



SUPERIOR UNIVERSITY

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Section:AI(4A)

SUBJECT:PAI-Lab

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Lab task 3:

Water Jug Problem:

Title: Solving the Water Jug Problem Using Depth-First Search (DFS)

Introduction

The Water Jug Problem is a classic puzzle in artificial intelligence and problem-solving. It involves two jugs with different capacities and the goal of measuring a specific amount of water using these jugs. In this project, we have implemented a solution using the Depth-First Search (DFS) algorithm.

Problem Statement

We are given two jugs:

Jug 1 with a capacity of 4 liters

Jug 2 with a capacity of 3 liters

Our task is to measure exactly 2 liters of water using these jugs.

Approach

To solve this problem, we use the Depth-First Search (DFS) algorithm. DFS explores possible states by performing operations such as filling, emptying, and transferring water between the jugs. The algorithm continues until the target amount of water is achieved in either jug.

Rules and Operations

The following operations can be performed on the jugs:

Fill Jug 1 completely.

Fill Jug 2 completely.

Empty Jug 1.

Empty Jug 2.

Pour water from Jug 1 to Jug 2 until Jug 2 is full or Jug 1 is empty.

Pour water from Jug 2 to Jug 1 until Jug 1 is full or Jug 2 is empty.

Implementation Details

The solution is implemented in Python using a stack for DFS. A set keeps track of visited states to avoid loops, and a dictionary stores the path leading to the solution.

Explanation of the Code

The function `get_successors` generates all possible states from the current state by applying the allowed operations.

The `dfs` function uses a stack to explore states, checking if the target is reached. If so, it reconstructs the path leading to the solution.

The algorithm starts with both jugs empty and explores all possibilities until it finds a solution or exhausts all options.

Output :

If the algorithm finds a solution, it prints the sequence of steps to reach the target. Otherwise, it states that no solution exists.

Conclusion Using DFS,

we successfully solved the Water Jug Problem. The algorithm efficiently explores possible states and finds a valid path to measure 2 liters of water. This approach demonstrates how AI techniques can be applied to real-world problem-solving.

Output:

```
PS E:\PAI\pai lab> & "C:/Users/Muhammad ilyas/AppData/Local/Programs/Python/Python312/python.exe"
Solution found:
(0, 0)
(0, 3)
(3, 0)
(3, 3)
(4, 2)
PS E:\PAI\pai lab>
```