**Assignment -2**

Data Visualization & Pre-processing

| | |
|---|---|
| Assignment Date | 22 September 2022 |
| Student Name | Miss.Kiruthika M |
| Student Roll Number | 620119106043 |
| Maximum Marks | 2 Marks |

**Question-1:**

# 1.Dataset downloaded as "model.csv"

# 2.Load the dataset

```
#importing lbraries
import pandas as pd
#load the dataset
df=pd.read_csv("model.csv")
df
```

Out[7]:

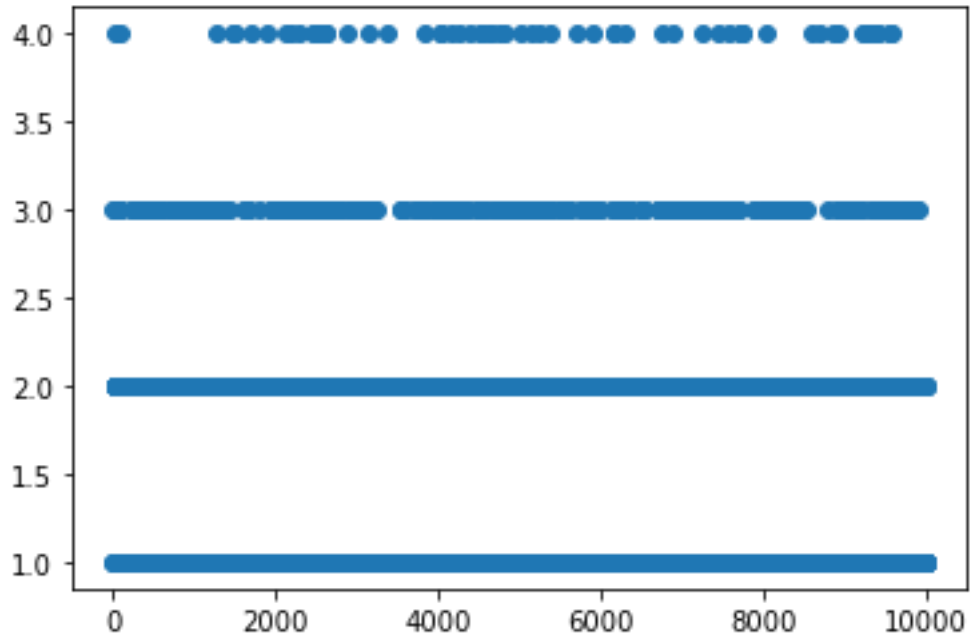
| | RowNumber | CustomerId | Surname | CreditScore | Geography | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveMember | EstimatedSalary | Exited |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 1 | 15634602 | Hargrave | 619 | France | Female | 42 | 2 | 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 |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| **9995** | 9996 | 15606229 | Obijiaku | 771 | France | Male | 39 | 5 | 0.00 | 2 | 1 | 0 | 96270.64 | 0 |
| **9996** | 9997 | 15569892 | Johnstone | 516 | France | Male | 35 | 10 | 57369.61 | 1 | 1 | 1 | 101699.77 | 0 |
| **9997** | 9998 | 15584532 | Liu | 709 | France | Female | 36 | 7 | 0.00 | 1 | 0 | 1 | 42085.58 | 1 |
| **9998** | 9999 | 15682355 | Sabbatini | 772 | Germany | Male | 42 | 3 | 75075.31 | 2 | 1 | 0 | 92888.52 | 1 |
| **9999** | 10000 | 15628319 | Walker | 792 | France | Female | 28 | 4 | 130142.79 | 1 | 1 | 0 | 38190.78 | 0 |

10000 rows × 14 columns

# 3. Perform Below Visualizations

# 3.1 Univariate Analysis

```
#scatterplot
import matplotlib.pyplot as plt
import pandas as pd
import seaborn as sns
#load the dataset
df=pd.read_csv("model.csv")
plt.scatter(df.index,df['NumOfProducts'])
plt.show()
```

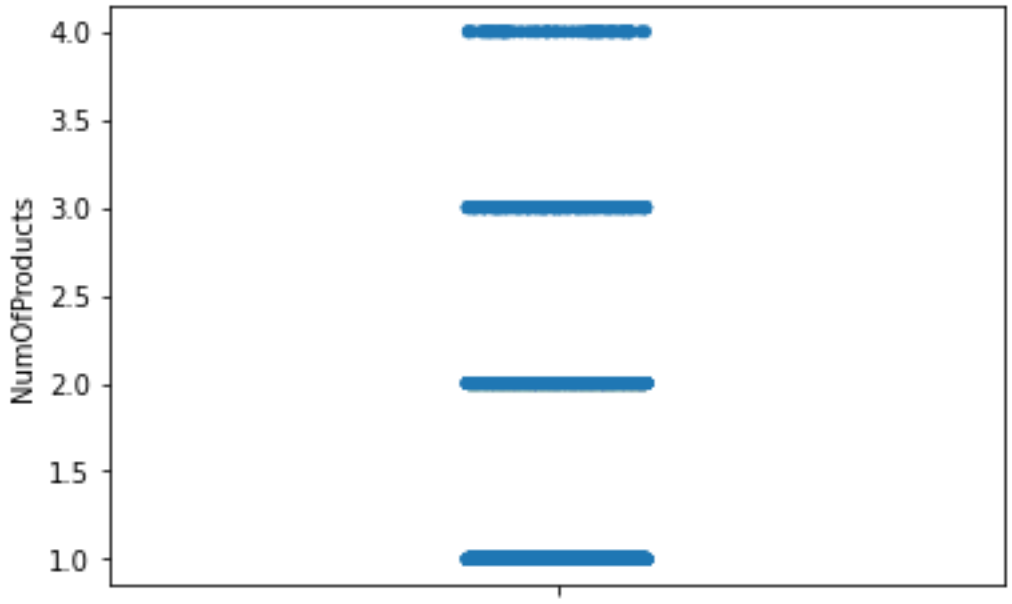



*#strip plot*

```
sns.stripplot(y=df['NumOfProducts'])
```

```
<AxesSubplot:ylabel='NumOfProducts'>
```

Out[7]

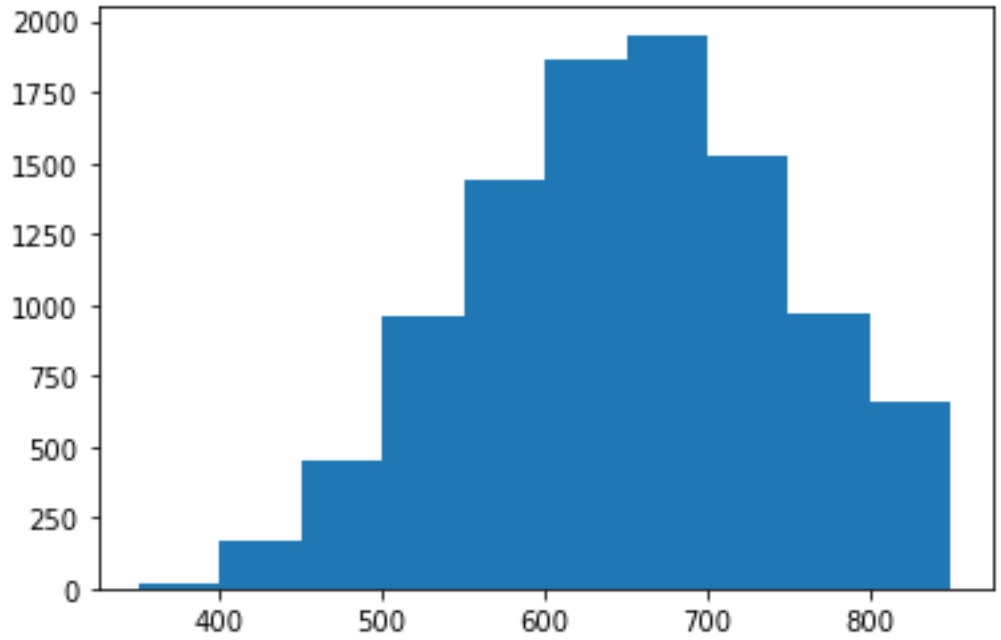



*#histogram*

```
plt.hist(df['CreditScore'])
```

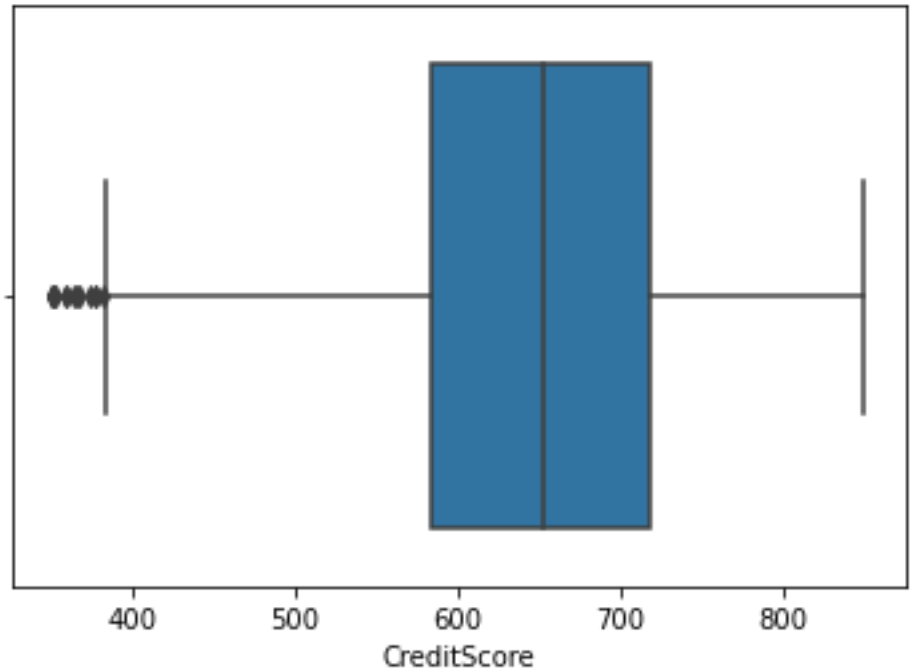
Out[8]:

```
(array([  19.,  166.,  447.,  958., 1444., 1866., 1952., 1525.,  968.,
         655.]),
 array([350., 400., 450., 500., 550., 600., 650., 700., 750., 800., 850.]),
 <BarContainer object of 10 artists>)
```



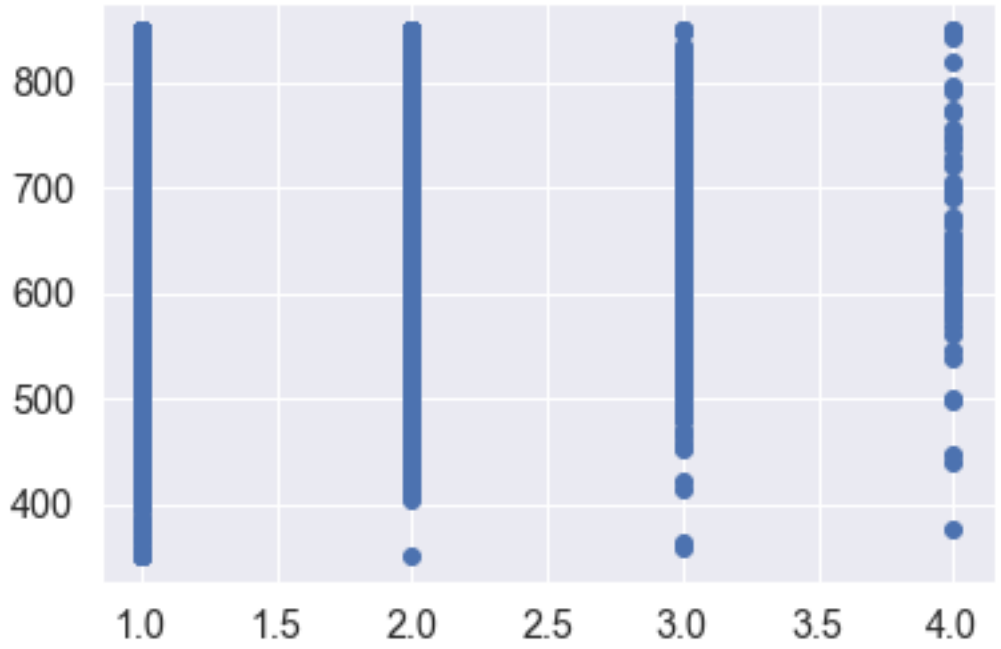

*#boxplot*
sns.boxplot(df['CreditScore'])

C:\ProgramData\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(
Out[10]:
<AxesSubplot:xlabel='CreditScore'>



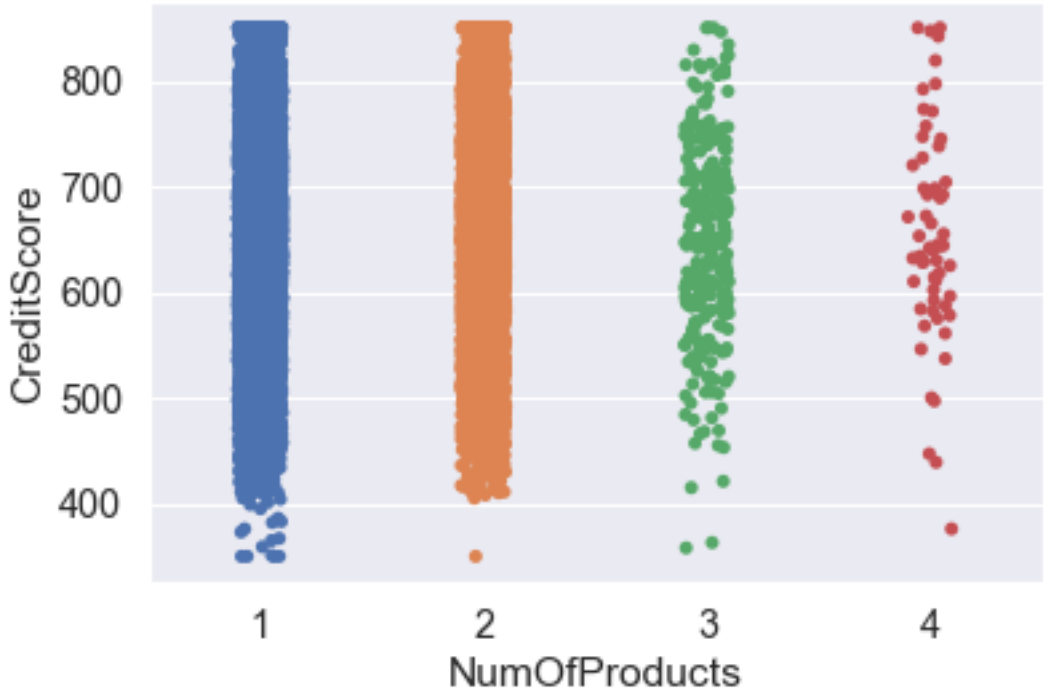

# 3.2 Bivariate Analysis

In [21]:
*#scatter plot*
plt.scatter(df.NumOfProducts,df.CreditScore)
plt.show()




In [22]:
*#strip plot*
sns.stripplot(x=df['NumOfProducts'],y=df['CreditScore'])

Out[22]:
<AxesSubplot:xlabel='NumOfProducts', ylabel='CreditScore'>




# 3.3 Mulitivariate Analysis

In [12]:

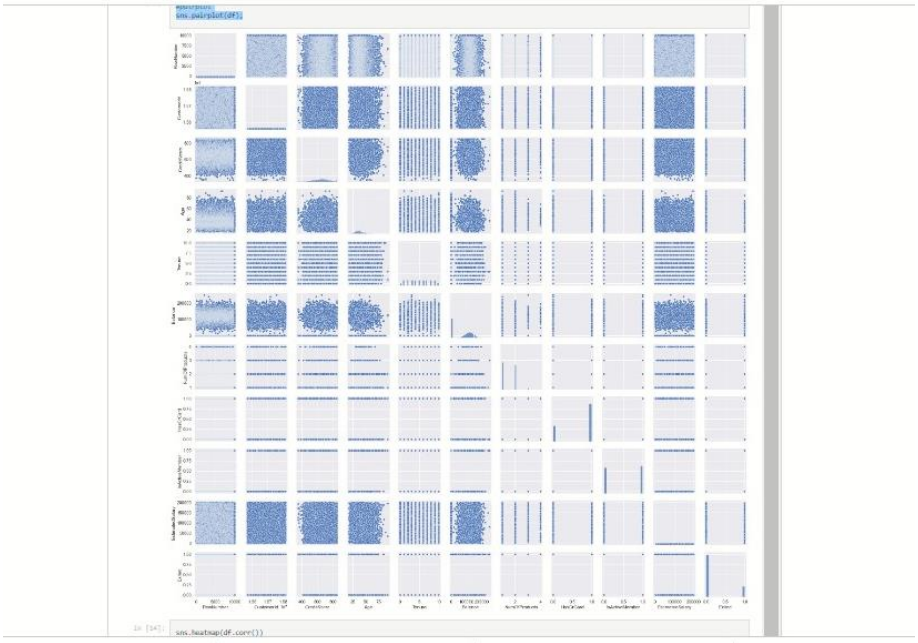
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

sns.set_style('darkgrid')
sns.set(font_scale=1.3)

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

Out[12]:

| | 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 |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| **9995** | 9996 | 15606229 | Obijiaku | 771 | France | Male | 39 | 5 | 0.00 | 2 | 1 | 0 | 96270.64 | 0 |
| **9996** | 9997 | 15569892 | Johnstone | 516 | France | Male | 35 | 10 | 57369.61 | 1 | 1 | 1 | 101699.77 | 0 |
| **9997** | 9998 | 15584532 | Liu | 709 | France | Female | 36 | 7 | 0.00 | 1 | 0 | 1 | 42085.58 | 1 |
| **9998** | 9999 | 15682355 | Sabbatini | 772 | Germany | Male | 42 | 3 | 75075.31 | 2 | 1 | 0 | 92888.52 | 1 |
| **9999** | 10000 | 15628319 | Walker | 792 | France | Female | 28 | 4 | 130142.79 | 1 | 1 | 0 | 38190.78 | 0 |

10000 rows × 14 columns

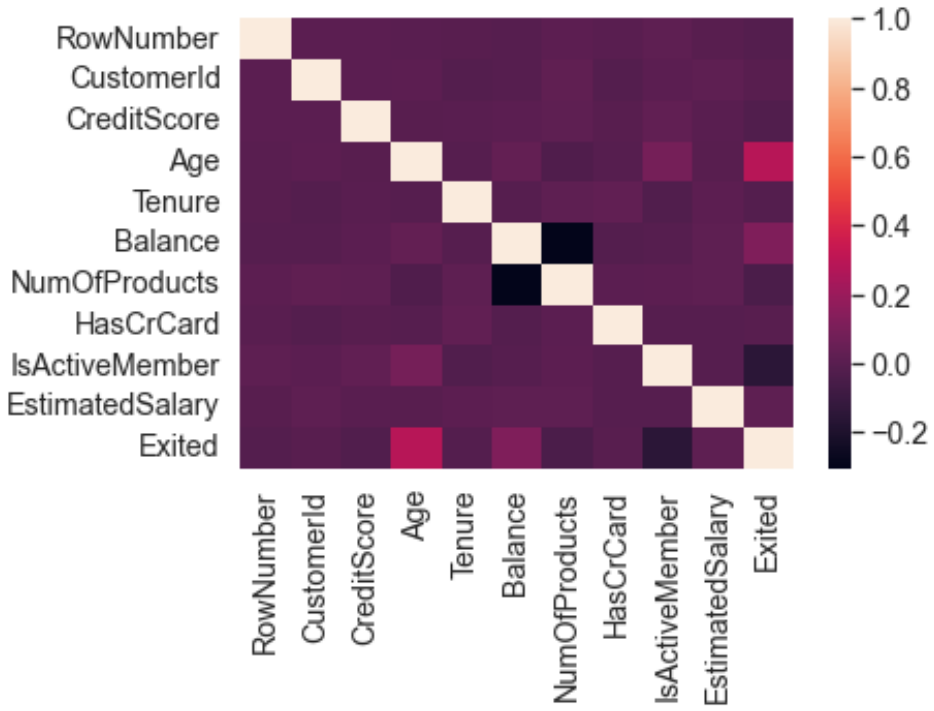
```
#pairplot
sns.pairplot(df);
```



```
sns.heatmap(df.corr())
```

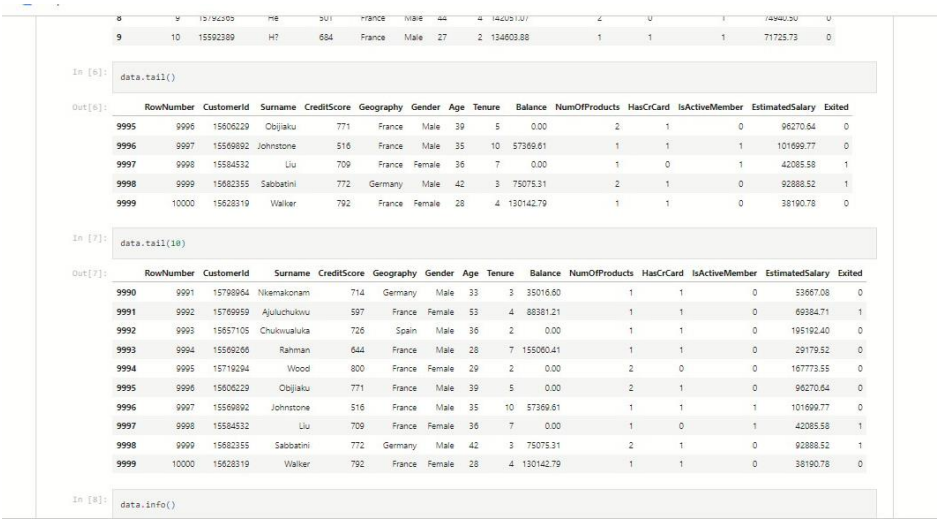
<AxesSubplot:>

Out[14]:




# 4. Perform descriptive statistics on the dataset.

*#load the dataset*
**import** pandas **as** pd
data=pd.read_csv("model.csv")
data.head()



```
In [6]: data.tail()
```

Out[6]:

| | RowNumber | CustomerId | Surname | CreditScore | Geography | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveMember | EstimatedSalary | Exited |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9995 | 9996 | 15606229 | Obijiaku | 771 | France | Male | 39 | 5 | 0.00 | 2 | 1 | 0 | 96270.64 | 0 |
| 9996 | 9997 | 15569892 | Johnstone | 516 | France | Male | 35 | 10 | 57369.61 | 1 | 1 | 1 | 101699.77 | 0 |
| 9997 | 9998 | 15584532 | Liu | 709 | France | Female | 36 | 7 | 0.00 | 1 | 0 | 1 | 42085.58 | 1 |
| 9998 | 9999 | 15682355 | Sabbatini | 772 | Germany | Male | 42 | 3 | 75075.31 | 2 | 1 | 0 | 92888.52 | 1 |
| 9999 | 10000 | 15628319 | Walker | 792 | France | Female | 28 | 4 | 130142.79 | 1 | 1 | 0 | 38190.78 | 0 |

```
In [7]: data.tail(10)
```

Out[7]:

| | RowNumber | CustomerId | Surname | CreditScore | Geography | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveMember | EstimatedSalary | Exited |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9990 | 9991 | 15798964 | Nkemakonam | 714 | Germany | Male | 33 | 3 | 35016.60 | 1 | 1 | 0 | 53667.08 | 0 |
| 9991 | 9992 | 15769959 | Ajuluchukwu | 597 | France | Female | 53 | 4 | 88381.21 | 1 | 1 | 0 | 69384.71 | 1 |
| 9992 | 9993 | 15657105 | Chukwualuka | 726 | Spain | Male | 36 | 2 | 0.00 | 1 | 1 | 0 | 195192.40 | 0 |
| 9993 | 9994 | 15569266 | Rahman | 644 | France | Male | 28 | 7 | 155060.41 | 1 | 1 | 0 | 29179.52 | 0 |
| 9994 | 9995 | 15719294 | Wood | 800 | France | Female | 29 | 2 | 0.00 | 2 | 0 | 0 | 167773.55 | 0 |
| 9995 | 9996 | 15606229 | Obijiaku | 771 | France | Male | 39 | 5 | 0.00 | 2 | 1 | 0 | 96270.64 | 0 |
| 9996 | 9997 | 15569892 | Johnstone | 516 | France | Male | 35 | 10 | 57369.61 | 1 | 1 | 1 | 101699.77 | 0 |
| 9997 | 9998 | 15584532 | Liu | 709 | France | Female | 36 | 7 | 0.00 | 1 | 0 | 1 | 42085.58 | 1 |
| 9998 | 9999 | 15682355 | Sabbatini | 772 | Germany | Male | 42 | 3 | 75075.31 | 2 | 1 | 0 | 92888.52 | 1 |
| 9999 | 10000 | 15628319 | Walker | 792 | France | Female | 28 | 4 | 130142.79 | 1 | 1 | 0 | 38190.78 | 0 |

```
In [8]: data.info()
```

Out[4]:

| | 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 |

In [5]:
```
data.head(10)
```

Out[5]:

| | 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 | 6 | 15574012 | Chu | 645 | Spain | Male | 44 | 8 | 113755.78 | 2 | 1 | 0 | 149756.71 | 1 |
| 6 | 7 | 15592531 | Bartlett | 822 | France | Male | 50 | 7 | 0.00 | 2 | 1 | 1 | 10062.80 | 0 |
| 7 | 8 | 15656148 | Obinna | 376 | Germany | Female | 29 | 4 | 115046.74 | 4 | 1 | 0 | 119346.88 | 1 |
| 8 | 9 | 15792365 | He | 501 | France | Male | 44 | 4 | 142051.07 | 2 | 0 | 1 | 74940.50 | 0 |

```
<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
```

In [9]:
```
data.shape
```

Out[9]:
```
(10000, 14)
```

In [10]:
```
data.mean()
```

```
C:\Users\janar vijay\AppData\Local\Temp\ipykernel_5088\531903386.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.
  data.mean()
```

Out[10]:
```
RowNumber          5.000500e+03
CustomerId         1.569094e+07
CreditScore        6.505288e+02
Age                3.892180e+01
Tenure             5.012800e+00
Balance            7.648589e+04
NumOfProducts      1.530200e+00
HasCrCard          7.055000e-01
IsActiveMember     5.151000e-01
```

```
C:\Users\janar vijay\AppData\Local\Temp\ipykernel_5088\4184645713.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.
  data.median()
```

Out[11]:
```
RowNumber          5.000500e+03
CustomerId         1.569074e+07
CreditScore        6.520000e+02
Age                3.700000e+01
Tenure             5.000000e+00
Balance            9.719854e+04
NumOfProducts      1.000000e+00
HasCrCard          1.000000e+00
IsActiveMember     1.000000e+00
EstimatedSalary    1.001939e+05
Exited             0.000000e+00
dtype: float64
```

In [12]:
```
data.mode()
```

Out[12]:

| | RowNumber | CustomerId | Surname | CreditScore | Geography | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveMember | EstimatedSalary | Exited |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 15565701 | Smith | 850.0 | France | Male | 37.0 | 2.0 | 0.0 | 1.0 | 1.0 | 1.0 | 24924.92 | 0.0 |
| 1 | 2 | 15565706 | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN |
| 2 | 3 | 15565714 | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN |
| 3 | 4 | 15565779 | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN |
| 4 | 5 | 15565796 | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 9995 | 9996 | 15815628 | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN |
| 9996 | 9997 | 15815645 | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN |
| 9997 | 9998 | 15815656 | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN |
| 9998 | 9999 | 15815660 | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN |
| 9999 | 10000 | 15815690 | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN |

10000 rows × 14 columns

we ca see the wealthier passengers in the higher classes tend to be older,which makes sense average age

values to impute based on Pclass for Age

In [29]:
```
def impute_age(cols):
    Age=cols[0]
    Pclass=cols[1]

    if pd.isnull(Age):

        if Pclass==1:
            return 37

        elif Pclass ==2:
            return 29

        else:
            return 24
    else:
        return Age
```

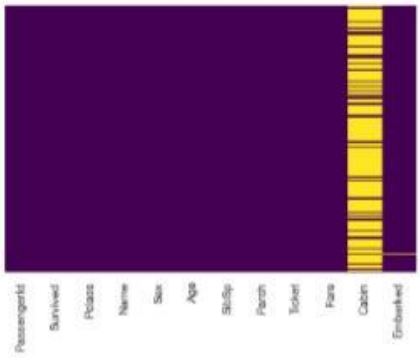
Now Apply This Function

In [30]:
```
train['Age'] = train[['Age','Pclass']].apply(impute_age,axis=1)
```

Now let's check Heapmap Again..

In [31]:
```
sns.heatmap(train.isnull(),yticklabels=False,cbar=False,cmap='viridis')
```

Out[31]:
```
<AxesSubplot:>
```




Now The Age Missing Values Can be Handled.

## 6. Find the outliers and replace the outliers

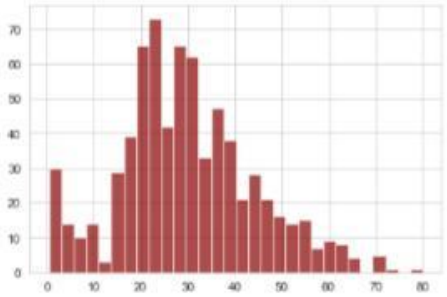
In [16]:
```
#import libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt

#load the dataset
df=pd.read_csv('model.csv')
df
```

Out[16]:

| | RowNumber | CustomerId | Surname | CreditScore | Geography | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 15634602 | Hargrave | 619 | France | Female | 42 | 2 | 0.00 | 1 | 1 | |
| 1 | 2 | 15647311 | Hill | 608 | Spain | Female | 41 | 1 | 83807.86 | 1 | 0 | |
| 2 | 3 | 15619304 | Onio | 502 | France | Female | 42 | 8 | 159660.80 | 3 | 1 | |
| 3 | 4 | 15701354 | Boni | 699 | France | Female | 39 | 1 | 0.00 | 2 | 0 | |
| 4 | 5 | 15737888 | Mitchell | 850 | Spain | Female | 43 | 2 | 125510.82 | 1 | 1 | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 9995 | 9996 | 15606229 | Obijiaku | 771 | France | Male | 39 | 5 | 0.00 | 2 | 1 | |
| 9996 | 9997 | 15569892 | Johnstone | 516 | France | Male | 35 | 10 | 57369.61 | 1 | 1 | |
| 9997 | 9998 | 15584532 | Liu | 709 | France | Female | 36 | 7 | 0.00 | 1 | 0 | |
| 9998 | 9999 | 15682355 | Sabbatini | 772 | Germany | Male | 42 | 3 | 75075.31 | 2 | 1 | |
| 9999 | 10000 | 15628319 | Walker | 792 | France | Female | 28 | 4 | 130142.79 | 1 | 1 | |

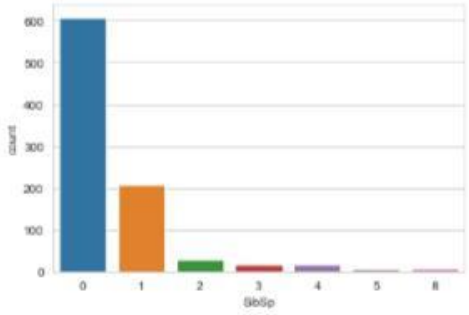
10000 rows × 14 columns

Out[18]: <AxesSubplot:>



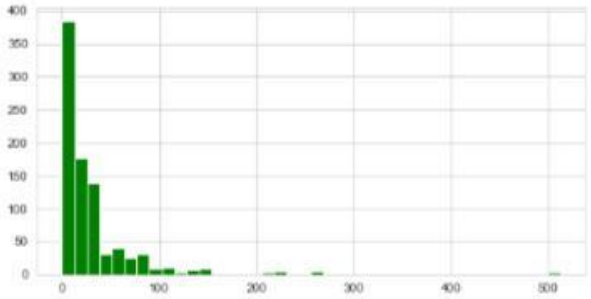
In [19]:
```
sns.countplot(x='SibSp',data=train)
```

Out[19]: <AxesSubplot:xlabel='SibSp', ylabel='count'>



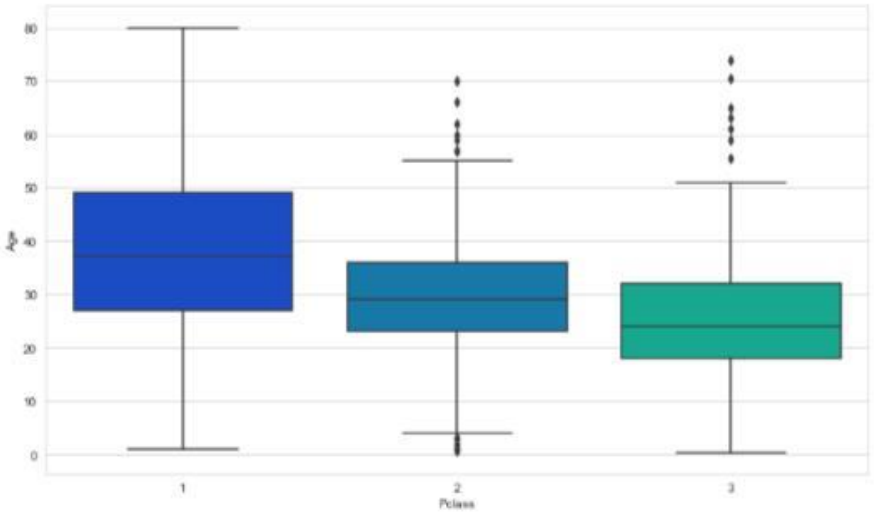

In [20]:
```
train['Fare'].hist(color='green',bins=40,figsize=(8,4))
```

Out[20]: <AxesSubplot:>



In [21]:
```
#Data cleaning
plt.figure(figsize=(12,7))
sns.boxplot(x='Pclass',y='Age',data=train,palette='winter')
```

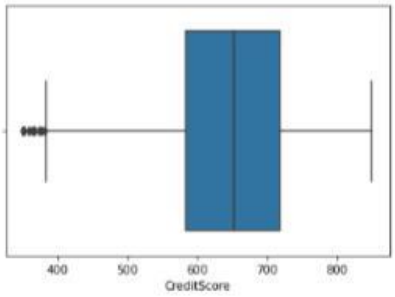
Out[21]: <AxesSubplot:xlabel='Pclass', ylabel='Age'>



In [11]:
```
#plotting outliers
sns.boxplot(df["CreditScore"])
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the followi
ng 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 misinterpretati
on.
  warnings.warn(
```

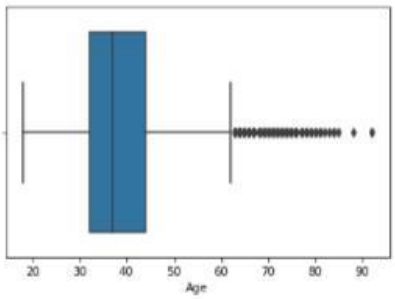
Out[11]:
```
<AxesSubplot:xlabel='CreditScore'>
```




In [39]:
```
sns.boxplot(df["Age"])
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the followi
ng 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 misinterpretati
on.
  warnings.warn(
```

Out[39]:
```
<AxesSubplot:xlabel='Age'>
```




In [12]:
```
qnt=df.quantile(q=(0.75,0.25))

qnt
```

Out[12]:

| | RowNumber | CustomerId | CreditScore | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveMember | EstimatedSalary |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.75 | 7500.25 | 15753233.75 | 718.0 | 44.0 | 7.0 | 127644.24 | 2.0 | 1.0 | 1.0 | 149388.2475 |
| 0.25 | 2500.75 | 15628528.25 | 584.0 | 32.0 | 3.0 | 0.00 | 1.0 | 0.0 | 0.0 | 51002.1100 |

In [14]:
```
iqr = qnt.loc[0.75]-qnt.loc[0.25] #iqr calculations
iqr
```

Out[14]:
```
RowNumber            4999.5000
CustomerId         124705.5000
CreditScore           134.0000
Age                    12.0000
Tenure                  4.0000
Balance            127644.2400
NumOfProducts           1.0000
HasCrCard               1.0000
IsActiveMember          1.0000
EstimatedSalary     98386.1375
Exited                  0.0000
dtype: float64
```

In [26]:
```
#lower extreme values
lower=qnt.loc[0.25] - 1.5*iqr
lower
```

Out[26]:
```
RowNumber          -4.998500e+03
CustomerId          1.544147e+07
CreditScore         3.830000e+02
Age                 1.400000e+01
Tenure             -3.000000e+00
Balance            -1.914664e+05
NumOfProducts      -5.000000e-01
HasCrCard          -1.500000e+00
IsActiveMember     -1.500000e+00
EstimatedSalary    -9.657710e+04
Exited              0.000000e+00
dtype: float64
```

In [27]:
```
#upper extreme values
upper=qnt.loc[0.75] + 1.5*iqr

upper
```

Out[27]:
```
RowNumber          1.499950e+04
CustomerId         1.594029e+07
CreditScore        9.190000e+02
Age                6.200000e+01
Tenure             1.300000e+01
Balance            3.191106e+05
NumOfProducts      3.500000e+00
HasCrCard          2.500000e+00
IsActiveMember     2.500000e+00
EstimatedSalary    2.969675e+05
Exited             0.000000e+00
dtype: float64
```

In [18]:
```
df.mean()
```

```
C:\Users\janar vijay\AppData\Local\Temp\ipykernel_10016\3698961737.py:1: FutureWarning: Dropping of n
uisance 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.
  df.mean()
```

Out[18]:
```
RowNumber          5.000500e+03
CustomerId         1.569094e+07
CreditScore        6.505288e+02
Age                3.892180e+01
Tenure             5.012800e+00
Balance            7.648589e+04
NumOfProducts      1.530200e+00
HasCrCard          7.055000e-01
IsActiveMember     5.151000e-01
EstimatedSalary    1.000902e+05
Exited             2.037000e-01
dtype: float64
```

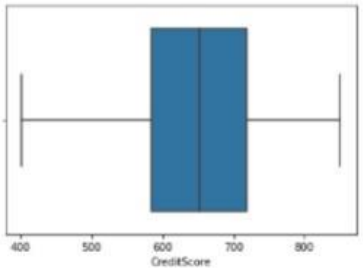
## Replacing outlier

In [45]:
```
#import libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt

#load the dataset
df=pd.read_csv('model.csv')
df['CreditScore']=np.where(df['CreditScore']<400,402,df['CreditScore'])
```

In [49]:
```
#remove outlier on the CreditScore column
sns.boxplot(df["CreditScore"])
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the followi
ng 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 misinterpretati
on.
  warnings.warn(
```

Out[49]:
```
<AxesSubplot:xlabel='CreditScore'>
```

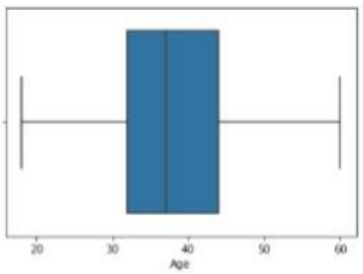



In [50]:
```
#remove outlier on the Age column
df['Age']=np.where(df['Age']>60,50,df['Age'])
```

In [51]:
```
sns.boxplot(df["Age"])
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the followi
ng 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 misinterpretati
on.
  warnings.warn(
```

Out[51]:
```
<AxesSubplot:xlabel='Age'>
```



## 7. Check for Categorical columns and perform encoding

In [53]:
```
df.head()
```

Out[53]:

| | RowNumber | CustomerId | Surname | CreditScore | Geography | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 15674602 | Hargrave | 619 | France | Female | 42 | 2 | 0.00 | 1 | 1 | |
| 1 | 2 | 15647311 | Hill | 608 | Spain | Female | 41 | 1 | 83807.86 | 1 | 0 | |
| 2 | 3 | 15619304 | Onio | 502 | France | Female | 42 | 8 | 159660.80 | 3 | 1 | |
| 3 | 4 | 15701354 | Boni | 699 | France | Female | 39 | 1 | 0.00 | 2 | 0 | |
| 4 | 5 | 15737888 | Mitchell | 850 | Spain | Female | 43 | 2 | 125510.82 | 1 | 1 | |

### encoding

In [57]:
```
#manually handling categorincal data

df['Gender'].replace({'Female':1,'Male':2},inplace=True)
df.head()
```

Out[57]:

| | RowNumber | CustomerId | Surname | CreditScore | Geography | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 15674602 | Hargrave | 619 | France | 1 | 42 | 2 | 0.00 | 1 | 1 | |
| 1 | 2 | 15647311 | Hill | 608 | Spain | 1 | 41 | 1 | 83807.86 | 1 | 0 | |
| 2 | 3 | 15619304 | Onio | 502 | France | 1 | 42 | 8 | 159660.80 | 3 | 1 | |
| 3 | 4 | 15701354 | Boni | 699 | France | 1 | 39 | 1 | 0.00 | 2 | 0 | |
| 4 | 5 | 15737888 | Mitchell | 850 | Spain | 1 | 43 | 2 | 125510.82 | 1 | 1 | |

In [62]:
```
df['Geography'].replace({'France':100,'Spain':200},inplace=True)
df.head()
```

Out[62]:

| | RowNumber | CustomerId | Surname | CreditScore | Geography | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 15674602 | Hargrave | 619 | 100 | 1 | 42 | 2 | 0.00 | 1 | 1 | |
| 1 | 2 | 15647311 | Hill | 608 | 200 | 1 | 41 | 1 | 83807.86 | 1 | 0 | |
| 2 | 3 | 15619304 | Onio | 502 | 100 | 1 | 42 | 8 | 159660.80 | 3 | 1 | |
| 3 | 4 | 15701354 | Boni | 699 | 100 | 1 | 39 | 1 | 0.00 | 2 | 0 | |
| 4 | 5 | 15737888 | Mitchell | 850 | 200 | 1 | 43 | 2 | 125510.82 | 1 | 1 | |

In [60]:
```
#dummy variable function
df_main=pd.get_dummies(df,columns=['Geography'])
df_main
```

Out[60]:

| | RowNumber | CustomerId | Surname | CreditScore | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveMember |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 15674602 | Hargrave | 619 | 1 | 42 | 2 | 0.00 | 1 | 1 | 1 |
| 1 | 2 | 15647311 | Hill | 608 | 1 | 41 | 1 | 83807.86 | 1 | 0 | 1 |
| 2 | 3 | 15619304 | Onio | 502 | 1 | 42 | 8 | 159660.80 | 3 | 1 | 0 |
| 3 | 4 | 15701354 | Boni | 699 | 1 | 39 | 1 | 0.00 | 2 | 0 | 0 |
| 4 | 5 | 15737888 | Mitchell | 850 | 1 | 43 | 2 | 125510.82 | 1 | 1 | 1 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 9995 | 9996 | 15606229 | Obijiaku | 771 | 2 | 39 | 5 | 0.00 | 2 | 1 | 0 |
| 9996 | 9997 | 15569892 | Johnstone | 516 | 2 | 35 | 10 | 57369.61 | 1 | 1 | 1 |
| 9997 | 9998 | 15584532 | Liu | 709 | 1 | 36 | 7 | 0.00 | 1 | 0 | 1 |
| 9998 | 9999 | 15682355 | Sabbatini | 772 | 2 | 42 | 3 | 75075.31 | 2 | 1 | 0 |
| 9999 | 10000 | 15628319 | Walker | 792 | 1 | 28 | 4 | 130142.79 | 1 | 1 | 0 |

10000 rows × 16 columns

## 8. Split the data into dependent and independent variables.

In [64]:
```
#target variable or  dependent variable.
import pandas as pd
df=pd.read_csv('model.csv')
y=df['EstimatedSalary']
y.head()
```

Out[64]:
```
0    101348.88
1    112542.58
2    113931.57
3     93826.63
4     79084.10
Name: EstimatedSalary, dtype: float64
```

In [74]:
```
#independent variables
x = df.drop(columns=['EstimatedSalary'],axis=1)

x.head()
```

Out[74]:

| | RowNumber | CustomerId | Surname | CreditScore | Geography | Gender | Age | Tenure | Balance | NumOfProducts | HasCrCard | IsActiveM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 15674602 | Hargrave | 619 | France | Female | 42 | 2 | 0.00 | 1 | 1 | |
| 1 | 2 | 15647311 | Hill | 608 | Spain | Female | 41 | 1 | 83807.86 | 1 | 0 | |
| 2 | 3 | 15619304 | Onio | 502 | France | Female | 42 | 8 | 159660.80 | 3 | 1 | |
| 3 | 4 | 15701354 | Boni | 699 | France | Female | 39 | 1 | 0.00 | 2 | 0 | |
| 4 | 5 | 15737888 | Mitchell | 850 | Spain | Female | 43 | 2 | 125510.82 | 1 | 1 | |