Project 2

. Ship Layout Generation Algorithm

Algorithm Used: Randomized Grid-Based Generation

* Purpose: To generate a structured grid representing a ship layout with open and blocked cells.
* Steps:
  1. Initialize a D × D grid where all cells are set to '1' (blocked).
  2. Create boundaries by setting the outermost rows and columns to '1'.
  3. Randomly select a starting position within the grid and set it to '0' (open cell).
  4. Expand open cells by choosing random neighboring cells and marking them '0'.
  5. Ensure connectivity so that open cells form a navigable path.
* Block Cells Used:
  1. '1' → Represents blocked areas (ship walls, obstacles).
  2. '0' → Represents open paths where movement is allowed.

2. Pathfinding & Movement Algorithm for Rat Bot

I implemented different movement strategies for the Rat Bot, both stationary and moving.

A. Stationary Rat Bot

Algorithm Used: Random Walk / Greedy Approach

* The stationary bot does not actively seek a path but interacts based on predefined behaviors.
* It remains in one position and reacts to conditions (e.g., detecting nearby obstacles).

B. Moving Rat Bot

Algorithm Used: *Breadth-First Search (BFS) / Depth-First Search (DFS) / A (if used)*\*

* Baseline Bot (Moving Rat)
  + Uses BFS or DFS to explore available paths.
  + If BFS is used, it finds the shortest path by exploring neighbors level by level.
  + If DFS is used, it takes a depth-first approach, which may not always be optimal.
* My Bot (Optimized Moving Rat)
  + Uses an improved version of BFS/A\* to find the shortest path efficiently.
  + Considers heuristic values (distance from goal) to prioritize movements.
  + May include backtracking if no valid path is found.
* Block Cells & Effects:
  + '1' → Blocks movement and forces the bot to find an alternate route.
  + '0' → Allows movement in four possible directions (up, down, left, right).
  + Visited Cells → May be marked to prevent looping.

3. Graphs & Their Meaning

I visualized the following aspects using matplotlib.pyplot:

1. Ship Layout Graphs
   * Represents the generated grid, showing open ('0') and blocked ('1') cells.
   * Helps analyze how randomization affects ship structures.
2. Rat Movement Path Graphs
   * Tracks the movement of the bot from the start to the goal.
   * Highlights the chosen path, obstacles, and dead ends.
3. Performance Comparisons
   * Time taken by different algorithms.
   * Path length and efficiency comparison between Baseline and My Bot.