EXPERIMENT 01:MDP REPRESENTATION

AIM:

To represent any one real world problem in Markov Decision Problem(MDP).

PROBLEM STATEMENT:

Problem Description:

Move a coin to reach the goal in a 3*3 grid.

State Space:

{0,1,2,3,4,5,6,7,8}

Sample State:

2

Action Space:

{Up[0],Down[1],Left[2],Right[3]}

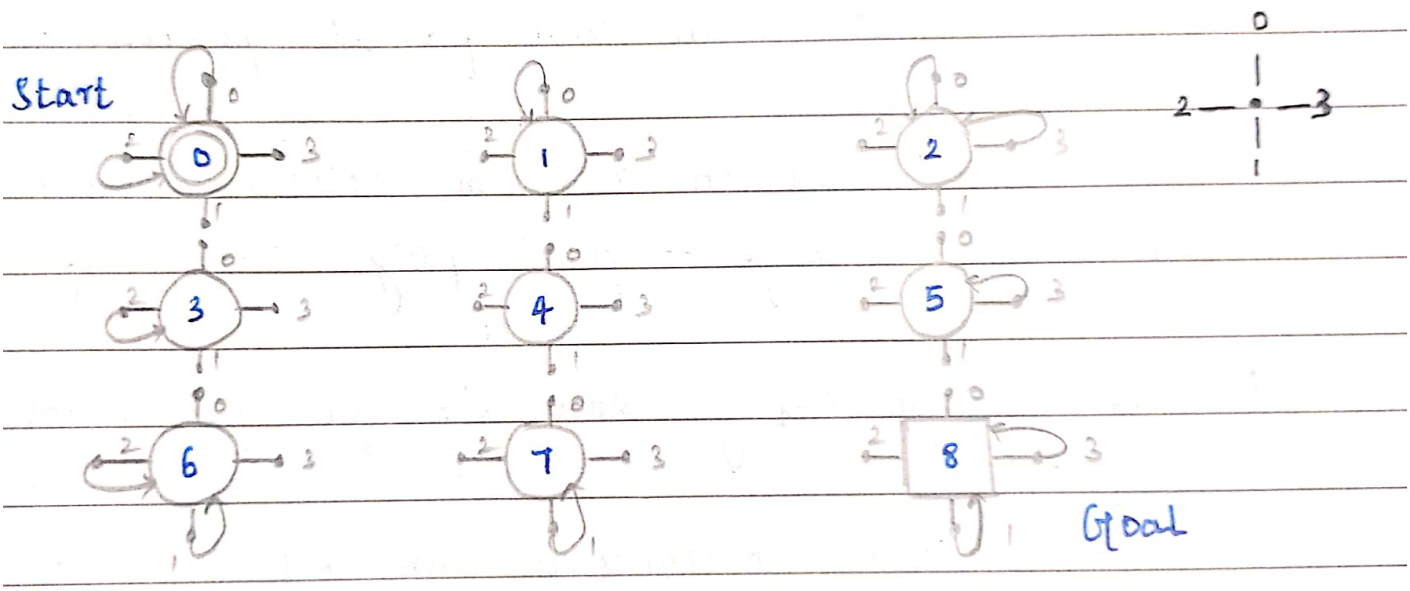
Sample Action:

Down[1]

Reward Function:

To reach goal ->+1(Reward) Otherwise ->0

GRAPHICAL REPRESENTATION:



PYTHON REPRESENTATION:

```
# Creating Dictionary
P={
    0:{
        0:[(0.666,0,0.0,False),(0.333,3,0.0,False)],
        1:[(0.333,3,0.0,False),(0.333,0,0.0,False),(0.333,1,0.0,False)],
        2:[(0.666,0,0.0,False),(0.333,3,0.0,False)],
        3:[(0.333,1,0.0,False),(0.333,0,0.0,False),(0.333,3,0.0,False)]
    },
    1:{
        0:[(0.333,1,0.0,False),(0.333,0,0.0,False),(0.333,2,0.0,False)],
        1:[(0.333,4,0.0,False),(0.333,0,0.0,False),(0.333,2,0.0,False)],
        2:[(0.333,0,0.0,False),(0.333,1,0.0,False),(0.333,4,0.0,False)],
        3:[(0.333,2,0.0,False),(0.333,1,0.0,False),(0.333,4,0.0,False)]
    },
    2:{
        0:[(0.666,2,0.0,False),(0.333,1,0.0,False)],
        1:[(0.333,5,0.0,False),(0.333,1,0.0,False),(0.333,2,0.0,False)],
        2:[(0.333,1,0.0,False),(0.333,2,0.0,False),(0.333,5,0.0,False)],
        3:[(0.666,2,0.0,False),(0.333,5,0.0,False)]
    },
```

```
    3:{
        0:[(0.333,0,0.0,False),(0.333,3,0.0,False),(0.333,4,0.0,False)],
        1:[(0.333,6,0.0,False),(0.333,3,0.0,False),(0.333,4,0.0,False)],
        2:[(0.333,3,0.0,False),(0.333,0,0.0,False),(0.333,6,0.0,False)],
        3:[(0.333,4,0.0,False),(0.333,0,0.0,False),(0.333,6,0.0,False)]
    },
    4:{
        0:[(0.333,1,0.0,False),(0.333,3,0.0,False),(0.333,5,0.0,False)],
        1:[(0.333,7,0.0,False),(0.333,3,0.0,False),(0.333,5,0.0,False)],
        2:[(0.333,3,0.0,False),(0.333,1,0.0,False),(0.333,7,0.0,False)],
        3:[(0.333,5,0.0,False),(0.333,1,0.0,False),(0.333,7,0.0,False)]
    },
    5:{
        0:[(0.333,2,0.0,False),(0.333,4,0.0,False),(0.333,5,0.0,False)],
        1:[(0.333,8,1.0,True),(0.333,4,0.0,False),(0.333,5,0.0,False)],
        2:[(0.333,4,0.0,False),(0.333,1,0.0,False),(0.333,7,0.0,False)],
        3:[(0.333,5,0.0,False),(0.333,1,0.0,False),(0.333,7,0.0,False)]
    },
    6:{
        0:[(0.333,3,0.0,False),(0.333,6,0.0,False),(0.333,7,0.0,False)],
        1:[(0.666,6,0.0,False),(0.333,7,0.0,False)],
        2:[(0.666,6,0.0,False),(0.333,3,0.0,False)],
        3:[(0.333,7,0.0,False),(0.333,3,0.0,False),(0.333,6,0.0,False)]
    },
    7:{
        0:[(0.333,4,0.0,False),(0.333,6,0.0,False),(0.333,8,1.0,True)],
        1:[(0.333,7,0.0,False),(0.333,6,0.0,False),(0.333,8,1.0,True)],
        2:[(0.333,6,0.0,False),(0.333,4,0.0,False),(0.333,7,0.0,False)],
        3:[(0.333,8,1.0,True),(0.333,4,0.0,False),(0.333,7,0.0,False)]
    },
    8:{
        0:[(0.333,5,0.0,False),(0.333,7,0.0,False),(0.333,8,1.0,True)],
        1:[(0.666,8,1.0,True),(0.333,7,0.0,False)],
        2:[(0.333,7,0.0,False),(0.333,5,0.0,False),(0.333,8,1.0,True)],
        3:[(0.666,8,1.0,True),(0.333,5,0.0,False)]
    }
}
```

OUTPUT:

```
In [3]: P
```

```
Out[3]: {0: {0: [(0.666, 0, 0.0, False), (0.333, 3, 0.0, False)],
          1: [(0.333, 3, 0.0, False), (0.333, 0, 0.0, False), (0.333, 1, 0.0, False)],
          2: [(0.666, 0, 0.0, False), (0.333, 3, 0.0, False)],
          3: [(0.333, 1, 0.0, False), (0.333, 0, 0.0, False), (0.333, 3, 0.0, False)]},
         1: {0: [(0.333, 1, 0.0, False),
           (0.333, 0, 0.0, False),
           (0.333, 2, 0.0, False)],
          1: [(0.333, 4, 0.0, False), (0.333, 0, 0.0, False), (0.333, 2, 0.0, False)],
          2: [(0.333, 0, 0.0, False), (0.333, 1, 0.0, False), (0.333, 4, 0.0, False)],
          3: [(0.333, 2, 0.0, False), (0.333, 1, 0.0, False), (0.333, 4, 0.0, False)]},
         2: {0: [(0.666, 2, 0.0, False), (0.333, 1, 0.0, False)],
          1: [(0.333, 5, 0.0, False), (0.333, 1, 0.0, False), (0.333, 2, 0.0, False)],
          2: [(0.333, 1, 0.0, False), (0.333, 2, 0.0, False), (0.333, 5, 0.0, False)],
          3: [(0.666, 2, 0.0, False), (0.333, 5, 0.0, False)]},
         3: {0: [(0.333, 0, 0.0, False),
           (0.333, 3, 0.0, False),
           (0.333, 4, 0.0, False)],
          1: [(0.333, 6, 0.0, False), (0.333, 3, 0.0, False), (0.333, 4, 0.0, False)],
          2: [(0.333, 3, 0.0, False), (0.333, 0, 0.0, False), (0.333, 6, 0.0, False)],
          3: [(0.333, 4, 0.0, False), (0.333, 0, 0.0, False), (0.333, 6, 0.0, False)]},
         4: {0: [(0.333, 1, 0.0, False),
           (0.333, 3, 0.0, False),
           (0.333, 5, 0.0, False)],
          1: [(0.333, 7, 0.0, False), (0.333, 3, 0.0, False), (0.333, 5, 0.0, False)],
          2: [(0.333, 3, 0.0, False), (0.333, 1, 0.0, False), (0.333, 7, 0.0, False)],
          3: [(0.333, 5, 0.0, False), (0.333, 1, 0.0, False), (0.333, 7, 0.0, False)]},
         5: {0: [(0.333, 2, 0.0, False),
           (0.333, 4, 0.0, False),
           (0.333, 5, 0.0, False)],
          1: [(0.333, 8, 1.0, True), (0.333, 4, 0.0, False), (0.333, 5, 0.0, False)],
          2: [(0.333, 4, 0.0, False), (0.333, 1, 0.0, False), (0.333, 7, 0.0, False)],
          3: [(0.333, 5, 0.0, False), (0.333, 1, 0.0, False), (0.333, 7, 0.0, False)]},
         6: {0: [(0.333, 3, 0.0, False),
           (0.333, 6, 0.0, False),
           (0.333, 7, 0.0, False)],
          1: [(0.666, 6, 0.0, False), (0.333, 7, 0.0, False)],
          2: [(0.666, 6, 0.0, False), (0.333, 3, 0.0, False)],
          3: [(0.333, 7, 0.0, False), (0.333, 3, 0.0, False), (0.333, 6, 0.0, False)]},
         7: {0: [(0.333, 4, 0.0, False),
           (0.333, 6, 0.0, False),
           (0.333, 8, 1.0, True)],
          1: [(0.333, 7, 0.0, False), (0.333, 6, 0.0, False), (0.333, 8, 1.0, True)],
          2: [(0.333, 6, 0.0, False), (0.333, 4, 0.0, False), (0.333, 7, 0.0, False)],
          3: [(0.333, 8, 1.0, True), (0.333, 4, 0.0, False), (0.333, 7, 0.0, False)]},
         8: {0: [(0.333, 5, 0.0, False),
           (0.333, 7, 0.0, False),
           (0.333, 8, 1.0, True)],
          1: [(0.666, 8, 1.0, True), (0.333, 7, 0.0, False)],
          2: [(0.333, 7, 0.0, False), (0.333, 5, 0.0, False), (0.333, 8, 1.0, True)],
          3: [(0.666, 8, 1.0, True), (0.333, 5, 0.0, False)]}}
```

RESULT:

Thus a real world problem is represented as Markov Decision Problem in the following ways successfully:

1. Graphical Representation
2. Python Representation