Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

CS7IS2 - Artificial Intelligence

8-Puzzle Problem

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Problem Description

8-Puzzle Problem

A 8-Puzzle consists of 9 tiles arranged in a 3X3 grid with:-

- 1 blank tile
- 8 tiles numbered from 1 to 8.

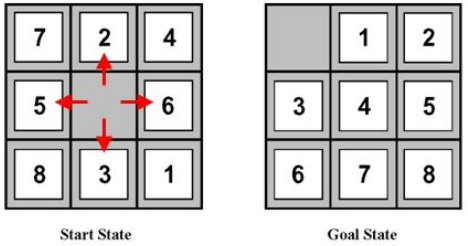
Target:-

- Reach goal state from initial state by making possible moves.

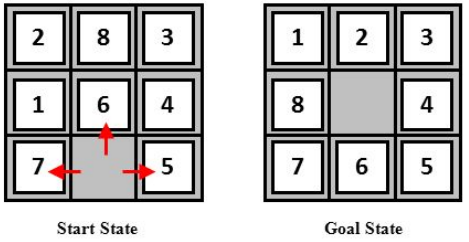
Possible Moves:-

- Vertical (Up and Down)
- Horizontal(Left and Right)

Example: 8-puzzle



- Blank moves left, right, up or down



- Here, blank moves left, right, or up

Algorithms Implemented

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Algorithm	Strategy Used	Description
Uniform Cost Search (UCS)	Uninformed Search	Explores the path with the lowest cost first. Hence, an optimal solution gets preference.
A Star Search (A*)	Informed Search	Uses heuristics to determine the path. Path with the lowest cost is explored first. Heuristics Used – Manhattan Distance Fixed Cost (Up= 0.1, Down=0.2,Left=0.3, Right=0.4)
Iterative Deepening Depth First Search (IDDFS)	Uninformed Search	Form of Depth First Search with a limit. Limit is incremented after each iteration. Optimal solution is guaranteed .

Results and Conclusion

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Comparative analysis of a testcase –

Testcase – 3,1,2,4,5,0,6,7,8			
Factors	UCS	A-Star	IDDFS
Path to goal	[Left, Left, Up]	[Left, Left, Up]	[Left, Left, Up]
Cost of Path	3	3	3
Nodes Expanded	30	3	11
Search Depth	3	3	3
Maximum Search Depth	4	3	3
Execution Time	0.00074506	0.00026393	0.00023556
RAM Usage	9.86328125	10.00000000	9.84375000

Conclusion –

- A* came out as the best performing algorithm and justifies the importance of heuristic measures.
- UCS was the worst performer in terms of node expanded or execution time.

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Thank You!