Assignment 3: BlocksWorld

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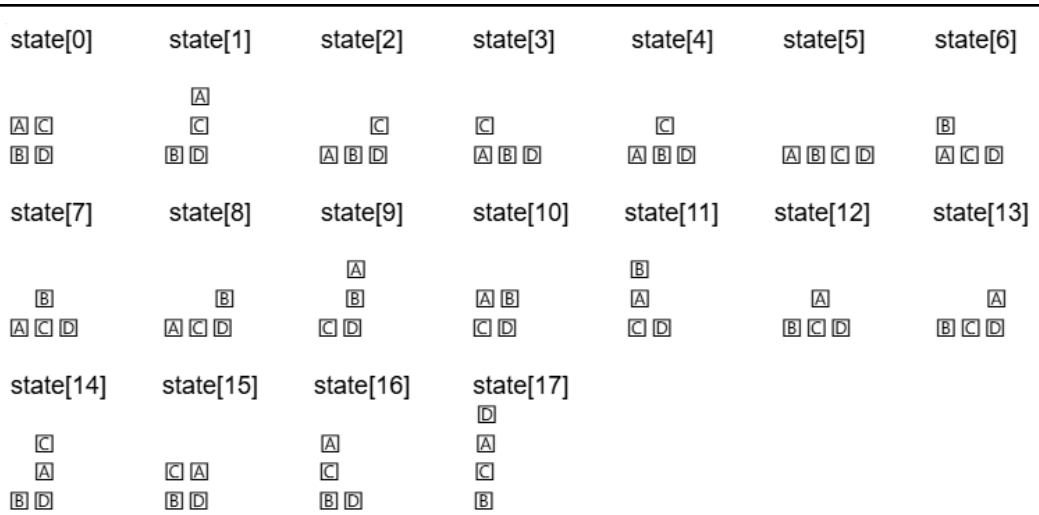
Group 14 Contributions: All contributed equally.

Results:

	TEST 1: (4 blocks)
Start	start([[on,a,b],[on,b,table],[on,c,d],[clear,a],[clear,c],[on,d,table]]). A C B D
Goal	goal([[on,d,a],[on,a,c],[on,c,b],[on,b,table],[clear,d]]). D A C B
Steps (DFS)	[[[on,a,b],[on,b,table],[on,c,d],[clear,a],[clear,c],[on,d,table]], [[on,a,c],[on,b,table],[on,c,d],[clear,a],[clear,b],[on,d,table]], [[clear,c],[on,a,table],[on,b,table],[on,c,d],[clear,a],[clear,b],[on,d,table]], [[clear,c],[on,a,table],[on,b,table],[on,c,a],[clear,d],[clear,b],[on,d,table]], [[clear,c],[on,a,table],[on,b,table],[on,c,b],[clear,d],[clear,a],[on,d,table]], [[clear,b],[clear,c],[on,a,table],[on,b,table],[on,c,table],[clear,d],[clear,a],[on,d,table]], [[clear,b],[clear,c],[on,a,table],[on,b,a],[on,c,table],[clear,d],[on,d,table]], [[clear,b],[clear,a],[on,a,table],[on,b,c],[on,c,table],[clear,d],[on,d,table]], [[clear,b],[clear,a],[on,a,table],[on,b,d],[on,c,table],[clear,c],[on,d,table]], [[clear,a],[on,a,b],[on,b,d],[on,c,table],[clear,c],[on,d,table]], [[clear,a],[on,a,c],[on,b,d],[on,c,table],[clear,b],[on,d,table]], [[clear,d],[on,a,c],[on,b,a],[on,c,table],[clear,b],[on,d,table]], [[clear,a],[clear,d],[on,a,c],[on,b,table],[on,c,table],[clear,b],[on,d,table]], [[clear,a],[clear,c],[on,a,d],[on,b,table],[on,c,table],[clear,b],[on,d,table]], [[clear,c],[on,a,d],[on,b,table],[on,c,a],[clear,b],[on,d,table]], [[clear,c],[on,a,d],[on,b,table],[on,c,b],[clear,a],[on,d,table]], [[clear,d],[on,a,c],[on,b,table],[on,c,b],[clear,a],[on,d,table]], [[clear,d],[on,a,c],[on,b,table],[on,c,b],[on,d,a]]] Path Length: 18

	
Notes	The program successfully found a solution path, but explored far more states than necessary to reach the goal, since it's an uninformed DFS. 
Updated Notes	Test 4 couldn't find a solution, so I implemented Iterative Deepening Depth First Search (IDDFS). Revised Path: (Length: 5) [[on,a,b],[on,b,table],[on,c,d],[clear,a],[clear,c],[on,d,table]], [[clear,b],[on,a,table],[on,b,table],[on,c,d],[clear,a],[clear,c],[on,d,table]], [[clear,d],[on,a,table],[on,b,table],[on,c,b],[clear,a],[clear,c],[on,d,table]], [[clear,d],[on,a,c],[on,b,table],[on,c,b],[clear,a],[on,d,table]], [[clear,d],[on,a,c],[on,b,table],[on,c,b],[on,d,a]],

	TEST 2: (4 blocks)
Start	start([[on,a,c],[on,b,table],[on,c,b],[clear,d],[on,d,a]]). 
Goal	goal([[on,b,c],[on,a,table],[on,c,table],[on,d,table],[clear,b],[clear,a],[clear,d]]). 
Steps (DFS)	[[[on,a,c],[on,b,table],[on,c,b],[clear,d],[on,d,a]], [[clear,a],[on,a,c],[on,b,table],[on,c,b],[clear,d],[on,d,table]], [[clear,a],[on,a,d],[on,b,table],[on,c,b],[clear,c],[on,d,table]],

	[[clear,b],[on,a,d],[on,b,table],[on,c,a],[clear,c],[on,d,table]], [[clear,a],[clear,b],[on,a,d],[on,b,table],[on,c,table],[clear,c],[on,d,table]], [[clear,a],[clear,d],[on,a,b],[on,b,table],[on,c,table],[clear,c],[on,d,table]], [[clear,a],[clear,d],[on,a,c],[on,b,table],[on,c,table],[clear,b],[on,d,table]], [[clear,c],[clear,a],[clear,d],[on,a,table],[on,b,table],[on,c,table],[clear,b],[on,d,table]], [[clear,c],[clear,d],[on,a,table],[on,b,table],[on,c,a],[clear,b],[on,d,table]], [[clear,c],[clear,a],[on,a,table],[on,b,table],[on,c,d],[clear,b],[on,d,table]], [[clear,c],[clear,a],[on,a,table],[on,b,table],[on,c,b],[clear,d],[on,d,table]], [[clear,c],[on,a,table],[on,b,table],[on,c,b],[clear,d],[on,d,a]], [[clear,c],[on,a,table],[on,b,table],[on,c,d],[clear,b],[on,d,a]], [[clear,d],[clear,c],[on,a,table],[on,b,table],[on,c,table],[clear,b],[on,d,a]], [[clear,d],[clear,a],[on,a,table],[on,b,table],[on,c,table],[clear,b],[on,d,c]], [[clear,d],[on,a,table],[on,b,a],[on,c,table],[clear,b],[on,d,c]], [[clear,d],[on,a,table],[on,b,a],[on,c,table],[clear,c],[on,d,b]], [[clear,b],[clear,d],[on,a,table],[on,b,a],[on,c,table],[clear,c],[on,d,table]], [[clear,b],[clear,a],[on,a,table],[on,b,d],[on,c,table],[clear,c],[on,d,table]], [[clear,b],[clear,a],[on,a,table],[on,b,c],[on,c,table],[clear,d],[on,d,table]]] Path Length: 20
	state[0] D A C B state[1] A C B D state[2] C A B D state[3] C A B D state[4] A B C D state[5] A B C D state[6] A B C D state[7] A B C D state[8] C A B D state[9] C A B D state[10] C A B D state[11] D C A B state[12] C D A B state[13] D A B C state[14] D A B C state[15] B D A C state[16] D B A C state[17] B A C D state[18] B A C D state[19] B A C D
Notes	Similar to test 1. A solution was found but the returned path was not efficient.
Updated Notes	Revised (IDDFS): (Length: 5) [[on,a,c],[on,b,table],[on,c,b],[clear,d],[on,d,a]], [[clear,a],[on,a,c],[on,b,table],[on,c,b],[clear,d],[on,d,table]], [[clear,c],[clear,a],[on,a,table],[on,b,table],[on,c,b],[clear,d],[on,d,table]], [[clear,b],[clear,c],[clear,a],[on,a,table],[on,b,table],[on,c,table],[clear,d],[on,d,table]], [[clear,b],[clear,a],[on,a,table],[on,b,c],[on,c,table],[clear,d],[on,d,table]], state[0] D A C B state[1] A C B D state[2] C A B D state[3] A B C D state[4] B A C D

	TEST 4: (6 blocks)

Start	start([[on,e,d],[on,d,a],[on,a,table],[on,b,c],[on,c,table],[on,f,table],[clear,e],[clear,b],[clear,f]]). E D B A C F
Goal	goal([[on,e,a],[on,a,b],[on,b,c],[on,c,table],[on,d,f],[on,f,table],[clear,e],[clear,d]]). E A B D C F
Steps (DFS)	[....] [[clear,e],[clear,b],[clear,a],[on,e,d],[on,d,f],[on,a,c],[on,b,table],[on,c,table],[on,f,table]], [[clear,c],[clear,b],[clear,a],[on,e,d],[on,d,f],[on,a,e],[on,b,table],[on,c,table],[on,f,table]], [[clear,c],[clear,b],[on,e,d],[on,d,f],[on,a,e],[on,b,a],[on,c,table],[on,f,table]], [[clear,a],[clear,b],[on,e,d],[on,d,f],[on,a,e],[on,b,c],[on,c,table],[on,f,table]], [[clear,a],[clear,e],[on,e,d],[on,d,f],[on,a,b],[on,b,c],[on,c,table],[on,f,table]], [[clear,d],[clear,e],[on,e,a],[on,d,f],[on,a,b],[on,b,c],[on,c,table],[on,f,table]] Steps: 1640
Notes	The algorithm successfully found a solution, but the path length was very long (1640 steps), as uninformed DFS is not efficient for this task.
Updated Notes	IDDFS Path: (Length: 5) [[on,e,d],[on,d,a],[on,a,table],[on,b,c],[on,c,table],[on,f,table],[clear,e],[clear,b],[clear,f]], [[clear,d],[on,e,table],[on,d,a],[on,a,table],[on,b,c],[on,c,table],[on,f,table],[clear,e],[clear,b],[clear,f]], [[clear,d],[on,e,table],[on,d,f],[on,a,table],[on,b,c],[on,c,table],[on,f,table],[clear,e],[clear,b],[clear,a]], [[clear,d],[on,e,table],[on,d,f],[on,a,b],[on,b,c],[on,c,table],[on,f,table],[clear,e],[clear,a]], [[clear,d],[on,e,a],[on,d,f],[on,a,b],[on,b,c],[on,c,table],[on,f,table],[clear,e]] state[0] state[1] state[2] state[3] state[4] E E D B A A A C F D B E A C F B D E A C F B D E C F B D C F

	TEST 4: (5 blocks)
Start	start([[on,e,b],[on,b,a],[on,a,table],[on,c,table],[on,d,table],[clear,e],[clear,c],[clear,d]]). E B A C D
Goal	goal([[on,e,a],[on,a,c],[on,c,d],[on,d,table],[on,b,table],[clear,b],[clear,e]]). E A C B D
Notes	The program got stuck and couldn't find a solution. Since the DFS wasn't effectively finding

	solutions because it was searching too deep, I changed it to an Iterative deepening DFS to improve it, and find shorter paths.
Path (IDDFS)	[[on,e,b],[on,b,a],[on,a,table],[on,c,table],[on,d,table],[clear,e],[clear,c],[clear,d]], [[clear,b],[on,e,table],[on,b,a],[on,a,table],[on,c,table],[on,d,table],[clear,e],[clear,c],[clear,d]], [[clear,a],[clear,b],[on,e,table],[on,b,table],[on,a,table],[on,c,table],[on,d,table],[clear,e],[clear,c],[clear,d]], [[clear,a],[clear,b],[on,e,table],[on,b,table],[on,a,table],[on,c,d],[on,d,table],[clear,e],[clear,c]], [[clear,a],[clear,b],[on,e,table],[on,b,table],[on,a,c],[on,c,d],[on,d,table],[clear,e]], [[clear,b],[on,e,a],[on,b,table],[on,a,c],[on,c,d],[on,d,table],[clear,e]], Path Length: 6
	state[0] E B A C D state[1] B E A C D state[2] E B A C D state[3] C E B A D state[4] A C E B D state[5] E A C B D
Updated Notes	With IDDFS, the program is more efficient in finding a solution and the shortest path is returned.

GitHub Code:
https://github.com/elys33ve/AI-principles-CS4033/blob/main/BlocksWorld/BlocksWorld-Group14-FionaOconnell-Code.pl