**AI LAB 03 REPORT**

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1. Lab report answers:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Best First Search** | | | **A\* Search (manhattanHeuristic)** | | | **A\* Search (euclideanHeuristic)** | | |
| **Maze** | **#nodes expanded** | **Solution length** | **Is it optimal?** | **#nodes expanded** | **Solution length** | **Is it optimal?** | **#nodes explored** | **Solution length** | **Is it optimal?** |
| **tiny** | 8 | 8 | Yes | 14 | 8 | Yes | 13 | 8 | Yes |
| **medium** | 78 | 74 | No | 221 | 68 | Yes | 226 | 68 | Yes |
| **big** | 466 | 210 | No | 549 | 210 | Yes | 557 | 210 | Yes |

1. **openMaze** for different search strategies:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **BFS** | **DFS** | **UCS** | **BEFS** | **A\* (manhattan)** | **A\* (euclidean)** |
| **#node expanded** | 682 | 577 | 682 | 682 | 535 | 550 |
| **Solution**  **length** | 54 | 298 | 54 | 54 | 54 | 54 |

* **BFS, UCS,** and **BEFS** find the least-cost path but expand a high number of nodes.
* **DFS** explores fewer nodes but finds the highest cost path.
* ***A (with both heuristics)*\*** finds an optimal path while expanding to fewer nodes than **BFS** and **UCS** due to the heuristic guidance.

1. Discussion about different informed searches and to the uninformed searches:

* **Efficiency**: Informed searches, particularly A\* with a well-chosen heuristic, generally explore fewer nodes than uninformed searches. This efficiency is especially evident in larger, more complex mazes, as heuristics guide the search towards the goal instead of exhaustively exploring all possible paths.
* **Optimality**: A\* consistently finds optimal solutions across various maze configurations. While uninformed methods like Breadth-First Search (BFS) and Uniform Cost Search (UCS) are also optimal, they are less efficient in terms of node expansions. Best-First Search, though heuristic-based, does not guarantee optimal solutions because it does not consider cumulative path costs.
* **Heuristic Impact on A\***: The choice of heuristic significantly influences the efficiency of A\*. The Manhattan heuristic often leads to fewer node expansions compared to the Euclidean heuristic, as it aligns better with grid-based movement, enhancing the search's effectiveness.