BLOCKS WORLD DOMAIN

AI Lab Assignment 2

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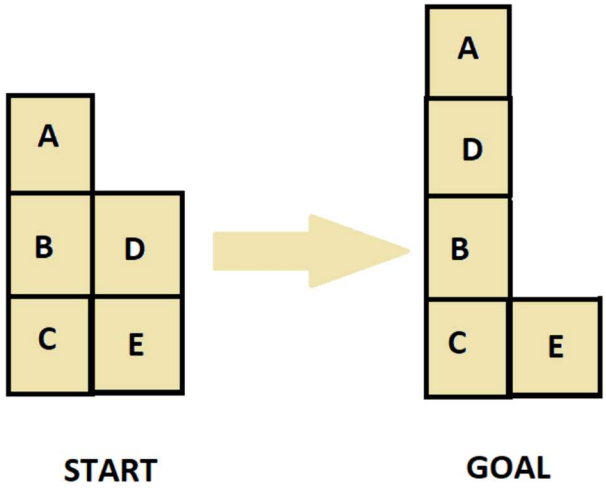
1. State Space :

Block worlds domain is a problem that starts with an initial condition with objects stacked on one another and we have a goal state which we need to achieve. This can be done so by moving only one block at the top of any stack to any other time at a single time. Throughout, there will be multiple intermediate states out of which we need to choose so that we reach the goal state. For this we need to figure out a good heuristic function which leads us to the goal state. We go on choosing the states in increasing order of heuristic which is known as hill climb approach. For our problem we have been constrained to use 3 stacks only.

2. Start and Goal node:

Start node is the initial condition we start with and goal is the one we need to reach through our algorithm of calculating heuristics and hill climb approach of solving. Both specify an ordered stack of blocks . Goal is to reach goal node from the start node using hill climbing.



3. MoveGen and GoalTest:

As we have only three stacks, we have tried out all 6 possibilities i.e., popping from stack1 and pushing into stack 2 or stack3 and so on for other two stacks also. So, moveGen generates all 6 neighbors if possible (popping from empty stack not possible) and calculates their heuristic value and choses the one with maximum heuristic value. Goal test is done by checking if the heuristic value of our current state and goal state is same or not.

4. Heuristic Functions:

Heuristic functions used here are based on the positions of the blocks in the current state and the goal state.For each correct position defined below heuristic is awarded some points and similarly for incorrect positions heuristic is penalized.

Heuristic_1:

Heuristic value = 0

If an element is present in same stack in goal and current state:

Heuristic value +=1

If the element is present at same height in goal and current state:

Heuristic value +=1

Else:

Heuristic value +=0

Else:

Heuristic value -=2

Heuristic_2:

Heuristic value = 0

If an element is present in the exact same position in the current state as that in the goal state:

Heuristic value += the height of the element

Else:

Heuristic value -= the height of the element in the current state

Hill Climbing:

a) **States explored:** The moveGen function first generates all six neighboring states to our start/initial state. Then it chooses best of them based on the heuristic value and proceeds forward to do the same until we reach a local maximum. Once local maxima is reached then loop terminates. For 3 stack problem , 6 configurations are possible after each pop and push so in each iteration 6 states are obtained and only one best state is explored.
b) **Time Taken :** Compared to BFS and DFS , hill climbing algorithm takes considerably lesser time as it may not find an optimal solution or it finds no solution at all. In our implementations of the both heuristic it follows that time is consumed in the order of milli-seconds.
c) **Optimal Solution :** BFS is complete in terms of finding solution , however need not be optimal. DFS is not complete in terms of finding solution. Hill climbing on the other hand checks in each iteration if new heuristic value obtained is better than before one , if not it terminates as it reaches a local maxima. And when the goal state is reached by following certain paths, it is not necessary that solution was obtained in minimum number of steps. Also it wont allow us to reach the global maxima. Hence the solution provided is not optimal always.