



The Superior University

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Lab Task 03

Water Jug Problem

The Water Jug Problem is a traditional artificial intelligence and algorithm problem that is frequently utilized to demonstrate state-space search methods. It is a situation in which you are given two jugs of different capacities and a limitless supply of water. The objective is to measure a given quantity of water using the two jugs under some constraints.

Problem Statement

Given:

Two jugs with capacities 7 liters and 3 liters.

A target quantity 2 liters that has to be quantified.

Allowed Operations

Completely fill a jug from the water supply.

Completely empty a jug on the ground.

Transfer water from one jug to another until one jug is filled or the jug being poured becomes empty.

Solution Approach

We can solve the problem through varying approaches:

Breadth-First Search (BFS) – Finds shortest sequence of operations.

Depth-First Search (DFS) – Searches for possible solutions in-depth.

By DFS:

```
def w_p(cap1, cap2, goal):  
  
    stack=[]  
  
    v=set()  
  
    stack.append((0,0))  
  
    v.add((0,0))  
  
    act=[]  
  
    while stack:  
  
        j1,j2=stack.pop()  
  
        act.append((j1,j2))  
  
        if j1==goal or j2 == goal:  
  
            print("perfect solution found")  
  
            for act in act:  
  
                print(act)  
  
            return True
```

```

rules =[

    (cap1,j2),#filling jug one

    (j1,cap2),#filling jug two

    (0,j2),#empty jug1

    (j1,0),#empty jug2

    (j1 - min(j1,cap2 -j2),j2+ min(j1,cap2-j2)),#pour jug 1 into jug2 untill
jug2 is full

    (j1 +min(j2,cap1-j1),j2 -min(j2,cap1-j1)),#pour jug 2 untill jug 1 is full

    (0, j1 + j2) if j1 + j2 <= cap2 else (j1 + j2 - cap2, cap2), # Pour Jug 1
into Jug 2 until empty

    (j1 + j2, 0) if j1 + j2 <= cap1 else (cap1, j1 + j2 - cap1) # Pour Jug 2
into Jug 1 until empty

]

for state in rules:

    if state not in v:

        v.add(state)

        stack.append(state)

print("no solution found")

return False

jug_1=7

jug_2=3

target=2

w_p(jug_1,jug_2,target)

```

```

■ (venv) (base) fajarfatima@fatima-MacBook PAI_LAB % /Users/fajarfatima/venv/bin/python /Users/fajarfatima/Desktop/PAI_LAB/water_jug_problem.py
perfect solution found
(0, 0)
(0, 3)
(3, 0)
(3, 3)
(6, 0)
(6, 3)
(7, 2)
○ (venv) (base) fajarfatima@fatima-MacBook PAI_LAB % █

```
