

Assignment-2

Data  
Visualization  
and Data  
Preprocessing

Assignment Date	03 October 2022
Student Name	Gunasekaran A
Student Roll Number	2127190801023
Maximum Marks	2 Marks

Question-1:

Download the dataset

Solution:

Download the given dataset in the given attached link.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProd	HasCrCard	IsActiveMember	EstimatedSalary	Exited							
1	15634602	Hargrave	619	France	Female	42	2	0	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	159660.8	3	1	0	113931.57	1							
4	15701354	Boni	699	France	Female	39	1	0	2	0	0	93826.63	0							
5	15737888	Mitchell	850	Spain	Female	43	2	125510.82	1	1	1	79084.1	0							
6	15574012	Chu	645	Spain	Male	44	8	113755.78	2	1	0	149756.71	1							
7	15592531	Buerkle	822	France	Male	50	7	0	2	1	1	10062.8	0							
8	15656148	Obinna	376	Germany	Female	29	4	115046.74	4	1	0	119346.88	1							
9	15792365	He	501	France	Male	44	4	142051.07	2	0	1	74940.5	0							
10	15592389	Vij	684	France	Male	27	2	134603.88	1	1	1	71725.73	0							
11	15767821	Beauce	528	France	Male	31	6	102016.72	2	0	0	80181.12	0							
12	15737173	Andrews	497	Spain	Male	24	3	0	2	1	0	76390.01	0							
13	15632284	Kay	476	France	Female	34	10	0	2	1	0	26260.98	0							
14	15601484	Chiu	549	France	Female	25	5	0	2	0	0	190857.79	0							
15	15600882	Scott	635	Spain	Female	35	7	0	2	1	1	65951.65	0							
16	15643969	Gorforth	616	Germany	Male	45	3	143129.41	2	0	1	64327.26	0							
17	15737452	Romeo	653	Germany	Male	58	1	132602.88	1	1	0	5097.67	1							
18	15788218	Henderson	540	Spain	Female	24	9	0	2	1	1	14486.41	0							
19	15661507	Muldown	587	Spain	Male	45	6	0	1	0	0	158684.81	0							
20	15568882	Hao	726	France	Female	24	6	0	2	1	1	54724.03	0							
21	15577657	McDonald	732	France	Male	41	8	0	2	1	1	170886.17	0							
22	15597945	Dellucci	636	Spain	Female	32	8	0	2	1	0	138555.46	0							
23	15699309	Gerasimov	510	Spain	Female	38	4	0	1	1	0	118913.53	1							
24	15725737	Mosman	669	France	Male	46	3	0	2	0	1	8487.75	0							
25	15625047	Yen	846	France	Female	38	5	0	1	1	1	187616.16	0							
26	15738191	Maclean	577	France	Male	25	3	0	2	0	1	124508.29	0							
27	15758416	Young	756	Germany	Male	36	2	136815.64	1	1	1	170041.95	0							
28	15700772	Nebechi	571	France	Male	44	9	0	2	0	0	38433.35	0							
29	15728693	McWilliams	574	Germany	Female	43	3	141349.43	1	1	1	100187.43	0							

Question-2:

Load the dataset

Solution:

df=pd.read\_csv('Churn\_Modelling.csv')

df.head()

IMPORT THE DATA SET INTO DATAFRAME

```
In [2]: df=pd.read_csv('Churn_Modelling.csv')

In [3]: df.head()

Out[3]:
```

	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

### Question 3:

Perform Below Visualizations:

- Univariate analysis
- Bi-variate analysis
- Multi-variate analysis

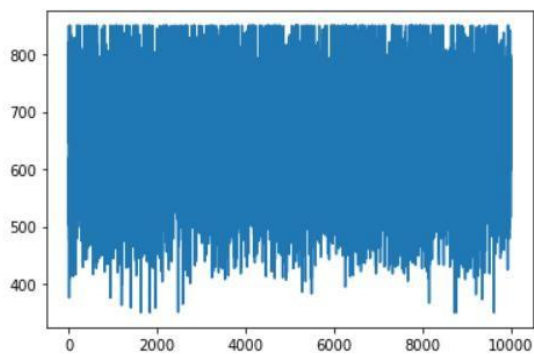
**Solution:**

Univariate analysis:

`df.CreditScore.plot()`

```
#univariate analysis  
df.CreditScore.plot()
```

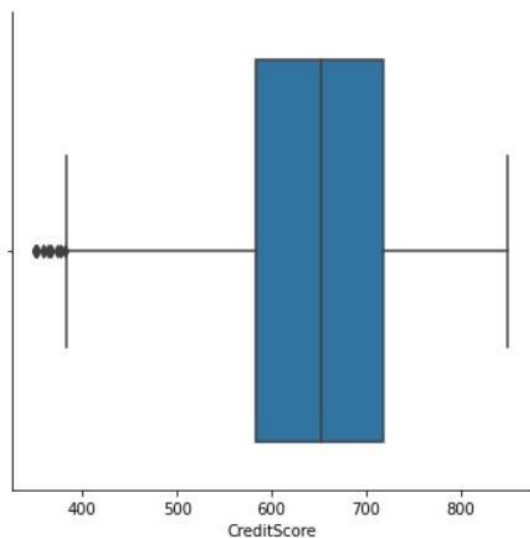
<AxesSubplot:>



`sns.catplot(x='CreditScore',kind='box',data=df)`

```
sns.catplot(x='CreditScore',kind='box',data=df)
```

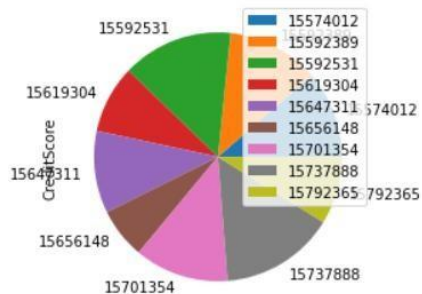
<seaborn.axisgrid.FacetGrid at 0x2ca156c06a0>



```
df[1:10].groupby(['CustomerId']).sum().plot(kind='pie', y='CreditScore')
```

```
df[1:10].groupby(['CustomerId']).sum().plot(kind='pie', y='CreditScore')
```

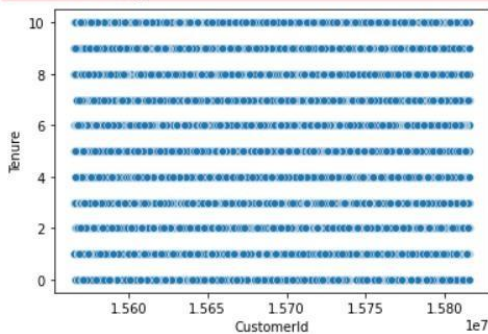
<AxesSubplot:ylabel='CreditScore'>



```
sns.scatterplot(df.CustomerId,df.Tenure)
plt.show()
```

```
sns.scatterplot(df.CustomerId,df.Tenure)
plt.show()
```

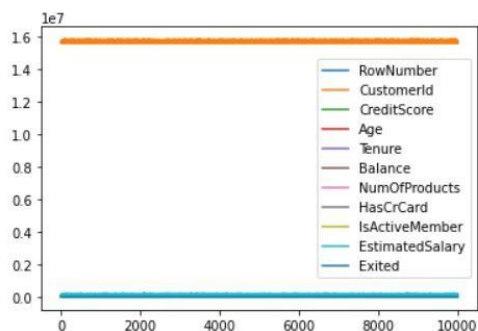
C:\Users\darat\AppData\Local\Programs\Python\Python36\lib\site-packages\seaborn\\_decorators.py:100: FutureWarning: From version 0.12, the only valid positional argument will be `data`, and any other arguments will result in an error or misinterpretation.



```
Multivariate Analysis:
df.plot()
```

```
#multivariate analysis
df.plot()
```

<AxesSubplot:>

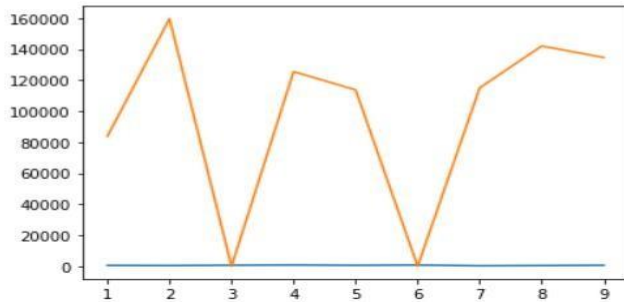


## Bivariate Analysis:

```
df.CreditScore[1:10].plot()  
df.Balance[1:10].plot()
```

```
#bivariate analysis  
df.CreditScore[1:10].plot()  
df.Balance[1:10].plot()
```

<AxesSubplot:>



## Question 4:

Perform descriptive statistics on the dataset.

## Solution:

```
df.describe()
```

```
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

## Question 5:

### Handle the missing values

#### Solution:

`df.isnull().any()`

```
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.isnull().sum()`

## Question 6:

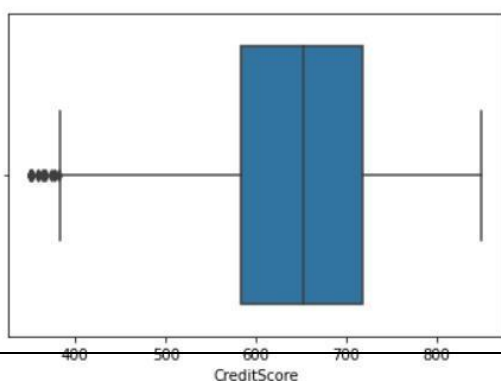
```
#occurence of outliers
sns.boxplot(df.CreditScore)
```

```
C:\Users\darat\AppData\Local\Programs\Python\Python36\lib\site-pack
ord arg: x. From version 0.12, the only valid positional argument w
n an error or misinterpretation.
FutureWarning
<AxesSubplot:xlabel='CreditScore'>
```

**Find the outliers and replace the outliers.**

#### Solution:

```
#occurence of outliers
sns.boxplot(df.CreditScore)
```



```
Q1= df.CreditScore.quantile(0.25)
```

```
Q3=df.CreditScore.quantile(0.75)
```

```
IQR=Q3-Q1
```

```
upper_limit =Q3 + 1.5*IQR
```

```
lower_limit =Q1 - 1.5*IQR
```

```
df['CreditScore'] = np.where(df['CreditScore']>upper_limit,30,df['CreditScore'])
```

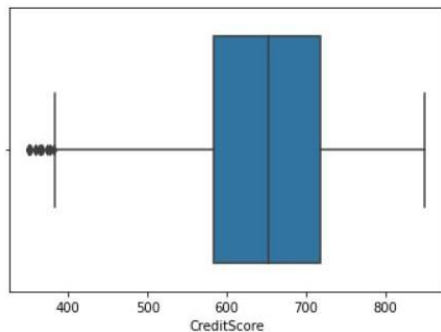
```
sns.boxplot(df.CreditScore)
```

```
sns.boxplot(df.CreditScore)
```

```
C:\Users\darat\AppData\Local\Programs\Python\Python36\lib\site-packages\
ord arg: x. From version 0.12, the only valid positional argument will be
n an error or misinterpretation.
```

```
FutureWarning
```

```
<AxesSubplot:xlabel='CreditScore'>
```



### Question 7:

**Check for Categorical columns and perform encoding.**

**Solution:**

```
#label encoder
```

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

```
le=LabelEncoder()
```

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

```
df.head(5)
```

```
df.head(5)
```

	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

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

```
df_main.head()
```

```
#one hot encoding
df_main=pd.get_dummies(df,columns=['Geography'])
df_main.head()
```

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

### Question 8:

Split the data into dependent and independent variables.

**Solution:**

```
X=df_main.drop(columns=['EstimatedSalary'],axis=1)
```

```
X.head()
```

```
X_scaled=pd.DataFrame(scale(X),columns=X.columns)
```

```
X_scaled.head()
```

```
X=df_main.drop(columns=['EstimatedSalary'],axis=1)
X.head()
X_scaled=pd.DataFrame(scale(X),columns=X.columns)
X_scaled.head()
```

	RowNumber	CustomerId	CreditScore	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	Exited	Geography_France	Geography_Germany
0	-1.731878	-0.783213	-0.326221	-1.095988	0.293517	-1.041760	-1.225848	-0.911583	0.646092	0.970243	1.977165	0.997204	-0.57873
1	-1.731531	-0.606534	-0.440036	-1.095988	0.198164	-1.387538	0.117350	-0.911583	-1.547768	0.970243	-0.505775	-1.002804	-0.57873
2	-1.731185	-0.995885	-1.536794	-1.095988	0.293517	1.032908	1.333053	2.527057	0.646092	-1.030670	1.977165	0.997204	-0.57873
3	-1.730838	0.144767	0.501521	-1.095988	0.007457	-1.387538	-1.225848	0.807737	-1.547768	-1.030670	-0.505775	0.997204	-0.57873
4	-1.730492	0.652659	2.063884	-1.095988	0.388871	-1.041760	0.785728	-0.911583	0.646092	0.970243	-0.505775	-1.002804	-0.57873

```
y=df_main.EstimatedSalary
```

```
y
```

```
y=df_main.EstimatedSalary
y
```

```
0      101348.88
1      112542.58
2      113931.57
3       93826.63
4       79084.10
...
9995    96270.64
9996    101699.77
9997     42085.58
9998     92888.52
9999     38190.78
Name: EstimatedSalary, Length: 10000, dtype: float64
```



### Question 9:

Scale the independent variables.

**Solution:**

from sklearn.preprocessing import scale

X\_scaled=pd.DataFrame(scale(X),columns=X.columns)

X\_scaled.head()

```
X_scaled=pd.DataFrame(scale(X),columns=X.columns)
X_scaled.head()
```

	RowNumber	CustomerId	CreditScore	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	Exited	Geography_France	Geography_Germany
0	-1.731878	-0.783213	-0.326221	-1.095988	0.293517	-1.041760	-1.225848	-0.911583	0.646092	0.970243	1.977165	0.997204	-0.57873
1	-1.731531	-0.606534	-0.440036	-1.095988	0.198164	-1.387538	0.117350	-0.911583	-1.547768	0.970243	-0.505775	-1.002804	-0.57873
2	-1.731185	-0.995885	-1.536794	-1.095988	0.293517	1.032908	1.333053	2.527057	0.646092	-1.030670	1.977165	0.997204	-0.57873
3	-1.730838	0.144767	0.501521	-1.095988	0.007457	-1.387538	-1.225848	0.807737	-1.547768	-1.030670	-0.505775	0.997204	-0.57873
4	-1.730492	0.652659	2.063884	-1.095988	0.388871	-1.041760	0.785728	-0.911583	0.646092	0.970243	-0.505775	-1.002804	-0.57873

### Question 10:

Split the data into training and testing.

**Solution:**

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, 14)

```
X_test.shape
```

(3000, 14)

```
y_train.shape
```

(7000,)

```
y_test.shape
```

(3000,)