Assignment -2

Assignment Date	19 September 2022
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Student Roll Number	210519205042
Maximum Marks	2 Marks

Question 1:

Importing Libraries

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

Queastion 2:

Loading Data Set

```
ds=pd.read_csv(r'C:\Users\veera\Desktop\Assignment 2/Churn_Modelling.csv')

ds.shape

(10000, 14)

ds.head()
```

Row Number	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

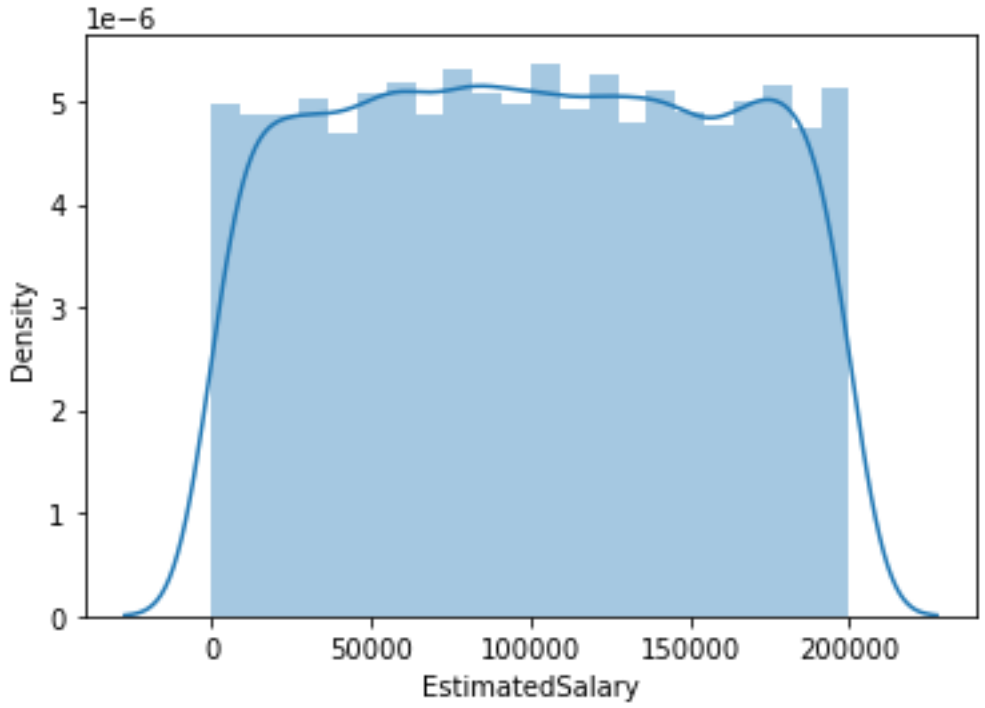
Row Number	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited	
4	5	15737888	Mitchell	850	Spain	Female	43	2	125510.82	1	1	1	79084.10	(

Question 3:

Visualizations

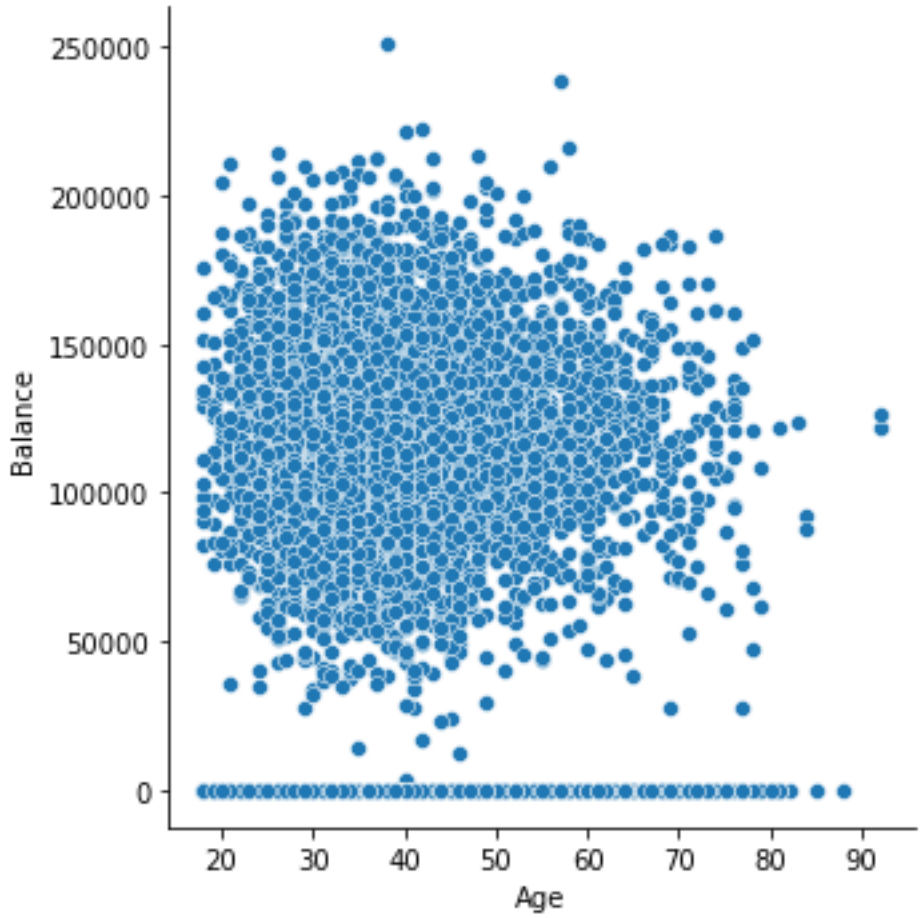
Univariate

```
sns.distplot(ds['EstimatedSalary'],hist=True)

C:\Users\veera\anaconda3\lib\site-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)

<AxesSubplot:xlabel='EstimatedSalary', ylabel='Density'>
```

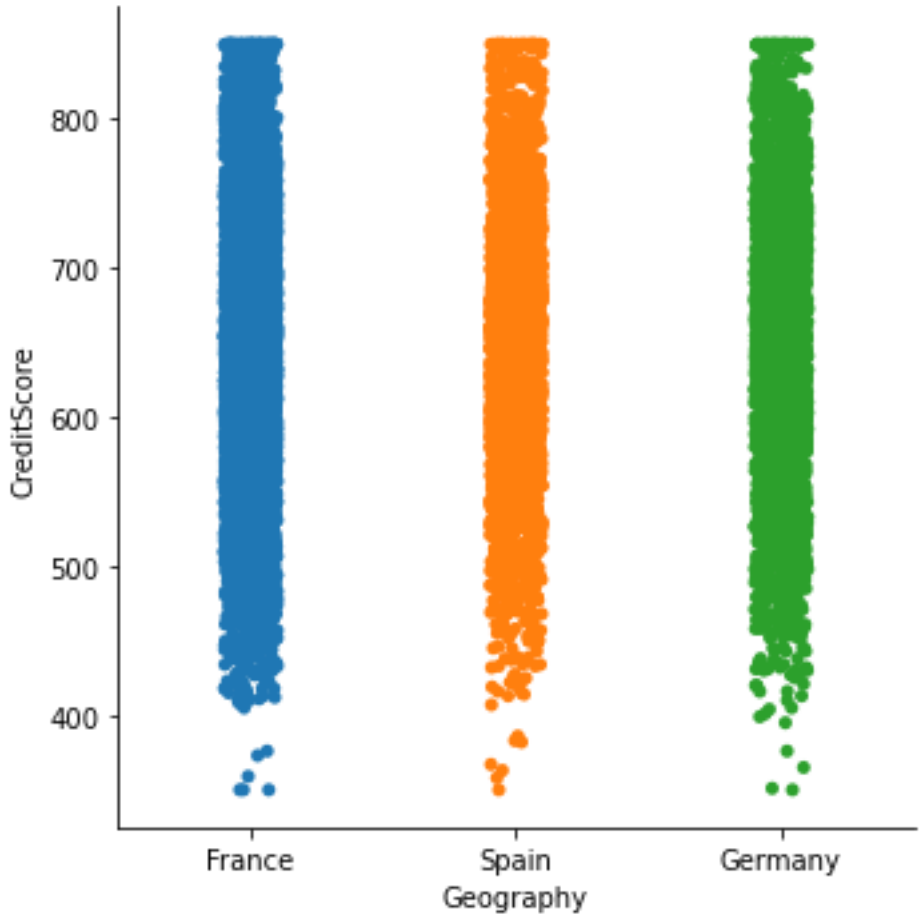


Bivariate

```
sns.relplot(x='Age',y='Balance',data=ds)

<seaborn.axisgrid.FacetGrid at 0x25cfcd45b20>
```

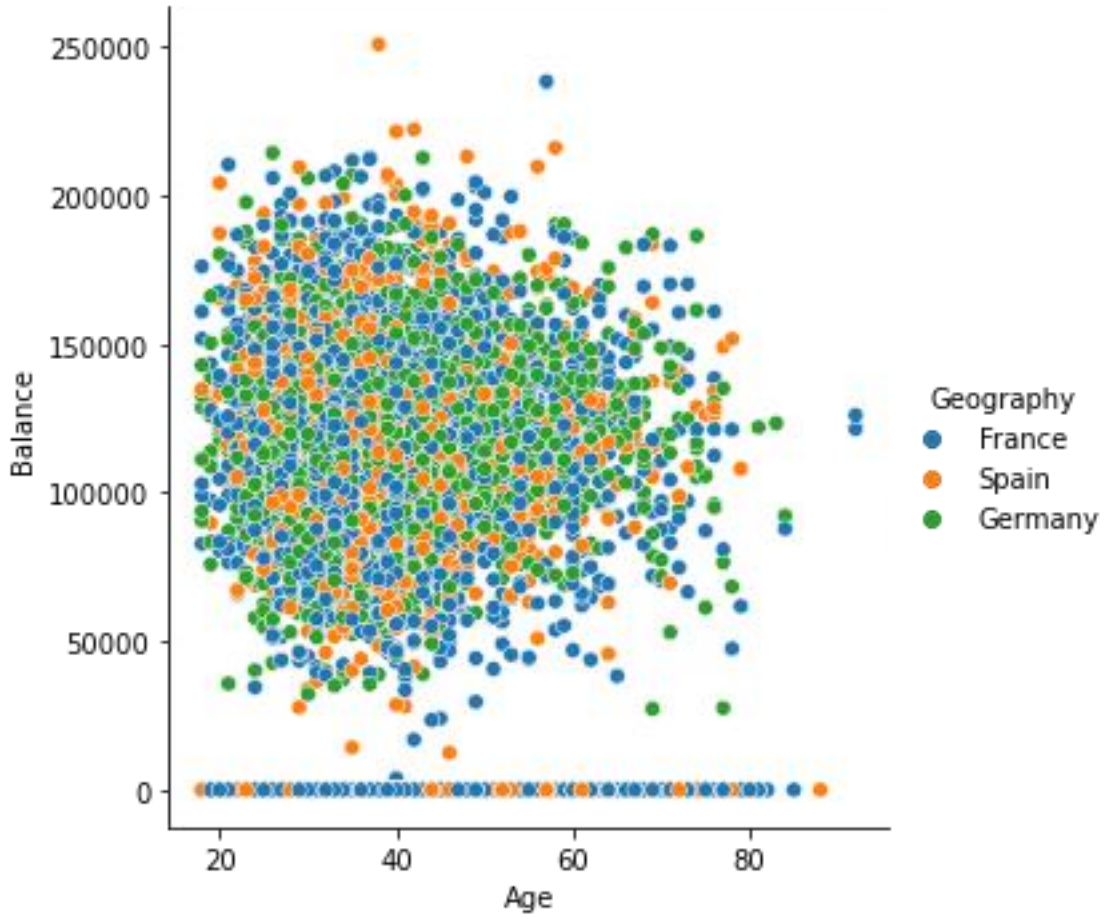



```
#categorical data
sns.catplot(x='Geography',y='CreditScore',data=ds)

<seaborn.axisgrid.FacetGrid at 0x25cfcbe7490>
```

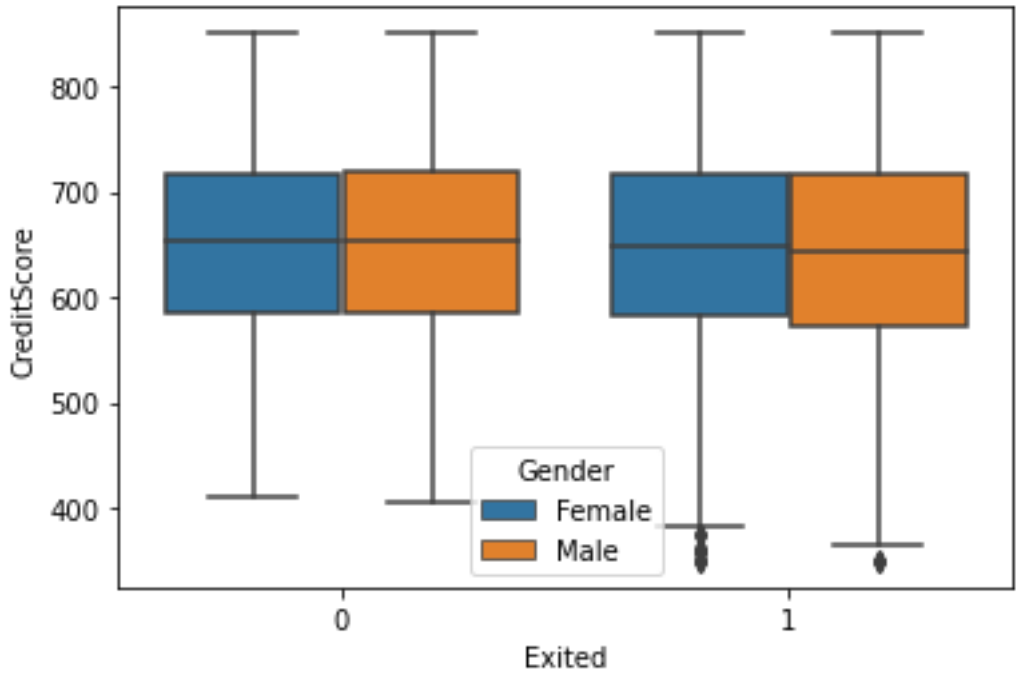


Multivariate

```
sns.relplot(x='Age',y='Balance',hue='Geography',data=ds)

<seaborn.axisgrid.FacetGrid at 0x25cfdd4f310>
```




```
#categorical data
sns.boxplot(x='Exited',y='CreditScore',hue='Gender',data=ds)

<AxesSubplot:xlabel='Exited', ylabel='CreditScore'>
```



Question 4:

Descriptive Statistics

	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

	RowNumber	CustomerId	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
max	10000.00000	1.581569e+07	850.000000	92.000000	10.000000	250898.090000	4.000000	1.00000	1.000000	199992.480000	1.000000

Handling the missing(null) values

```
ds.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
ds.isnull().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
```

Question 5:

Split the data into dependent and independent variables

```
x=ds.iloc[:,3:13].values
print(x.shape)
y=ds.iloc[:,13:14].values
print(y.shape)
```

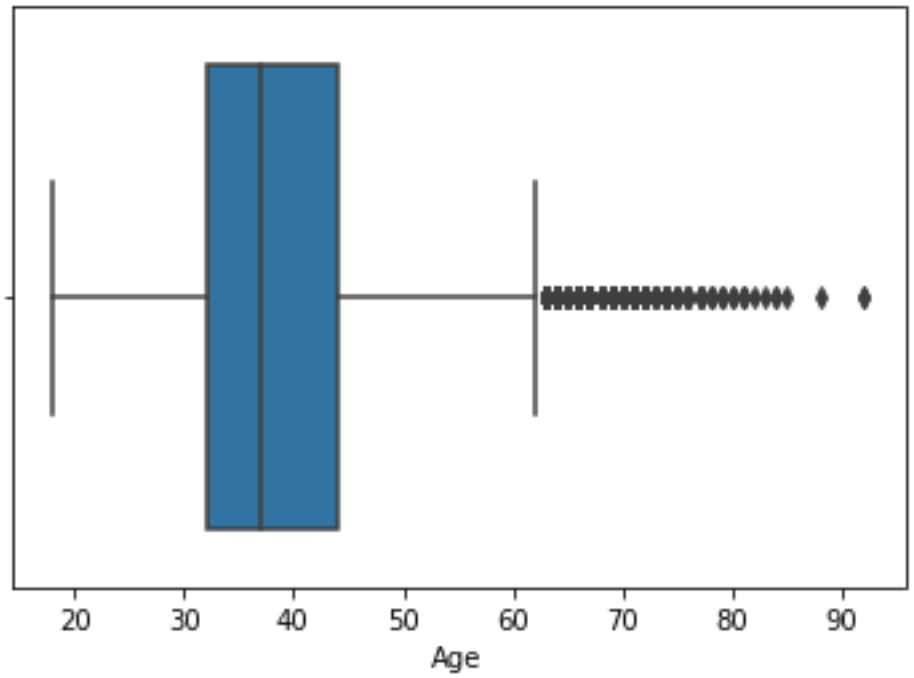
```
(10000, 10)
(10000, 1)
```

Question 6:

Finding and Replacing Outliers

```
ds.skew()

C:\Users\veera\AppData\Local\Temp\ipykernel_5256\4252094064.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.
  ds.skew()
```

```
RowNumber           0.000000
CustomerId          0.001149
CreditScore        -0.071607
Age                 1.011320
Tenure              0.010991
Balance            -0.141109
NumOfProducts       0.745568
HasCrCard          -0.901812
IsActiveMember     -0.060437
EstimatedSalary     0.002085
Exited              1.471611
dtype: float64
sns.boxplot(ds["Age"])
C:\Users\veera\anaconda3\lib\site-packages\seaborn\_decorators.py:36:
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.
  warnings.warn(
<AxesSubplot:xlabel='Age'>
```




```
q0 =
ds["Age"].describe()["25%"]
q1 = ds["Age"].describe()["75%"]
iqr=q1-q0
lb = q0 -(1.5*iqr)
ub = q1 + (1.5*iqr)
ds[ds["Age"]<lb]
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited

```
ds[ds["Age"]>ub]
```

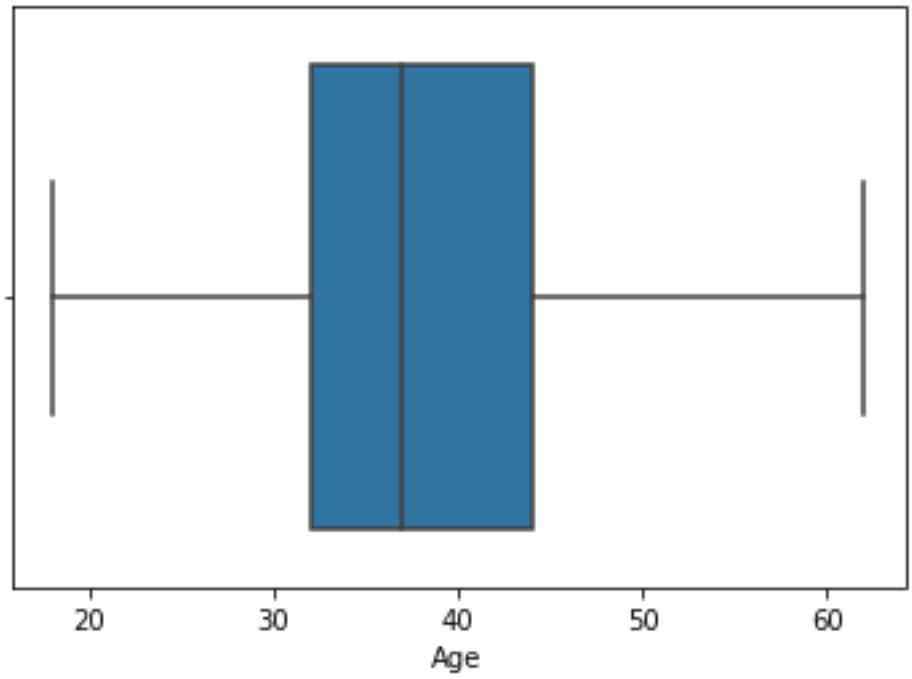
	Row Number	Customer Id	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
58	59	15623944	T'ien	511	Spain	Female	66	4	0.00	1	1	0	1643.11	1
85	86	15805254	Nduka aku	652	Spain	Female	75	10	0.00	2	1	1	114675.75	0
104	105	15804919	Dunbabin	670	Spain	Female	65	1	0.00	1	1	1	177655.68	1
158	159	15589975	Maclean	646	France	Female	73	6	97259.25	1	0	1	104719.66	0
181	182	15789669	Hsia	510	France	Male	65	2	0.00	2	1	1	48071.61	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
9753	9754	15705174	Chiedozie	656	Germany	Male	68	7	153545.11	1	1	1	186574.68	0
9765	9766	15777067	Thomas	445	France	Male	64	2	136770.67	1	0	1	43678.06	0
9832	9833	15814690	Chukwujekwu	595	Germany	Female	64	2	105736.32	1	1	1	89935.73	1
9894	9895	15704795	Vagin	521	France	Female	77	6	0.00	2	1	1	49054.10	0
9936	9937	15653037	Parks	609	France	Male	77	1	0.00	1	0	1	18708.76	0

359 rows × 14 columns

```
#Replacing the outlier
outlier_list = list(ds[ds["Age"] > ub]["Age"])
print(outlier_list)
[66, 75, 65, 73, 65, 72, 67, 67, 79, 80, 68, 75, 66, 66, 70, 63, 72, 64,
64, 70, 67, 82, 63, 69, 65, 69, 64, 65, 74, 67, 66, 67, 63, 70, 71, 72, 67,
74, 76, 66, 63, 66, 68, 67, 63, 71, 66, 69, 73, 65, 66, 64, 69, 64, 77, 74,
65, 70, 67, 69, 67, 74, 69, 74, 74, 64, 63, 63, 70, 74, 65, 72, 77, 66, 65,
74, 88, 63, 71, 63, 64, 67, 70, 68, 72, 71, 66, 75, 67, 73, 69, 76, 63, 85,
67, 74, 76, 66, 69, 66, 72, 63, 71, 63, 74, 67, 72, 72, 66, 84, 71, 66, 63,
74, 69, 84, 67, 64, 68, 66, 77, 70, 67, 79, 67, 76, 73, 66, 67, 64, 73, 76,
72, 64, 71, 63, 70, 65, 66, 65, 80, 66, 63, 63, 63, 63, 66, 74, 69, 63, 64,
76, 75, 68, 69, 77, 64, 66, 74, 71, 67, 68, 64, 68, 70, 64, 75, 66, 64, 78,
65, 74, 64, 64, 71, 77, 79, 70, 81, 64, 68, 68, 63, 79, 66, 64, 70, 69, 71,
72, 66, 68, 63, 71, 72, 72, 64, 78, 75, 65, 65, 67, 63, 68, 71, 73, 64, 66,
71, 69, 71, 66, 76, 69, 73, 64, 64, 75, 73, 71, 72, 63, 67, 68, 73, 67, 64,
63, 92, 65, 75, 67, 71, 64, 66, 64, 66, 67, 77, 92, 67, 63, 66, 66, 68, 65,
72, 71, 76, 63, 67, 67, 66, 67, 63, 65, 70, 72, 77, 74, 72, 73, 77, 67, 71,
64, 72, 81, 76, 69, 68, 74, 64, 64, 71, 68, 63, 67, 63, 64, 76, 63, 63, 68,
67, 72, 70, 81, 67, 73, 66, 68, 71, 66, 63, 75, 69, 64, 69, 70, 71, 71, 66,
70, 63, 64, 65, 63, 67, 71, 67, 65, 66, 63, 73, 66, 64, 72, 71, 69, 67, 64,
81, 73, 63, 67, 74, 83, 69, 71, 78, 63, 70, 69, 72, 70, 63, 74, 80, 69, 72,
67, 76, 71, 67, 71, 78, 63, 63, 68, 64, 70, 78, 69, 68, 64, 64, 77, 77]
outlier_dict = {}.fromkeys(outlier_list,ub)
print(outlier_dict)
{66: 62.0, 75: 62.0, 65: 62.0, 73: 62.0, 72: 62.0, 67: 62.0, 79: 62.0, 80:
62.0, 68: 62.0, 70: 62.0, 63: 62.0, 64: 62.0, 82: 62.0, 69: 62.0, 74: 62.0,
```

```
71: 62.0, 76: 62.0, 77: 62.0, 88: 62.0, 85: 62.0, 84: 62.0, 78: 62.0, 81:
62.0, 92: 62.0, 83: 62.0}
ds["Age"] = ds["Age"].replace(outlier_dict)
sns.boxplot(ds["Age"])
C:\Users\veera\anaconda3\lib\site-packages\seaborn\_decorators.py:36:
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.
  warnings.warn(
<AxesSubplot:xlabel='Age'>
```




```
ds[ds["Age"]>ub]
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited

Question 7:

Check for Categorical columns and perform encoding

```
from sklearn.compose import ColumnTransformer
from sklearn.preprocessing import OneHotEncoder
ct=ColumnTransformer([('oh',OneHotEncoder(),[1,2])],remainder='passthrough')
x=ct.fit_transform(x)
print(x.shape)

(10000, 13)

# saving the data
import joblib
joblib.dump(ct,"churnct.pkl")
```

```
['churnct.pkl']
```

Question 8:

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,y,test_size=0.2,random_state=0)
print(x_train.shape)
print(x_test.shape)

(8000, 13)
(2000, 13)

from sklearn.preprocessing import StandardScaler
sc=StandardScaler()
x_train=sc.fit_transform(x_train)
x_test=sc.transform(x_test)

joblib.dump(sc,"churnsc.pkl")

['churnsc.pkl']
```