Homework Assignment 02

ITCS 5153 – Fall 2024

Introduction

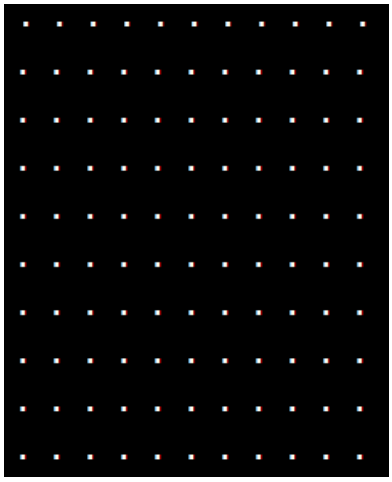
This assignment introduces students to the implementation of Artificial Intelligence search algorithms using Python.

Objectives

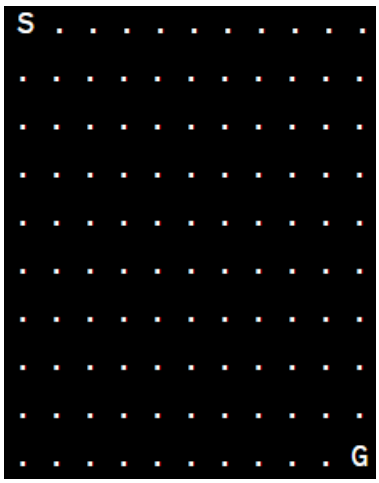
Implementing a grid-based search algorithm in Python using functions, arrays, and 2D arrays. The assignment focuses on building a modular and structured program through step-by-step process.

Tasks

1- **Define Grid Structure:**
   Create a Python function to initialize a 2D array representing the grid. Allow the user to input the size of the grid (rows and columns).
2- **Display Grid Function:**
   Implement a function to display the grid. Print the grid to ensure proper initialization.



3- **User Input for Start and Goal:**
   Prompt the user to input the starting and goal positions on the grid. Ensure the positions are valid (within grid boundaries).



4- **Basic Grid Display with Start and Goal:**
   Modify the display function to highlight the start and goal positions.
5- **Define Search Algorithm Structure:**
   Create a function for a simple Breadth-First search algorithm that takes the grid, start, and goal positions as parameters.
6- **Initialize Search Algorithm:**
   Initialize necessary data structures (e.g., queue, visited set, path array) within the search algorithm function.
7- **Implement Search Algorithm Loop:**
   Build the main loop of the search algorithm to explore neighboring cells and update the path array.
8- **Reconstruct Optimal Path Function:**
   Create a function to reconstruct the optimal path from the start to the goal using the path array.

9- **Modify Grid Display for Path:**
   Adapt the grid display function to highlight the optimal path found by the search algorithm.
10- **User Output and Metrics:**
   Print the final grid with the optimal path marked. Display the length of the optimal path and the total number of cells visited/explored.
11- **Additional Features (Optional):**
   Allow users to specify obstacles (e.g., walls) in the grid.

What to submit

When you have completed all the programs in an assignment you will need to create a single zip file that includes your source code for each program. **The zip file should only include the .py files.** Upload and submit your zip file to Canvas in the corresponding assignment, in this case the ***Programming Assignment 2***. Make sure to use the *zip* format for your submission. Archive files in any other format (rar for example) do not meet this criterion.

Submit the Python program with step-by-step implementation using functions and arrays. Include any challenges faced during implementation and how they were addressed.
Note: This assignment focuses on implementing the different AI agent types. Students are encouraged to explore various goals and experiment with different scenarios to observe the agent's behavior.

Grading Criteria

Correctness of the step-by-step implementation.
Proper documentation and comments.
Functionality of the final program.

Grading Rubric

+20 points for submission
+8 points for the correct implementation of every step from 1 to 10
+10 points for the optional step #11
-10 points if the submission instructions are not correctly followed