**Lab Task 3**  
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**Report: Solving the Water Jug Problem Using DFS**

## **1. Introduction**

The Water Jug Problem is a well-known puzzle in artificial intelligence and problem-solving. Given two jugs of different capacities, the goal is to measure a specific amount of water using only these jugs. This report presents a Depth-First Search (DFS) approach to solving this problem programmatically.

## **2. Problem Statement**

Given two jugs with known capacities (jug1, jug2), determine the sequence of actions required to measure an exact target amount of water.

## **3. Methodology**

### **3.1 Approach**

* The solution is implemented using **Depth-First Search (DFS)** to explore all possible states.
* A stack is used for traversal, and a visited set ensures no state is revisited.
* The algorithm considers six possible operations:
  + Fill Jug 1.
  + Fill Jug 2.
  + Empty Jug 1.
  + Empty Jug 2.
  + Pour water from Jug 1 into Jug 2.
  + Pour water from Jug 2 into Jug 1.
* A backtracking method is used to reconstruct the solution path.

### **3.2 Implementation**

* The function water\_jug\_dfs(jug1, jug2, target) explores the state space using DFS.
* A helper function is\_valid(state, capacity) ensures that no invalid states are considered.
* The print\_rules() function displays possible actions.
* The program takes user inputs for jug capacities and target volume.

## **4. Results and Conclusion**

* The algorithm successfully finds a solution path if one exists.
* If no solution is found, the program returns "No solution found."
* Future improvements can include using Breadth-First Search (BFS) for an optimal solution.

**Screenshots**  
