# Aim: To implement a Machine Learning Classification model using a Logistic regression algorithm.

In [11]:
```
import pandas as pd
from matplotlib import pyplot as plt
%matplotlib inline
import seaborn as sns
import plotly.express as px
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split
from sklearn.metrics import confusion_matrix,accuracy_score
from sklearn.metrics import precision_recall_fscore_support
from sklearn import metrics
```

In [12]:
```
df = pd.read_csv(r"C:\Users\VICTUS\Desktop\Sem 6 Practicals\ML\Diabetes.csv")
df.head()
```

Out[12]:

| | Pregnancies | Glucose | BloodPressure | SkinThickness | Insulin | BMI | DiabetesPedigreeF |
|---|---|---|---|---|---|---|---|
| **0** | 6 | 148 | 72 | 35 | 0 | 33.6 | |
| **1** | 1 | 85 | 66 | 29 | 0 | 26.6 | |
| **2** | 8 | 183 | 64 | 0 | 0 | 23.3 | |
| **3** | 1 | 89 | 66 | 23 | 94 | 28.1 | |
| **4** | 0 | 137 | 40 | 35 | 168 | 43.1 | |

In [13]:
```
df.isna().sum()
```

Out[13]:
```
Pregnancies                 0
Glucose                     0
BloodPressure               0
SkinThickness               0
Insulin                     0
BMI                         0
DiabetesPedigreeFunction    0
Age                         0
Outcome                     0
dtype: int64
```

In [14]:
```
df.info
```

Out[14]:
```
<bound method DataFrame.info of      Pregnancies  Glucose  BloodPressure  SkinT
hickness  Insulin   BMI  \
0              6      148             72             35        0  33.6
1              1       85             66             29        0  26.6
2              8      183             64              0        0  23.3
3              1       89             66             23       94  28.1
4              0      137             40             35      168  43.1
..           ...      ...            ...            ...      ...   ...
763           10      101             76             48      180  32.9
764            2      122             70             27        0  36.8
765            5      121             72             23      112  26.2
766            1      126             60              0        0  30.1
767            1       93             70             31        0  30.4

     DiabetesPedigreeFunction  Age  Outcome
0                       0.627   50        1
1                       0.351   31        0
2                       0.672   32        1
3                       0.167   21        0
4                       2.288   33        1
..                        ...  ...      ...
763                     0.171   63        0
764                     0.340   27        0
765                     0.245   30        0
766                     0.349   47        1
767                     0.315   23        0

[768 rows x 9 columns]>
```

In [15]:
```
df.describe()
```

Out[15]:

| | Pregnancies | Glucose | BloodPressure | SkinThickness | Insulin | BMI |
|---|---|---|---|---|---|---|
| **count** | 768.000000 | 768.000000 | 768.000000 | 768.000000 | 768.000000 | 768.000000 |
| **mean** | 3.845052 | 120.894531 | 69.105469 | 20.536458 | 79.799479 | 31.992578 |
| **std** | 3.369578 | 31.972618 | 19.355807 | 15.952218 | 115.244002 | 7.884160 |
| **min** | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| **25%** | 1.000000 | 99.000000 | 62.000000 | 0.000000 | 0.000000 | 27.300000 |
| **50%** | 3.000000 | 117.000000 | 72.000000 | 23.000000 | 30.500000 | 32.000000 |
| **75%** | 6.000000 | 140.250000 | 80.000000 | 32.000000 | 127.250000 | 36.600000 |
| **max** | 17.000000 | 199.000000 | 122.000000 | 99.000000 | 846.000000 | 67.100000 |

In [16]:
```
x = df.iloc[:,[0,7]].values
y = df.iloc[:, -1].values
```

In [17]:
```
x_train,x_test,y_train,y_test = train_test_split(x,y,test_size=0.25,random_state
```

In [19]:
```
classifier = LogisticRegression()
classifier.fit(x_train,y_train)
```

Out[19]:
```
▾ LogisticRegression
LogisticRegression()
```

In [20]:
```
y_pred= classifier.predict(x_test)
```

In [21]:
```
print(y_test)
```

```
[1 0 0 1 0 0 1 1 0 0 1 1 0 0 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1
 0 0 0 0 0 0 1 1 0 0 1 1 1 0 0 1 0 0 0 0 1 1 1 1 0 0 1 1 1 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 1 0 1 1 0 0 0 0 0 1 0 0 0 1 0
 1 1 1 1 1 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 0 1 0 1 1 0 0 0 0 0 1 0 0 0
 0 1 0 1 0 0 1 0 0 0 1 1 1 1 0 0 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0 0 1 1 0 1 1
 0 1 1 1 0 0 0]
```

In [22]:
```
print(y_pred)
```

```
[0 0 0 1 0 0 0 0 0 1 0 1 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0 1
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0
 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 1 0 0 0 1 0 1 0 1 0 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 0 0 0 0 0 1 0 1 0 0 0 0 1 0 0 0
 0 0 0 0 0 1 0]
```

# Confusion Matrix

In [24]:
```
cm = confusion_matrix(y_test,y_pred)
print(cm)
```

```
[[117  13]
 [ 49  13]]
```

In [25]:
```
precision_recall_fscore_support(y_test,y_pred, average='macro')
```

Out[25]: (0.6024096385542168, 0.5548387096774193, 0.542997542997543, None)

In [26]:
```
precision_recall_fscore_support(y_test,y_pred, average='micro')
```

Out[26]: (0.6770833333333334, 0.6770833333333334, 0.6770833333333334, None)

In [27]:
```
precision_recall_fscore_support(y_test,y_pred, average='weighted')
```

Out[27]: (0.638679718875502, 0.6770833333333334, 0.6306690212940212, None)

In [28]:
```
accuracy_score(y_test,y_pred)
```

Out[28]: 0.6770833333333334

In [29]:
```
Accuracy = metrics.accuracy_score(y_test,y_pred)
Accuracy
```

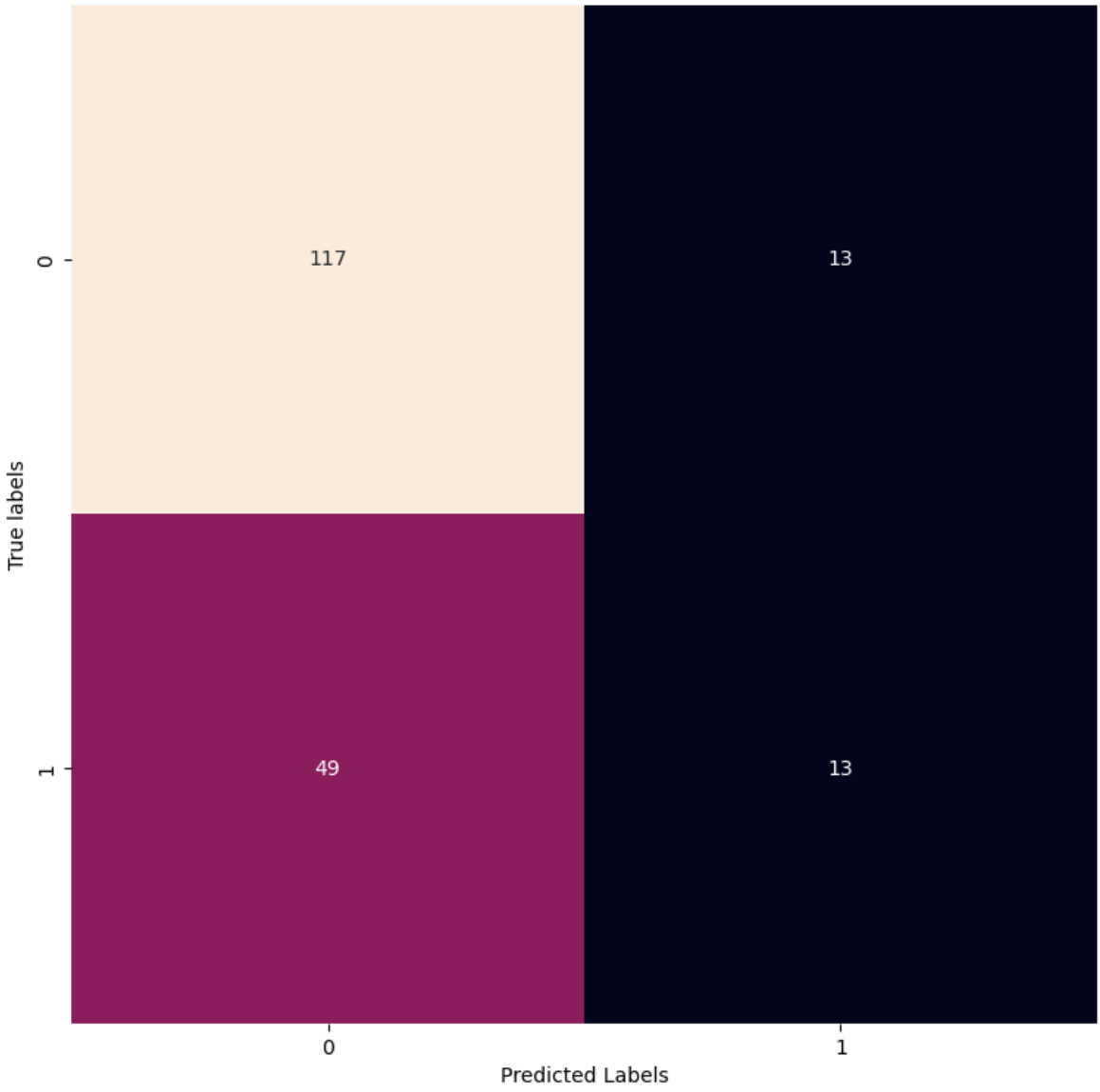
Out[29]: 0.6770833333333334

In [30]:
```
classifier.intercept_
classifier.coef_
```

Out[30]:
```
array([[0.05180623, 0.03442028]])
```

In [32]:
```
plt.figure(figsize=(9,9))
sns.heatmap(cm, annot=True, fmt='d', cbar=False)
plt.xlabel('Predicted Labels')
plt.ylabel('True labels')
plt.show
```

Out[32]:
```
<function matplotlib.pyplot.show(close=None, block=None)>
```




In [36]:
```
precision, recall, f1_score,_ = precision_recall_fscore_support(y_test,y_pred)
print('Precision: ', precision)
print('Recall: ', recall)
print('F1_score: ', f1_score)
```

```
Precision:  [0.70481928 0.5       ]
Recall:  [0.9        0.20967742]
F1_score:  [0.79054054 0.29545455]
```