In [ ]:

```
                                             Assignment No: 5
#AIM:
1. Logistic Regression
2. Differentiate between Linear and Logistic Regression
3. Sigmoid Function
4. Types of LogisticRegression
5. Confusion Matrix Evaluation Metrics
```

In [1]:

```
import pandas as pd
```

In [ ]:

In [2]:

```
import numpy as np
```

In [22]:

```
import seaborn as sns
```

In [3]:

```
import matplotlib.pyplot as plt
```

In [4]:

```
from sklearn.model_selection import train_test_split
```

In [5]:

```
from sklearn.preprocessing import StandardScaler
```

In [6]:

```
from sklearn.linear_model import LogisticRegression
```

In [7]:

```
from sklearn.metrics import accuracy_score, confusion_matrix, classification_repo
```

In [9]:

```
df = pd.read_csv("C:\\Users\\Welcome\\Downloads\\diabetes (1).csv")
```

In [10]:

```
print(df.head())
```

```
   Pregnancies  Glucose  BloodPressure  SkinThickness  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

   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
```

```
In [11]: if df.select_dtypes(include=['object']).shape[1] > 0:
             df = pd.get_dummies(df, drop_first=True)
```

```
In [12]: df.dropna(inplace=True)
```

```
In [13]: cov_matrix = df.cov()
         print("Covariance Matrix:\n", cov_matrix)
```

```
Covariance Matrix:
                            Pregnancies      Glucose  BloodPressure  \
Pregnancies                  11.354056    13.947131       9.214538
Glucose                      13.947131  1022.248314      94.430956
BloodPressure                 9.214538    94.430956     374.647271
SkinThickness                -4.390041    29.239183      64.029396
Insulin                     -28.555231  1220.935799     198.378412
BMI                           0.469774    55.726987      43.004695
DiabetesPedigreeFunction     -0.037426     1.454875       0.264638
Age                          21.570620    99.082805      54.523453
Outcome                       0.356618     7.115079       0.600697

                          SkinThickness       Insulin        BMI  \
Pregnancies                   -4.390041    -28.555231   0.469774
Glucose                       29.239183   1220.935799  55.726987
BloodPressure                 64.029396    198.378412  43.004695
SkinThickness                254.473245    802.979941  49.373869
Insulin                      802.979941  13281.180078 179.775172
BMI                           49.373869    179.775172  62.159984
DiabetesPedigreeFunction       0.972136      7.066681   0.367405
Age                          -21.381023    -57.143290   3.360330
Outcome                        0.568747      7.175671   1.100638

                          DiabetesPedigreeFunction         Age   Outcome
Pregnancies                              -0.037426   21.570620  0.356618
Glucose                                   1.454875   99.082805  7.115079
BloodPressure                             0.264638   54.523453  0.600697
SkinThickness                             0.972136  -21.381023  0.568747
Insulin                                   7.066681  -57.143290  7.175671
BMI                                       0.367405    3.360330  1.100638
DiabetesPedigreeFunction                  0.109779    0.130772  0.027472
Age                                       0.130772  138.303046  1.336953
Outcome                                   0.027472    1.336953  0.227483
```

```
In [15]: X = df.drop(columns=["Outcome"])
         y = df["Outcome"]
```

```
In [16]: xtrain, xtest, ytrain, ytest = train_test_split(X, y, test_size=0.2, random_state
```

```
In [17]: scaler = StandardScaler()
         xtrain = scaler.fit_transform(xtrain)
         xtest = scaler.transform(xtest)
```

In [18]:
```
logreg = LogisticRegression()
logreg.fit(xtrain, ytrain)
```

Out[18]:
```
▸ LogisticRegression
```

In [19]:
```
y_pred_train = logreg.predict(xtrain)
y_pred_test = logreg.predict(xtest)
```

In [20]:
```
train_accuracy = accuracy_score(ytrain, y_pred_train)
test_accuracy = accuracy_score(ytest, y_pred_test)
conf_matrix = confusion_matrix(ytest, y_pred_test)
class_report = classification_report(ytest, y_pred_test)
```

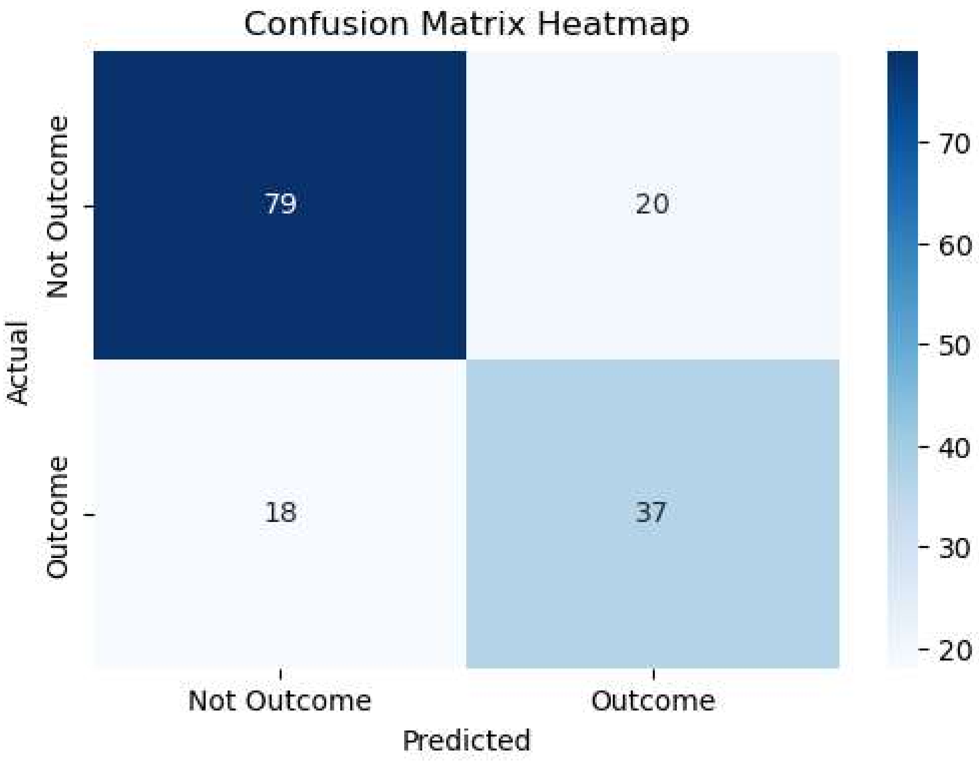
In [21]:
```
print("Training Accuracy:", train_accuracy)
print("Testing Accuracy:", test_accuracy)
print("Confusion Matrix:\n", conf_matrix)
print("Classification Report:\n", class_report)
```

```
Training Accuracy: 0.7703583061889251
Testing Accuracy: 0.7532467532467533
Confusion Matrix:
 [[79 20]
 [18 37]]
Classification Report:
               precision    recall  f1-score   support

           0       0.81      0.80      0.81        99
           1       0.65      0.67      0.66        55

    accuracy                           0.75       154
   macro avg       0.73      0.74      0.73       154
weighted avg       0.76      0.75      0.75       154
```

In [23]:
```
plt.figure(figsize=(6,4))
sns.heatmap(conf_matrix, annot=True, fmt='d', cmap='Blues', xticklabels=['Not Out
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.title('Confusion Matrix Heatmap')
plt.show()
```



In [ ]:
```
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