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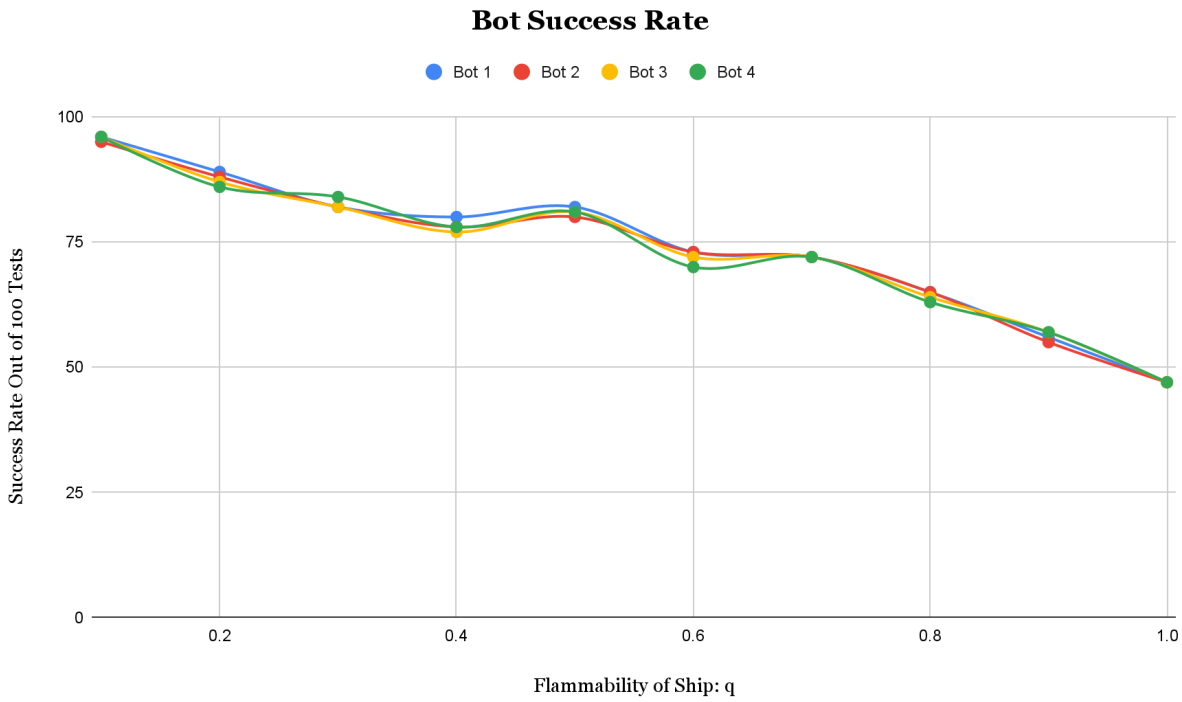
Project 1: Writeup

1. To begin, my Bot 4 is designed to predict the future and make a decision as to its next move based on how it predicted the fire spread. More specifically, Bot 4 is running a simulation of the actual ship, in which the fire has spread over a certain amount of time steps. Bot 4 is then finding the shortest path through the simulated ship to the button, while avoiding all current fire cells of the simulated ship and all cells currently adjacent to the current fire cells of the simulated ship. Using said shortest path, Bot 4 makes one move towards the button on the actual ship, before the fire spreads on the actual ship. Then, again, Bot 4 recalculates the shortest path to the button by simulating the fire spread, and the process repeats. The exact amount of time steps over which the bot is simulating the fire spread before finding the shortest path to the button is two. If the bot or the button were to be set on fire during the simulation, then the simulation is counted as a failure, and Bot 4 simply tries to find the shortest path to the button on the actual ship, while avoiding the current fire cells and any cells adjacent to the current fire cells, if possible, then executes the next move in said path on the actual ship. If the simulation was a failure and Bot 4 was not able to find the shortest path to the button on the actual ship using the above stated criteria, then Bot 4 simply tries to find the shortest path to the button on the ship while avoiding the current fire cells. Moreover, Bot 4 factors in the available information to make more informed decisions about what to do next by using the flammability of the ship, as well as the current cells that are on fire on the ship, to make a prediction as to what cells will be on fire after two time steps. Said prediction is

then used to plan out a path to the button which will hopefully prevent Bot 4 from moving into a cell which will then be set on fire right after the bot finishes its movement, and which will hopefully prevent Bot 4 from moving into a cell where it will then be cut off from the button by the fire.



2.

   a. https://docs.google.com/spreadsheets/d/1BoXYXpQKfHvZfTjvfcl41q82ugk2D7a5p-JUx7v7ufA/edit?usp=sharing

3. When bots fail or get trapped by fire, they fail because of a number of possibilities: either the bots move into a position where the fire will reach them in the same time step; the bots follow a path which will eventually be cut off by the fire before the bots make it to the button; the fire starts close to the button, and therefore makes it to the button before the bots; the fire starts close to the bots, and therefore the bots have little opportunity to get away from the fire before it catches them; the button has only one path to it, possibly

making it easy for the fire to cut the bots off from the button; or the bots simply start in a location which is blocked off from open cells by the initial fire cell. In only one of the aforementioned cases is it possible for the bots to have made a better decision which would have saved them. To be specific, in the case where the bots follow a path which will eventually be cut off by fire, the bots could have possibly predicted, much in advance, that the fire would have cut them off if they were to follow said path, and thus taken a different path from where they were located, if possible. It is important to note, however, that such a prediction would have to be done much in advance because otherwise, the bots could follow a path which eventually puts them in a position where they have no other option, but to follow the doomed path. Also, such an option is only available to Bot 4, as it is the only bot which is not required to follow a restricted set of rules. Aside from predicting, much in advance, what the ship will look like, there is not much which the bots could have done to avoid failure. Furthermore, the graph indicates the few options the bots had in order to avoid failure by showing that the success rates of the bots were similar for ten different tested values of q. Despite calculating paths to the button in different ways, and one bot even attempting to predict the future of the ship in order to avoid the fire, the bots still achieved similar results to one another, which would suggest that there weren't many options available to the bots in order to avoid failure. No matter how the bots calculated a path to the button, no bot was much more successful than another.

4. The ideal bot would use the flammability of the ship as well as knowledge of the current cells which are on fire in order to find a valid path to the button. In particular, the bot would use the flammability of the ship to calculate the probability that the cells which are

next to fire will ignite. Using that probability, the bot will put a weight on all paths it can find to the button equal to the sum of all probabilities of the cells along a given path. Then, the bot would try to travel along the path with the lowest possible probability of being obstructed by fire, while also avoiding the current fire cells. The bot would recalculate this path at every time step as the fire cells spread throughout the ship and new probabilities are found along various paths.