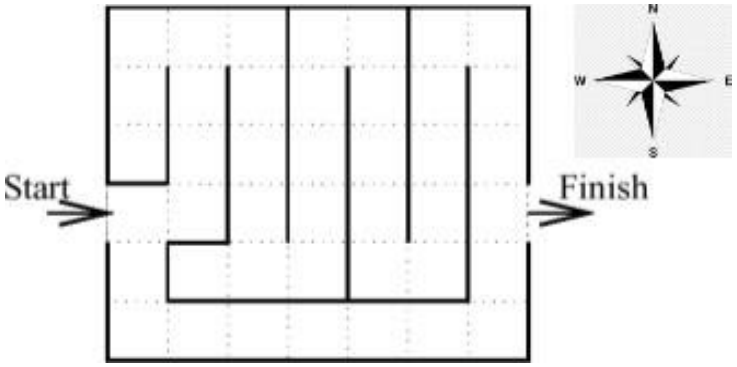
Artificial & Computational Intelligence
Assignment 1 - Question 1

Problem statement

Given the below maze configuration, the task of the robot is to navigate in the maze and find the optimal path to reach the finish position. It can move to the north, south, west and east direction. While navigating through the environment it has obstacles like walls. For each transition, a path cost of +3 is added in search. Assume that the robot's vision sensors are sensitive to the exposure to the sunlight and whenever it tries to move towards the east direction resulting in incurring an additional penalty of +5 cost. Use Manhattan distance as a heuristic wherever necessary.



a. Explain the PEAS (Performance measure, Environment, Actuator, Sensor.) for your agent. (2 Marks)

b. Implement A* algorithm using python. Use the below combination and interpret your observations (6 Marks)

$$f(n) = g(n) + w \cdot h(n)$$

Scenario 1

- Heuristic: Manhattan Distance
- Heuristic Weight (w): 1.0
- Observation Focus: Optimal path guaranteed, slower due to full exploration.

Scenario 2

- Heuristic: Manhattan Distance
- Heuristic Weight (w): 2.5
- Observation Focus: Faster search with fewer nodes expanded, but path may be suboptimal

c. Carefully read the question and submit your individual response using this form: (5 Marks)

PS10 : https://forms.gle/KrJ5sS9SS8h6ub2w9

Final Evaluation Instructions – Read Carefully

Evaluation will be conducted comparatively and based on the following key criteria:

1. **PEAS Definition and Justification:** Clearly define the PEAS (Performance measure, Environment, Actuators, Sensors) for the given agent type. Justify your choice of algorithm, its complexity, data structures used, and the design of fringes.
2. **Code Quality:** Ensure neat, efficient, and well-commented code.
3. **Output Requirements:** The solution must print the expected output along with a proper complexity analysis, exactly as mentioned in the problem statement.
4. **Plagiarism Policy:** Any group found involved in plagiarism will be penalized without notification at the sole discretion of the evaluator. No excuses or post-submission requests will be entertained.
5. **Deadline Strictness:** No extensions will be granted. Plan and submit before the due time.
6. **Confidentiality:** DO NOT publish questions or solutions on any public platform. This is strictly for BITS WILP internal use. Sharing externally will be treated as facilitating plagiarism and is a serious violation.
7. **Follow the solution template exactly as provided—no modifications allowed.**
8. **Submission is limited to one attempt. Double-check your document before final upload. No further requests will be considered.**

Submission Requirements

1. **Only one group submission** is required.
   - Submit the following **two files** in a single upload:

   Part A – Word Document (.doc/.docx):
   - Clearly explain the theoretical components including PEAS.
   - Include **screenshots of the output** and **step-by-step code execution flow**.

   Part B – Python Code (.ipynb Jupyter Notebook):
   - Provide implementation for the **algorithms** as stated in the problem.
   - Avoid theoretical descriptions; use brief comments for clarity.
2. Part C – Individual Submission (Mandatory)
   - Each member must **individually upload a PDF** using the **Google Form** provided separately. This is essential for individual evaluation tracking.
3. **Mandatory Detail: The Word document and IPYNB FILE must include:**
   - BITS IDs of **all team members**
   - Their **individual contribution percentages**

Example 1: If all members equally contributed

S.NO	NAME	BITS ID	CONTIBUTION %
1	XXXX	XXXX	100 %
2	XXXX	XXXX	100 %
3	XXXX	XXXX	100 %
4	XXXX	XXXX	100 %
5	XXXX	XXXX	100 %

Example 2: If some members did not contribute

S.NO	NAME	BITS ID	CONTIBUTION %
1	XXXX	XXXX	100 %
2	XXXX	XXXX	0%
3	XXXX	XXXX	100 %
4	XXXX	XXXX	100 %
5	XXXX	XXXX	100 %

⚠ Only students who actively contributed (as reported by the group) will receive marks. Inactive members marked with 0% will receive no marks.