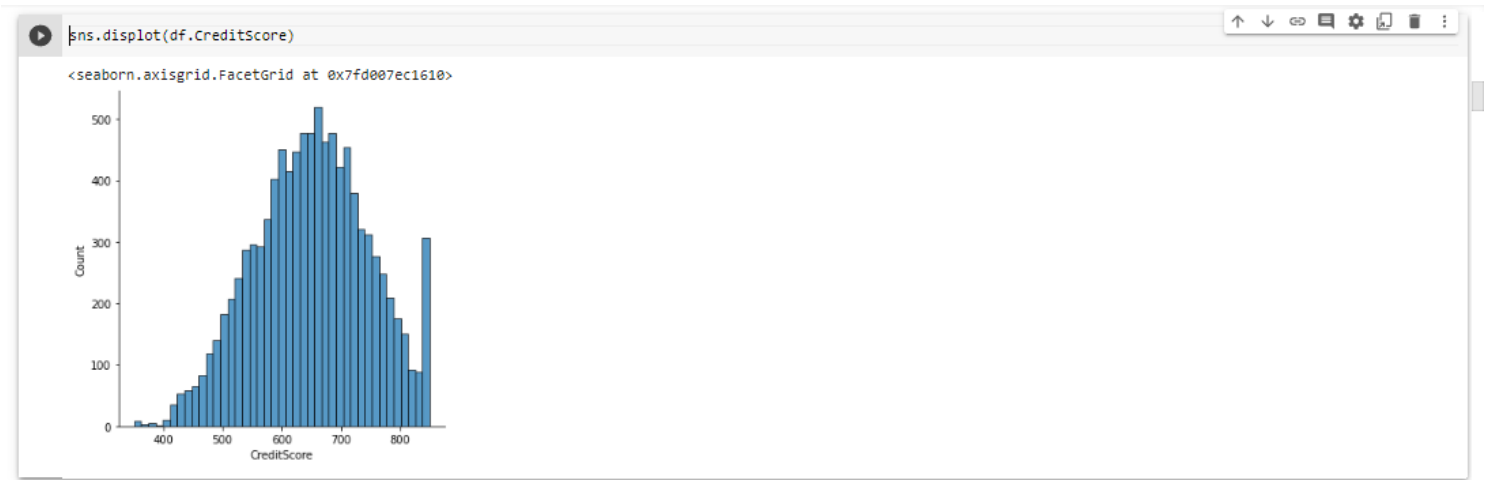
Bi - Variate Analysis

Multi - Variate Analysis

Univaíiate Analysis:

SOLUTION:

```
sns.displot(df.CreditScore)
```




```
plt.pie(df.Geography.value_counts(),[0,0.2,0],shadow='True',autopct="1%.1f%%")    #categ
orial column
```

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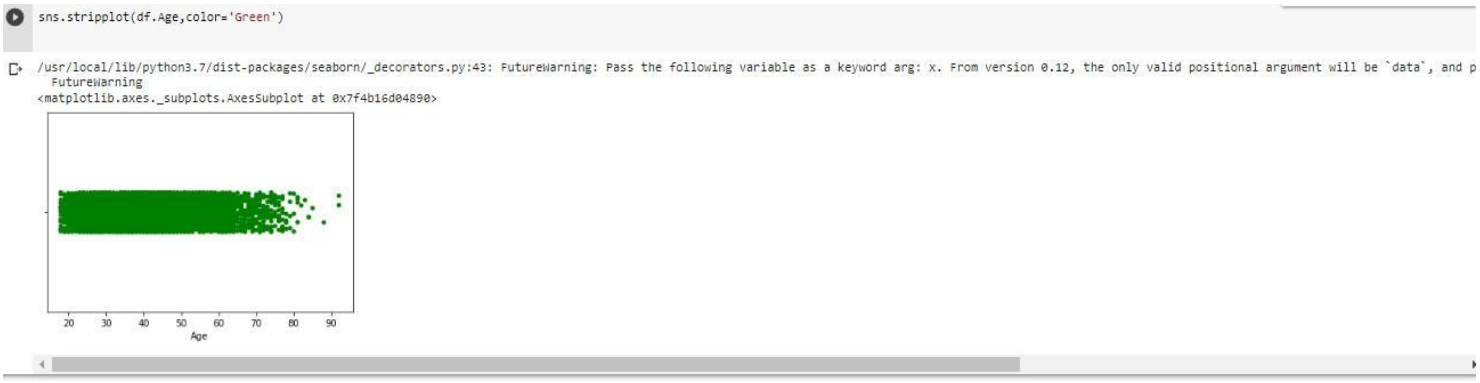
```
sns.stripplot(df.Age,color='Green')
```

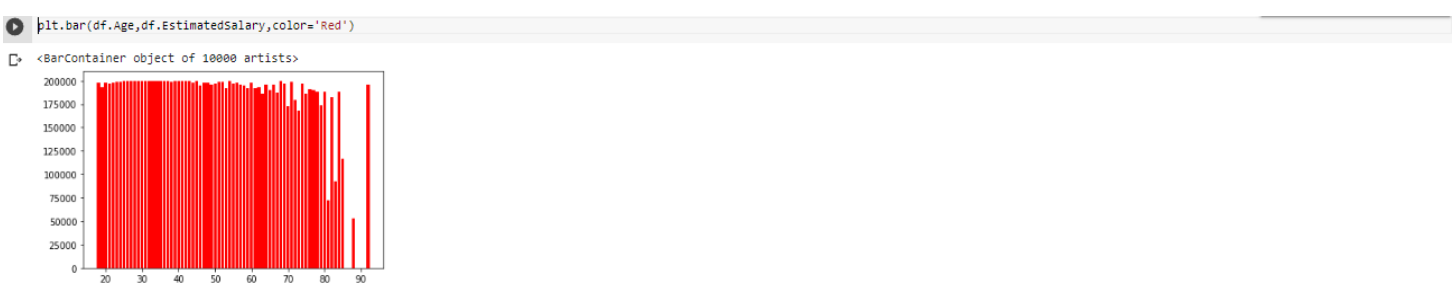



```
sns.ecdfplot(df.Balance)
```

Bi-vaíiate Analysis:

SOLUTION**:**

plt.bar(df.Age,df.EstimatedSalary,color='Red')



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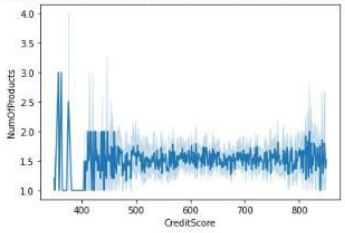
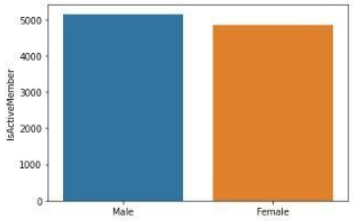
```
sns.lineplot(df.CreditScore,df.NumOfProducts)
```

```
/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
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f4b10269950>
```



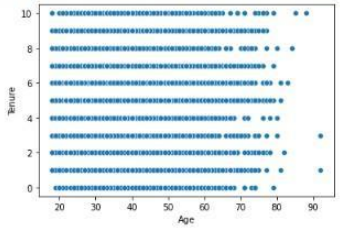

```
[20] sns.barplot(df.Gender.value_counts().index,df.IsActiveMember.value_counts())
```

```
/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
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f4b0fff5790>
```



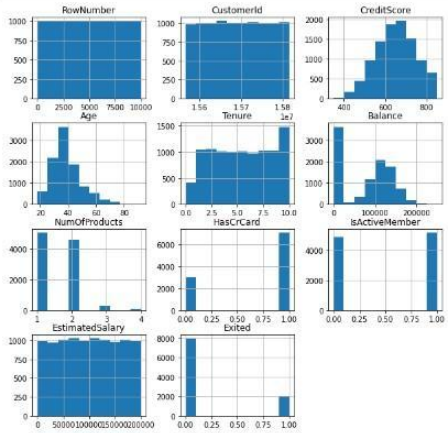

```
sns.scatterplot(df.Age,df.Tenure)
```

```
/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
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f4b0ff03910>
```



Multi-Variate Analysis:

```
multi=df.hist(figsize=(10,10))
```



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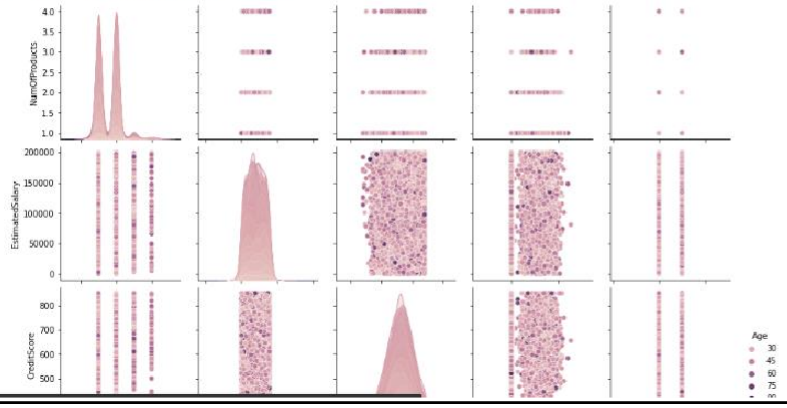
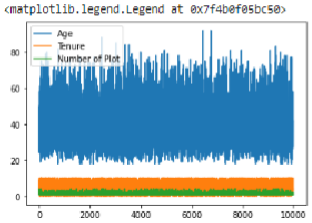
```
[ ] sns.pairplot(data=df[['Geography','Age','NumOfProducts','EstimatedSalary','CreditScore','Balance','IsActiveMember']],hue='Age',kind='scatter')
```

```
<seaborn.axisgrid.PairGrid at 0x7fce780bbc10>
```



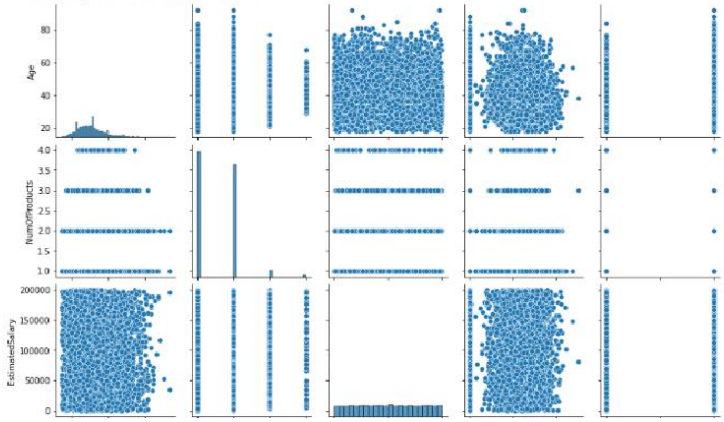

```
df.Age.plot()
df.Tenure.plot()
df.NumOfProducts.plot()
plt.legend(['Age','Tenure','Number of Plot'])
```

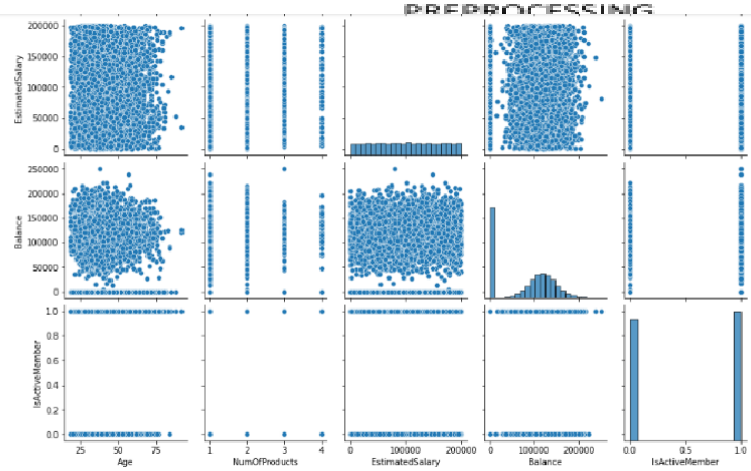
```
<matplotlib.legend.Legend at 0x7f4b0f05bc50>
```




```
sns.pairplot(data=df[['Age','NumOfProducts','EstimatedSalary','Balance','IsActiveMember']],diag_kind='hist')
```

```
<seaborn.axisgrid.PairGrid at 0x7f4b0f437650>
```





Task-4:

Descriptive Statistic

```
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

Task-5:

Handle the Missing Data:

```
[27] df1=pd.read_csv('mtcars_missing_data.csv')
     df1.head()
```

	model	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
0	Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
1	Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
2	Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
3	Hornet 4 Drive	21.4	6	258.0	110	3.08	NaN	19.44	1	0	3	1
4	Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2

```
[ ] df1.shape

    (32, 12)

[ ] df1.info()

    <class 'pandas.core.frame.DataFrame'>
    RangeIndex: 32 entries, 0 to 31
    Data columns (total 12 columns):
     #   Column  Non-Null Count  Dtype
    ---  ------  --------------  -----
     0   model   32 non-null     object
     1   mpg     30 non-null     float64
     2   cyl     32 non-null     int64
     3   disp    30 non-null     float64
     4   hp      32 non-null     int64
     5   drat    30 non-null     float64
     6   wt      29 non-null     float64
```

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```
[ ] df1.isnull().any()

model    False
mpg       True
cyl      False
disp      True
hp       False
drat      True
wt        True
qsec     False
vs       False
am       False
gear     False
carb     False
dtype: bool
```

```
[ ] df1.isnull().sum()

model    0
mpg      2
cyl      0
disp     2
hp       0
drat     2
wt       3
qsec     0
vs       0
am       0
gear     0
carb     0
dtype: int64
```

```
[ ] df1['mpg'].fillna(df1['mpg'].median(),inplace=True)
    df1['disp'].fillna(df1['disp'].median(),inplace=True)
    df1['drat'].fillna(df1['drat'].median(),inplace=True)
    df1['wt'].fillna(df1['wt'].median(),inplace=True)
```

```
df1.head()
```

	model	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
0	Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
1	Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
2	Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
3	Hornet 4 Drive	21.4	6	258.0	110	3.08	3.435	19.44	1	0	3	1
4	Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2

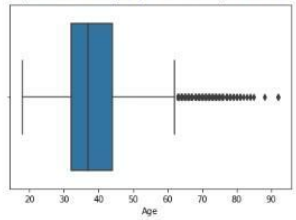
Task-6:

Outliers Replacement:

Outliers Replacement

```
[ ] 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 only valid positional argument will be `data`, and passing other a
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7fcf123b6990>
```




```
[ ] q1=df.Age.quantile(0.25)
    q3=df.Age.quantile(0.75)
```

```
IQR = q3-q1
upper_limit=q3 + 1.5 * IQR
```

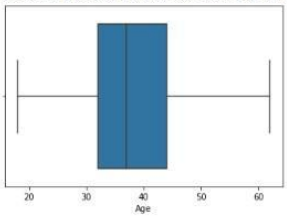
```
upper_limit
```

```
62.0
```

```
df.Age=np.where(df.Age>upper_limit,44,df.Age) #Median=44.000000
```

```
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 only valid positional argument will be `data`, and passing other arg
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7fcf07d1d450>
```



Task-7:

Check for Categorical column and perform encoding:

Check for Categorical column and perform encoding

Label Encoding for Gender column

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

```
le = LabelEncoder()
```

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

+ Code + Text

```
df.head()
```

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

One Hot Encoding for Geography column

```
df2=pd.get_dummies(df,columns=['Geography'])
df2.head()
```

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

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Task-7:

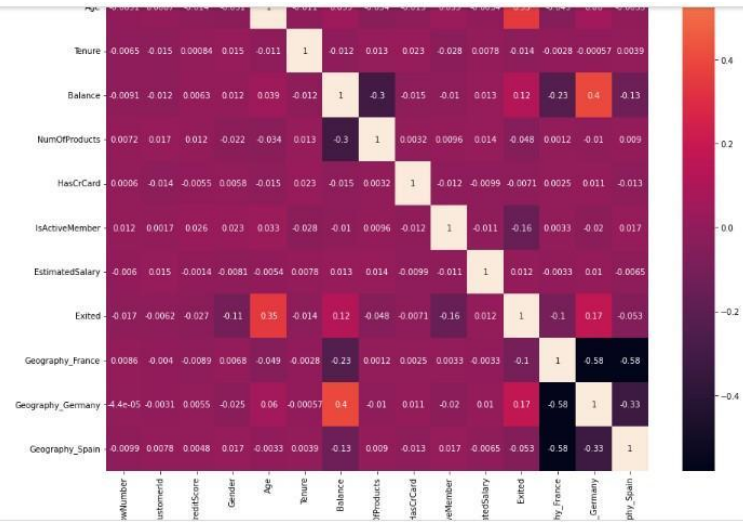
Correlation:

```
df2.corr()
```

	RowNumber	CustomerId	CreditScore	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited	Geography_France	Geography_Germany	Geography_Spain
RowNumber	1.000000	0.004202	0.005840	0.018196	-0.003079	-0.006495	-0.009067	0.007246	0.000599	0.012044	-0.005988	-0.016571	0.008590	-0.000044	-0.009905
CustomerId	0.004202	1.000000	0.005308	-0.002641	0.008700	-0.014883	-0.012419	0.016972	-0.014025	0.001665	0.015271	-0.006248	-0.004049	-0.003097	0.007800
CreditScore	0.005840	0.005308	1.000000	-0.002857	-0.013854	0.000842	0.006268	0.012238	-0.005458	0.025651	-0.001384	-0.027094	-0.008928	0.005538	0.004780
Gender	0.018196	-0.002641	-0.002857	1.000000	-0.030740	0.014733	0.012087	-0.021859	0.005766	0.022544	-0.008112	-0.106512	0.006772	-0.024628	0.016889
Age	-0.003079	0.008700	-0.013854	-0.030740	1.000000	-0.010722	0.039293	-0.033586	-0.015448	0.033451	-0.005418	0.349269	-0.048858	0.059633	-0.003299
Tenure	-0.006495	-0.014883	0.000842	0.014733	-0.010722	1.000000	-0.012254	0.013444	0.022583	-0.028362	0.007784	-0.014001	-0.002848	-0.000567	0.003868
Balance	-0.009067	-0.012419	0.006268	0.012087	0.039293	-0.012254	1.000000	-0.304180	-0.014858	-0.010084	0.012797	0.118533	-0.231329	0.401110	-0.134892
NumOfProducts	0.007246	0.016972	0.012238	-0.021859	-0.033586	0.013444	-0.304180	1.000000	0.003183	0.009612	0.014204	-0.047820	0.001230	-0.010419	0.009039
HasCrCard	0.000599	-0.014025	-0.005458	0.005766	-0.015448	0.022583	-0.014858	0.003183	1.000000	-0.011866	-0.009933	-0.007138	0.002467	0.010577	-0.013480
IsActiveMember	0.012044	0.001665	0.025651	0.022544	0.033451	-0.028362	-0.010084	0.009612	-0.011866	1.000000	-0.011421	-0.156128	0.003317	-0.020486	0.016732
EstimatedSalary	-0.005988	0.015271	-0.001384	-0.008112	-0.005418	0.007784	0.012797	0.014204	-0.009933	-0.011421	1.000000	0.012097	-0.003332	0.010297	-0.006482
Exited	-0.016571	-0.006248	-0.027094	-0.106512	0.349269	-0.014001	0.118533	-0.047820	-0.007138	-0.156128	0.012097	1.000000	-0.104955	0.173488	-0.052667
Geography_France	0.008590	-0.004049	-0.008928	0.006772	-0.048858	-0.002848	-0.231329	0.001230	0.002467	0.003317	-0.003332	-0.104955	1.000000	-0.580359	-0.575418
Geography_Germany	-0.000044	-0.003097	0.005538	-0.024628	0.059633	-0.000567	0.401110	-0.010419	0.010577	-0.020486	0.010297	0.173488	-0.580359	1.000000	-0.332084
Geography_Spain	-0.009905	0.007800	0.004780	0.016889	-0.003299	0.003868	-0.134892	0.009039	-0.013480	0.016732	-0.006482	-0.052667	-0.575418	-0.332084	1.000000

```
[ ] plt.figure(figsize=(15,15))
    sns.heatmap(df2.corr(),annot=True)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fcf30985a10>
```



ASSIGNMENT-2
DATA VISUALIZATION AND
PREPROCESSING

Task-8

Split the data into dependent and independent variables:

Split the data into dependent and independent variables

```
[ ] #y - target columns
    #X - predicting columns
```

```
[ ] y=df2['Surname']
    y
```

```
0        Hargrave
1            Hill
2            Onio
3            Boni
4        Mitchell
          ...
9995     Obijiaku
9996    Johnstone
9997          Liu
9998    Sabbatini
9999       Walker
Name: Surname, Length: 10000, dtype: object
```

```
X=df2.drop(columns=['Surname'],axis=1)
X.head()
```

```
[ ] X=df2.drop(columns=['Surname'],axis=1)
    X.head()
```

	RowNumber	CustomerId	CreditScore	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited	Geography_France	Geography_Germany	Geography_Spain
0	1	15634602	619	0	42	2	0.00	1	1	1	101348.88	1	1	0	0
1	2	15647311	608	0	41	1	83807.86	1	0	1	112542.58	0	0	0	1
2	3	15619304	502	0	42	8	159660.80	3	1	0	113931.57	1	1	0	0
3	4	15701354	699	0	39	1	0.00	2	0	0	93826.63	0	1	0	0
4	5	15737888	850	0	43	2	125510.82	1	1	1	79084.10	0	0	0	1

Task-9:

Scale the independent variables:

Scale the independent variables

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

```
[ ] x_scaled=pd.DataFrame(scale(X),columns=X.columns)
    x_scaled.head()
```

	RowNumber	CustomerId	CreditScore	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited	Geography_France	Geography_Germany	Geography_Spain
0	-1.731878	-0.783213	-0.326221	-1.095988	0.457039	-1.041760	-1.225848	-0.911583	0.646092	0.970243	0.021886	1.977165	0.997204	-0.578736	-0.573809
1	-1.731531	-0.606534	-0.440036	-1.095988	0.342361	-1.387538	0.117350	-0.911583	-1.547768	0.970243	0.216534	-0.505775	-1.002804	-0.578736	1.742740
2	-1.731185	-0.995885	-1.536794	-1.095988	0.457039	1.032908	1.333053	2.527057	0.646092	-1.030670	0.240687	1.977165	0.997204	-0.578736	-0.573809
3	-1.730838	0.144767	0.501521	-1.095988	0.113004	-1.387538	-1.225848	0.807737	-1.547768	-1.030670	-0.108918	-0.505775	0.997204	-0.578736	-0.573809
4	-1.730492	0.652659	2.063884	-1.095988	0.571717	-1.041760	0.785728	-0.911583	0.646092	0.970243	-0.365276	-0.505775	-1.002804	-0.578736	1.742740

Task-10:

Split the data into training and testing:

Split 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_scaled,y,test_size=0.3,random_state=0)
```

```
[ ] X_train.shape
```

```
(7000, 15)
```

```
[ ] X_test.shape
```

```
(3000, 15)
```

```
[ ] y_train.shape
```

```
(7000,)
```

```
[ ] y_test.shape
```

```
(3000,)
```