

CSC 421 Assignment 1

Zimeng Ming V00844078

Ronald Liu V00838627

This is the result for Question 2 Wolf-Goat-Cabbage

Tree search:

BreadthFirstTreeSearch: (cost=7.0, expansions=112) [1, 0, 1, 0, 1, 0, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 0, 1, 1, 0] [0, 1, 0, 1, 0, 1, 1, 0] [1, 0, 0, 1, 1, 0, 1, 0] [0, 1, 0, 1, 1, 0, 0, 1] [1, 0, 0, 1, 1, 0, 0, 1] [0, 1, 0, 1, 0, 1, 0, 1]

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DepthFirstTreeSearch: (cost=37.0, expansions=37) [1, 0, 1, 0, 1, 0, 1, 0] [0, 1, 1,  
0, 0, 1, 1, 0] [1, 0, 1, 0, 0, 1, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 1, 0, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0]  
[1, 0, 1, 0, 0, 1, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 1, 0, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 0,  
1, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 1, 0, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 0, 1, 1, 0] [0, 1,  
1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 1, 0, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 1, 0, 1, 0] [0, 1, 1, 0, 0, 1, 1,  
0] [1, 0, 1, 0, 1, 0, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 0, 1, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0,  
0, 1, 1, 0] [0, 1, 1, 0, 0, 1, 0, 1] [1, 0, 1, 0, 1, 0, 0, 1] [0, 1, 1, 0, 0, 1, 0, 1] [1, 0, 1, 0, 1, 0, 0, 1] [0,  
1, 1, 0, 0, 1, 0, 1] [1, 0, 1, 0, 1, 0, 0, 1] [0, 1, 1, 0, 0, 1, 0, 1] [1, 0, 1, 0, 1, 0, 0, 1] [0, 1, 0, 1, 1, 0,  
0, 1] [1, 0, 0, 1, 1, 0, 0, 1] [0, 1, 0, 1, 1, 0, 0, 1] [1, 0, 0, 1, 1, 0, 0, 1] [0, 1, 0, 1, 0, 1, 0, 1]
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UniformCostTreeSearch: (cost=7.0, expansions=83) [1, 0, 1, 0, 1, 0, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 0, 1, 1, 0] [0, 1, 0, 1, 0, 1, 1, 0] [1, 0, 0, 1, 1, 0, 1, 0] [0, 1, 0, 1, 1, 0, 0, 1] [1, 0, 0, 1, 1, 0, 0, 1] [0, 1, 0, 1, 0, 1, 0, 1]

GreedyBestFirstTreeSearch: (cost=7.0, expansions=9) [1, 0, 1, 0, 1, 0, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 0, 1, 1, 0] [0, 1, 0, 1, 0, 1, 1, 0] [1, 0, 0, 1, 1, 0, 1, 0] [0, 1, 0, 1, 1, 0, 0, 1] [1, 0, 0, 1, 1, 0, 0, 1] [0, 1, 0, 1, 0, 1, 0, 1]

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AstarTreeSearch: (cost=7.0, expansions=19) [1, 0, 1, 0, 1, 0, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 0, 1, 1, 0] [0, 1, 0, 1, 0, 1, 1, 0] [1, 0, 0, 1, 1, 0, 1, 0] [0, 1, 0, 1, 1, 0, 0, 1] [1, 0, 0, 1, 1, 0, 0, 1] [0, 1, 0, 1, 0, 1, 0, 1]
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IterativeDeepeningTreeSearch: (cost=7.0, expansions=35) [1, 0, 1, 0, 1, 0, 1, 0]
[0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 0, 1, 1, 0] [0, 1, 1, 0, 0, 1, 0, 1] [1, 0, 1, 0, 1, 0, 0, 1] [0, 1, 0, 1, 1,
0, 0, 1] [1, 0, 0, 1, 1, 0, 0, 1] [0, 1, 0, 1, 0, 1, 0, 1]
```

Graph search:

BreadthFirstGraphSearch: (cost=7.0, expansions=91) [1, 0, 1, 0, 1, 0, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 0, 1, 1, 0] [0, 1, 0, 1, 0, 1, 1, 0] [1, 0, 0, 1, 1, 0, 1, 0] [0, 1, 0, 1, 1, 0, 0, 1] [1, 0, 0, 1, 1, 0, 0, 1] [0, 1, 0, 1, 0, 1, 0, 1]

```
DepthFirstGraphSearch: (cost=7.0, expansions=7) [1, 0, 1, 0, 1, 0, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 0, 1, 1, 0] [0, 1, 0, 1, 0, 1, 1, 0] [1, 0, 0, 1, 1, 0, 1, 0] [0, 1, 0, 1, 1, 0, 0, 1] [1, 0, 0, 1, 1, 0, 0, 1] [0, 1, 0, 1, 0, 1, 0, 1]
```

UniformCostGraphSearch: (cost=7.0, expansions=9) [1, 0, 1, 0, 1, 0, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 0, 1, 1, 0] [0, 1, 1, 0, 0, 1, 0, 1] [1, 0, 1, 0, 1, 0, 0, 1] [0, 1, 0, 1, 1, 0, 0, 1] [1, 0, 0, 1, 1, 0, 0, 1] [0, 1, 0, 1, 0, 1, 0, 1]

```
GreedyBestGraphTreeSearch: (cost=7.0, expansions=8) [1, 0, 1, 0, 1, 0, 1, 0]
[0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 0, 1, 1, 0] [0, 1, 0, 1, 0, 1, 1, 0] [1, 0, 0, 1, 1, 0, 1, 0] [0, 1, 0, 1, 1,
0, 0, 1] [1, 0, 0, 1, 1, 0, 0, 1] [0, 1, 0, 1, 0, 1, 0, 1]
```

```
AstarGraphSearch: (cost=7.0, expansions=8) [1, 0, 1, 0, 1, 0, 1, 0] [0, 1, 1, 0, 0, 1, 1, 0] [1, 0, 1, 0, 0, 1, 1, 0] [0, 1, 0, 1, 0, 1, 1, 0] [1, 0, 0, 1, 1, 0, 1, 0] [0, 1, 0, 1, 1, 0, 0, 1] [1, 0, 0, 1, 1, 0, 0, 1] [0, 1, 0, 1, 0, 1, 0, 1]
```


BreadthFirstGraphSearch: (cost=11.0, expansions=11425) [0, 3, 0, 3, 0, 1] [2, 1, 0, 3, 1, 0] [1, 2, 0, 3, 0, 1] [3, 0, 0, 3, 1, 0] [2, 1, 0, 3, 0, 1] [2, 1, 2, 1, 1, 0] [1, 2, 1, 2, 0, 1] [1, 2, 3, 0, 1, 0] [0, 3, 3, 0, 0, 1] [2, 1, 3, 0, 1, 0] [2, 1, 2, 1, 0, 1] [3, 0, 3, 0, 1, 0]

DepthFirstGraphSearch: (cost=11.0, expansions=12) [0, 3, 0, 3, 0, 1] [2, 1, 0, 3, 1, 0] [1, 2, 0, 3, 0, 1] [3, 0, 0, 3, 1, 0] [2, 1, 0, 3, 0, 1] [2, 1, 2, 1, 1, 0] [1, 2, 1, 2, 0, 1] [1, 2, 3, 0, 1, 0] [0, 3, 3, 0, 0, 1] [2, 1, 3, 0, 1, 0] [1, 2, 3, 0, 0, 1] [3, 0, 3, 0, 1, 0]

UniformCostGraphSearch: (cost=11.0, expansions=14) [0, 3, 0, 3, 0, 1] [2, 1, 0, 3, 1, 0] [1, 2, 0, 3, 0, 1] [3, 0, 0, 3, 1, 0] [2, 1, 0, 3, 0, 1] [2, 1, 2, 1, 1, 0] [1, 2, 1, 2, 0, 1] [1, 2, 3, 0, 1, 0] [0, 3, 3, 0, 0, 1] [2, 1, 3, 0, 1, 0] [1, 2, 3, 0, 0, 1] [3, 0, 3, 0, 1, 0]

GreedyBestGraphTreeSearch: (cost=11.0, expansions=12) [0, 3, 0, 3, 0, 1] [1, 2, 1, 2, 1, 0] [1, 2, 0, 3, 0, 1] [3, 0, 0, 3, 1, 0] [2, 1, 0, 3, 0, 1] [2, 1, 2, 1, 1, 0] [1, 2, 1, 2, 0, 1] [1, 2, 3, 0, 1, 0] [0, 3, 3, 0, 0, 1] [2, 1, 3, 0, 1, 0] [2, 1, 2, 1, 0, 1] [3, 0, 3, 0, 1, 0]

AstarGraphSearch: (cost=11.0, expansions=13) [0, 3, 0, 3, 0, 1] [2, 1, 0, 3, 1, 0] [1, 2, 0, 3, 0, 1] [3, 0, 0, 3, 1, 0] [2, 1, 0, 3, 0, 1] [2, 1, 2, 1, 1, 0] [1, 2, 1, 2, 0, 1] [1, 2, 3, 0, 1, 0] [0, 3, 3, 0, 0, 1] [2, 1, 3, 0, 1, 0] [2, 1, 2, 1, 0, 1] [3, 0, 3, 0, 1, 0]

IterativeDeepeningGraphSearch: (cost=11.0, expansions=12) [0, 3, 0, 3, 0, 1] [1, 2, 1, 2, 1, 0] [1, 2, 0, 3, 0, 1] [3, 0, 0, 3, 1, 0] [2, 1, 0, 3, 0, 1] [2, 1, 2, 1, 1, 0] [1, 2, 1, 2, 0, 1] [1, 2, 3, 0, 1, 0] [0, 3, 3, 0, 0, 1] [2, 1, 3, 0, 1, 0] [1, 2, 3, 0, 0, 1] [3, 0, 3, 0, 1, 0]

The Heuristic function is using the '2n-1'

This is the result for Question 4 Water Jugs

Tree search:

BreadthFirstTreeSearch: (cost=23.0, expansions=38) [0, 0, 0] [12, 0, 0] [4, 8, 0] [1, 8, 3]

DepthFirstTreeSearch: (cost=170.0, expansions=36) [0, 0, 0] [0, 8, 0] [12, 8, 0] [9, 8, 3] [9, 8, 0] [9, 5, 3] [9, 8, 0] [9, 8, 3] [9, 8, 0] [6, 8, 3] [6, 0, 3] [6, 0, 0] [3, 0, 3] [3, 3, 0] [0, 3, 3] [12, 3, 3] [12, 3, 0] [12, 3, 3] [0, 3, 3] [3, 3, 0] [3, 3, 3] [3, 3, 0] [3, 0, 3] [3, 0, 0] [3, 8, 0] [3, 8, 3] [6, 8, 0] [6, 8, 3] [9, 8, 0] [9, 8, 3] [9, 0, 3] [9, 8, 3] [12, 8, 0] [9, 8, 3] [9, 8, 0] [9, 0, 0] [1, 8, 0]

UniformCostTreeSearch: (cost=23.0, expansions=614) [0, 0, 0] [12, 0, 0] [4, 8, 0] [1, 8, 3]

GreedyBestFirstTreeSearch: (cost=243.0, expansions=122) [0, 0, 0] [0, 8, 0] [8, 0, 0] [5, 0, 3] [5, 8, 3] [5, 8, 0] [5, 0, 0] [5, 8, 0] [5, 5, 3] [8, 5, 0] [8, 5, 3] [8, 5, 0] [8, 2, 3] [8, 2, 0] [8, 2, 3] [8, 5, 0] [8, 5, 3] [11, 5, 0] [11, 5, 3] [11, 5, 0] [8, 5, 3] [8, 8, 0] [8, 0, 0] [8, 0, 3] [8, 0, 0] [5, 0, 3] [5, 0, 0] [5, 8, 0] [2, 8, 3] [5, 8, 0] [5, 0, 0] [2, 0, 3] [2, 0, 0] [2, 8, 0] [2, 5, 3] [2, 8, 0] [10, 0, 0] [10, 0, 3] [10, 0, 0] [10, 8, 0] [10, 8, 3] [10, 8, 0] [10, 5, 3] [10, 8, 0] [10, 8, 3] [10, 8, 0] [7, 8, 3] [7, 8, 0] [7, 0, 0] [4, 0, 3] [4, 3, 0] [4, 0, 3] [7, 0, 0] [4, 0, 3] [7, 0, 0] [4, 0, 3] [4, 3, 0] [4, 3, 3] [4, 3, 0] [4, 3, 3] [4, 6, 0] [1, 6, 3]

AstarTreeSearch: (cost=23.0, expansions=521) [0, 0, 0] [12, 0, 0] [9, 0, 3] [1, 8, 3]

IterativeDeepeningTreeSearch: (cost=23.0, expansions=4) [0, 0, 0] [12, 0, 0] [9, 0, 3] [1, 8, 3]

Graph search:

BreadthFirstGraphSearch: (cost=23.0, expansions=48) [0, 0, 0] [12, 0, 0] [4, 8, 0] [1, 8, 3]

DepthFirstGraphSearch: (cost=215.0, expansions=59) [0, 0, 0] [12, 0, 0] [9, 0, 3] [9, 0, 0] [6, 0, 3] [6, 3, 0] [6, 3, 3] [6, 6, 0] [3, 6, 3] [3, 6, 0] [3, 3, 3] [3, 3, 0] [0, 3, 3] [0, 6, 0] [12, 6, 0] [12, 3, 3] [12, 3, 0] [0, 3, 0] [0, 0, 3] [3, 0, 0] [3, 0, 3] [6, 0, 0] [6, 8, 0] [6, 8, 3] [9, 8, 0] [9, 5, 3] [12, 5, 0] [12, 5, 3] [0, 5, 3] [0, 5, 0] [0, 2, 3] [12, 2, 3] [12, 2, 0] [9, 2, 3] [9, 2, 0] [6, 2, 3] [6, 5, 0] [3, 5, 3] [3, 8, 0] [0, 8, 3] [0, 8, 0] [12, 8, 0] [12, 8, 3] [12, 0, 3] [4, 8, 3] [4, 8, 0] [4, 0, 0] [1, 0, 3]

UniformCostGraphSearch: (cost=23.0, expansions=54) [0, 0, 0] [12, 0, 0] [4, 8, 0] [1, 8, 3]
 GreedyBestGraphTreeSearch: (cost=188.0, expansions=56) [0, 0, 0] [0, 8, 0] [0, 5, 3] [12, 5, 3] [12, 5, 0] [9, 5, 3] [9, 8, 0] [9, 8, 3] [9, 0, 3] [9, 3, 0] [6, 3, 3] [6, 6, 0] [6, 6, 3] [9, 6, 0] [9, 6, 3] [12, 6, 0] [0, 6, 0] [0, 3, 3] [0, 3, 0] [0, 0, 3] [12, 0, 3] [12, 8, 3] [0, 8, 3] [8, 0, 3] [8, 3, 0] [5, 3, 3] [5, 6, 0] [5, 6, 3] [8, 6, 0] [8, 3, 3] [11, 3, 0] [11, 0, 3] [3, 8, 3] [3, 8, 0] [3, 0, 0] [3, 0, 3] [6, 0, 0] [6, 0, 3] [9, 0, 0] [1, 8, 0]
 AstarGraphSearch: (cost=23.0, expansions=53) [0, 0, 0] [12, 0, 0] [9, 0, 3] [1, 8, 3]
 IterativeDeepeningGraphSearch: (cost=23.0, expansions=4) [0, 0, 0] [12, 0, 0] [4, 8, 0] [1, 8, 3]

The Heuristic function is not valid , the step_cost is show on the code.

This is the result for Question 5 Pancake

Tree search:

BreadthFirstTreeSearch: (cost=5.0, expansions=2069) [1, 0, 3, 5, 2, 4] [5, 3, 0, 1, 2, 4] [4, 2, 1, 0, 3, 5] [3, 0, 1, 2, 4, 5] [2, 1, 0, 3, 4, 5] [0, 1, 2, 3, 4, 5]
 DepthFirstTreeSearch: (cost=628.0, expansions=628) [1, 0, 3, 5, 2, 4] [2, 5, 3, 0, 1, 4] [4, 1, 0, 3, 5, 2] [1, 4, 0, 3, 5, 2] [3, 0, 4, 1, 5, 2] [5, 1, 4, 0, 3, 2] [3, 0, 4, 1, 5, 2] [4, 0, 3, 1, 5, 2] [2, 5, 1, 3, 0, 4] [3, 1, 5, 2, 0, 4] [2, 5, 1, 3, 0, 4] [0, 3, 1, 5, 2, 4] [5, 1, 3, 0, 2, 4] [4, 2, 0, 3, 1, 5] [5, 1, 3, 0, 2, 4] [3, 1, 5, 0, 2, 4] [5, 1, 3, 0, 2, 4] [1, 5, 3, 0, 2, 4] [3, 5, 1, 0, 2, 4] [4, 2, 0, 1, 5, 3] [3, 5, 1, 0, 2, 4] [4, 2, 0, 1, 5, 3] [2, 4, 0, 1, 5, 3] [0, 4, 2, 1, 5, 3] [4, 0, 2, 1, 5, 3] [2, 0, 4, 1, 5, 3] [5, 1, 4, 0, 2, 3] [3, 2, 0, 4, 1, 5] [1, 4, 0, 2, 3, 5] [3, 2, 0, 4, 1, 5] [0, 2, 3, 4, 1, 5] [1, 4, 3, 2, 0, 5] [2, 3, 4, 1, 0, 5] [1, 4, 3, 2, 0, 5] [0, 2, 3, 4, 1, 5] [3, 2, 0, 4, 1, 5] [4, 0, 2, 3, 1, 5] [5, 1, 3, 2, 0, 4] [4, 0, 2, 3, 1, 5] [5, 1, 3, 2, 0, 4] [0, 2, 3, 1, 5, 4] [5, 1, 3, 2, 0, 4] [1, 5, 3, 2, 0, 4] [2, 3, 5, 1, 0, 4] [4, 0, 1, 5, 3, 2] [3, 5, 1, 0, 4, 2] [1, 5, 3, 0, 4, 2] [2, 4, 0, 3, 5, 1] [0, 4, 2, 3, 5, 1] [1, 5, 3, 2, 4, 0] [2, 3, 5, 1, 4, 0] [0, 4, 1, 5, 3, 2] [2, 3, 5, 1, 4, 0] [1, 5, 3, 2, 4, 0] [4, 2, 3, 5, 1, 0] [2, 4, 3, 5, 1, 0] [0, 1, 5, 3, 4, 2] [1, 0, 5, 3, 4, 2] [2, 4, 3, 5, 0, 1] [5, 3, 4, 2, 0, 1] [2, 4, 3, 5, 0, 1] [5, 3, 4, 2, 0, 1] [3, 5, 4, 2, 0, 1] [4, 5, 3, 2, 0, 1] [5, 4, 3, 2, 0, 1] [4, 5, 3, 2, 0, 1] [5, 4, 3, 2, 0, 1] [4, 5, 3, 2, 0, 1] [1, 0, 2, 3, 5, 4] [5, 3, 2, 0, 1, 4] [2, 3, 5, 0, 1, 4] [3, 2, 5, 0, 1, 4] [2, 3, 5, 0, 1, 4] [3, 2, 5, 0, 1, 4] [0, 5, 2, 3, 1, 4] [1, 3, 2, 5, 0, 4] [3, 1, 2, 5, 0, 4] [0, 5, 2, 1, 3, 4] [2, 5, 0, 1, 3, 4] [4, 3, 1, 0, 5, 2] [0, 1, 3, 4, 5, 2] [5, 4, 3, 1, 0, 2] [0, 1, 3, 4, 5, 2] [1, 0, 3, 4, 5, 2] [3, 0, 1, 4, 5, 2] [5, 4, 1, 0, 3, 2] [2, 3, 0, 1, 4, 5] [4, 1, 0, 3, 2, 5] [2, 3, 0, 1, 4, 5] [1, 0, 3, 2, 4, 5] [0, 1, 3, 2, 4, 5] [2, 3, 1, 0, 4, 5] [5, 4, 0, 1, 3, 2] [2, 3, 1, 0, 4, 5] [1, 3, 2, 0, 4, 5] [3, 1, 2, 0, 4, 5] [0, 2, 1, 3, 4, 5] [5, 4, 3, 1, 2, 0] [3, 4, 5, 1, 2, 0] [0, 2, 1, 5, 4, 3] [4, 5, 1, 2, 0, 3] [3, 0, 2, 1, 5, 4] [2, 0, 3, 1, 5, 4] [4, 5, 1, 3, 0, 2] [3, 1, 5, 4, 0, 2] [2, 0, 4, 5, 1, 3] [5, 4, 0, 2, 1, 3] [3, 1, 2, 0, 4, 5] [5, 4, 0, 2, 1, 3] [0, 4, 5, 2, 1, 3] [2, 5, 4, 0, 1, 3] [3, 1, 0, 4, 5, 2] [0, 1, 3, 4, 5, 2] [2, 5, 4, 3, 1, 0] [1, 3, 4, 5, 2, 0] [0, 2, 5, 4, 3, 1] [4, 5, 2, 0, 3, 1] [5, 4, 2, 0, 3, 1] [1, 3, 0, 2, 4, 5] [5, 4, 2, 0, 3, 1] [3, 0, 2, 4, 5, 1] [1, 5, 4, 2, 0, 3] [2, 4, 5, 1, 0, 3] [1, 5, 4, 2, 0, 3] [5, 1, 4, 2, 0, 3] [2, 4, 1, 5, 0, 3] [3, 0, 5, 1, 4, 2] [2, 4, 1, 5, 0, 3] [3, 0, 5, 1, 4, 2] [0, 3, 5, 1, 4, 2] [3, 0, 5, 1, 4, 2] [4, 1, 5, 0, 3, 2] [5, 1, 4, 0, 3, 2] [4, 1, 5, 0, 3, 2] [3, 0, 5, 1, 4, 2] [1, 5, 0, 3, 4, 2] [5, 1, 0, 3, 4, 2] [2, 4, 3, 0, 1, 5] [5, 1, 0, 3, 4, 2] [1, 5, 0, 3, 4, 2] [3, 0, 5, 1, 4, 2] [0, 3, 5, 1, 4, 2] [2, 4, 1, 5, 3, 0] [3, 5, 1, 4, 2, 0] [5, 3, 1, 4, 2, 0] [3, 5, 1, 4, 2, 0] [2, 4, 1, 5, 3, 0] [3, 5, 1, 4, 2, 0] [5, 3, 1, 4, 2, 0] [2, 4, 1, 5, 3, 0] [5, 1, 4, 2, 3, 0] [4, 1, 5, 2, 3, 0] [3, 2, 5, 1, 4, 0] [1, 5, 2, 3, 4, 0] [3, 2, 5, 1, 4, 0] [0, 4, 1, 5, 2, 3] [5, 1, 4, 0, 2, 3] [2, 0, 4, 1, 5, 3] [0, 2, 4, 1, 5, 3] [2, 0, 4, 1, 5, 3] [0, 2, 4, 1, 5, 3] [5, 1, 4, 2, 0, 3] [0, 2, 4, 1, 5, 3] [1, 4, 2, 0, 5, 3] [0, 2, 4, 1, 5, 3] [4, 2, 0, 1, 5, 3] [5, 1, 0, 2, 4, 3] [2, 0, 1, 5, 4, 3] [4, 5, 1, 0, 2, 3] [2, 0, 1, 5, 4, 3] [5, 1, 0, 2, 4, 3] [4, 2, 0, 1, 5, 3] [2, 4, 0, 1, 5, 3] [0, 4, 2, 1, 5, 3] [3, 5, 1, 2, 4, 0] [5, 3, 1, 2, 4, 0] [3, 5, 1, 2, 4, 0] [0, 4, 2, 1, 5, 3] [2, 4, 0, 1, 5, 3] [4, 2, 0, 1, 5, 3] [2, 4, 0, 1, 5, 3] [5, 1, 0, 4, 2, 3] [2, 4, 0, 1, 5, 3] [3, 5, 1, 0, 4, 2] [5, 3, 1, 0, 4, 2] [0, 1, 3, 5, 4, 2] [2, 4, 5, 3, 1, 0] [1, 3, 5, 4, 2, 0] [4, 5, 3, 1, 2, 0] [5, 4, 3, 1, 2, 0] [3, 4, 5, 1, 2, 0] [2, 1, 5, 4, 3, 0] [1, 2, 5, 4, 3, 0] [2, 1, 5, 4, 3, 0] [3, 4, 5, 1, 2, 0] [5, 4, 3, 1, 2, 0] [1, 3, 4, 5, 2, 0] [5, 4, 3, 1, 2, 0] [3, 4, 5, 1, 2, 0]

[0, 2, 1, 5, 4, 3] [5, 1, 2, 0, 4, 3] [2, 1, 5, 0, 4, 3] [3, 4, 0, 5, 1, 2] [0, 4, 3, 5, 1, 2] [4, 0, 3, 5, 1, 2]
 [5, 3, 0, 4, 1, 2] [1, 4, 0, 3, 5, 2] [0, 4, 1, 3, 5, 2] [5, 3, 1, 4, 0, 2] [0, 4, 1, 3, 5, 2] [3, 1, 4, 0, 5, 2]
 [0, 4, 1, 3, 5, 2] [1, 4, 0, 3, 5, 2] [2, 5, 3, 0, 4, 1] [4, 0, 3, 5, 2, 1] [2, 5, 3, 0, 4, 1] [1, 4, 0, 3, 5, 2]
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UniformCostTreeSearch: (cost=5.0, expansions=3481) [1, 0, 3, 5, 2, 4] [5, 3, 0, 1, 2, 4] [4, 2, 1, 0, 3, 5] [3, 0, 1, 2, 4, 5] [2, 1, 0, 3, 4, 5] [0, 1, 2, 3, 4, 5]

GreedyBestFirstTreeSearch: (cost=6.0, expansions=6) [1, 0, 3, 5, 2, 4] [5, 3, 0, 1, 2, 4] [2, 1, 0, 3, 5, 4] [0, 1, 2, 3, 5, 4] [4, 5, 3, 2, 1, 0] [5, 4, 3, 2, 1, 0] [0, 1, 2, 3, 4, 5]

AstarTreeSearch: (cost=5.0, expansions=29) [1, 0, 3, 5, 2, 4] [5, 3, 0, 1, 2, 4] [4, 2, 1, 0, 3, 5] [3, 0, 1, 2, 4, 5] [2, 1, 0, 3, 4, 5] [0, 1, 2, 3, 4, 5]

IterativeDeepeningTreeSearch: (cost=5.0, expansions=414) [1, 0, 3, 5, 2, 4] [5, 3, 0, 1, 2, 4] [4, 2, 1, 0, 3, 5] [3, 0, 1, 2, 4, 5] [2, 1, 0, 3, 4, 5] [0, 1, 2, 3, 4, 5]

Graph search:

BreadthFirstGraphSearch: (cost=5.0, expansions=1273) [1, 0, 3, 5, 2, 4] [5, 3, 0, 1, 2, 4] [4, 2, 1, 0, 3, 5] [3, 0, 1, 2, 4, 5] [2, 1, 0, 3, 4, 5] [0, 1, 2, 3, 4, 5]

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 [2, 0, 3, 1, 5, 4] [1, 3, 0, 2, 5, 4] [0, 3, 1, 2, 5, 4] [2, 1, 3, 0, 5, 4] [5, 0, 3, 1, 2, 4] [3, 0, 5, 1, 2, 4]
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 [4, 1, 0, 2, 5, 3] [2, 0, 1, 4, 5, 3] [3, 5, 4, 1, 0, 2] [5, 3, 4, 1, 0, 2] [2, 0, 1, 4, 3, 5] [3, 4, 1, 0, 2, 5]
 [0, 1, 4, 3, 2, 5] [2, 3, 4, 1, 0, 5] [4, 3, 2, 1, 0, 5] [0, 1, 2, 3, 4, 5]

----- Water Jugs Problems:

Tree search:

BreadthFirstTreeSearch: (cost=23.0, expansions=70) [0, 0, 0] [12, 0, 0] [4, 8, 0] [1, 8, 3]

DepthFirstTreeSearch: (cost=473.0, expansions=110) [0, 0, 0] [0, 0, 3] [3, 0, 0] [3, 8, 0] [11, 0, 0] [3, 8, 0] [0, 8, 3] [8, 0, 3] [8, 0, 0] [8, 8, 0] [5, 8, 3] [5, 8, 0] [2, 8, 3] [2, 0, 3] [2, 8, 3] [2, 8, 0] [10, 0, 0] [2, 8, 0] [2, 5, 3] [2, 5, 0] [2, 2, 3] [5, 2, 0] [2, 2, 3] [5, 2, 0] [5, 2, 3] [5, 2, 0] [2, 2, 3] [2, 2, 0] [2, 2, 3] [2, 2, 0] [2, 2, 3] [2, 5, 0] [2, 2, 3] [5, 2, 0] [2, 2, 3] [5, 2, 0] [2, 2, 3] [2, 2, 0] [2, 2, 3] [5, 2, 0] [2, 2, 3] [2, 5, 0] [2, 2, 3] [5, 2, 0] [2, 2, 3] [2, 5, 0] [2, 2, 3] [5, 5, 0] [2, 5, 3] [5, 5, 0] [5, 5, 3] [5, 8, 0] [5, 8, 3] [5, 0, 3] [8, 0, 0] [0, 8, 0] [0, 5, 3] [3, 5, 0] [3, 5, 3] [6, 5, 0] [6, 5, 3] [6, 8, 0] [6, 0, 0] [3, 0, 3] [3, 0, 0] [3, 8, 0] [3, 5, 3] [3, 5, 0] [3, 5, 3] [3, 8, 0] [3, 5, 3] [3, 5, 0] [0, 5, 3] [0, 5, 0] [0, 5, 3] [12, 5, 3] [0, 5, 3] [12, 5, 3] [0, 5, 3] [12, 5, 3] [12, 8, 0] [0, 8, 0] [0, 8, 3] [12, 8, 3] [12, 0, 3] [12, 0, 0] [4, 8, 0] [4, 5, 3] [4, 5, 0] [4, 2, 3] [7, 2, 0] [7, 2, 3] [10, 2, 0] [10, 2, 3] [10, 2, 0] [10, 2, 3] [10, 5, 0] [7, 5, 3] [7, 5, 0] [7, 5, 3] [7, 8, 0] [7, 5, 3] [7, 8, 0] [4, 8, 3] [7, 8, 0] [7, 8, 3] [7, 0, 3] [7, 3, 0] [4, 3, 3] [4, 6, 0] [1, 6, 3]

UniformCostTreeSearch: (cost=23.0, expansions=530) [0, 0, 0] [12, 0, 0] [9, 0, 3] [1, 8, 3]

GreedyBestFirstTreeSearch: (cost=26.0, expansions=7) [0, 0, 0] [12, 0, 0] [9, 0, 3] [9, 0, 0] [1, 8, 0]

AstarTreeSearch: (cost=23.0, expansions=563) [0, 0, 0] [12, 0, 0] [9, 0, 3] [1, 8, 3]

IterativeDeepeningTreeSearch: (cost=23.0, expansions=9) [0, 0, 0] [12, 0, 0] [4, 8, 0] [1, 8, 3]

Graph search:

BreadthFirstGraphSearch: (cost=23.0, expansions=62) [0, 0, 0] [12, 0, 0] [4, 8, 0] [1, 8, 3]

DepthFirstGraphSearch: (cost=131.0, expansions=45) [0, 0, 0] [0, 0, 3] [3, 0, 0] [3, 8, 0] [11, 0, 0] [11, 8, 0] [11, 8, 3] [11, 0, 3] [11, 3, 0] [8, 3, 3] [8, 3, 0] [8, 0, 3] [8, 8, 3] [8, 8, 0] [8, 0, 0] [5, 0, 3] [5, 0, 0] [2, 0, 3] [2, 8, 3] [2, 8, 0] [10, 0, 0] [10, 8, 0] [7, 8, 3] [7, 0, 3] [7, 3, 0] [4, 3, 3] [4, 6, 0] [1, 6, 3]

UniformCostGraphSearch: (cost=23.0, expansions=51) [0, 0, 0] [12, 0, 0] [4, 8, 0] [1, 8, 3]

GreedyBestGraphTreeSearch: (cost=71.0, expansions=29) [0, 0, 0] [0, 8, 0] [0, 8, 3] [8, 0, 3] [8, 0, 0] [5, 0, 3] [5, 0, 0] [2, 0, 3] [2, 8, 3] [10, 0, 3] [10, 3, 0] [7, 3, 3] [7, 3, 0] [7, 0, 3] [7, 0, 0] [4, 0, 3] [4, 0, 0] [1, 0, 3]

AstarGraphSearch: (cost=23.0, expansions=54) [0, 0, 0] [12, 0, 0] [9, 0, 3] [1, 8, 3]

IterativeDeepeningGraphSearch: (cost=23.0, expansions=12) [0, 0, 0] [12, 0, 0] [9, 0, 3] [1, 8, 3]

----- Pancake:

Tree search:

BreadthFirstTreeSearch: (cost=5.0, expansions=1918) [1, 0, 3, 5, 2, 4] [5, 3, 0, 1, 2, 4] [4, 2, 1, 0, 3, 5] [3, 0, 1, 2, 4, 5] [2, 1, 0, 3, 4, 5] [0, 1, 2, 3, 4, 5]

DepthFirstTreeSearch: (cost=1797.0, expansions=1797) [1, 0, 3, 5, 2, 4] [0, 1, 3, 5, 2, 4] [1, 0, 3, 5, 2, 4] [5, 3, 0, 1, 2, 4] [3, 5, 0, 1, 2, 4] [0, 5, 3, 1, 2, 4] [1, 3, 5, 0, 2, 4] [2, 0, 5, 3, 1, 4] [4, 1, 3, 5, 0, 2] [3, 1, 4, 5, 0, 2] [4, 1, 3, 5, 0, 2] [3, 1, 4, 5, 0, 2] [0, 5, 4, 1, 3, 2] [3, 1, 4, 5, 0, 2] [5, 4, 1, 3, 0, 2] [2, 0, 3, 1, 4, 5] [3, 0, 2, 1, 4, 5] [0, 3, 2, 1, 4, 5] [3, 0, 2, 1, 4, 5] [4, 1, 2, 0, 3, 5] [3, 0, 2, 1, 4, 5] [0, 3, 2, 1, 4, 5] [2, 3, 0, 1, 4, 5] [1, 0, 3, 2, 4, 5] [4, 2, 3, 0, 1, 5] [0, 3, 2, 4, 1, 5] [4, 2, 3, 0, 1, 5] [5, 1, 0, 3, 2, 4] [4, 2, 3, 0, 1, 5] [5, 1, 0, 3, 2, 4] [4, 2, 3, 0, 1, 5] [5, 1, 0, 3, 2, 4]

[3, 0, 1, 5, 2, 4] [5, 1, 0, 3, 2, 4] [2, 3, 0, 1, 5, 4] [4, 5, 1, 0, 3, 2] [1, 5, 4, 0, 3, 2] [0, 4, 5, 1, 3, 2]
 [5, 4, 0, 1, 3, 2] [4, 5, 0, 1, 3, 2] [3, 1, 0, 5, 4, 2] [4, 5, 0, 1, 3, 2] [5, 4, 0, 1, 3, 2] [4, 5, 0, 1, 3, 2]
 [2, 3, 1, 0, 5, 4] [0, 1, 3, 2, 5, 4] [2, 3, 1, 0, 5, 4] [0, 1, 3, 2, 5, 4] [2, 3, 1, 0, 5, 4] [3, 2, 1, 0, 5, 4]
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 [4, 3, 1, 0, 2, 5] [3, 4, 1, 0, 2, 5] [0, 1, 4, 3, 2, 5] [5, 2, 3, 4, 1, 0] [2, 5, 3, 4, 1, 0] [5, 2, 3, 4, 1, 0]
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 [0, 3, 5, 1, 2, 4] [5, 3, 0, 1, 2, 4] [3, 5, 0, 1, 2, 4] [4, 2, 1, 0, 5, 3] [3, 5, 0, 1, 2, 4] [4, 2, 1, 0, 5, 3]
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UniformCostTreeSearch: (cost=5.0, expansions=1008) [1, 0, 3, 5, 2, 4] [5, 3, 0, 1, 2, 4] [4, 2, 1, 0, 3, 5] [3, 0, 1, 2, 4, 5] [2, 1, 0, 3, 4, 5] [0, 1, 2, 3, 4, 5]

GreedyBestFirstTreeSearch: (cost=6.0, expansions=6) [1, 0, 3, 5, 2, 4] [5, 3, 0, 1, 2, 4] [2, 1, 0, 3, 5, 4] [0, 1, 2, 3, 5, 4] [4, 5, 3, 2, 1, 0] [5, 4, 3, 2, 1, 0] [0, 1, 2, 3, 4, 5]

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IterativeDeepeningTreeSearch: (cost=5.0, expansions=20) [1, 0, 3, 5, 2, 4] [5, 3, 0, 1, 2, 4] [4, 2, 1, 0, 3, 5] [3, 0, 1, 2, 4, 5] [2, 1, 0, 3, 4, 5] [0, 1, 2, 3, 4, 5]

Graph search:

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