Date: Ex No: 1.4	Title of the Lab Water and Jug	Name: Yuvraj Singh Chauhan Registration Number: RA1911027010058 Section: N1 Lab Batch: 1 Day Order: 3

AIM:

To implement Water and Jug problem.

Description of the Concept or Problem given:

We have 3 water jugs. They can hold 12L, 8L, 5L respectively without marking. The initial state is (12,0,0) and the final state should be (6,6,0).

Manual Solution:

a) First, we pour 8L into the middle jug and transfer the rest 4L into the third jug from first jug, (0,8,4).
b) Then we transfer the 8L from middle jug to the first jug, and transfer the 4L into the middle jug, (8,4,0).
c) Now transfer 5L from first jug to the third jug, (3,4,5).
d) Then add the 4L from the third jug and fill up the middle jug completely. (3,8,1).
e) Now transfer 8L into the first jug from the middle jug and transfer 1L from the third jug to the middle jug. (11,1,0).
f) Add 5L from the first jug to the third jug. (6,1,5).
g) Finally transfer the 5L from third jug to the middle jug and we have the final state. (6,6,0).

Program Implementation [Coding]

```
initial_capacity=(12,8,5)
x=initial_capacity[0]
y=initial_capacity[1]
z=initial_capacity[2]
memory={}
ans=[]
def get_all_states(state):
    a=state[0]
    b=state[1]
    c=state[2]
    if(a==6 and b==6):
        ans.append(state)
        return True
    if((a,b,c) in memory):
        return False
    memory[(a,b,c)] = 1
    if(a>0):
```

```
    if(a+b<=y):
        if( get_all_states((0,a+b,c)) ):
            ans.append(state)
            return True
    else:
        if( get_all_states((a-(y-b), y, c)) ):
            ans.append(state)
            return True
    if(a+c<=z):
        if( get_all_states((0,b,a+c)) ):
            ans.append(state)
            return True
        else:
            if( get_all_states((a-(z-c), b, z)) ):
                ans.append(state)
                return True
    if(b>0):
        if(a+b<=x):
            if( get_all_states((a+b, 0, c)) ):
                ans.append(state)
                return True
        else:
            if( get_all_states((x, b-(x-a), c)) ):
                ans.append(state)
                return True
    if(b+c<=z):
        if( get_all_states((a, 0, b+c)) ):
            ans.append(state)
            return True
    else:
        if( get_all_states((a, b-(z-c), z)) ):
            ans.append(state)
            return True
if(c>0):
    if(a+c<=x):
        if( get_all_states((a+c, b, 0)) ):
            ans.append(state)
            return True
    else:
        if( get_all_states((x, b, c-(x-a))) ):
            ans.append(state)
            return True
if(b+c<=y):
    if( get_all_states((a, b+c, 0)) ):
        ans.append(state)
```

```
            return True
        else:
            if( get_all_states((a, y, c-(y-b))) ):
                ans.append(state)
                return True
        return False
    initial_state=(12,0,0)
    get_all_states(initial_state)
    ans.reverse()
    for i in ans:
        print(i)
```

Screenshots of the Outputs:

```
(12, 0, 0)
(4, 8, 0)
(4, 3, 5)
(9, 3, 0)
(9, 0, 3)
(1, 8, 3)
(1, 6, 5)
(6, 6, 0)
```

Signature of the Student

[YUVRAJ SINGH CHAUHAN]