Assignment -2 Artificial Intelligence

Student Name	SRINATH S
Student Roll Number	73771921195
Maximum Marks	2 Marks

Question-1:

- 1. Download the dataset:
- 2. Load the dataset.

import pandas as pd import
numpy as np import
matplotlib.pyplot as plt

url =

'https://drive.google.com/file/d/1_HcM0K8wt4b7FMLkc1V1dv0y6I_9ULzy/
view?usp=sharing' path = 'https://drive.google.com/uc?
export=download&id='+url.split('/')[-2] df = pd.read_csv(path)

df.sample(20)

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender
Age \						
8075	8076	15745250	Simpson	850	France	Male
58						
4957	4958	15600478	Watson	752	France	Male
39						
6841	6842	15793491	Cherkasova	714	Germany	Male
26						
4965	4966	15729515	McCarthy	782	France	Male
36						
2828	2829	15716449	Fraser	527	Spain	Male
33						
4732	4733	15653937	McIntyre	63	38 Germany	Female
53						
6210	6211	15592197	Simmons	522	Spain	Male
30						
5505	5506	15802466	Donaldson	534	France	Female
53						
6450	6451	15781409	Lazarev	834	France	Female
28						
5407	5408	15714431	Yeh	561	France	Male
37						
7529	7530	15575430	Robson	579	France	Female
33						
1887	1888	15680918	Freeman	613	Spain	Male

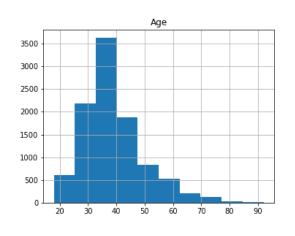
34						
1590 39	1591	15651802	Day	632	Spain	Female
7578 39	7579	15656417	Marsh	582	France	Female
2692 31	2693	15736274 Prokh	norova	751 Fi	rance	Male
7031 48	7032	15580914 Okec	hukwu	478	Spain	Male
2158	2159	15685706	Bird	731	France	Female

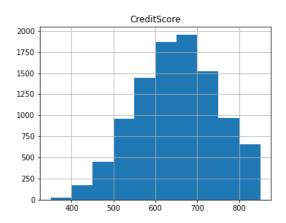
3599 3590 15647725 Napolitano 675 France Female 61 3772 3773 15699486 Johnson 745 Spain Male 34 5328 5329 15680234 Bray 667 Germany Male 27 Tenure Balance NumOfProducts HasCrCard IsActiveMember \ 8075 8 156652.13 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	40					
34 5328 5329 15680234 Bray 667 Germany Male 7 Tenure Balance NumOfProducts HasCrCard IsActiveMember \ 8075 8 156652.13 1 0 0 0 4957 3 0.00 1 1 0 0 4965 1 148795.17 2 1 1 1 2828 9 132168.28 1 0 0 0 4732 1 123916.67 1 1 1 0 0 5505 7 0.00 2 1 0 6450 6 0.00 1 1 0 0 5505 7 0.00 2 1 1 0 6450 6 0.00 1 1 1 0 6450 6 0.00 1 1 1 0 6450 6 0.00 1 1 1 0 6450 6 0.00 1 1 1 0 6450 6 0.00 1 1 1 0 6450 7529 1 118392.75 1 1 1 1 1 0 6450 6 0.00 1 1 1 0 6450 6 0.00 1 1 1 0 6450 6 0.00 1 1 1 0 6450 6 0.00 1 1 1 0 6450 6 0.00 1 1 1 0 6450 6 0.00 6450 7529 1 118392.75 1 1 1 1 1 1 6450 6 0.00 6450 5 97854.37 2 1 0 6450 6 0.00 6450 6 0.00 6450 6 0.00 6450 6 0.00 6450 6 0.00 6450 6 0.00 6450 6 0.00 6450 6 0.00 6450 6 0.00 6450 6 0.00 6450 6 0.00 6450 6 0.00 6450 6 0.00 6450 6 0.00 6450 74287.53 0 74287.63 0 74287.63 0 74287.63 0 74287.63 0 74287.63 0 74287.63 0 74287.63 0		3550	15647725 1	Napolitano	67	5 France Female
Tenure Balance NumOfProducts HasCrCard IsActiveMember \ 8075		3773	15699486	Johnson	745	Spain Male
8075 8 156652.13		5329	15680234	Bray	66	67 Germany Male
8075 8 156652.13						
4957 3 0.00 1 1 1 0 0 6841 3 119545.48 2 1 0 0 4965 1 148795.17 2 1 1 0 0 6451 1 148795.17 2 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
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4965		_				
2828 9 132168.28 1 0 0 0 4732 1 123916.67 1 1 1 0 6210 3 0.00 2 1 0 5505 7 0.00 2 1 1 1 6450 6 0.00 1 1 1 0 5407 1 100443.36 2 0 1 7529 1 118392.75 1 1 1 1 1 1887 8 117300.02 1 1 1 0 1590 5 97854.37 2 1 0 7578 1 132077.48 2 1 0 6452 8 0.00 2 0 0 7031 0 83287.05 2 0 0 62158 7 118991.79 1 1 1 5328 2 138032.15 1 1 1 6540 5 62055.17 3 1 1 1 6540 6 6482.94 0 6450 7 4287.53 0 65407 101693.73 0 7529 157564.75 0 1887 13941.08 0 1590 93536.38 0						
4732						
6210 3 0.00 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					_	
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6450 6 0.00 1 1 1 0 0 5407 1 100443.36 2 0 0 1 1 7529 1 118392.75 1 1 1 1 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1		_				
5407						
7529						
1887 8 117300.02 1 1 0 1590 5 97854.37 2 1 0 0 17578 1 132077.48 2 1 0 0 0 0 0 0 0 0 0 0 0 0						
1590						
7578						
2692 8 0.00 2 0 0 7031 0 83287.05 2 0 1 2158 7 118991.79 1 1 1 3549 5 62055.17 3 1 0 3772 7 132944.53 1 1 1 1 5328 2 138032.15 1 0 EstimatedSalary Exited 8075 25899.21 1 4957 188187.05 0 6841 65482.94 0 4965 195681.43 0 2828 98734.15 0 4732 16657.68 1 6210 145490.85 0 5505 80619.17 0 6450 74287.53 0 5407 101693.73 0 7529 157564.75 0 1887 139410.08 0 1590 93536.38 0						
2158 7 118991.79 1 1 1 0 0 3549 5 62055.17 3 1 1 1 1 1 1 5328 7 132944.53 1 1 1 1 0 0 5328 2 138032.15 1 1 1 0 0 5 5 5 5 5 80619.17 0 6450 74287.53 0 1 5 5 6407 101693.73 0 1590 93536.38 0						
3549	7031	0 83287	7.05	2	0	1
3772 7 132944.53 1 1 1 0 5328 2 138032.15 1 1 0 EstimatedSalary Exited 8075 25899.21 1 4957 188187.05 0 6841 65482.94 0 4965 195681.43 0 2828 98734.15 0 4732 16657.68 1 6210 145490.85 0 5505 80619.17 0 6450 74287.53 0 5407 101693.73 0 7529 157564.75 0 1887 139410.08 0 1590 93536.38 0	2158	7 11899	1.79	1	1	1
5328 2 138032.15 1 1 0 EstimatedSalary Exited 8075 25899.21 1 4957 188187.05 0 6841 65482.94 0 4965 195681.43 0 2828 98734.15 0 4732 16657.68 1 6210 145490.85 0 5505 80619.17 0 6450 74287.53 0 5407 101693.73 0 7529 157564.75 0 1887 139410.08 0 1590 93536.38 0	3549	5 62055	5.17	3	1	0
EstimatedSalary Exited 8075	3772	7 13294	4.53	1	1	1
8075 25899.21 1 4957 188187.05 0 6841 65482.94 0 4965 195681.43 0 2828 98734.15 0 4732 16657.68 1 6210 145490.85 0 5505 80619.17 0 6450 74287.53 0 5407 101693.73 0 7529 157564.75 0 1887 139410.08 0 1590 93536.38 0	5328	2 13803	2.15	1	1	0
8075 25899.21 1 4957 188187.05 0 6841 65482.94 0 4965 195681.43 0 2828 98734.15 0 4732 16657.68 1 6210 145490.85 0 5505 80619.17 0 6450 74287.53 0 5407 101693.73 0 7529 157564.75 0 1887 139410.08 0 1590 93536.38 0						
4957 188187.05 0 6841 65482.94 0 4965 195681.43 0 2828 98734.15 0 4732 16657.68 1 6210 145490.85 0 5505 80619.17 0 6450 74287.53 0 5407 101693.73 0 7529 157564.75 0 1887 139410.08 0 1590 93536.38 0	0075					
6841 65482.94 0 4965 195681.43 0 2828 98734.15 0 4732 16657.68 1 6210 145490.85 0 5505 80619.17 0 6450 74287.53 0 5407 101693.73 0 7529 157564.75 0 1887 139410.08 0 1590 93536.38 0						
4965 195681.43 0 2828 98734.15 0 4732 16657.68 1 6210 145490.85 0 5505 80619.17 0 6450 74287.53 0 5407 101693.73 0 7529 157564.75 0 1887 139410.08 0 1590 93536.38 0						
2828 98734.15 0 4732 16657.68 1 6210 145490.85 0 5505 80619.17 0 6450 74287.53 0 5407 101693.73 0 7529 157564.75 0 1887 139410.08 0 1590 93536.38 0						
4732 16657.68 1 6210 145490.85 0 5505 80619.17 0 6450 74287.53 0 5407 101693.73 0 7529 157564.75 0 1887 139410.08 0 1590 93536.38 0						
6210 145490.85 0 5505 80619.17 0 6450 74287.53 0 5407 101693.73 0 7529 157564.75 0 1887 139410.08 0 1590 93536.38 0						
5505 80619.17 0 6450 74287.53 0 5407 101693.73 0 7529 157564.75 0 1887 139410.08 0 1590 93536.38 0						
6450 74287.53 0 5407 101693.73 0 7529 157564.75 0 1887 139410.08 0 1590 93536.38 0						
5407 101693.73 0 7529 157564.75 0 1887 139410.08 0 1590 93536.38 0						
7529 157564.75 0 1887 139410.08 0 1590 93536.38 0						
1887 139410.08 0 1590 93536.38 0						
7579 102255 15 0	1590	93536.	.38 0			
13/0 132233.13 0	7578	192255.	15 0			

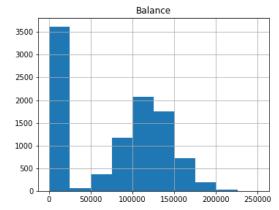
2692	17550.49	0
7031	44147.95	1
2158	156048.64	0
3549	166305.16	1
3772	31802.92	0
5328	166317.71	0

Perform Below Visualizations Univariate Analysis

features =['Age', 'CreditScore', 'Balance']
df[features].hist(figsize=(13, 10));



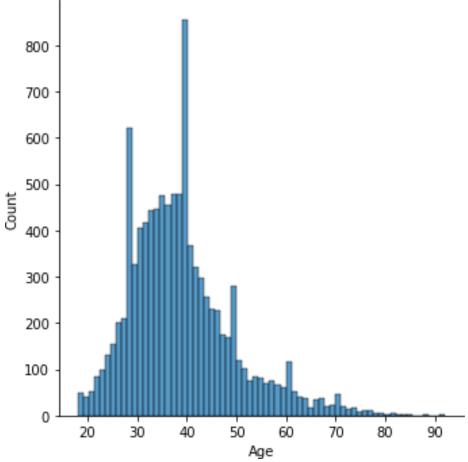




import seaborn as sns

sns.displot(df["Age"])

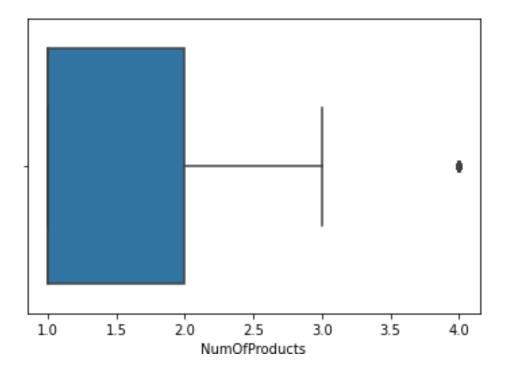
<seaborn.axisgrid.FacetGrid at 0x7fc07c40a350>



sns.boxplot(df["NumOfProducts"])

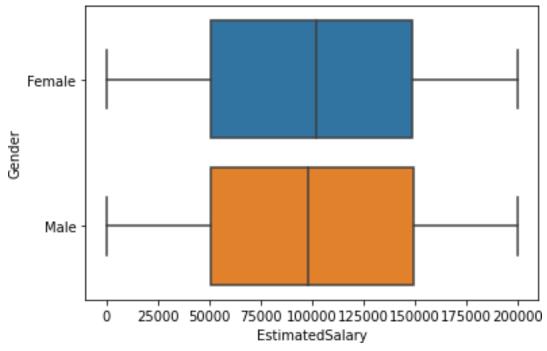
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.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

<matplotlib.axes._subplots.AxesSubplot at 0x7fc0889c6a90>

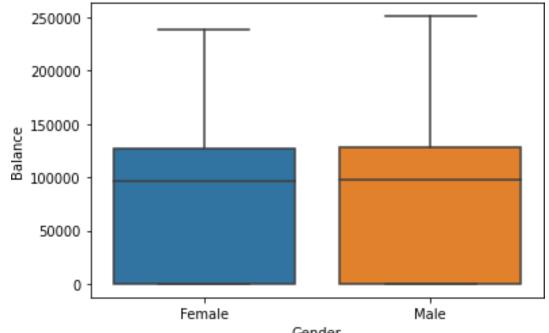


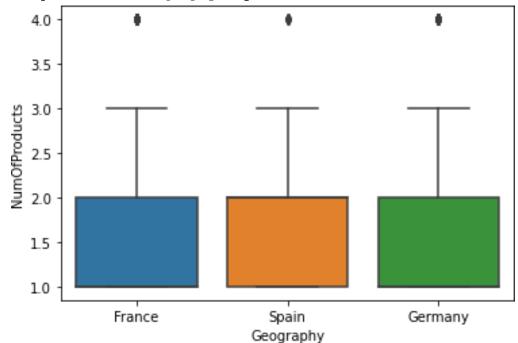
Bivariate Analysis

import seaborn as sns
sns.boxplot(x = df['EstimatedSalary'], y = df['Gender']);



sns.boxplot(x=df['Gender'],y=df['Balance']);





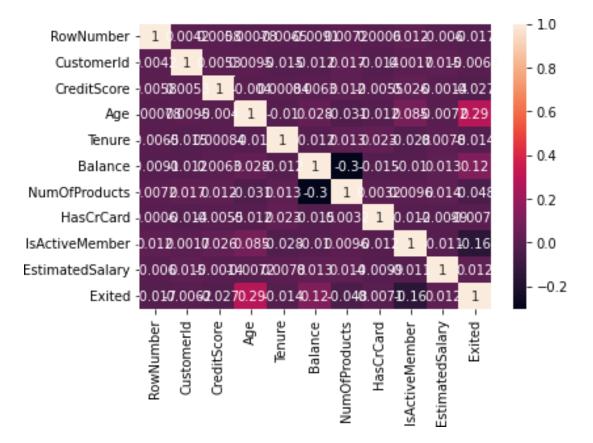
Multivariate Analysis

```
df_1 =
pd.DataFrame(df,columns=['NumOfProducts','EstimatedSalary','Balance'])
corrMatrix = df_1.corr()
sns.heatmap(corrMatrix, annot=True)
plt.show()
```



sns.heatmap(df.corr(),annot = True)

<matplotlib.axes._subplots.AxesSubplot at 0x7fc079668750>



4. Perform descriptive statistics on the dataset.

```
df.describe(include=['object'])
```

```
Surname Geography Gender
                   10000 10000
count
         10000
unique
          2932
                                2
                  France Male
top
         Smith
freq
            32
                       5014 5457
df['CreditScore'].value counts()
df['CreditScore'].value counts().to frame()
df['Geography'].value counts()
France
           5014
Germany
           2509
Spain
        2477 Name:
Geography, dtype: int64
geography counts=df['Geography'].value counts().to frame()
geography counts.rename(columns={'Geography':'value counts'},inplace=T
rue) geography counts
         value counts
France
        5014
```

Germany 2509 Spain 2477

5. Handle the Missing values.

df.shape (10000, 14)

df.isnull()

,	RowNumber	Customer	Id Surname	CreditScore	Geography	Gender	
Age \							
0 False	False	False	False	False	False	False	
1 False	False	False	False	False	False	False	
2 False	False	False	False	False	False	False	
3 False	False	False	False	False	False	False	
4 False	False	False	False	False	False	False	
		• • •	• • •	• • •	• • •	•••	
9995 False	False	False	False	False	False	False	
9996 False	False	False	False	False	False	False	
9997 False	False	False	False	False	False	False	
9998 False	False	False	False	False	False	False	
9999 False	False	False	False	False	False	False	
Ten	ure Balance	NumOfProdu	ucts HasCr(Card IsActive	eMember \		
				False			
		lse		False			
		lse :		False			
		lse :		False			
4 False False False False							

9995FalseFalseFalseFalse9996FalseFalseFalseFalse9997FalseFalseFalseFalse

9998 False EstimatedSalary Exited False False 1 False False 2 False False 3 False False 4 False False 9995 False False 9996 False False 9997 False False 9998 False False 9999 False False [10000 rows x 14 columns] df.notnull() RowNumber CustomerId Surname CreditScore Geography Gender Age \ 0 True 2 True True True True True True 3 True 9995 True True True True True True 9996 True True True True True

True
9997 True True True True True True
9998 True True True True True True
9999 True True True True True True
True

Tenure Balance NumOfProducts HasCrCard IsActiveMember \
True True True True True

```
1 True True True True True
2 True True True True
3 True True True True
4 True True True True True
9995 True True True True True
9996 True True True True True
9997 True True True True True
9998 True True True True
9999 True True True True
9999 True True True True
```

EstimatedSalary Exited

0	True	True		
1	True	True		
2	True	True		
3	True	True		
4	True	True	 	
999	95		True	True
999	96		True	True
999	97		True	True
999	98		True	True
999	99		True	True

[10000 rows x 14 columns]

df.fillna(df.mean())

/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: FutureWarning: Dropping of nuisance columns in DataFrame reductions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError. Select only valid columns before calling the reduction.

"""Entry point for launching an IPython kernel.

	RowNumber	CustomerId	Surnam	e CreditScore Geography Gender
Age \				
0	1	15634602	Hargrave	619 France Female
42				
1	2	15647311	Hill 608	Spain Female
41				
2	3	15619304	Onio 502	France Female
42				
3	4	15701354	Boni 699	France Female
39				
4	5	15737888	Mitchell	850 Spain Female
43				-
		• • •	• • •	

• • •

```
9995
       9996 15606229 Obijiaku 771 France
                                              Male
39
9996
       9997 15569892 Johnstone
                                516 France
                                               Male
35
9997
       9998 15584532 Liu 709 France Female
36
9998
       9999 15682355 Sabbatini
                                772 Germany
                                               Male
42
9999 10000
                                     792 France Female 28
                 15628319 Walker
                Balance NumOfProducts HasCrCard IsActiveMember \
\Omega
         2 0.00 1
                      1
                           1
         1 83807.86
1
                      1
                                1
2
         8 159660.80
3
         1 0.00 2 0 0 4 2 125510.82 1 1 1
... ... ... ... ...
9995
       5 0.00 2
                      1
9996
       10 57369.61
                      1
                           1
                                1
9997
       7
            0.00 1
                      0
9998 3 75075.31 2
                          0 9999 4 130142.79 1
                      1
                                                         1
```

EstimatedSalary Exited

```
101348.88 1
  112542.58 0
 113931.57 1
2
 93826.63
4 79084.10 0 ... ... ...
9995
           96270.64
           101699.77
9996
9997
           42085.58
           92888.52
9998
                     1
9999
           38190.78
                     0
```

[10000 rows x 14 columns]

df.fillna(df.median())

/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: FutureWarning: Dropping of nuisance columns in DataFrame reductions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError. Select only valid columns before calling the reduction.

"""Entry point for launching an IPython kernel.

 $\mbox{RowNumber CustomerId} \qquad \mbox{Surname CreditScore Geography Gender} \\ \mbox{Age } \backslash \\$

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

[10000 rows x 14 columns]

df.isnull().sum

Q1.1511	.u.i. () .bu	111								
<pre><bound method="" ndframeadd_numeric_operations.<locals="">.sum of RowNumber CustomerId Surname CreditScore Geography Gender \</bound></pre>								Age		
0 Fal	se	False Fals	se	False	<u> </u>	False	Fals	е		
False										
1 Fal	se False	False Fal	lse Fal	lse Fa	lse Fa	alse				
2 Fal	se	False	False)	False	<u></u>	False	False	:	
False										
3 Fal	se	False	False)	False	<u></u>	False	False	:	
False										
4 Fal	se	False	False)	False	;	False	False	:	
False										
9995	Fals	e Fals	е	False	<u> </u>	False	9	False	False	
False										
9996	Fals	e Fals	е	False	<u> </u>	False)	False	False	
False										
9997	Fals	e Fals	е	False	<u> </u>	False	9	False	False	
False										
9998	Fals	e Fals	е	False	<u> </u>	False	9	False	False	
False										
9999	Fals	e Fals	е	False	<u> </u>	False)	False	False	
False										
	_								,	
^		Balance Nu							er \	
0	False		False			<u> </u>				
1			False			<u> </u>				
2	False		False		False					
3		False			False		False			
4		False	raise		False		False			
0005			∏alaa						• • •	
9995			False		False False		False			
9996 9997		False False	False False		False		False False			
9998		False	False		False		False			
9999		False	False		False		False			
2222	raise	Talbe	гатье	-	гатье	•	гатье	•		

EstimatedSalary Exited

⁰ False False

¹ False False

² False False

```
3 False False
4 False False ... ...
9995
                False False
9996
                False False
9997
                False False
9998
                False False
9999
                False False
[10000 rows x 14 columns]>
df[df.CreditScore.isnull()] Empty DataFrame
Columns: [RowNumber, CustomerId, Surname, CreditScore, Geography,
Gender, Age, Tenure, Balance, NumOfProducts, HasCrCard,
IsActiveMember, EstimatedSalary,
Exited] Index: []
df.dropna(how='any').shape
(10000, 14)
df.dropna(subset=['CreditScore', 'Tenure'], how='any').shape
(10000, 14)
df.dropna(subset=['CreditScore', 'Tenure'], how='any')
      RowNumber CustomerId
                                  Surname CreditScore Geography Gender
Age \
0
              1
                   15634602 Hargrave
                                          619 France Female
42
1
                   15647311 Hill 608 Spain Female
41
2
              3
                   15619304 Onio 502 France Female
42
3
                   15701354 Boni 699 France Female
39
4
              5
                   15737888 Mitchell
                                          850
                                               Spain Female
43
. . .
                                   . . .
            . . .
                        . . .
                                                 . . .
                                                           . . .
                                                                     . . .
9995
           9996
                   15606229 Obijiaku
                                          771 France
                                                          Male
39
9996
           9997
                   15569892 Johnstone
                                          516 France Male
35
9997
           9998
                   15584532
                              Liu 709 France Female
36
9998
           9999
                   15682355 Sabbatini
                                          772 Germany Male
42
```

```
9999
      10000 15628319 Walker 792 France Female
2.8
            Tenure Balance NumOfProducts HasCrCard IsActiveMember \
          2 0.00 1
0
                      1
                           1
          1 83807.86
1
                      1
2
          8 159660.80
                      3
                           1
          1 0.00 2 0 0 4 2 125510.82 1 1 1
3
           0.00 2
9995
        5
                      1
       10 57369.61
                      1
9996
                           1
                                1
9997
       7
            0.00 1
                     0
                           1
9998
       3 75075.31 2 1 0 9999 4 130142.79 1 1
     EstimatedSalary Exited
  101348.88 1
0
  112542.58 0
1
  113931.57 1
3
 93826.63 0
4 79084.10 0 ... ...
           96270.64
9995
9996
           101699.77
9997
           42085.58
                     1
9998
           92888.52
                     1
9999
           38190.78 0
[10000 rows x 14 columns]
df.dropna(subset=['CreditScore','Tenure'],how='all').shape
(10000, 14)
df.dropna(subset=['CreditScore', 'Tenure'], how='all')
      RowNumber CustomerId Surname CreditScore Geography Gender
Age \
0
            1 15634602 Hargrave 619 France Female
42
1
            2 15647311
                           Hill 608 Spain Female
41
2
            3 15619304
                          Onio 502 France Female
42
3
            4 15701354 Boni 699 France Female
39
4
            5 15737888 Mitchell 850 Spain Female
43
```

. . .

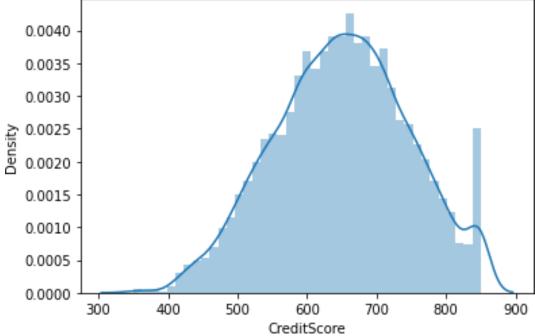
. . .

```
9995
          9996
                  15606229 Obijiaku 771 France Male
39
9996
          9997 15569892 Johnstone 516 France Male
35
9997
          9998 15584532
                           Liu 709 France Female
36
9998
          9999 15682355 Sabbatini 772 Germany Male
42
9999
          10000 15628319
                           Walker
                                      792 France Female
28
     Tenure Balance NumOfProducts HasCrCard IsActiveMember \ 0
                                                                2
  0.00 1
1
          1 83807.86
                       1
                            ()
2
          8 159660.80
                      3
                            1
3
          1 0.00 2 0 0 4 2 125510.82 1 1 1
... ... ... ... ...
9995
       5
           0.00 2
                       1
9996
        10 57369.61
                            1
                       1
                                 1
9997
       7
             0.00 1
                       0
                            1
9998
        3 75075.31 2
                            0 9999 4 130142.79 1
                       1
                                                           1
                                                                0
     EstimatedSalary Exited
0
            101348.88
1
            112542.58
2
            113931.57
3
            93826.63
            79084.10 0
9995
           96270.64
                       0
9996
            101699.77
9997
            42085.58
                       1
9998
            92888.52
                       1
9999
            38190.78
[10000 rows x 14 columns]
6. Find the outliers and replace the outliers
```

. . .

/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. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms). warnings.warn(msg, FutureWarning)

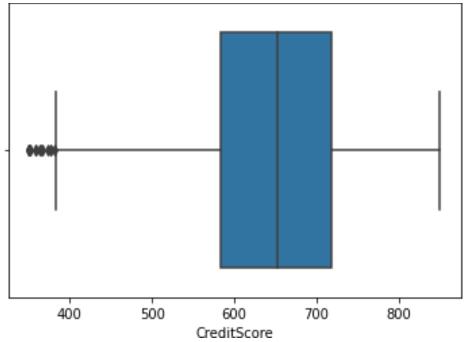
sns.distplot(df['CreditScore'])



sns.boxplot(df['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 keyword will result in an error or misinterpretation. FutureWarning

<matplotlib.axes. subplots.AxesSubplot at 0x7fc07989acd0>



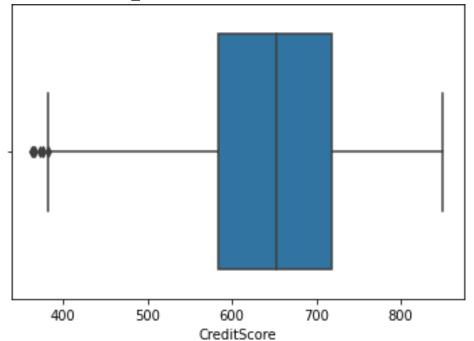
upper_limit = df['CreditScore'].mean() + 3*df['CreditScore'].std()
lower_limit = df['CreditScore'].mean() - 3*df['CreditScore'].std()

```
print('upper limit:', upper limit) print('lower limit:',
 lower limit)
upper limit: 940.488696208391
 lower limit:
 360.568903791609
 df.loc[(df['CreditScore'] > upper limit) | (df['CreditScore'] <</pre>
 lower limit)]
       RowNumber CustomerId Surname CreditScore Geography Gender
 Age \
 1405
          1406 15612494 Panicucci
                                            359
                                                   France Female
 44
 1631
           1632
                  15685372 Azubuike
                                            350
                                                   Spain
                                                           Male
 54
 1838
           1839
                  15758813 Campbell
                                            350 Germany
                                                            Male
 39
                                     358
 1962
          1963 15692416 Aikenhead
                                                    Spain Female
 52
 2473
                              Chou
        2474
                  15679249
                                       351 Germany Female
 57
 8723
           8724 15803202 Onyekachi
                                            350
                                                  France
                                                           Male
 51
 8762
           8763
                 15765173
                               Lin
                                            350
                                                    France Female
 60
 9624
           9625
                 15668309
                          Maslow
                                            350
                                                France Female
 40
             Tenure Balance NumOfProducts HasCrCard IsActiveMember \
           6 128747.69
 1405
                                  1
 1631
           1 152677.48
                                  1
                                                          1
 1838
           0 109733.20
                                            0
                                  2
                                                          0
 1962
           8 143542.36
                                  3
                                            1
                                                          0
 2473
          4 163146.46
                                  1
                                            1
                                                          0
         10
                 0.00
                                  1
                                                          1
 8723
                                            1
 8762 3
             0.00 1 0 0 9624 0 111098.85 1
                                                         1
                                                              1
      EstimatedSalary Exited
 1405
           146955.71
                          1
           191973.49
                          1
 1631
 1838
                          1
           123602.11
 1962
           141959.11
                          1
           169621.69
 2473
                          1
           125823.79
 8723
```

113796.15

/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 keyword will result in an error or misinterpretation. FutureWarning

<matplotlib.axes. subplots.AxesSubplot at 0x7fc0797e5310>

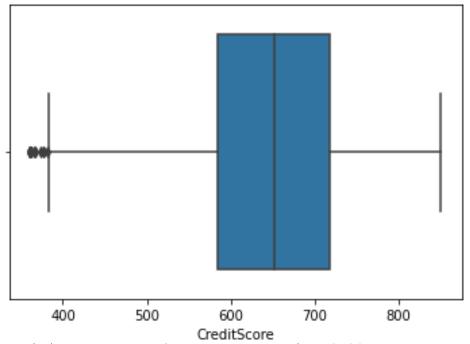


new df = df.copy()

8762

```
new_df.loc[(new_df['CreditScore']>=upper_limit), 'CreditScore'] =
upper_limit
new_df.loc[(new_df['CreditScore']<=lower_limit), 'CreditScore']
= lower limit sns.boxplot(new df['CreditScore'])</pre>
```

/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 keyword will result in an error or misinterpretation. FutureWarning

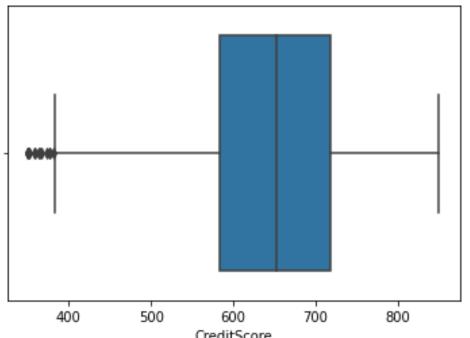


```
upper_limit = df['CreditScore'].quantile(0.99)
  lower_limit = df['CreditScore'].quantile(0.01)
  print('upper limit:', upper_limit)
  print('lower limit:', lower_limit)

upper limit: 850.0 lower
  limit: 432.0
  sns.boxplot(df['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 keyword will result in an error or misinterpretation. FutureWarning

<matplotlib.axes. subplots.AxesSubplot at 0x7fc077c4bd90>



CreditScore
df.loc[(df['CreditScore'] > upper_limit) | (df['CreditScore'] <
 lower_limit)]</pre>

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender
Age \ 7 29	8	15656148	Obinna	3-	76 Germany	Female
29 29	30	15656300	Lucciano	411	France	Male
79 41	80	15803136	Postle	4.5	16 Germany	Female
99 34	100	15633059	Fanucci	413	France	Male
149 32	150	15794413	Harris	416	France	Male
		• • •			• • •	
9357 46	9358	15814405	Chesnokova	418	France	Female
9407 27	9408	15652835	Liang	419	Spain	Female
9522 35	9523	15664504	Beede	418	France	Male
9624 40	9625	15668309	Maslow	350	France	Female
9930 40	9931	15713604	Rossi	425	Germany	Male

Tenure Balance NumOfProducts HasCrCard IsActiveMember \

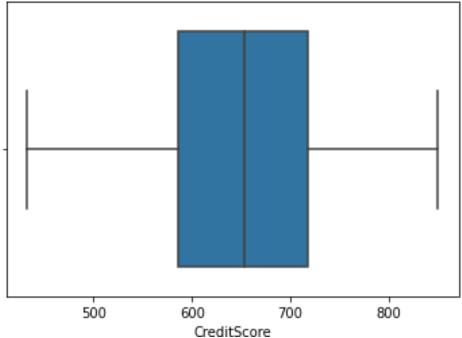
```
7
            4 115046.74
                                      4
                                                   1
                                                                    0
29
             0 59697.17
                                       2
                                                   1
79
           10 122189.66
                                       2
                                                   1
                                                                    0
99 9
         0.00 2
                   0
                          0 149
                                     0
                                           0.00 2
                                                       0
                                                             1
. . .
          . . .
9357
           9
                    0.00
                                       1
                                                   1
                                                                    1
9407
            2 121580.42
                                       1
                                                   0
                                                                    1
9522
           7
                    0.00
                                       2
                                                   1
                                                                    1
9624
           0 111098.85
                                       1
                                                   1
                                                                    1
9930
            9 166776.60
                                       2
                                                   0
                                                                    1
      EstimatedSalary Exited
7
            119346.88
29
             53483.21
                              0
79
             98301.61
                              \Omega
99
               6534.18
                              0
149 878.87 0 ... ...
9357
             81014.50
                             1
9407
            134720.51
                              \Omega
9522
             88878.15
                              0
9624
            172321.21
                              1
9930
            172646.88
[99 rows x 14 columns]
new df = df.loc[(df['CreditScore'] <= upper limit) &</pre>
(df['CreditScore'] >= lower limit)]
print('before removing outliers:', len(df))
print('after removing outliers:',len(new df))
print('outliers:', len(df)-len(new df))
```

before removing outliers: 10000 after removing outliers: 9901 outliers: 99

sns.boxplot(new_df['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 keyword will result in an error or misinterpretation. FutureWarning

<matplotlib.axes. subplots.AxesSubplot at 0x7fc077bc8550>

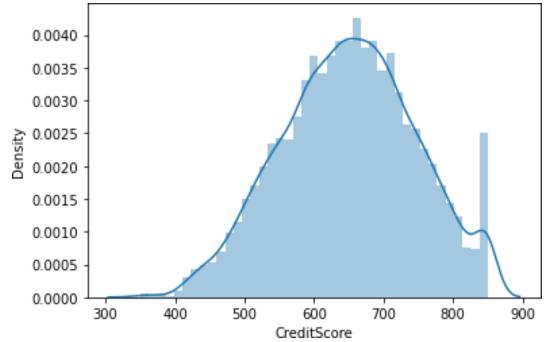


sns.distplot(df['CreditScore'])

/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. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).

warnings.warn(msg, FutureWarning)

<matplotlib.axes._subplots.AxesSubplot at 0x7fc077b2d510>

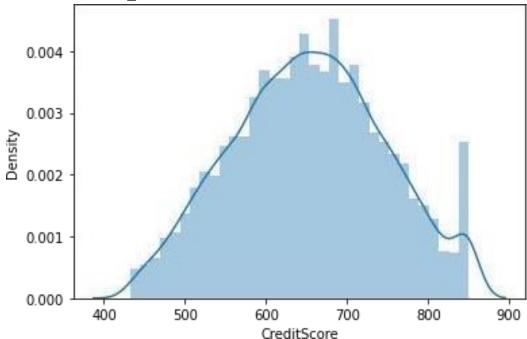


sns.distplot(new df['CreditScore'])

/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. Please adapt your code to use either `displot` (a

figure-level function with similar flexibility) or `histplot` (an
axes-level function for histograms).
 warnings.warn(msq, FutureWarning)

<matplotlib.axes. subplots.AxesSubplot at 0x7fc077c61990>



```
7.) Check for Categorical columns and perform encoding.
df=df.iloc[:,:].values
df
array([[1, 15634602, 'Hargrave', ..., 1, 101348.88, 1],
       [2, 15647311, 'Hill', ..., 1, 112542.58, 0],
       [3, 15619304, 'Onio', ..., 0, 113931.57, 1],
       . . . ,
       [9998, 15584532, 'Liu', ..., 1, 42085.58, 1],
       [9999, 15682355, 'Sabbatini', ..., 0, 92888.52, 1],
       [10000, 15628319, 'Walker', ..., 0, 38190.78, 0]],
dtype=object)
8. Split the data into dependent and independent variables
'https://drive.google.com/file/d/1 HcM0K8wt4b7FMLkc1V1dv0y6I 9ULzy/
view?usp=sharing' path = 'https://drive.google.com/uc?
export=download&id='+url.split('/')[-2] df = pd.read csv(path)
x=df.iloc[:,4:7]
```

Geography Gender Age 0 France

Female 42

1 Spain Female 41

```
2 France Female 42
3 France Female 39 4
                        Spain Female 43 ... ... ...
9995
        France Male 39
        France Male 35 9997 France Female 36
9996
        9998 Germany Male 42 9999 France Female
        28
[10000 rows x 3 columns]
y=df.iloc[:,7]
У
         2
0
1
         1
2
         8
3
                                                                      14
                                                                      14
4 ...
9995
                                                                      28
9996
                                                                      28
9997
         7
9998
         3
9999
         4
Name: Tenure, Length: 10000, dtype: int64 9.
Scale the independent variables
import pandas as pd import
numpy as np import
matplotlib.pyplot as plt df
array([[1, 15634602, 'Hargrave', ..., 1, 101348.88, 1],
       [2, 15647311, 'Hill', ..., 1, 112542.58, 0],
       [3, 15619304, 'Onio', ..., 0, 113931.57, 1],
       [9998, 15584532, 'Liu', ..., 1, 42085.58, 1],
       [9999, 15682355, 'Sabbatini', ..., 0, 92888.52, 1],
       [10000, 15628319, 'Walker', ..., 0, 38190.78, 0]],
dtype=object)
from sklearn.preprocessing import
scale x = scale(X) x
names=X.columns
names
10. Splitting the data into Training and Testing
x=np.array(df['CreditScore']).reshape(-1,1)
```

```
x.shape
  (10000, 1)
  print(x)
  [[619]
   [608]
   [502]
   . . .
   [709]
   [772]
   [792]]
  y.shape
  (10000,)
  print(y)
         2
0
1
         1
2
         8
3
         1
         2
9995
         5
9996
        10
        7
9997
9998
         3
9999
         4
  Name: Tenure, Length: 10000, dtype: int64
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)
  y_train.shape (7000,) y_test.shape (3000,) print(y_train.shape)
  (7000,)
  print(y_test.shape)
```