East West University

Lab Report 03

Course Title: Artificial Intelligence

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Section:01

Submitted to:

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Table :

Algorithm	Maze Type	Path Found	Execution Time (s)	Nodes Expanded
BFS	TinyMaze	8	0.034571 seconds	15
DFS	TinyMaze	10	0.021522 seconds	15
UCS	TinyMaze	8	0.020995 seconds	15
BFS	MediumMaze	210	0.025733 seconds	620
DFS	MediumMaze	130	0.183040 seconds	146
UCS	MediumMaze	68	0.267070 seconds	269
BFS	BigMaze	210	1.055383 seconds	620
DFS	BigMaze	210	0.758171 seconds	390
UCS	BigMaze	210	1.052238 seconds	620

Here is the comparison:

1. TinyMaze

Algorithm	Path Found	Execution Time (s)	Nodes Expanded
BFS	8	0.034571	15
DFS	10	0.021522	15
UCS	8	0.020995	15

- **Key Observations**:
  - All algorithms expanded the same number of nodes (15).
  - UCS was the fastest with the least execution time (0.020995 seconds).
  - DFS found a slightly longer path with 10 compared to BFS and UCS both with 8.

2. MediumMaze

Algorithm	Path Found	Execution Time (s)	Nodes Expanded
BFS	210	0.025733	620
DFS	130	0.18304	146
UCS	68	0.26707	269

- **Key Observations**:
  - BFS found the longest path with 210, while UCS found the shortest path with cost 68.
  - BFS had the fastest execution time (0.025733 seconds), followed by DFS, and UCS was the slowest.
  - BFS expanded the most nodes (620), while DFS expanded the least nodes (146).

3. BigMaze

Algorithm	Path Found	Execution Time (s)	Nodes Expanded
BFS	210	1.055383	620
DFS	210	0.758171	390
UCS	210	1.052238	620

- **Key Observations**:
  - All algorithms found the same path length with cost 210.
  - DFS was the fastest (0.758171 seconds), while UCS and BFS had similar execution times (~1.05 seconds).
  - DFS expanded fewer nodes (390) compared to BFS and UCS (both 620).

General Insights:

1. **Efficiency**:
   - DFS is generally faster for larger mazes, though it may not always yield the optimal solution (as seen in MediumMaze).
   - UCS and BFS have comparable execution times for BigMaze, but UCS often finds optimal solutions.
2. **Path Optimality**:
   - UCS consistently finds optimal paths (shortest), as it is designed for cost-based exploration.
   - BFS also finds the shortest path in cases with uniform cost but may take more time as maze size increases.
   - DFS may find suboptimal paths as it prioritizes depth over optimality.
3. **Scalability**:
   - DFS is more scalable in terms of nodes expanded for larger mazes, making it computationally cheaper.
   - BFS and UCS require significant node expansions, especially in larger mazes.

This comparison highlights trade-offs between time efficiency, optimality, and resource usage for the algorithms in different maze scenarios.