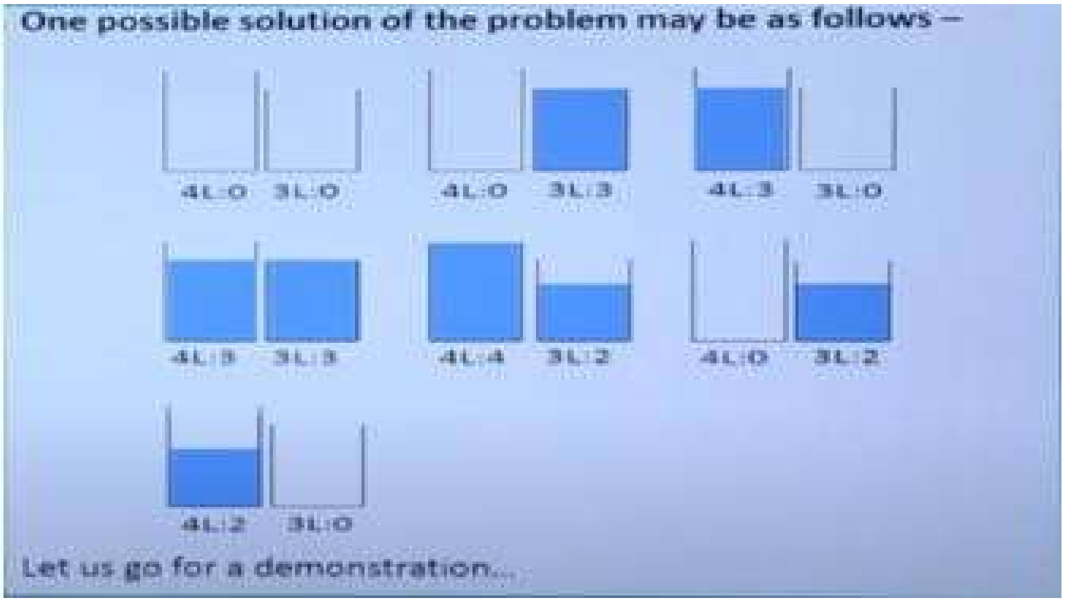
EX.NO: **DATE:**

DEPTH-FIRST SEARCH – WATER JUG PROBLEM

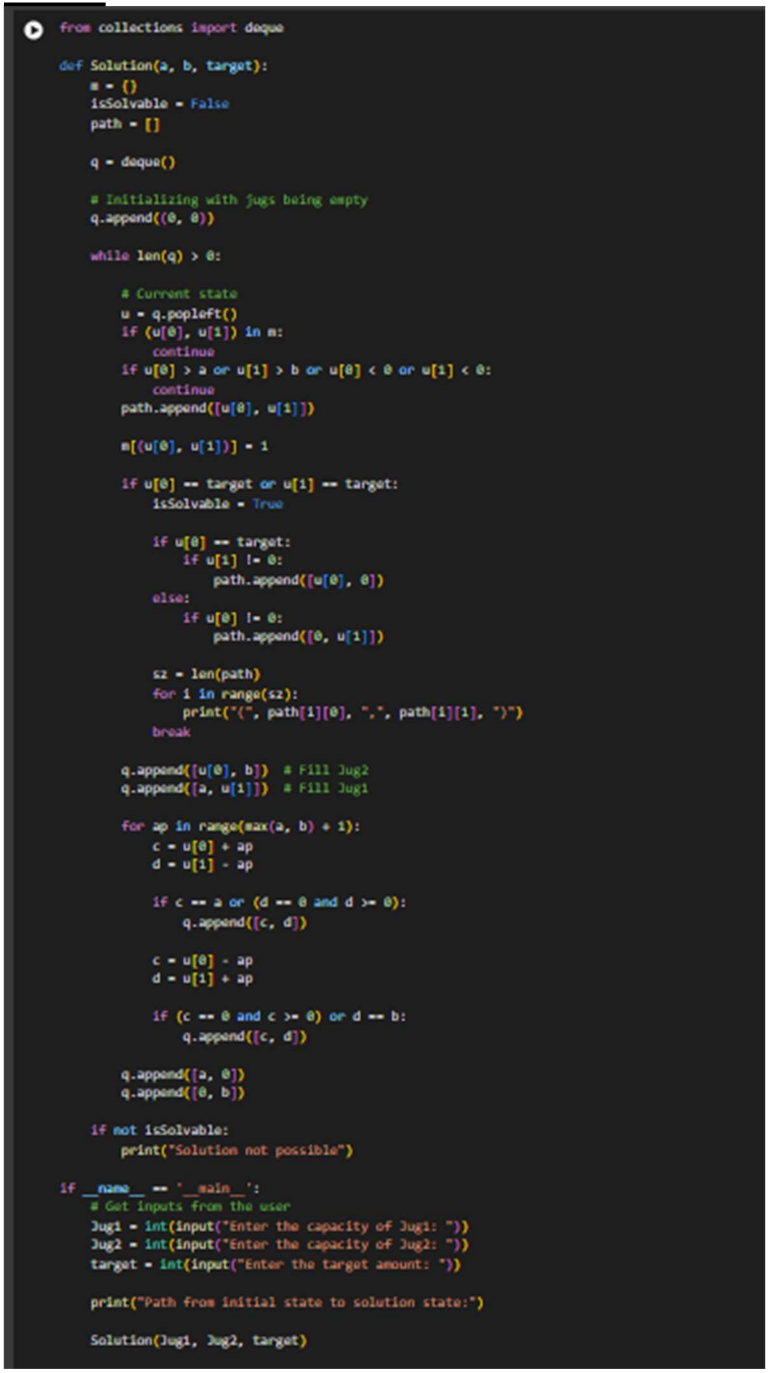
In the **water jug problem in Artificial Intelligence**, we are provided with two jugs: one having the capacity to hold 3 gallons of water and the other has the capacity to hold 4 gallons of water. There is no other measuring equipment available and the jugs also do not have any kind of marking on them. So, the agent's task here is to fill the 4-gallon jug with 2 gallons of water by using only these two jugs and no other material. Initially, both our jugs are empty.



One possible solution of the problem may be as follows –

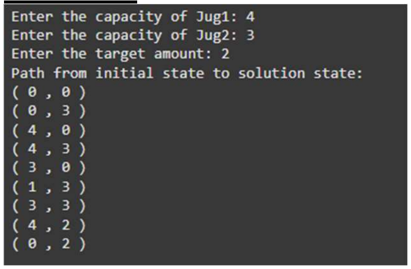
Let us go for a demonstration...

CODE:



```python
from collections import deque

def Solution(a, b, target):
    m = {}
    isSolvable = False
    path = []

    q = deque()

    # Initializing with jugs being empty
    q.append((0, 0))

    while len(q) > 0:

        # Current state
        u = q.popleft()
        if (u[0], u[1]) in m:
            continue
        if u[0] > a or u[1] > b or u[0] < 0 or u[1] < 0:
            continue
        path.append([u[0], u[1]])

        m[(u[0], u[1])] = 1

        if u[0] == target or u[1] == target:
            isSolvable = True

            if u[0] == target:
                if u[1] != 0:
                    path.append([u[0], 0])
            else:
                if u[0] != 0:
                    path.append([0, u[1]])

            sz = len(path)
            for i in range(sz):
                print("(", path[i][0], ",", path[i][1], ")")
            break

        q.append([u[0], b])  # Fill Jug2
        q.append([a, u[1]])  # Fill Jug1

        for ap in range(max(a, b) + 1):
            c = u[0] + ap
            d = u[1] - ap

            if c == a or (d == 0 and d >= 0):
                q.append([c, d])

            c = u[0] - ap
            d = u[1] + ap

            if (c == 0 and c >= 0) or d == b:
                q.append([c, d])

        q.append([a, 0])
        q.append([0, b])

    if not isSolvable:
        print("Solution not possible")

if __name__ == '__main__':
    # Get inputs from the user
    Jug1 = int(input("Enter the capacity of Jug1: "))
    Jug2 = int(input("Enter the capacity of Jug2: "))
    target = int(input("Enter the target amount: "))

    print("Path from initial state to solution state:")

    Solution(Jug1, Jug2, target)
```

OUTPUT:



```
Enter the capacity of Jug1: 4
Enter the capacity of Jug2: 3
Enter the target amount: 2
Path from initial state to solution state:
( 0 , 0 )
( 0 , 3 )
( 4 , 0 )
( 4 , 3 )
( 3 , 0 )
( 1 , 3 )
( 3 , 3 )
( 4 , 2 )
( 0 , 2 )
```

RESULT:

Thus Program is Executed Successfully And Output is Verified.