Assignment 2: Artificial Intelligence:

THE WATER JUG PROBLEM

ROHAAN ADVANI – 111903151

Problem Statement:

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.

Agent Function:

Percepts:

[x (No: of gallons of water in the 4-gallon jug), y (No: of gallons of water in the 3-gallon jug)]

Values: x = 0, 1, 2, 3, 4 & y = 0, 1, 2, 3

S.No.	Initial State	Condition	Final state	Description of action taken
1.	(x,y)	If x<4	(4, y)	Fill the 4-gallon jug completely
2.	(x,y)	if y<3	(x,3)	Fill the 3-gallon jug completely
3.	(x,y)	If x>0	(x-d,y)	Pour some part from the 4-gallon jug
4.	(x,y)	If y>0	(x,y-d)	Pour some part from the 3-gallon jug
5.	(x,y)	If x>0	(0, y)	Empty the 4-gallon jug
6.	(x,y)	If y>0	(x,0)	Empty the 3-gallon jug
7.	(x,y)	If (x+y) < 7	(4, y-[4-x])	Pour some water from the 3-gallon jug to fill the 4-gallon jug
8.	(x,y)	If (x+y) < 7	(x-[3-y], y)	Pour some water from the 4-gallon jug to fill the 3-gallon jug.
9.	(x,y)	If (x+y) < 4	(x+y,0)	Pour all water from 3-gallon jug to the 4-gallon jug
10.	(x,y)	if (x+y) < 3	(0, x+y)	Pour all water from the 4-gallon jug to the 3-gallon jug

Environment Type:

- Fully Observable – Agent is aware of all available states.
- Deterministic – Each state depends on previous state.
- Single Agent – Pours water to get desired result.
- Dynamic – Environment changes with respect to Agent action.
- Discrete – Finite Number of outputs.

PEAS:

- **Performance Measure:**
  +1 / +2 / +3 / +4 Water Poured Into 4-gallon jug.
  -1/ -2/ -3/ -4 Water Poured out of 4-gallon jug.
  -1/ -2/ -3 Water Poured into 3-gallon jug.
  +1/ +2/ +3 Water Poured out of 4-gallon jug.
- **Environment:** 4-gallon jug, 3-gallon jug, water
- **Actuators:**

  Fill the 4-gallon jug completely

  Fill the 3-gallon jug completely

  Pour some part from the 4-gallon jug

  Pour some part from the 3-gallon jug

  Empty the 4-gallon jug

  Empty the 3-gallon jug

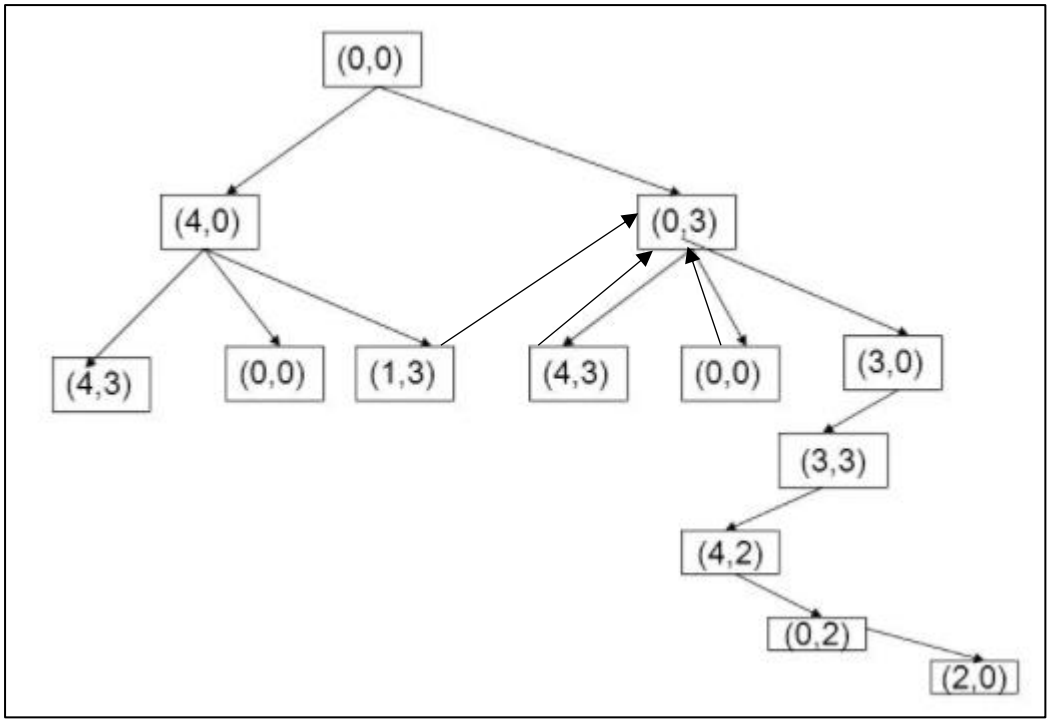
  Pour some water from the 3-gallon jug to fill the 4-gallon jug

  Pour some water from the 4-gallon jug to fill the 3-gallon jug.

  Pour all water from 3-gallon jug to the 4-gallon jug

  Pour all water from the 4-gallon jug to the 3-gallon jug
- **Sensors:** Entire State is Visible (except any kind of markings on jugs).

State Space Graph: (x, y)



Solution of water jug problem according to the production rules:

S.No.	4-gallon jug contents	3-gallon jug contents	Rule followed
1.	0 gallon	0 gallon	Initial state
2.	0 gallon	3 gallons	Rule no.2
3.	3 gallons	0 gallon	Rule no. 9
4.	3 gallons	3 gallons	Rule no. 2
5.	4 gallons	2 gallons	Rule no. 7
6.	0 gallon	2 gallons	Rule no. 5
7.	2 gallons	0 gallon	Rule no. 9