

(UCS) – 8 Puzzle

Initial State [Cost = 0]

1	2	3
4	0	5
6	7	8

Goal State

1	2	3
4	5	6
7	8	0

The blank tile (0) can move in four directions. UCS generates all valid successor states and assigns a cost of 1 to each move

Move Right [cost=1]

1	2	3
4	5	0
6	7	8

Move Left [cost=1]

1	2	3
4	0	5
6	7	8

Move Up [cost=1]

1	0	3
4	2	5
6	7	8

Move Down [cost=1]

1	2	3
4	7	5
6	0	8

Explanation:

All generated states have the same path cost (Cost = 1) and are added to the priority queue.

Node Selection Based on Cost

At this stage, all generated successor states have the same cumulative path cost. Uniform Cost Search selects one of these states from the priority queue for further expansion. Since UCS prioritizes nodes with the lowest path cost, any of these states can be selected without affecting the optimality of the final solution.

Goal Test and Termination

Uniform Cost Search continues expanding nodes in increasing order of path cost until the goal state is removed from the priority queue. Once the goal state is selected, the algorithm terminates.

Optimality of Uniform Cost Search

Since all actions in the 8-puzzle problem have equal cost, Uniform Cost Search guarantees finding the optimal solution. The first time the goal state is reached, it corresponds to the minimum number of moves.

Conclusion

Uniform Cost Search systematically explores the state space of the 8-puzzle problem by expanding nodes in order of increasing path cost. Because all moves have equal cost, UCS behaves similarly to Breadth-First Search and successfully finds the optimal solution.