Assignment-2

Assignment Date	20-09-2022
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Maximum Marks	2 Marks

1. Downloading Dataset: Chrun_Modelling

2. Load The Dataset

In [1]:

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

In [2]:

```
df = pd.read_csv('Churn_Modelling.csv') df.head()
```

Out[2]:

	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	1570 699 1354	Bon ma i le	Fran ce	Fe 1	3 0.00 9	2	0	0	0	93826. 63
4	5	1573 chel 7888	Mit 850 n 3	Spai ma l le	Fe 2	4 10.8 2	1255 1	1	1	0	79084.

In [3]:

```
df = df.drop(columns=['RowNumber', 'CustomerId', 'Surname'])
df.head()
```

Out[3]:

	CreditS core	Geogra phy	Gen der	Ag e	Ten ure	Balanc e	NumOfPro ducts	HasCrC ard	IsActiveMe mber	EstimatedS alary	Exit ed
0	619	France	Fem ale	42	2	0.00	1	1	1	101348.88	1
1	608	Spain	Fem ale	41	1	83807. 86	1	0	1	112542.58	0
2	502	France	Fem ale	42	8	15966 0.80	3	1	0	113931.57	1
3	699	France	Fem ale	39	1	0.00	2	0	0	93826.63	0
4	850	Spain	Fem ale	43	2	12551 1	1	1	1	79084.10	0

In [4]:

```
df['IsActiveMember'] = df['IsActiveMember'].astype('category')
df['Exited'] = df['Exited'].astype('category')
df['HasCrCard'] = df['HasCrCard'].astype('category')
```

3. Perform

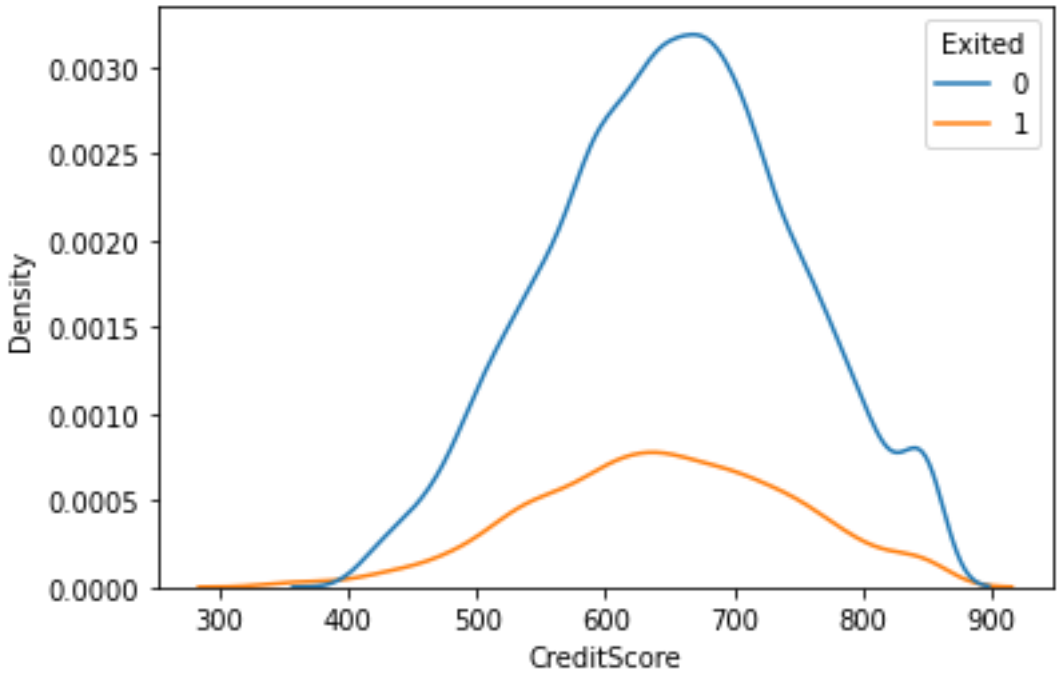
* Univariate Analysis

* Bi - Variate Analysis

* Multi - Variate Analysis

In [5]:

```
sns.kdeplot(x='CreditScore', data = df , hue = 'Exited')
plt.show()
```

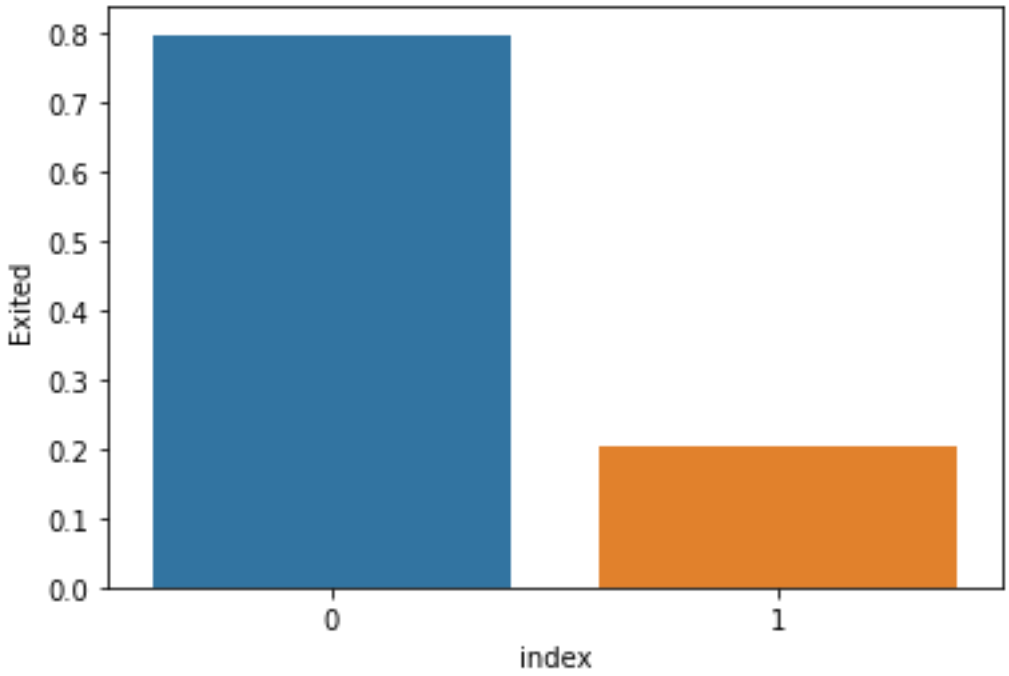


In [6]:

```
density = df['Exited'].value_counts(normalize=True).reset_index()
sns.barplot(data=density, x='index', y='Exited', ); density
```

Out[6]:

	index	Exited
0	0	0.7963
1	1	0.2037



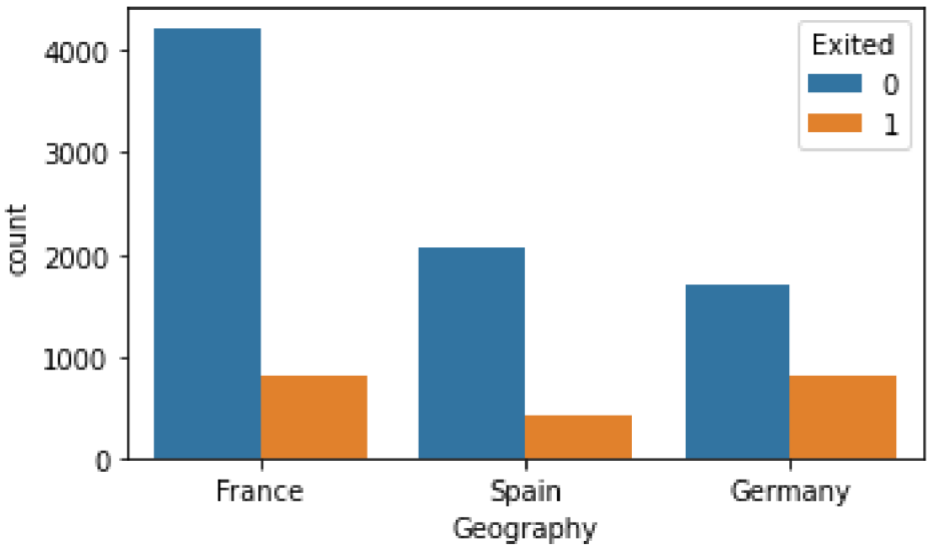

```
categorical = df.drop(columns=['CreditScore', 'Age', 'Tenure',
'Balance', 'EstimatedSalary']) rows =
int(np.ceil(categorical.shape[1] / 2)) - 1 fig, axes =
plt.subplots(nrows=rows, ncols=2, figsize=(10,6)) axes =
axes.flatten()
 for row in
range(rows):
    cols = min(2, categorical.shape[1] - row*2)
for col in range(cols):
        col_name = categorical.columns[2 * row + col]
ax = axes[row*2 + col]
         sns.countplot(data=categorical, x=col_name,
hue="Exited", ax=ax);          plt.tight_layout()
```

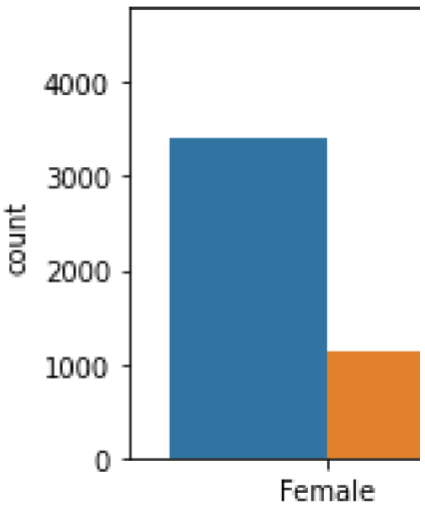
4. Descriptive statistics bold text

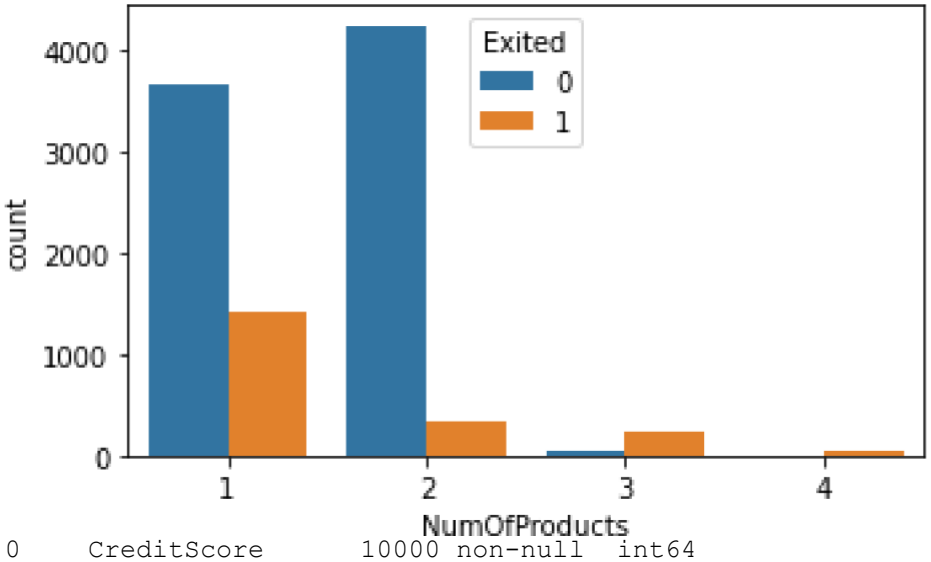
In [8]:

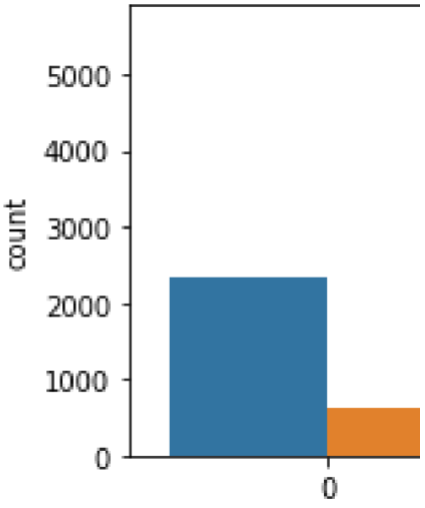
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'> RangeIndex:
10000 entries, 0 to 9999
Data columns (total 11 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
```










```
0     CreditScore       10000 non-null  int64
1     Geography         10000 non-null  object
2     Gender            10000 non-null  object
3     Age               10000 non-null  int64
4     Tenure            10000 non-null  int64
5     Balance           10000 non-null  float64
6     NumOfProducts     10000 non-null  int64
7     HasCrCard         10000 non-null  category
8     IsActiveMember    10000 non-null  category
9     EstimatedSalary   10000 non-null  float64
10    Exited            10000 non-null  category dtypes:
category(3), float64(2), int64(4), object(2) memory usage: 654.8+
KB
```

In [9]:

```
df.describe()
```

Out[9]:

	CreditScore	Age	Tenure	Balance	NumOfProducts	EstimatedSalary
count	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000

mean	650.528800	38.921800	5.012800	76485.889288	1.530200	100090.239881
std	96.653299	10.487806	2.892174	62397.405202	0.581654	57510.492818
min	350.000000	18.000000	0.000000	0.000000	1.000000	11.580000
25%	584.000000	32.000000	3.000000	0.000000	1.000000	51002.110000
50%	652.000000	37.000000	5.000000	97198.540000	1.000000	100193.915000
75%	718.000000	44.000000	7.000000	127644.240000	2.000000	149388.247500
max	850.000000	92.000000	10.000000	250898.090000	4.000000	199992.480000

5. Handle Missing Values

In [10]:

```
df.isna().sum()
```

Out[10]:

```
CreditScore        0
Geography          0
Gender             0
Age                0
Tenure             0
Balance            0
NumOfProducts      0
HasCrCard          0
IsActiveMember     0
EstimatedSalary    0
Exited             0
dtype: int64
```

In this dataset there is no missing values 6. Find the outliers and replace the outliers

Finding Outliers

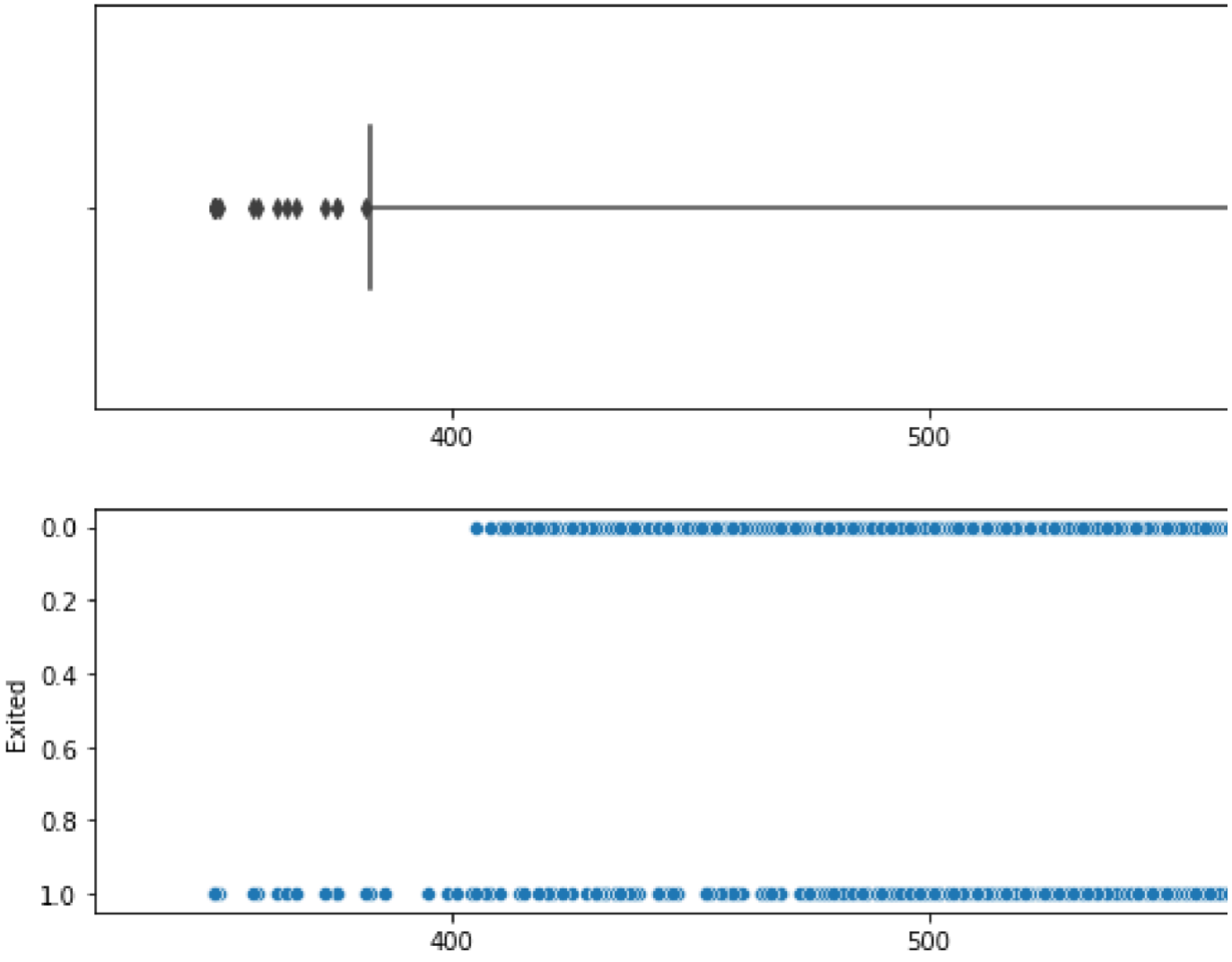
In [11]:

```
def box_scatter(data, x, y):
    fig, (ax1, ax2) = plt.subplots(nrows=2, ncols=1, figsize=(16,6))
sns.boxplot(data=data, x=x, ax=ax1)     sns.scatterplot(data=data,
x=x,y=y,ax=ax2)
```

In [12]:

```
box_scatter(df,'CreditScore','Exited'); plt.tight_layout()
print(f"# of Bivariate Outliers: {len(df.loc[df['CreditScore'] <
400])}")
```

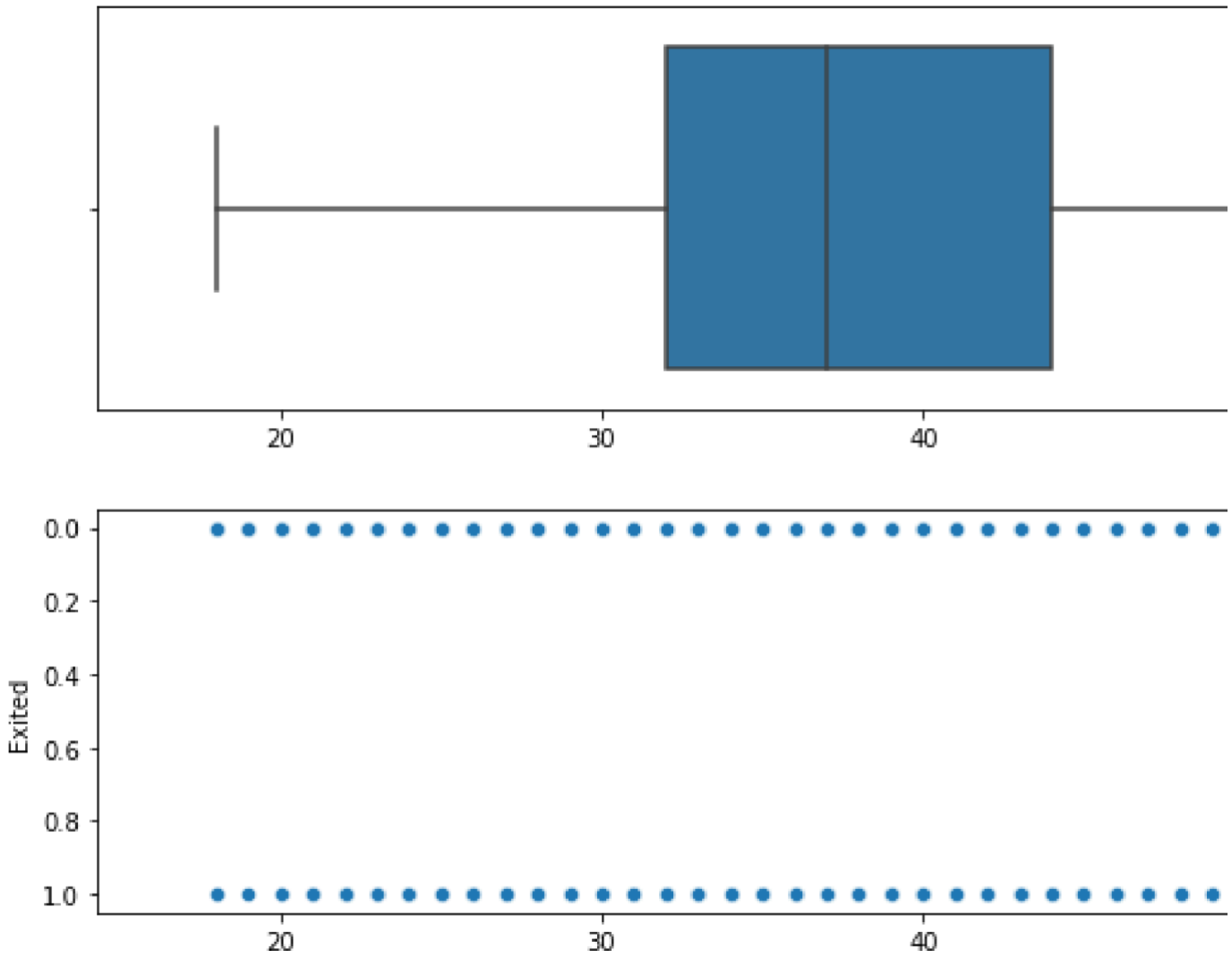
```
# of Bivariate Outliers: 19
```



In [13]:

```
box_scatter(df,'Age','Exited'); plt.tight_layout() print(f"# of
Bivariate Outliers: {len(df.loc[df['Age'] > 87])}")
```

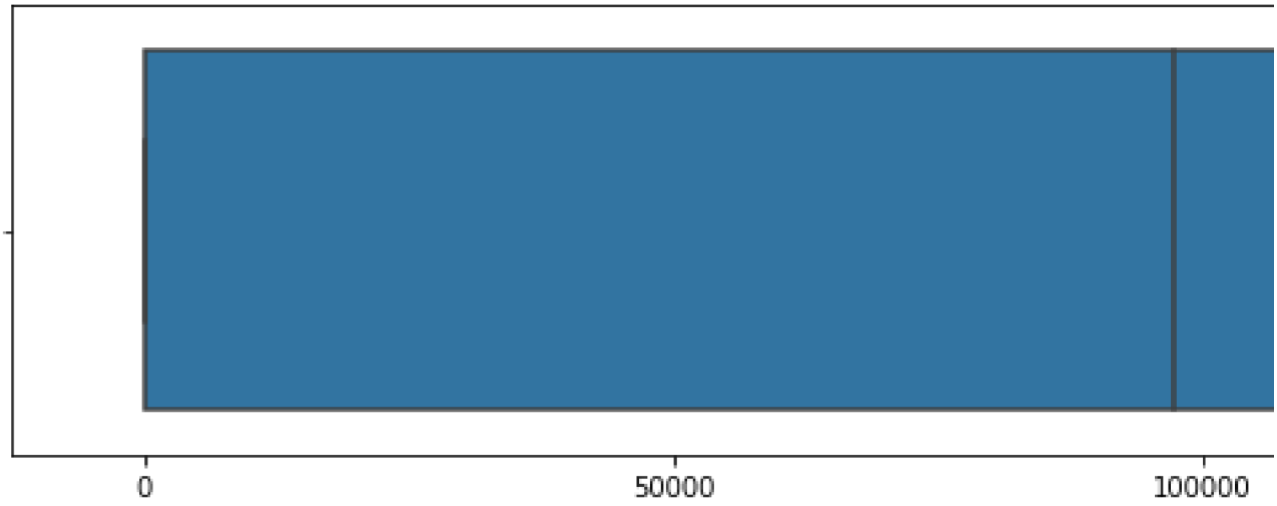
```
# of Bivariate Outliers: 3
```

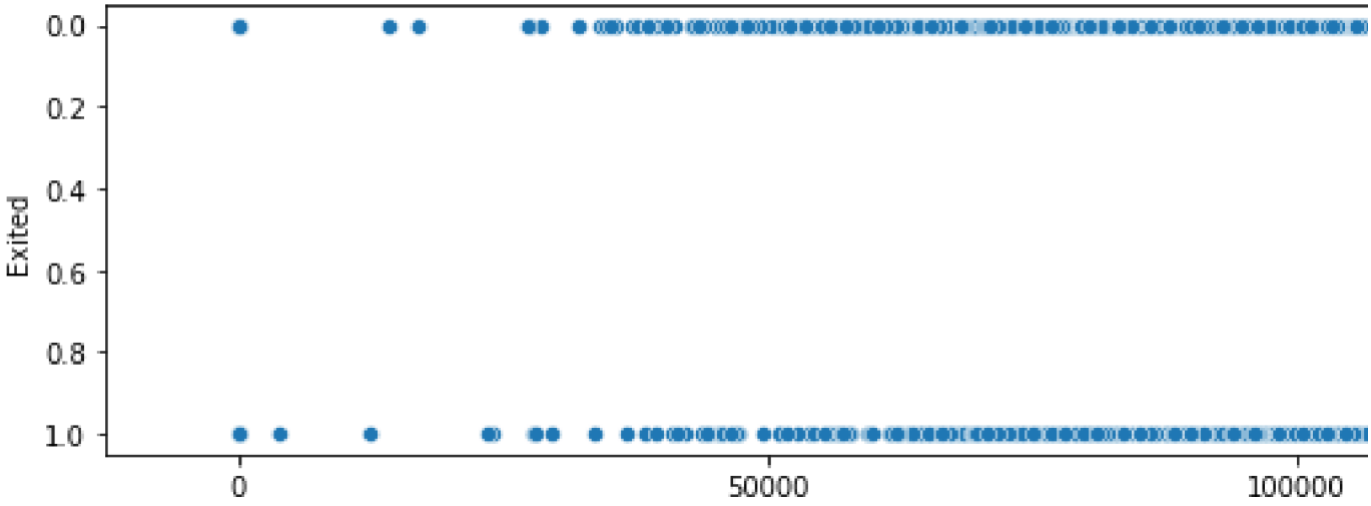


In [14]:

```
box_scatter(df,'Balance','Exited'); plt.tight_layout() print(f"# of
Bivariate Outliers: {len(df.loc[df['Balance'] > 220000])}")
```

```
# of Bivariate Outliers: 4
```





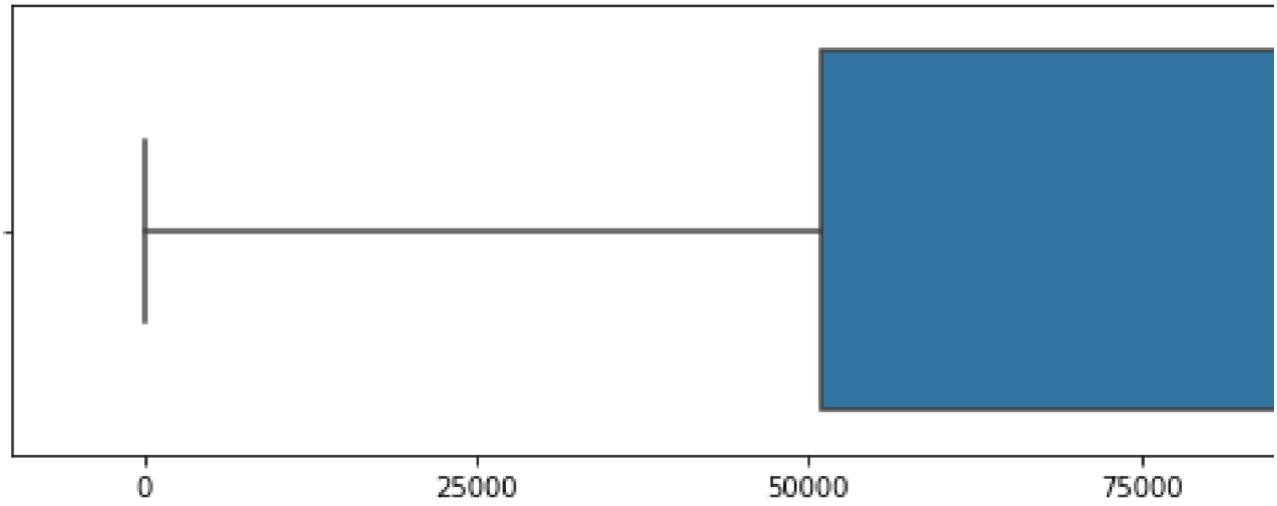
In [15]:

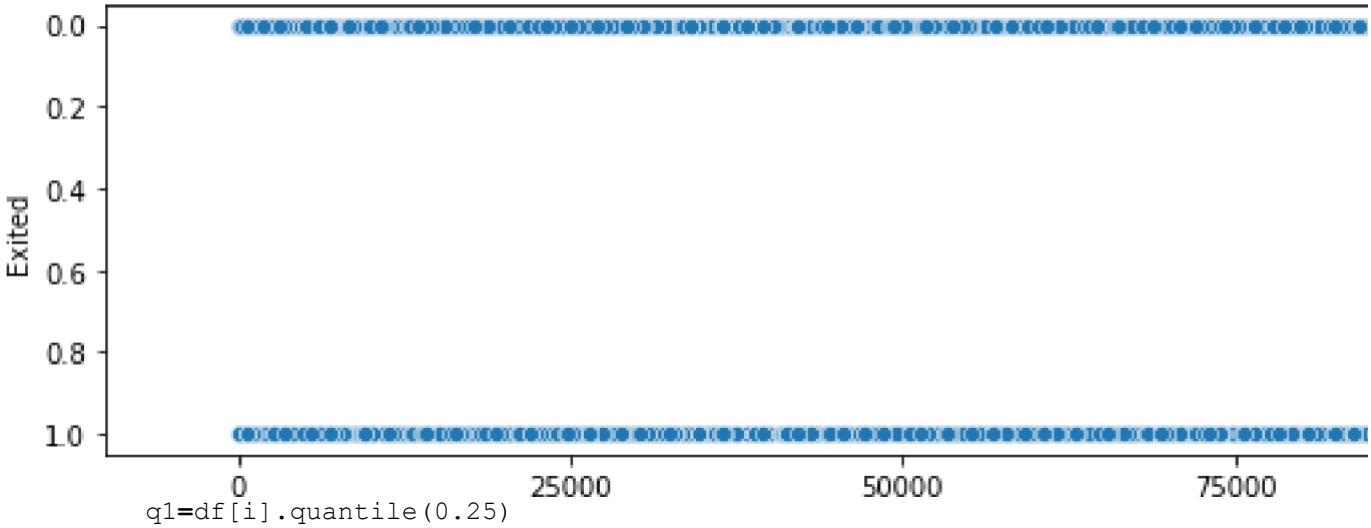
```
box_scatter(df,'EstimatedSalary','Exited'); plt.tight_layout()
```

Removing The Outliers

In [16]:

```
for i in df:     if df[i].dtype=='int64' or
df[i].dtypes=='float64':
```





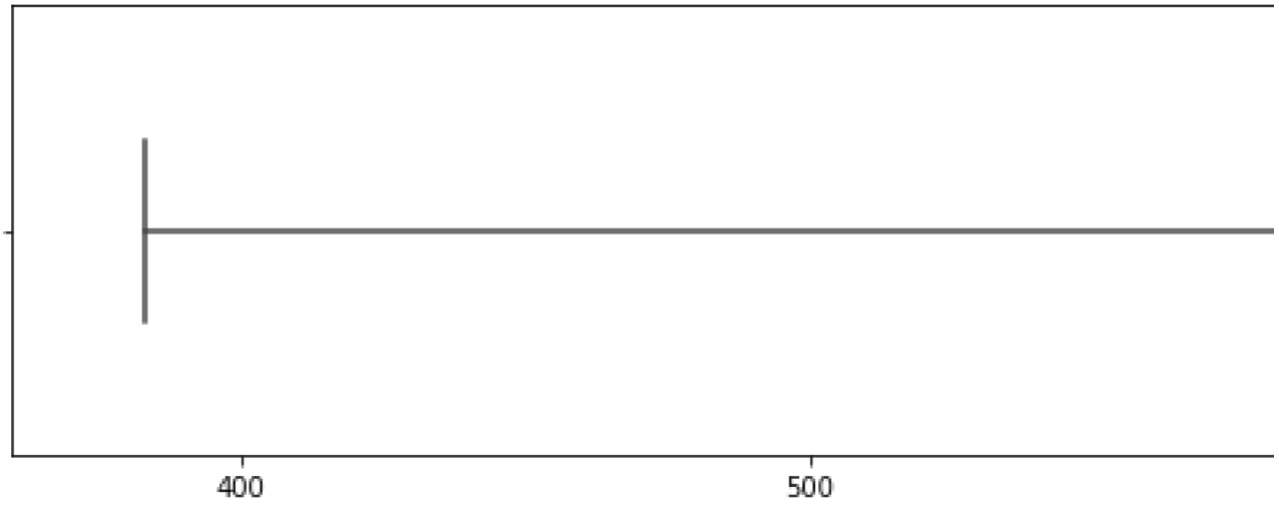

```
        q1=df[i].quantile(0.25)
q3=df[i].quantile(0.75)          iqr=q3-q1
upper=q3+1.5*iqr          lower=q1-1.5*iqr
df[i]=np.where(df[i] >upper, upper, df[i])
df[i]=np.where(df[i] <lower, lower, df[i])
```

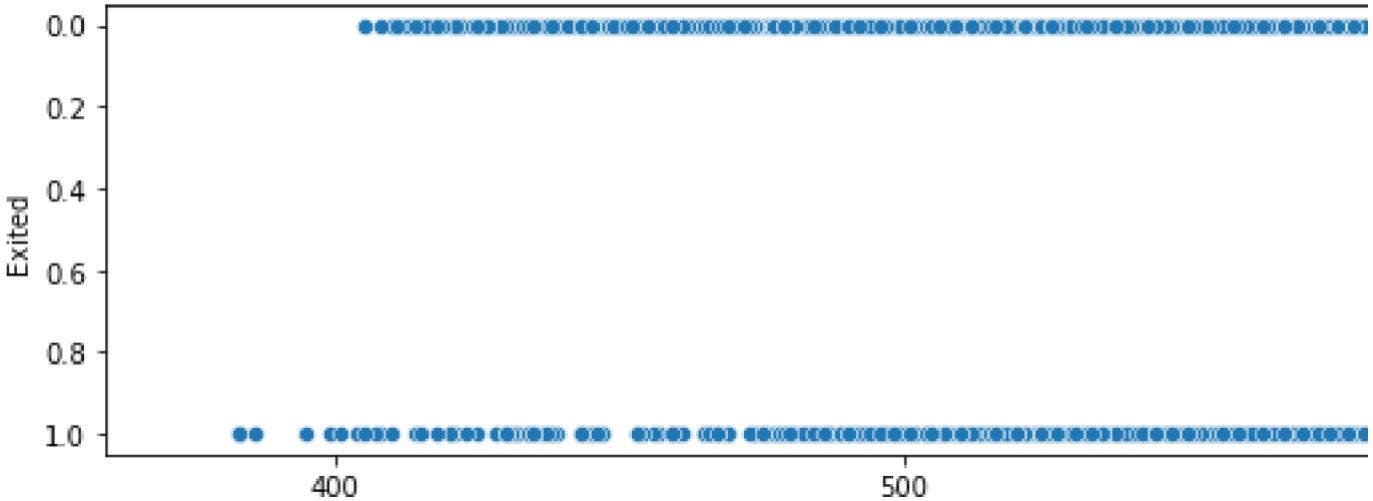
In [17]:

```
box_scatter(df,'CreditScore','Exited'); plt.tight_layout()
print(f"# of Bivariate Outliers: {len(df.loc[df['CreditScore'] <
400])}")
```

```
# of Bivariate Outliers: 19
```

In [18]:

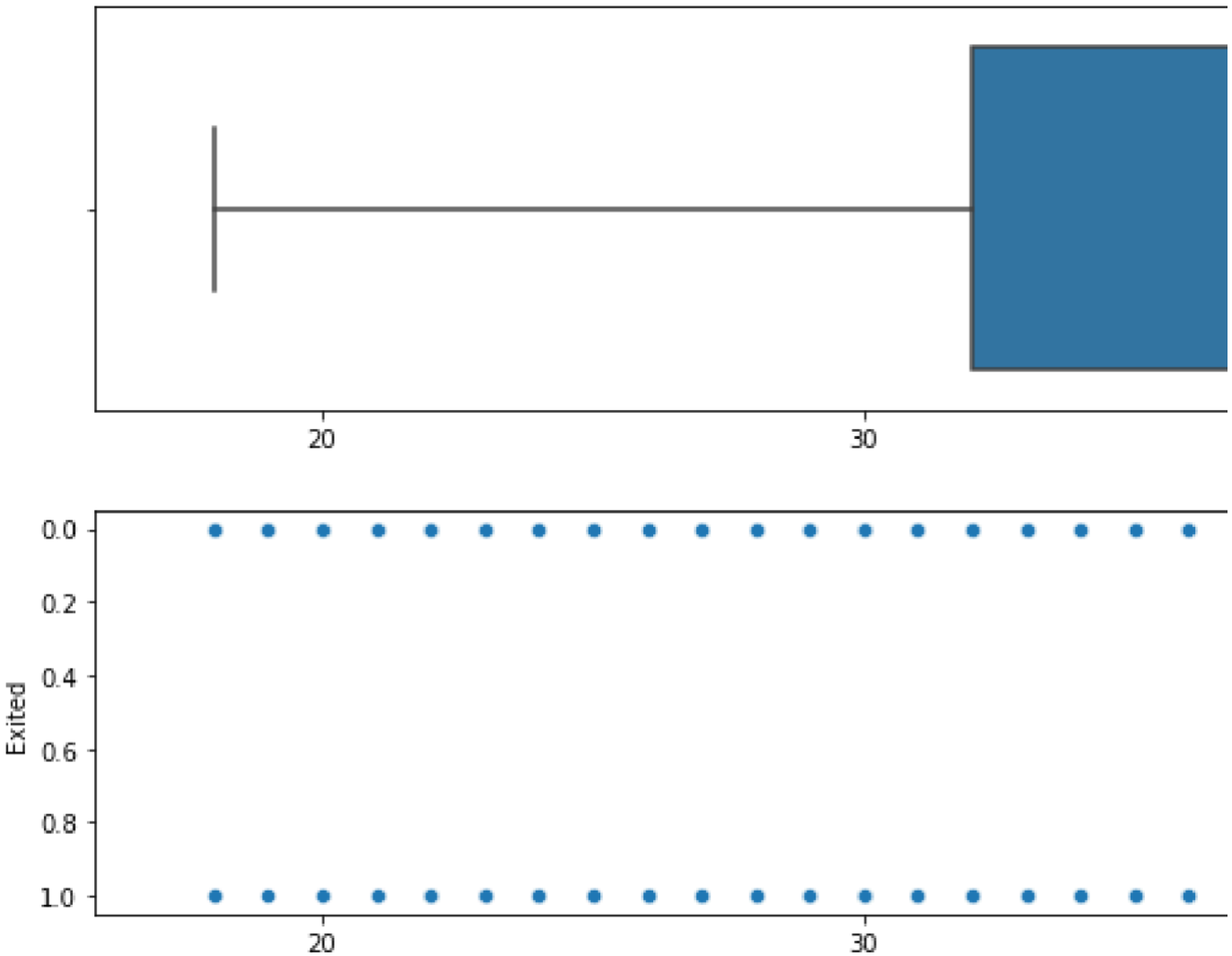





```
box_scatter(df,'Age','Exited'); plt.tight_layout() print(f"# of
Bivariate Outliers: {len(df.loc[df['Age'] > 87])}")
```

```
# of Bivariate Outliers: 0
```

In [19]:

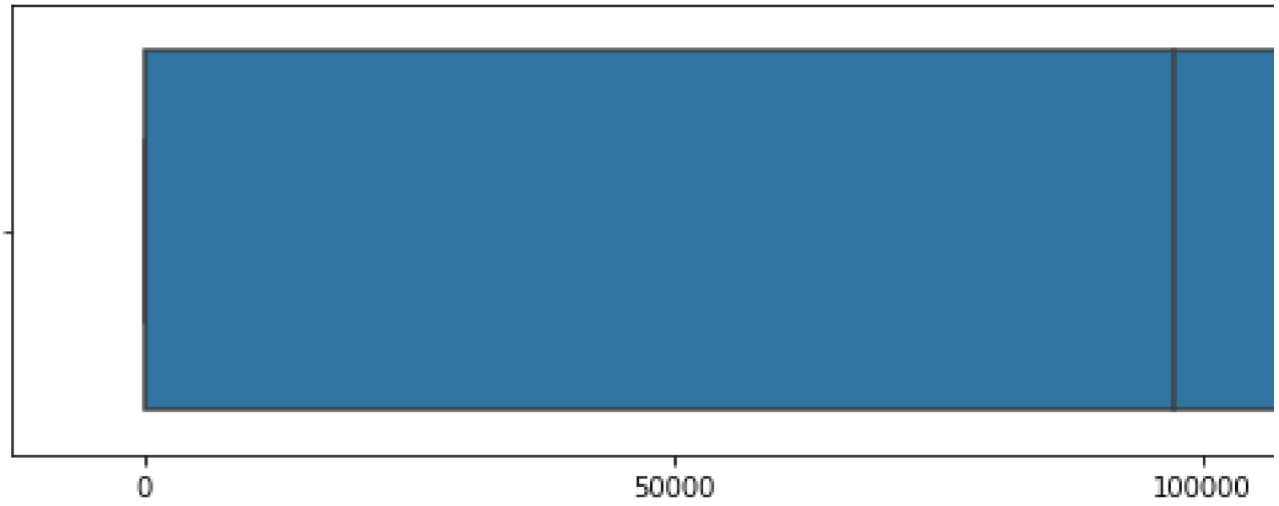


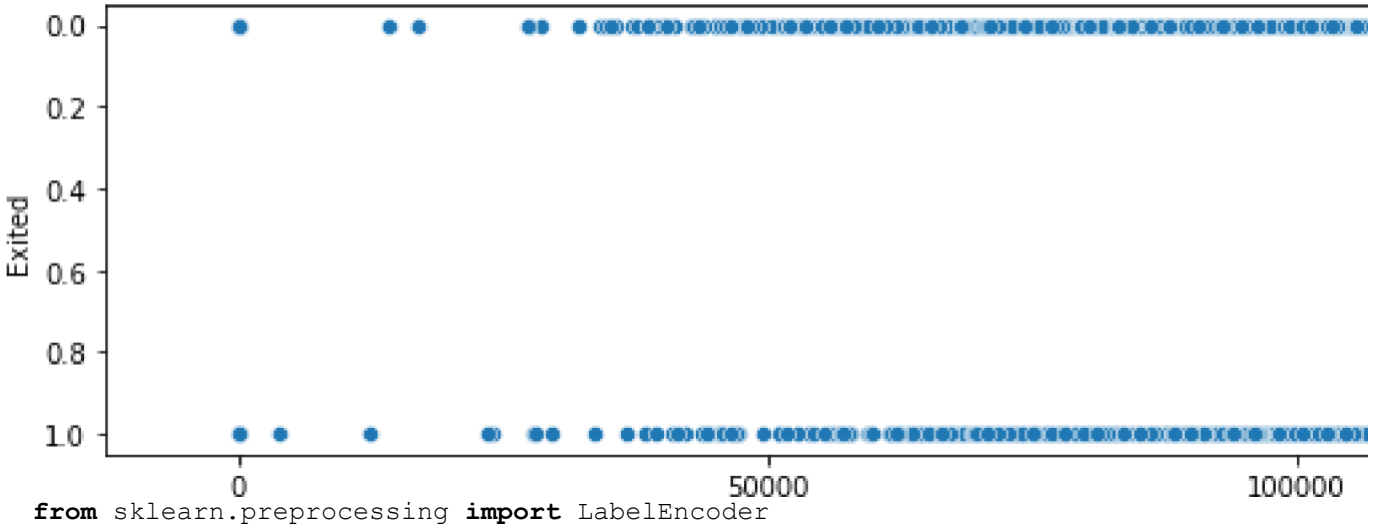

```
box_scatter(df,'Balance','Exited'); plt.tight_layout() print(f"# of
Bivariate Outliers: {len(df.loc[df['Balance'] > 220000])}")
```

```
# of Bivariate Outliers: 4
```

7. Check for Categorical columns and perform encoding.

In [20]:






```
from sklearn.preprocessing import LabelEncoder
encoder=LabelEncoder() for i in df:     if
df[i].dtype=='object' or df[i].dtype=='category':
df[i]=encoder.fit_transform(df[i])
```

8. Split the data into dependent and independent variables.

In [21]:

```
x=df.iloc[:,:-1]
x.head()
```

Out[21]:

	CreditSc ore	Geogra phy	Gend er	Ag e	Tenu re	Balance	NumOfProd ucts	HasCrC ard	IsActiveMe mber	EstimatedS alary
0	619.0	0	0	42.0	2.0	0.00	1.0	1	1	101348.88
				41.0		83807.				

1	608.0	2	0	1.0	1.0	0	1	112542.58	0	86
2	502.0	0	0	42. 8.0	3.0	159660 1	0	113931.57	0	.80
3	699.0	0	0	39. 1.0 0	0.00	2.0	0	0	93826.63	
4	850.0	2	0	43. 2.0	1.0	125510 1	1	79084.10	0	.82

In [22]:

```
y=df.iloc[:,-1]
y.head()
```

Out[22]:

```
0    1
1    0
2    1
3    0
4    0
Name: Exited, dtype: int64
```

9. Scale the independent variables

In [23]:

```
from sklearn.preprocessing import
StandardScaler scaler=StandardScaler()
x=scaler.fit_transform(x) print(x)
```

```
[[-0.32687761 -0.90188624 -1.09598752 ...  0.64609167  0.97024255
0.02188649]
 [-0.44080365  1.51506738 -1.09598752 ... -1.54776799  0.97024255
  0.21653375]
 [-1.53863634 -0.90188624 -1.09598752 ...  0.64609167 -1.03067011
0.2406869 ]
 ...
 [ 0.60524449 -0.90188624 -1.09598752 ... -1.54776799  0.97024255
 -1.00864308]
 [ 1.25772996  0.30659057  0.91241915 ...  0.64609167 -1.03067011
-0.12523071]
 [ 1.4648682  -0.90188624 -1.09598752 ...  0.64609167 -1.03067011
-1.07636976]]
```

10. Split the data into training and testing.

In [24]:

```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.20)
```

In [25]:

```
print(x_train.shape)
print(x_test.shape)
```

```
(8000, 10)
(2000, 10)
```

In [26]:

```
print(y_train.shape)
print(y_test.shape)
```

```
(8000,)
(2000,)
```