rit | RAJALAKSHMI INSTITUTE OF

DEPARTMENT OF
CSE (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)
ACADEMIC YEAR 2025 - 2026
SEMESTER III
ARTIFICIAL INTELLIGENCE LABORATORY

MINI PROJECT REVIEW

ROBOT NAVIGATION SYSTEM

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PROBLEM STATEMENT

- **Cities often have multiple routes between locations.**
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- **The challenge is to find the most cost-efficient (shortest or least expensive) route.**
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- **Traditional search methods may not guarantee optimality.**
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- **Goal: Use Uniform Cost Search (UCS) to identify the least-cost path between two points in a city map.**
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- **Applications:**
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- **GPS Navigation Systems (Google Maps, Uber)**
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- **Delivery Route Optimization**
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- **Traffic Management Systems**
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THEORETICAL BACKGROUND

Artificial Intelligence in Pathfinding:

AI algorithms help computers make intelligent decisions in route and pathfinding tasks.

Search Algorithms:

Techniques to explore possible paths from source to destination.

Examples: Breadth-First Search (BFS), Depth-First Search (DFS), UCS, A*.

Uniform Cost Search (UCS):

A weighted version of BFS.

Expands the least-cost node first.

Always finds the optimal path if path costs are non-negative.

UCS Characteristics:

Uses a priority queue (min-heap) based on cumulative path cost.

Continues exploring paths until the goal is reached.

Guarantees an optimal solutio

Mathematical Concept:

Total Cost (C) = Σ edge weights from start to current node.

Complexity:

Time: O(b^(C*/ε))

Space: O(b^(C*/ε))

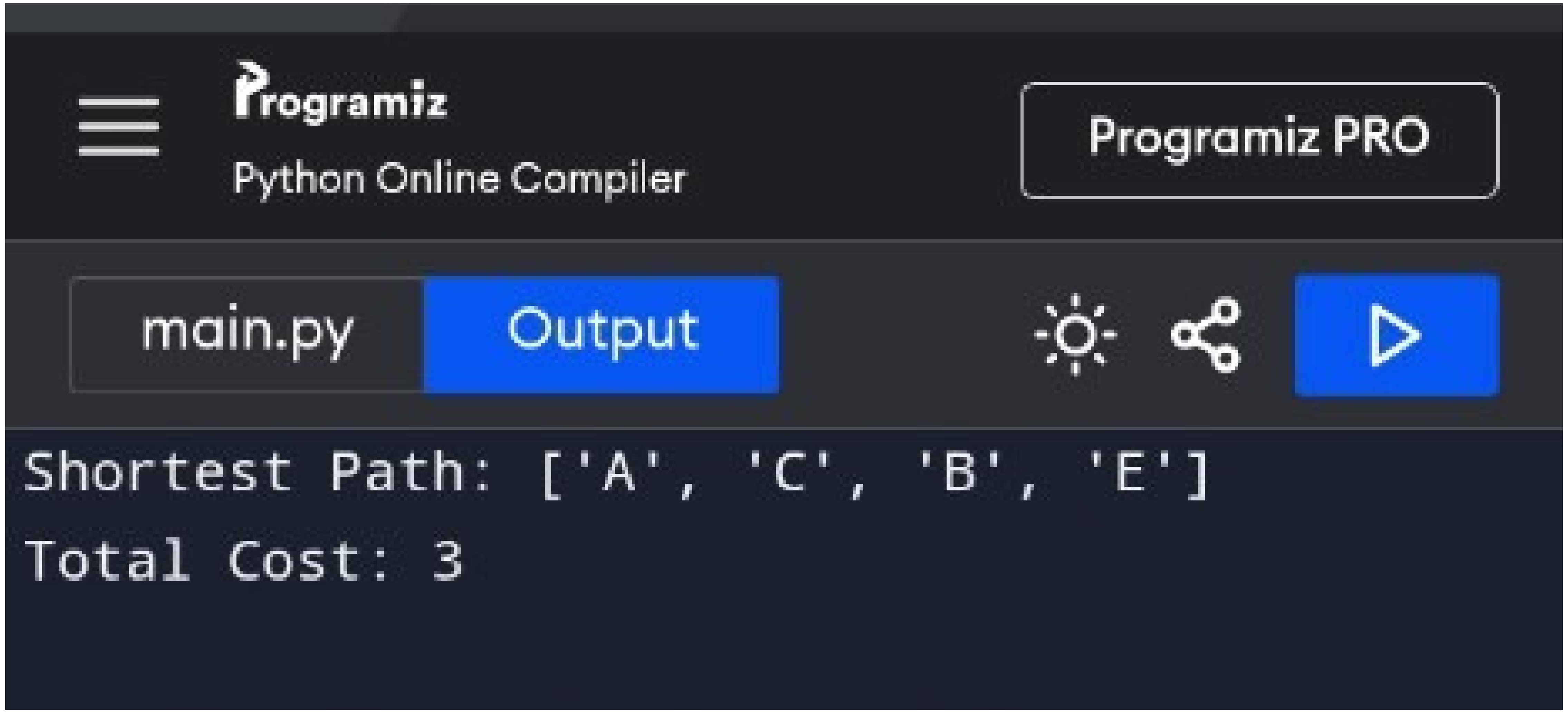
Where b = branching factor, C** = cost of optimal solution.

IMPLEMENTATION AND CODE

- Link to code in Git-hub Repository

List	Git-hub Repository Links
Implementation of Code Link	https://github.com/anushiya240008-droid/Route-optimization-in-a-city-map/blob/main/Programsystem/blob/main/Program
Word Document Report Link	https://github.com/anushiya240008-droid/Route-optimization-in-a-city-map/blob/main/DOC-20251028-WA0004..docx
PPT Link	

OUTPUT AND RESULTS



```
Shortest Path: ['A', 'C', 'B', 'E']
Total Cost: 3
```

OUTPUT AND RESULTS

- **Explanation:**
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- **UCS explores all possible routes and chooses the one with the least total cost.**
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- **In this case:**
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- **A → B → C → D = Cost 2 + 1 + 2 = 5**
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- **Other paths had higher costs, so they were not selected.**
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- **Result Visualization (optional):**
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- **Display graph/map using matplotlib or draw a simple route diagram.**
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REFERENCES

- **1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th Edition.**
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- **2. GeeksforGeeks – “Uniform Cost Search (UCS) Algorithm.”**
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- **3. Python NetworkX documentation – Graph representation and pathfinding.**

- **4. TutorialsPoint – “AI Search Algorithms.”**

5. Research papers on AI-based route optimization in smart cities.