**Assignment –2**
**Data Visualization and Pre-processing**

| | |
|---|---|
| Assignment Date | 26 September 2022 |
| Student Name | **Aswathy B B** |
| Student Roll Number | **7376191CS132** |
| Maximum Marks | 2 Marks |

**1. Downloaded the Dataset Churn_Modelling.csv and Uploaded into content folder:**

**Importing Required Libraries:**

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

**2. Loading the dataset:**

```
[ ] ds=pd.read_csv(r'/content/Churn_Modelling.csv')

[ ] ds.shape

    (10000, 14)

[ ] ds.head()
```

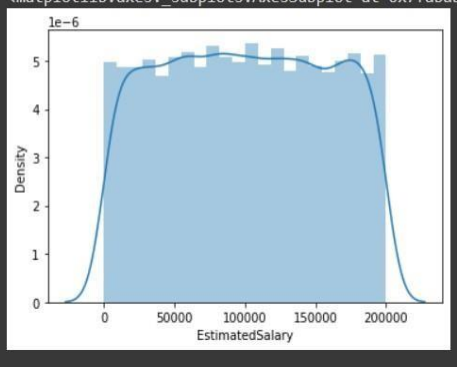
| | RowNumber | CustomerId | Surname | CreditScore | Geography | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveMember | EstimatedSalary | Exited |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 15634602 | Hargrave | 619 | France | Female | 42 | 2 | 0.00 | 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 |

## 3. Performing Visualization on Datasets

### Univariate Analysis

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

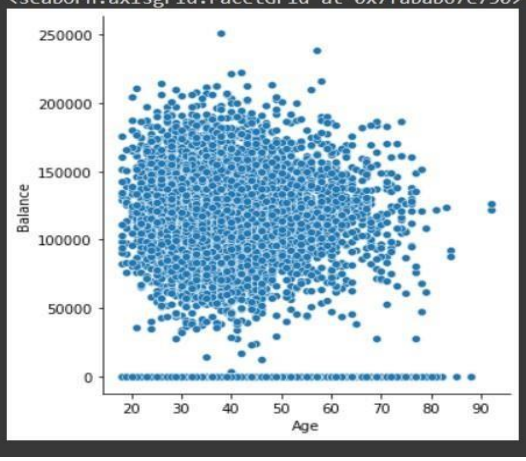
```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2619: FutureWarning: `distplot
  warnings.warn(msg, FutureWarning)
<matplotlib.axes._subplots.AxesSubplot at 0x7fabab6ed690>
```




### Bi-variate Analysis

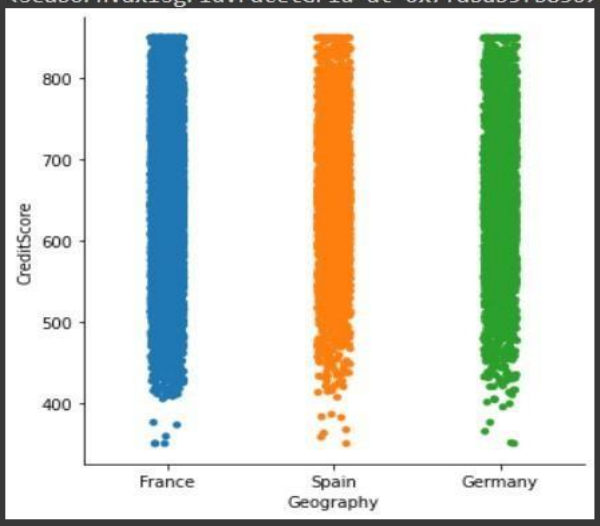
```
[ ]  sns.relplot(x='Age',y='Balance',data=ds)
```

```
<seaborn.axisgrid.FacetGrid at 0x7fabab67e750>
```



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

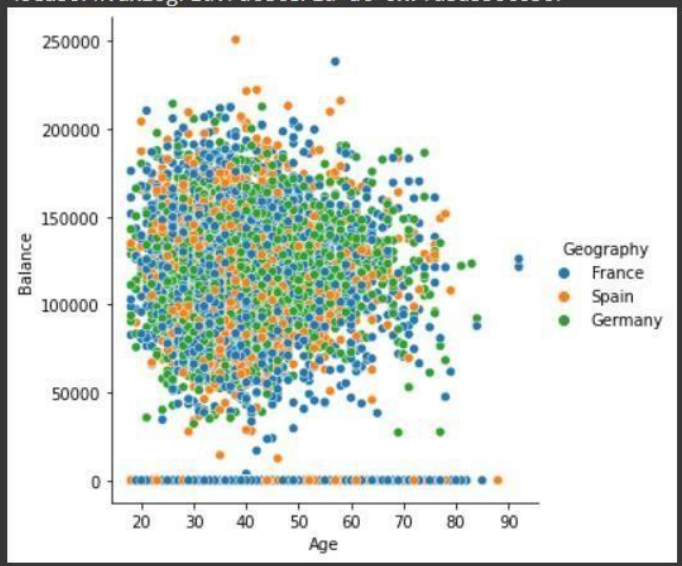
```
<seaborn.axisgrid.FacetGrid at 0x7fabab5fb850>
```




**Multivariate Analysis**

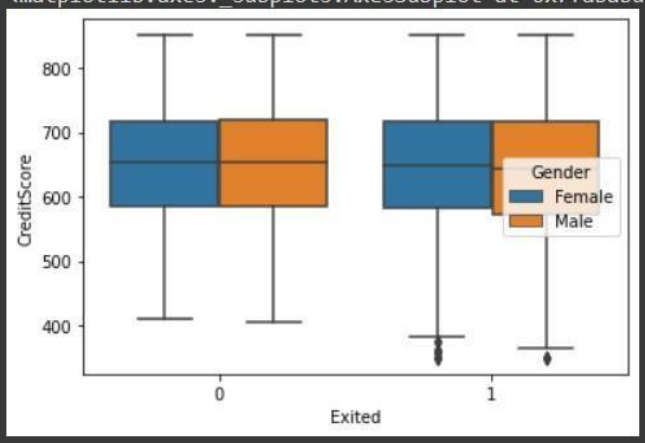
```
[ ]  sns.relplot(x='Age',y='Balance',hue='Geography',data=ds)
```

```
<seaborn.axisgrid.FacetGrid at 0x7fabab56c650>
```



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

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fababd473d0>
```




## 4. Performing Descriptive Statistics on the Dataset

```
[ ]  ds.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 |

## 5. Handling the Missing values

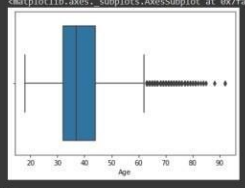
```
[ ]  ds.isnull().any()

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

[ ]  #no null values found , so no need to handle.
```

## 6. Finding the outliers and Replace the outliers:

```
[ ]  ds.skew()

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

/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
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7fabab455610>
```




```
[ ]  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
```

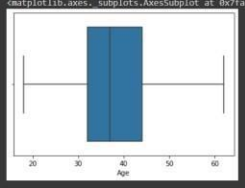
```
[ ] ds[ds["Age"]>ub]
```

| | RowNumber | CustomerId | 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 | Ndukaku | 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 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 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,

[ ] 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:

[ ] ds["Age"] = ds["Age"].replace(outlier_dict)
```

```
sns.boxplot(ds["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
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7fabab310650>
```




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

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

## 7. Check for categorical columns and perform coding:

```
[ ] 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']
```

## 8. 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)
```

## 9. Scale the independent variables:

```
[ ]  from sklearn.preprocessing import StandardScaler
     sc = StandardScaler()
     x_train = sc.fit_transform(x_train)
     x_test = sc.fit_transform(x_test)
     x_train = pd.DataFrame(x_train)
     x_train.head()
```

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | -1.014607 | -0.569844 | 1.743090 | 1.091687 | -1.091687 | 0.169582 | -0.464608 | 0.006661 | -1.215717 | 0.809503 | 0.642595 | -1.032270 | 1.106432 |
| 1 | -1.014607 | 1.754865 | -0.573694 | -0.916013 | 0.916013 | -2.304559 | 0.301026 | -1.377440 | -0.006312 | -0.921591 | 0.642595 | 0.968738 | -0.748664 |
| 2 | 0.985604 | -0.569844 | -0.573694 | 1.091687 | -1.091687 | -1.191196 | -0.943129 | -1.031415 | 0.579935 | -0.921591 | 0.642595 | -1.032270 | 1.485335 |
| 3 | -1.014607 | -0.569844 | 1.743090 | -0.916013 | 0.916013 | 0.035566 | 0.109617 | 0.006661 | 0.473128 | -0.921591 | 0.642595 | -1.032270 | 1.276528 |
| 4 | -1.014607 | -0.569844 | 1.743090 | 1.091687 | -1.091687 | 2.056114 | 1.736588 | 1.044737 | 0.810193 | 0.809503 | 0.642595 | 0.968738 | 0.558378 |

## 10. 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)
```