ML LAB ASSIGNMENT

SUPRATIM NAG -- CSE-AIML/22/057 -- GROUP-B

Q-3:Implementation of Logistic Regression

(a)Create your own dataset and apply Logistic Regression on the created dataset. Print the predicted score and confusion matrix.

In [5]:

```
import pandas as pd
import seaborn as sb
import numpy as np
import sklearn
from matplotlib import pyplot as plt
```

In [6]:

```
file_path="C:\\Users\SUPRATIM NAG\OneDrive\Documents\ML\Personal_Datasets\Dataset.csv"

data=pd.read_csv(file_path)
```

In [7]:

```
data.head()
```

Out[7]:

	Patient ID	Age	Blood Pressure	Cholesterol Levels	Heart Rate	BMI	Diagnosis	Treatment Plan	Recovery Status	Medication Type	Follow-up Requirement
0	101	65	130	250	72	28.0	Hypertension with high cholesterol.	Medication: Lisinopril (blood pressure), Stati...	Active Recovery	Lisinopril, Statins.	Quarterly.
1	102	42	110	150	76	24.0	Pre-hypertension.	Lifestyle modification: Regular exercise, heal...	Recovered	N/A.	Six months.
2	103	58	140	200	80	30.0	Type 2 Diabetes.	Medication: Metformin (blood sugar control). L...	Active Recovery	Metformin.	Quarterly.
3	104	71	160	220	88	32.0	Heart Failure.	Medication: Digoxin (heart function), Furosemi...	Active Recovery	Digoxin, Furosemide.	Monthly.
4	105	35	120	180	74	27.0	Overweight.	Lifestyle modification: Regular exercise, heal...	Recovered	N/A.	Three months.

In [8]:

```
data.isnull().sum()
```

Out[8]:

```
Patient ID                0
Age                       0
Blood Pressure            0
Cholesterol Levels        0
Heart Rate                0
BMI                       0
Diagnosis                 0
Treatment Plan            0
Recovery Status          13
Medication Type           1
Follow-up Requirement     0
dtype: int64
```

In [9]:

```
data.describe()
```

Out[9]:

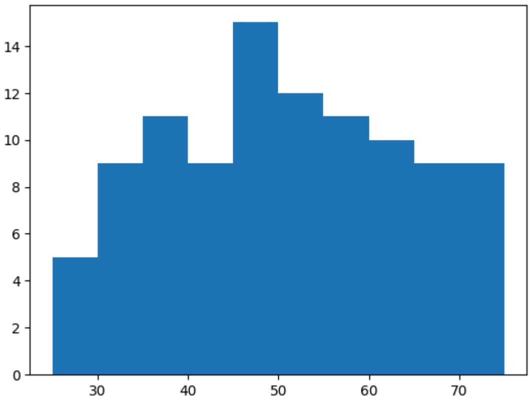
	Patient ID	Age	Blood Pressure	Cholesterol Levels	Heart Rate	BMI
count	100.000000	100.000000	100.000000	100.000000	100.000000	100.000000
mean	107.480000	49.210000	126.100000	199.850000	79.380000	26.970000
std	4.678513	13.121264	15.018171	37.121524	7.947784	4.255015
min	101.000000	25.000000	95.000000	120.000000	60.000000	18.000000
25%	103.750000	39.750000	115.000000	177.500000	75.000000	24.000000
50%	107.000000	50.000000	125.000000	200.000000	80.000000	27.000000
75%	111.000000	60.000000	135.000000	226.250000	85.000000	30.000000
max	118.000000	75.000000	160.000000	300.000000	110.000000	40.000000

In [10]:

```
plt.hist(data['Age'])
```

Out[10]:

```
(array([ 5.,  9., 11.,  9., 15., 12., 11., 10.,  9.,  9.]),
 array([25., 30., 35., 40., 45., 50., 55., 60., 65., 70., 75.]),
 <BarContainer object of 10 artists>)
```

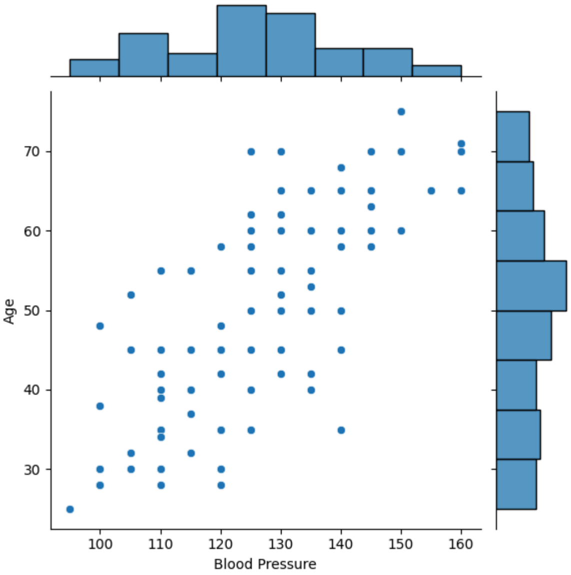


In [11]:

```
sb.jointplot(data=data, x='Blood Pressure', y='Age')
```

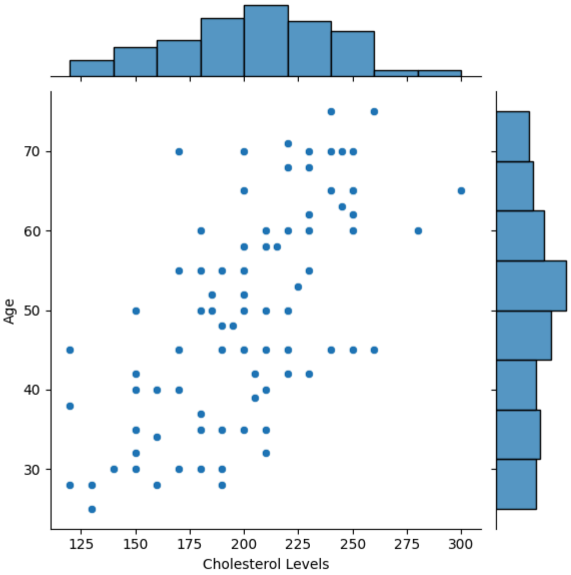
Out[11]:

```
<seaborn.axisgrid.JointGrid at 0x2367be56710>
```



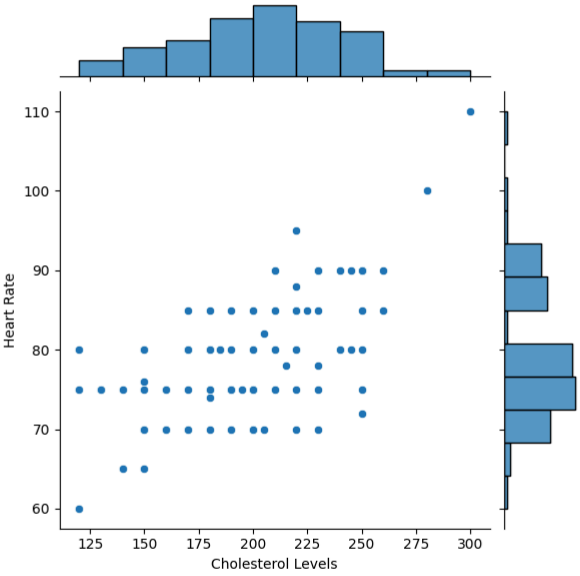
In [12]:
```
sb.jointplot(data=data, x='Cholesterol Levels', y='Age')
```

Out[12]:
```
<seaborn.axisgrid.JointGrid at 0x2367df8cb90>
```



In [13]:
```
sb.jointplot(data=data, x='Cholesterol Levels', y='Heart Rate')
```

Out[13]:
```
<seaborn.axisgrid.JointGrid at 0x2367e3a6350>
```



In [14]:
```
numerical_data = data[['Age', 'Blood Pressure', 'Cholesterol Levels', 'Heart Rate', 'BMI', 'Diagnosis']]
```

In [15]:
```
numerical_data['Diagnosis'] = numerical_data['Diagnosis'].apply(
    lambda x: 1 if 'Hypertension' in x  else 0
)
```

```
C:\Users\SUPRATIM NAG\AppData\Local\Temp\ipykernel_17360\3593694202.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  numerical_data['Diagnosis'] = numerical_data['Diagnosis'].apply(
```

In [16]:

```
print(numerical_data['Diagnosis'].value_counts())
```

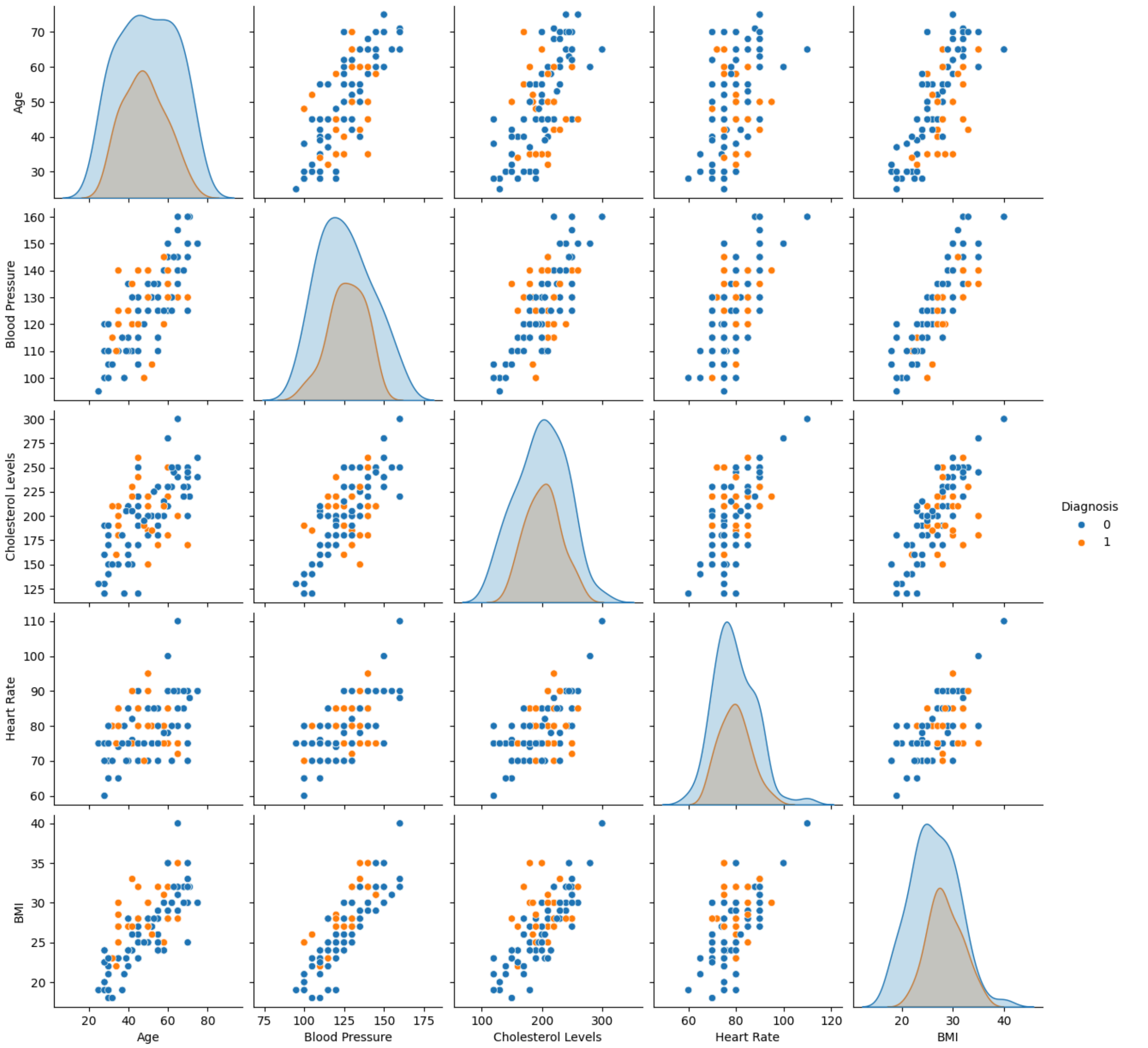
```
Diagnosis
0    69
1    31
Name: count, dtype: int64
```

In [17]:

```
sb.pairplot(numerical_data,hue='Diagnosis')
```

Out[17]:

```
<seaborn.axisgrid.PairGrid at 0x2367bba2150>
```



In [18]:

```
x = numerical_data.drop('Diagnosis', axis=1)
y = numerical_data['Diagnosis']
```

In [19]:

```
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x,y,test_size=0.25, random_state=42)
```

In [20]:

```
from sklearn.linear_model import LogisticRegression
logic = LogisticRegression()
logic.fit(x_train,y_train)
```

Out[20]:

```
▾ LogisticRegression
LogisticRegression()
```

In [21]:

```
logic.coef_
```

Out[21]:

```
array([[-0.11477862, -0.07414491, -0.0043565 , -0.03270354,  0.72757042]])
```

In [22]:

```
predict = logic.predict(x_test)
predict
```

Out[22]:

```
array([0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1,
       0, 1, 0], dtype=int64)
```

In [23]:

```
from sklearn.metrics import classification_report,confusion_matrix
print(classification_report(y_test,predict))
```

```
              precision    recall  f1-score   support

           0       0.79      0.88      0.83        17
           1       0.67      0.50      0.57         8

    accuracy                           0.76        25
   macro avg       0.73      0.69      0.70        25
weighted avg       0.75      0.76      0.75        25
```

In [24]:

```
print(confusion_matrix(y_test,predict))
```

```
[[15  2]
 [ 4  4]]
```

plotting the logistic regression graph

In [25]:

```
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
```

In [26]:

```
X_scaled = scaler.fit_transform(x)
```

In [27]:

```
model = LogisticRegression()
model.fit(X_scaled, y)
```

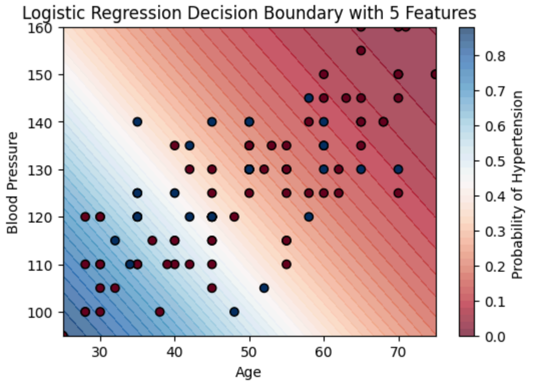
Out[27]:

```
▾ LogisticRegression
LogisticRegression()
```

In [30]:

```
# Create a grid for plotting
age_range = np.linspace(x['Age'].min(), x['Age'].max(), 100)
bp_range = np.linspace(x['Blood Pressure'].min(), x['Blood Pressure'].max(), 100)
cholesterol_range = np.linspace(x['Cholesterol Levels'].min(), x['Cholesterol Levels'].max(), 100)


# Create a meshgrid for Age and Blood Pressure
xx, yy = np.meshgrid(age_range, bp_range)

# Prepare a grid for predictions
Z = np.zeros((len(xx.ravel()), 5))  # 5 features
Z[:, 0] = xx.ravel()  # Age
Z[:, 1] = yy.ravel()  # Blood Pressure
Z[:, 2] = np.mean(x['Cholesterol Levels'])  # Average Cholesterol Levels
Z[:, 3] = np.mean(x['Heart Rate'])  # Average Heart Rate
Z[:, 4] = np.mean(x['BMI'])  # Average BMI

# Standardize the grid
Z_scaled = scaler.transform(Z)

# Predict probabilities for the grid
Z_prob = model.predict_proba(Z_scaled)[:, 1]
Z_prob = Z_prob.reshape(xx.shape)

# Plotting
plt.figure(figsize=(6, 4))
plt.contourf(xx, yy, Z_prob, levels=50, cmap='RdBu', alpha=0.7)
plt.colorbar(label='Probability of Hypertension ')
plt.scatter(x['Age'], x['Blood Pressure'], c=y, edgecolors='k', cmap='RdBu', marker='o')
plt.title('Logistic Regression Decision Boundary with 5 Features')
plt.xlabel('Age')
plt.ylabel('Blood Pressure')
plt.show()
```

```
c:\Users\SUPRATIM NAG\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\base.py:493: UserWarning: X does not have valid feature names, but StandardScaler was fitt
ed with feature names
  warnings.warn(
```


Logistic Regression Decision Boundary with 5 Features
Blood Pressure
Age
Probability of Hypertension