Aim: Using Python Logic Programming, form and manipulate logic expressions using symbolic and boolean values, compare expressions and find out unknown values.

Requirements:

Jupyter Notebook, IDLE, Any Python Editor

Step 1:- Install SymPy

```
! pip install sympy
```

```
Requirement already satisfied: sympy in /usr/local/lib/python3.10/dist-packages (1.12)
Requirement already satisfied: mpmath>=0.19 in /usr/local/lib/python3.10/dist-packages (from sympy) (1.3.0)
```

Step 2:- Import Sympy

```
import sympy as sp
```

Step 3:- Define Logic Expression

```
x = sp.symbols('x')
y = sp.symbols('y')
```

Step 4:- Create Logic Expression

```
expression = (x > 5) & (y < 10)
expression
```

Step 5:- Solve for Unknown Values

```
solutions = sp.satisfiable(expression)
solutions
```

```
{Q.gt(x, 5): True, Q.lt(y, 10): True}
```

Step 6:- Access Solutions

```
solutions = []
for x_value in range(6, 11):
    for y_value in range(1, 10):
        if sp.simplify(expression.subs({x: x_value, y: y_value})):
            solutions.append((x_value, y_value))

for solution in solutions:
    print(f"x = {solution[0]}, y = {solution[1]}")
```

```
x = 6, y = 1
x = 6, y = 2
x = 6, y = 3
x = 6, y = 4
x = 6, y = 5
x = 6, y = 6
x = 6, y = 7
x = 6, y = 8
x = 6, y = 9
x = 7, y = 1
x = 7, y = 2
x = 7, y = 3
x = 7, y = 4
x = 7, y = 5
x = 7, y = 6
```

```
x = 7, y = 7
x = 7, y = 8
x = 7, y = 9
x = 8, y = 1
x = 8, y = 2
x = 8, y = 3
x = 8, y = 4
x = 8, y = 5
x = 8, y = 6
x = 8, y = 7
x = 8, y = 8
x = 8, y = 9
x = 9, y = 1
x = 9, y = 2
x = 9, y = 3
x = 9, y = 4
x = 9, y = 5
x = 9, y = 6
x = 9, y = 7
x = 9, y = 8
x = 9, y = 9
x = 10, y = 1
x = 10, y = 2
x = 10, y = 3
x = 10, y = 4
x = 10, y = 5
x = 10, y = 6
x = 10, y = 7
x = 10, y = 8
x = 10, y = 9
```

Relative Applications:

Q1.

Suppose you're building an AI system that provides recommendations for outdoor activities based on weather conditions. You want to represent the rule: "If it's sunny and the temperature is above 20 degrees Celsius, then recommend going for a picnic."

```
import sympy as sp

# Define symbolic variables
sunny = sp.symbols('sunny')  # True if it's sunny, False if it's not
temperature = sp.symbols('temperature')  # Temperature in degrees Celsius

# Define the rule
recommend_picnic = sp.And(sunny, temperature > 20)

# Interpret the rule
if recommend_picnic:
    print("Recommend going for a picnic.")
else:
    print("Do not recommend going for a picnic.")
```

```
 Recommend going for a picnic.
```

Q2.

In this example, we'll simulate a basic medical diagnosis AI that determines whether a patient has a specific condition based on symptoms and lab test results. Suppose you have a medical rule: "If a patient has a fever (temperature > 100°F) and elevated white blood cell count (WBC > 10,000), then they may have an infection." You'll use symbolic logic to represent this rule and diagnose the patient.

```
# Define symbolic variables
fever = sp.symbols('fever')  # True if the patient has a fever, False if not
wbc_count = sp.symbols('wbc_count')  # White blood cell count

# Define the rule
may_have_infection = sp.And(fever, wbc_count > 10000)

# Interpret the rule
if may_have_infection:
    print("The patient may have an infection.")
```

```
else:
    print("The patient may not have an infection.")
```

```
 The patient may have an infection.
```