Artificial & Computational Intelligence
Assignment 1 - Question 1

Problem statement

There are two agents named R1 and G1. Both are searching for a "heart" as shown in the below configuration as “H” that gives everlasting power. Both agents are trying to reach the heart. In this process many obstacles may be encountered to reach the heart. Help them in finding the best path to reach the heart from any arbitrary start positions. [Dynamically fetch the start position while executing the code]

For the agent R1 the obstacle is the green room. If R1 enters the green room it incurs a penalty of +10 cost and if it uses the red room it incurs a penalty of -10 points. For the agent G1 the obstacle is the red room. If G1 enters the red room it incurs a penalty of +10 cost and if it uses the green room it incurs a penalty of -10 points. In addition to the given cost, for every transition an agent visits incurs a path cost of 1.

For any arbitrary node “n” the heuristic to reach the Heart h(n) is given by the below:

Manhattan distance + Color Penalty

where, Color Penalty = +5 if the node “n” and goal node is in different colored room and Color Penalty = -5 if the node “n” and goal node is in same colored room

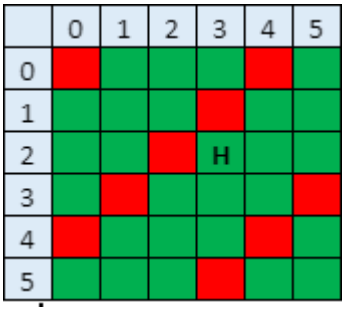
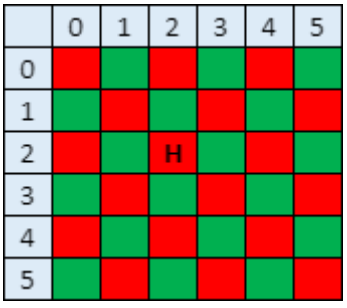
a. Explain the PEAS (Performance measure, Environment, Actuator, Sensor.) for your agent. (2 Marks)

b. Use the Recursive Best-First Search algorithm for both the below configurations and interpret which agent works well in which environment. Justify your interpretation with relevant performance metrics.

Note: The agents are not competing with each other. You need to run the simulation for both agents in each of the below scenarios separately & submit the results of 4 runs.

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

PS12 : https://forms.gle/UH3KA6sHsiYgi2ARA

Scenario I	Scenario II
	

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.