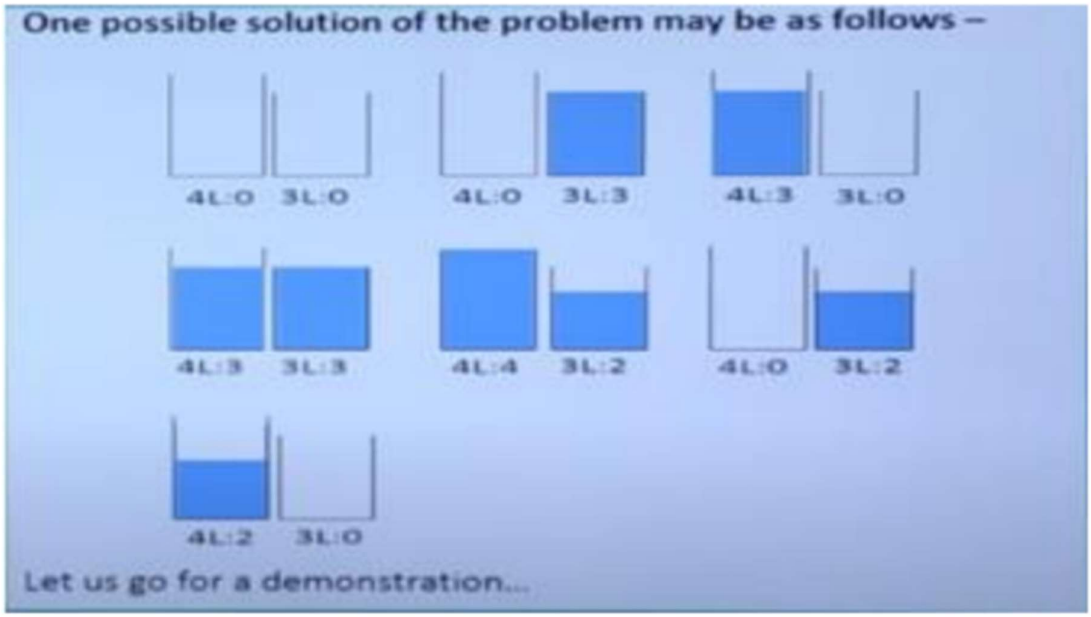
EX.NO:3 DATE:

REG NO:220701021

DEPTH-FIRST SEARCH – WATER JUG PROBLEM

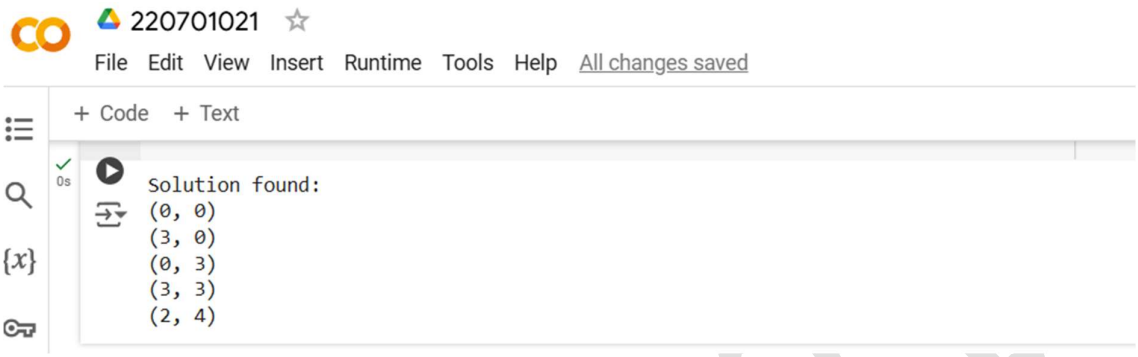
In the water jug problem in Artificial Intelligence, we are provided with two jugs: one having the capacity to hold 3 gallons of water and the other has the capacity to hold 4 gallons of water. There is no other measuring equipment available and the jugs also do not have any kind of marking on them. 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(jug1_capacity, jug2_capacity, target_capacity):
  """
  Solves the water jug problem using a breadth-first search algorithm.

  Args:
    jug1_capacity: The capacity of the first jug.
    jug2_capacity: The capacity of the second jug.
    target_capacity: The target amount of water to achieve in one of the jugs.

  Returns:
    A list of tuples representing the steps to achieve the target amount of water,
    or None if the target is not achievable.
  """

  visited = set()
  queue = [[(0, 0), []]]  # [(jug1_amount, jug2_amount), [path]]

  while queue:
    (jug1_amount, jug2_amount), path = queue.pop(0)

    if jug1_amount == target_capacity or jug2_amount == target_capacity:
      return path + [(jug1_amount, jug2_amount)]

    if (jug1_amount, jug2_amount) in visited:
      continue
    visited.add((jug1_amount, jug2_amount))

    # Possible actions:
    # 1. Fill jug1
    queue.append([(jug1_capacity, jug2_amount), path + [(jug1_amount, jug2_amount)]])
    # 3. Empty jug1
    queue.append([(0, jug2_amount), path + [(jug1_amount, jug2_amount)]])
    # 4. Empty jug2
    queue.append([(jug1_amount, 0), path + [(jug1_amount, jug2_amount)]])
    # 5. Pour water from jug1 to jug2
    pour_amount = min(jug1_amount, jug2_capacity - jug2_amount)
    queue.append([(jug1_amount - pour_amount, jug2_amount + pour_amount), path + [(jug1_amount, jug2_amount)]])
    # 6. Pour water from jug2 to jug1
    pour_amount = min(jug2_amount, jug1_capacity - jug1_amount)
    queue.append([(jug1_amount + pour_amount, jug2_amount - pour_amount), path + [(jug1_amount, jug2_amount)]])

  return None


# Example usage:
jug1_capacity = 3
jug2_capacity = 4
target_capacity = 2

solution = water_jug_problem(jug1_capacity, jug2_capacity, target_capacity)

if solution:
  print("Solution found:")
  for step in solution:
    print(step)
else:
  print("No solution found.")
```

OUTPUT:



RESULT:

Thus the DEPTH-FIRST SEARCH – WATER JUG PROBLEM has been executed successfully.