EX.NO:03 **DATE:23.08.2024**
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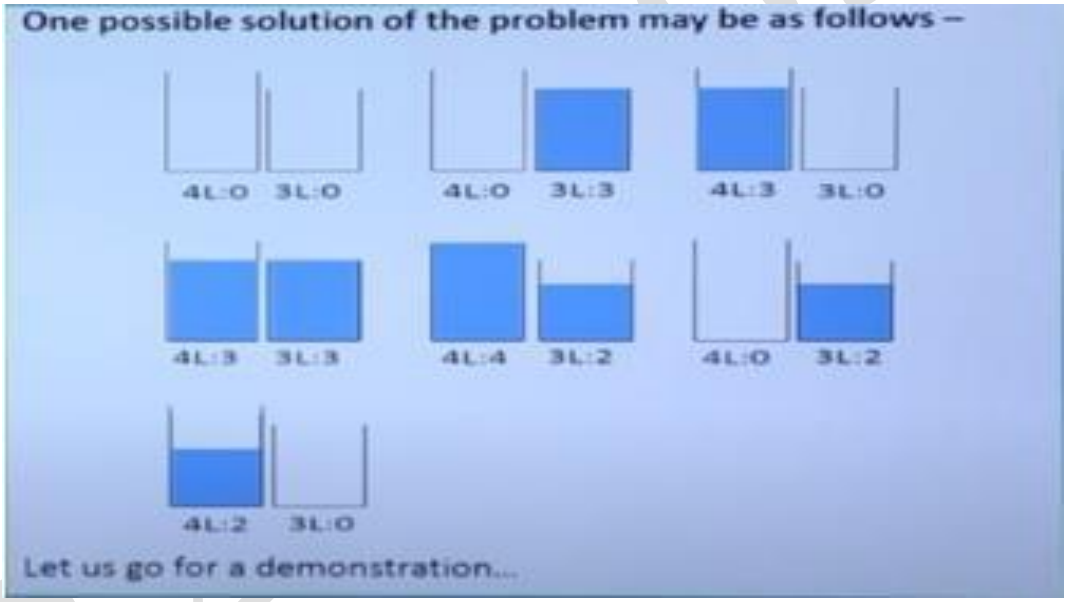
DEPTH-FIRST SEARCH – WATER JUG PROBLEM

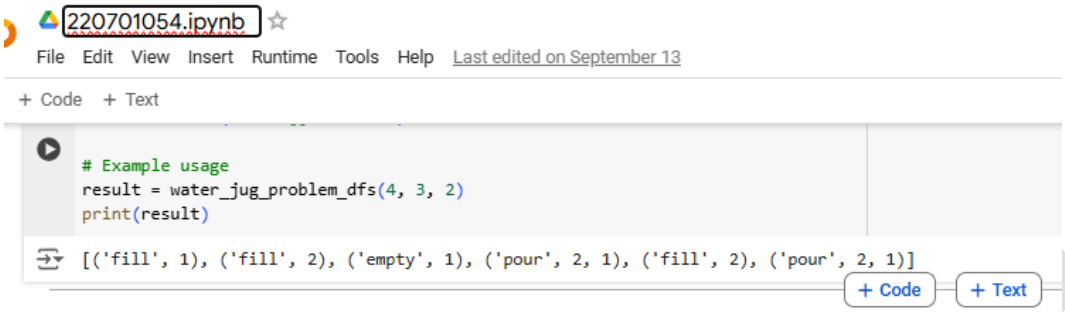
In the **water jug problem in Artificial Intelligence**, we are provided with two jugs: one having the capacity to hold 3 gallons of water and the other has the capacity to hold 4 gallons of water. There is no other measuring equipment available and the jugs also do not have any kind of marking on them. 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.



Code:

```
def water_jug_problem_dfs(jug1_cap, jug2_cap, target_amount):
    def dfs(j1, j2, seq, visited):
        # Check if we have reached the target amount
        if j1 == target_amount or j2 == target_amount:
            return seq

        # Mark this state as visited
        visited.add((j1, j2))

        # Possible actions
        actions = [
            ("fill", 1), ("fill", 2), ("empty", 1), ("empty", 2), ("pour", 1, 2), ("pour", 2, 1)
        ]

        for action in actions:
            if action[0] == "fill":
                if action[1] == 1:
                    next_state = (jug1_cap, j2)
                else:
                    next_state = (j1, jug2_cap)
            elif action[0] == "empty":
                if action[1] == 1:
                    next_state = (0, j2)
                else:
                    next_state = (j1, 0)
            else:  # action[0] == "pour"
                if action[1] == 1:
                    amount = min(j1, jug2_cap - j2)
                    next_state = (j1 - amount, j2 + amount)
                else:
                    amount = min(j2, jug1_cap - j1)
                    next_state = (j1 + amount, j2 - amount)

            if next_state not in visited:
                next_seq = seq + [action]
                result = dfs(next_state[0], next_state[1], next_seq, visited)
                if result:
                    return result

        return None

    # Initialize the DFS
    visited = set()
    return dfs(0, 0, [], visited)

# Example usage
result = water_jug_problem_dfs(4, 3, 2)
print(result)
```

Output:



Result:

Thus the code for water jug problem using dfs is executed successfully.