CS520 Project 2 Data and Analysis

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1 Bot Designs and Algorithms

1.1 Initial Setup

This project is similar to the first one in that it involves a bot traversing through a grid maze of cells to save crew members while avoiding aliens. In our project version, we created a 30 x 30 NumPy grid containing 0s and 1s, with 0 representing open cells that the bot, aliens, and crew members can exist/move on and 1 representing closed cells (or walls). We have included the Python project within a single file, *main.py*, which contains all the processes for probabilistic updates, sensing, bot and alien movement functions, version-specific bot simulations, and a thorough testing process for each bot that I shall outline in section 3. In our Python project, we use the following characters to represent each entity:

- 0: Open Cell
- 1: Closed Cell
- 2: Bot
- 3: Alien(s)
- 4: Crew Member(s)

Furthermore, as defined in the project outline, there are 8 possible scenarios involving different combinations of bots, crew members, and aliens. Bots 1 and 2 involve 1 bot, 1 crew member, and 1 alien; Bots 3, 4, and 5 involve 1 bot, 2 crew members, and 1 alien; and Bots 6, 7, and 8 involve 1 bot, 2 crew members, and 2 aliens. Each scenario involves certain similarities and differences in the grid traversal algorithm for the bot, but all of them involve deterministic and probabilistic processes that I shall outline below.

1.2 One Alien, One Crew

As mentioned earlier, Bot 1 and Bot 2 both involve 1 bot, 1 alien, and 1 crew member within a 30 x 30 grid maze.

1.2.1 Bot 1

Bot 1 utilizes a crew sensor and an alien sensor at every single time step to figure out if there is a crew member or alien nearby. On top of that, the probabilities of the crew member and alien being at a particular cell are updated every time the bot and alien move. Bot 1 stores the probabilities of the crew and alien being in a certain cell (i, j) within two probability matrices (represented as a dictionary of open cells + bot's current location) *crew_matrix* and *alien_matrix*.

1.2.2 Bot 2

1.3 One Alien, Two Crew

1.3.1 Bot 3

1.3.2 Bot 4

1.3.3 Bot 5

1.4 Two Aliens, Two Crew

1.4.1 Bot 6

1.4.2 Bot 7

1.4.3 Bot 8

2 Probability Models and Updates

2.1 One Alien, One Crew

2.1.1 Bot 1

Since bot 1 is 1 alien.

2.1.2 Bot 2

2.2 One Alien, Two Crew

2.2.1 Bot 3

2.2.2 Bot 4

2.2.3 Bot 5

2.3 Two Aliens, Two Crew

2.3.1 Bot 6

2.3.2 Bot 7

2.3.3 Bot 8

3 Performance Evaluation

3.1 Average Moves to Save All Crew

- Bot 1 vs. Bot 2
- Bot 3 vs. Bot 4 vs. Bot 5
- Bot 6 vs. Bot 7 vs. Bot 8

3.2 Probability of Avoiding Alien and Saving Crew

- Bot 1 vs. Bot 2
- Bot 3 vs. Bot 4 vs. Bot 5
- Bot 6 vs. Bot 7 vs. Bot 8

3.3 Average Number of Crew Saved

- Bot 1 vs. Bot 2
- Bot 3 vs. Bot 4 vs. Bot 5
- Bot 6 vs. Bot 7 vs. Bot 8

4 The Ideal Bot

5 Bonus

6 Final Thoughts and Relevant Information