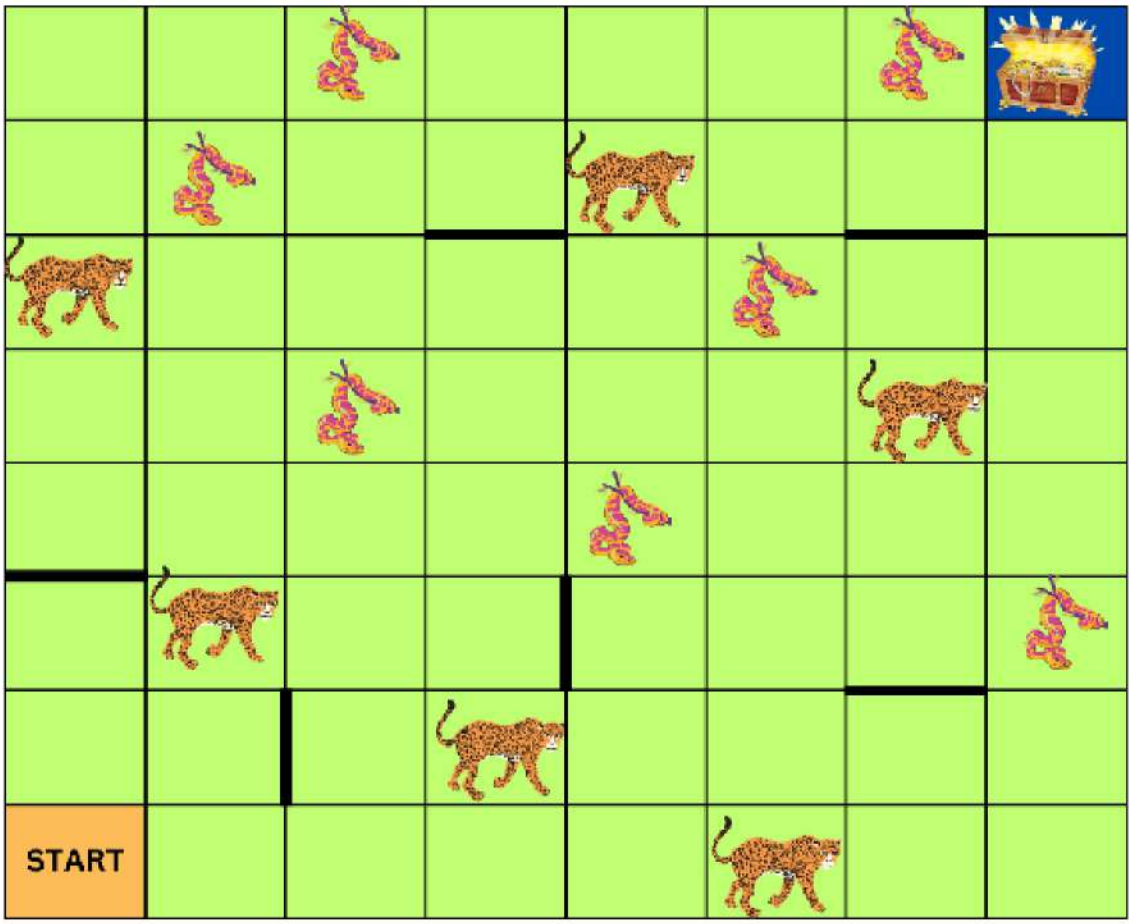
AI-2002 Artificial Intelligence Spring - 2024

[Assignment – 02] [Total Marks 100]

Assignment Title: " Treasure Hunt in the Enchanted Forest"



Problem Statement:

You are an adventurer on a quest to find a hidden treasure deep within the Enchanted Forest. The forest is represented by an **8x8 grid (random grid generation, size can be different),** and your journey begins at the northwest corner. Your goal is to navigate through the forest, avoiding dangerous animals, overcoming obstacles, and reaching the treasure located at the southeast corner.

Forest Grid:

The forest grid is an **8x8 matrix (random grid generation, size can be different),** where each cell represents a specific part of the forest. The grid contains various elements:

- 0: safegrid - A grid with no obstacles or animals. Moving into this grid incurs a cost of -1.
- (-1): Obstacle - Represents a challenging part of the forest that requires extra effort to traverse. Moving into this grid incurs a cost of -2.
- 2: Start - Your initial position in the northwest corner of the grid.
- 3: Goal - The hidden treasure's location in the southeast corner of the grid.
- 5: Endpoint - An impenetrable barrier that restricts movement in certain directions. If encountered, the adventurer must find an alternative path.

[Assignment – 02] **[Total Marks 100]**

Wild Animals:

- Certain grids in the forest are inhabited by wild animals.
- If the adventurer encounters a grid with animals, there is a probability of 0.8 that they may get killed and be forced to take a different path. With a probability of 0.2, the adventurer successfully navigates through the grid and continues their journey.

Endpoints:

- Endpoints act as barriers/walls, restricting movement in certain directions.
- If an endpoint is encountered on the east side of the grid, the adventurer cannot move to the right.
- The adventurer must find an alternative path by taking two steps backward.

Costs:

- Safegrid: Random cost between -1 and -3.
- Obstacle: Random cost between -2 and -4.
- Animal Encounter:
  - Random cost between -2 and -4 if the adventurer is killed.
  - Random cost between -1 and -3 if the adventurer successfully navigates through the grid.
- Endpoint: The adventurer must take two steps backward with a cost of -1.

Heuristic:

The heuristic function for A* Search is the Manhattan distance between the current position and the goal:

$$H = |x_{goal} - x_{current}| + |y_{goal} - y_{current}|$$

This heuristic estimates the cost from the current position to the goal.

Objective:

Find the optimal path through the dynamically changing Enchanted Forest, avoiding animals, overcoming obstacles, and navigating around endpoints to reach the hidden treasure. The adventurer should aim to minimize the total cost incurred during the journey.

Actions:

The adventurer can move left, right, up, or down to adjacent grids. Each movement incurs a cost based on the type of grid.

Implementation Details:

Create a **Python program** to simulate the adventurer's journey through the Enchanted Forest (Dynamic). Implement the **Uniform Cost Search (UCS) algorithm (AI version)** and **A* Search algorithm** to find the optimal path to the treasure, considering the challenges posed by animals and endpoints.

AI-2002 Artificial Intelligence Spring - 2024

[Assignment – 02] **[Total Marks 100]**

Note:

This problem aims to test your pathfinding algorithm's ability to navigate through a complex environment with dynamic challenges and uncertainties. Ensure that your implementation handles the following aspects:

- **Dynamic Challenges:** Account for the probabilistic nature of encountering wild animals. Implement the probability distribution to decide the outcome of an animal encounter.
- **Endpoints:** Implement the logic to handle endpoints, restricting movement in certain directions and requiring the adventurer to find alternative paths.
- **Heuristic Implementation:** To implement the A* Search algorithm, ensure that the heuristic function (Manhattan distance) is correctly calculated and influences the search.
- **Optimization:** Aim for an efficient implementation to find the optimal path with minimal cost.

Submission Requirements

1. **Mention at the top of your notebook file:**

   Title: Enchanted Forest Treasure Hunt - Python Implementation by:
   Group Members:
   1. [Member Name 1]
   2. [Member Name 2]

Submission Components:

2. **Source Code:**

   A well-documented Python script containing the implementation of the Enchanted Forest Treasure Hunt problem.
3. **Readme File:**
   - A Readme file (README.txt) provides detailed information about the assignment. Include the following:
     - Brief description of the problem.
     - Overview of the implemented algorithm (UCS and A* Search).
     - Instructions on how to run the program.
     - Any dependencies or external libraries used.
4. **Code Comments and Documentation:**
   - Ensure the code is well-commented, explaining key functionalities and decisions made during implementation.
   - Provide comments where applicable, especially for complex algorithms or sections.
5. **Optimization Details:**
   - Describe any optimization strategies employed in the implementation to find the optimal path with minimal cost.
6. **Dynamic Elements Handling:**
   - Clearly explain how dynamic elements such as animal encounters and endpoints are handled in the code.
7. **Randomization:**
   - Random grid generation: describe how it works in your code.
8. **Test Cases:**
   - Include a set of test cases that demonstrate the correctness of your implementation. Test cases should cover various scenarios, including different grid configurations.
9. **Group Collaboration Details:**
   - Briefly describe the collaboration process within the group, highlighting each member's contribution.

AI-2002 Artificial Intelligence Spring - 2024

[Assignment – 02] **[Total Marks 100]**

Submission Guidelines:

1. **File Format:**
   - Submit the assignment as a compressed file (zip) containing all necessary files.
2. **Submission Platform:**
   - Submit the assignment via the designated google classroom submission platform. Only one member will submit the assignment.
3. **Group Size:**
   - Only 2-member groups are allowed. No cross-sections or collaboration between groups are permitted.
4. **4. Deadline Adherence:**
   - There will be no deadline extensions under any circumstances. Late submissions will not be considered.
5. **5. Plagiarism Policy:**
   - Plagiarism will not be tolerated. Ensure that the implementation is original and developed by the group members.

Evaluation Criteria:

The assignment will be evaluated based on the following criteria:

1. Functionality: Does the implementation correctly solve the Enchanted Forest Treasure Hunt problem?
2. Code Quality: Is the code well-structured, well-commented, and easy to understand?
3. Optimization: Has the group applied optimization strategies to find the optimal path with minimal cost?
4. Documentation: Is the Readme file informative and does it provide clear instructions for running the program?
5. Handling of Dynamic Elements: Does the code effectively handle dynamic elements such as animal encounters and endpoints?
6. Randomization Implementation: If randomization is used, is it appropriately implemented and explained?
7. Test Cases: Are there comprehensive test cases that demonstrate the correctness of the implementation?
8. Group Collaboration: Is there evidence of effective collaboration within the 2-member group?

Important Note:

Late submissions and instances of plagiarism will result in penalties. Ensure that you adhere to the submission guidelines and meet the specified deadline.

Deadline 1: 7th March 2024 (Thursday) Time: 11:30 PM (UCS) (Member:1)
Deadline 2: 14th March 2024 (Thursday) Time: 11:30 PM (A* Search) (Member:2)
Location: Google Classroom