

CS 520 : Introduction to Artificial Intelligence

Final Exam: Finding Your Way



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Summary:

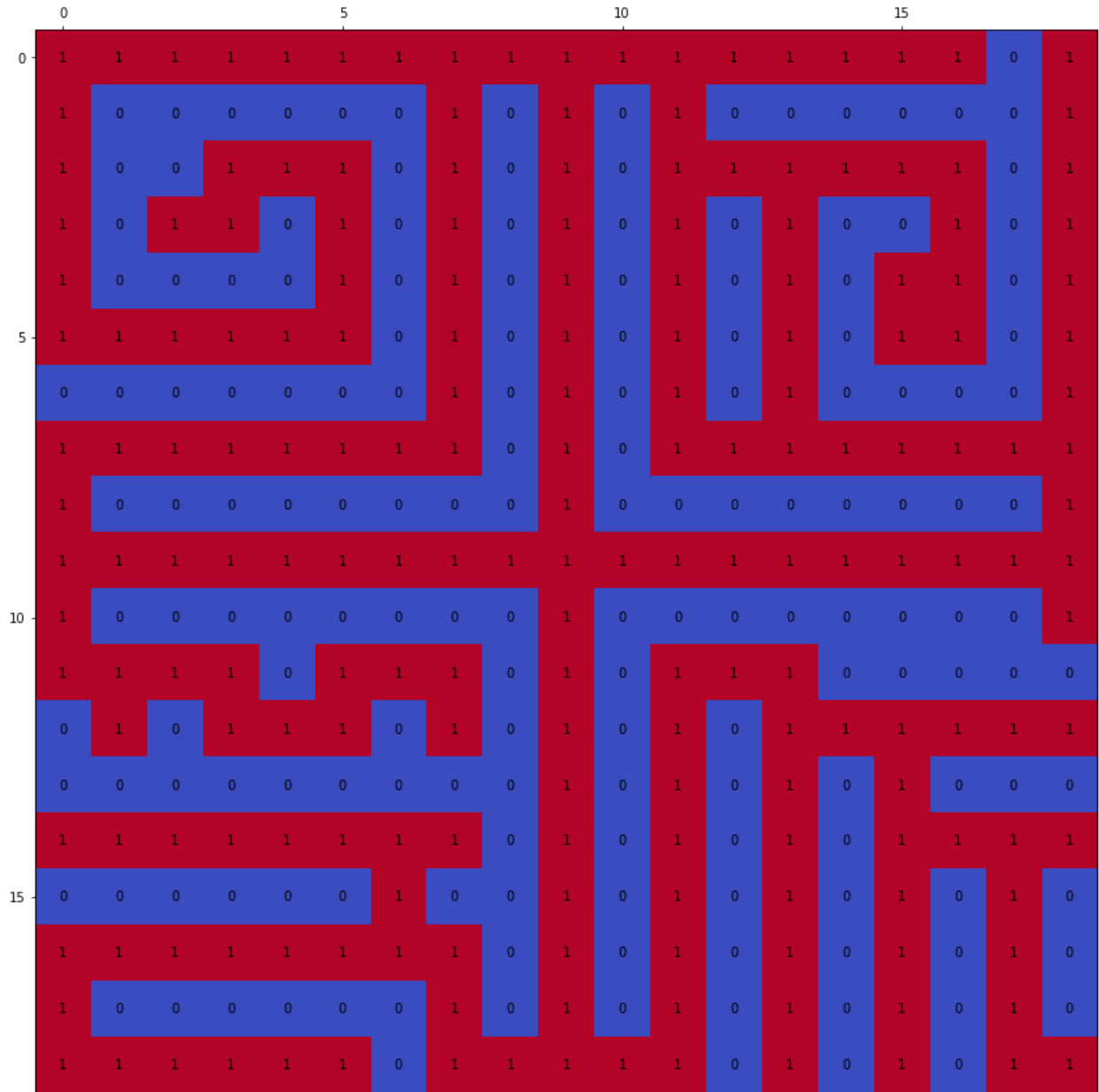
The aim of this project is to implement **search algorithms** and **heuristics** to solve the problem of the National Nuclear Power Station hijack. Given the schematic of the NNPS, we find the optimal action sequences required to find the repair drone.

Repair Drone:

In this project the repair drone is capable of moving from cell to cell within the reactor repairing internal mechanisms by performing following actions **Right, Left, Up, Down**. But we don't know the actual position of the drone.

Environment:

The environment in this project is a grid of size (18 x 18) with Blocked (blue) and Unblocked (Red) cells.

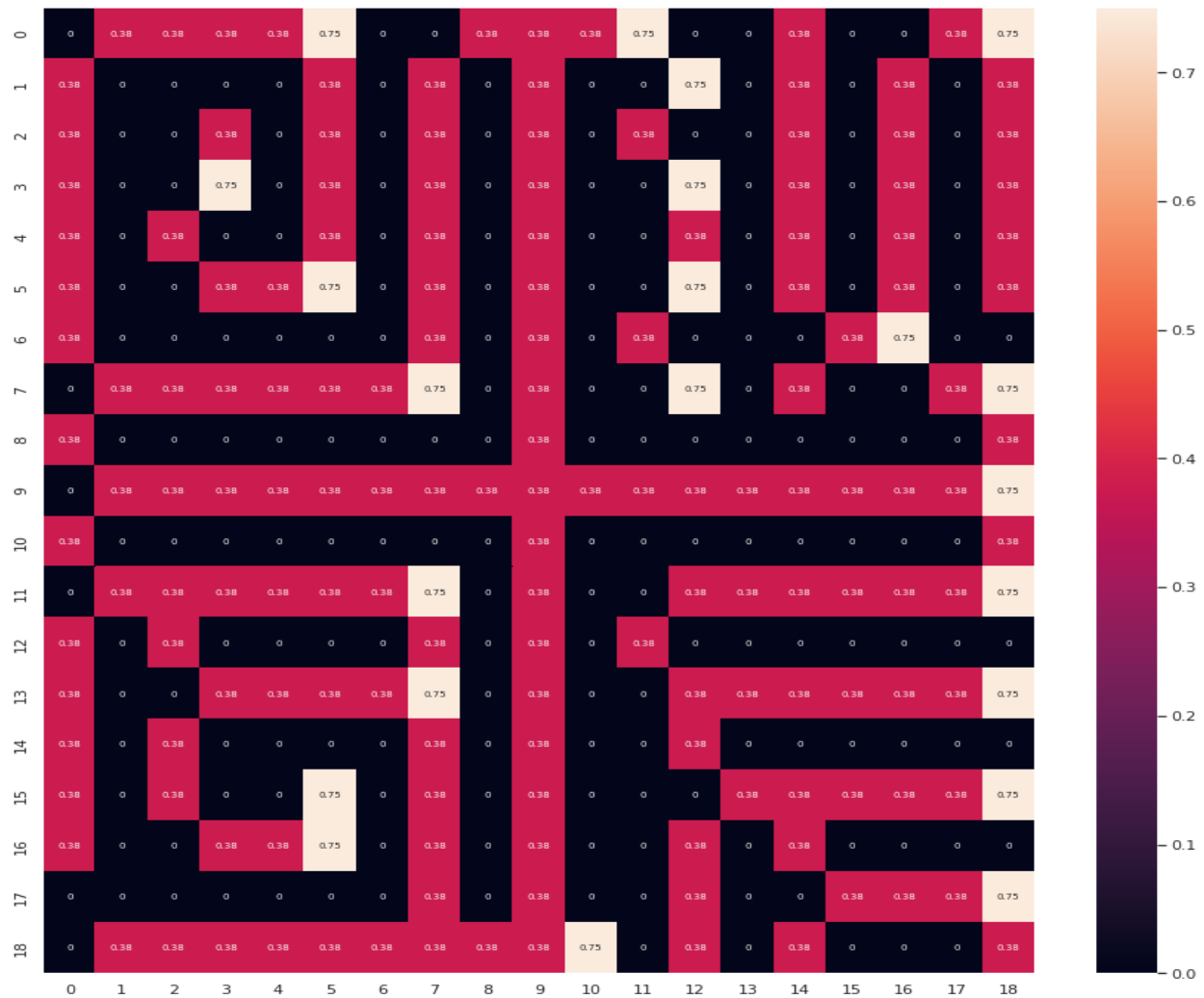


Questions

1. Before you do anything, what is the probability that the drone is in the top left corner? Why?

- We have a total of 199 empty cells, since the probability distribution is uniform, the drone being in each cell is equally likely.
- Probability(Drone in Top Left Corner) = $1/199$

2. After applying Down action, What are the locations where the drone is most likely to be? Least likely to be? How likely is it to be in all the other locations? Indicate your results visually.



Note: The Probability of each non zero cell is scaled by a factor of 75 to make the distinction between mostly likely and least likely cells clear

3. Write a program that takes a reactor schematic as a text file (see associated file for this reactor) and finds a sequence of commands that, at the end of which, you know exactly what cell the drone is located in. Be clear in your writeup about how you are formulating the problem, and the algorithms you are using to find this sequence. What is the sequence for this reactor?

- Since we have to find the location of the repair drone, the problem can be formulated as a search problem.
- Given a probability state we solve the problem by making greedy decisions at every state.
- We perform an action by comparing the respective action utility with all other actions
- Next we use the A* algorithm to solve the problem, with 3 different heuristics
 - Number of non-zeros
 - Mean Square Error
 - Shortest Distance between each other cells

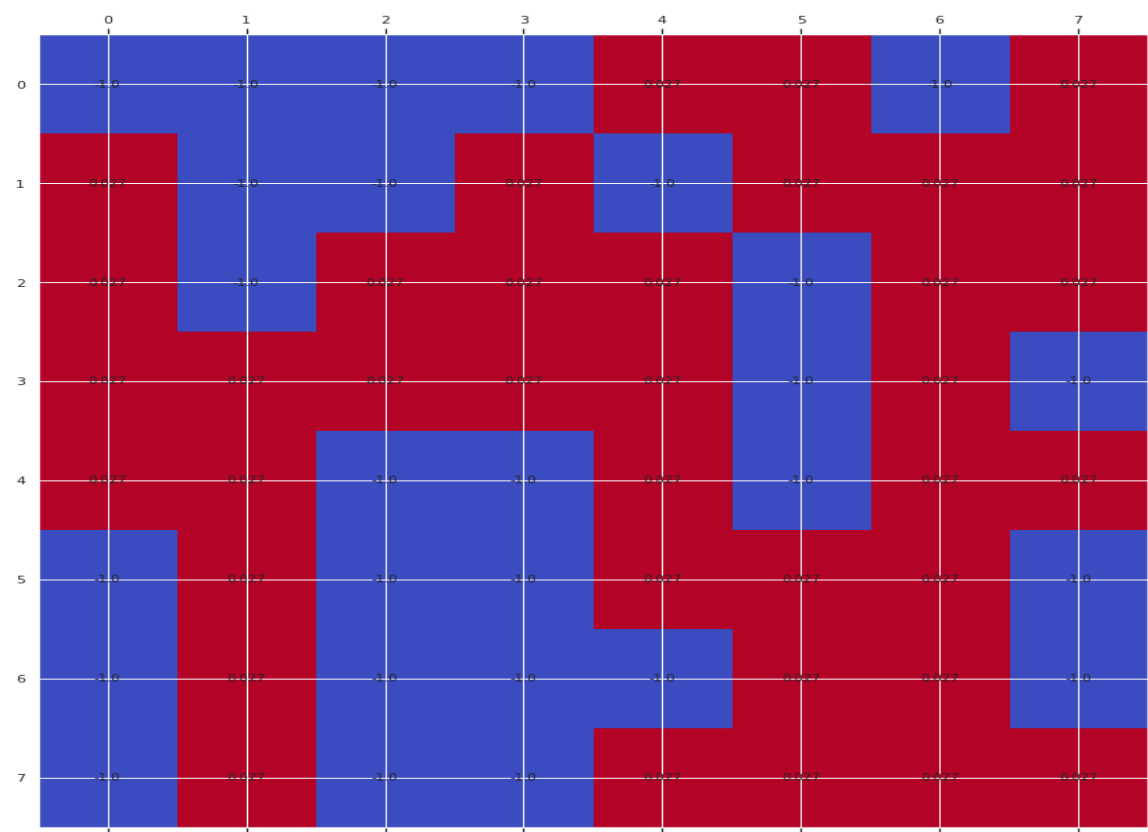
$$f(x) = g(x) + h(x)$$

Here $f(x)$ is our objective function, we want to find to minimize it as much possible and $g(x)$, $h(x)$ is the summation of all heuristics.

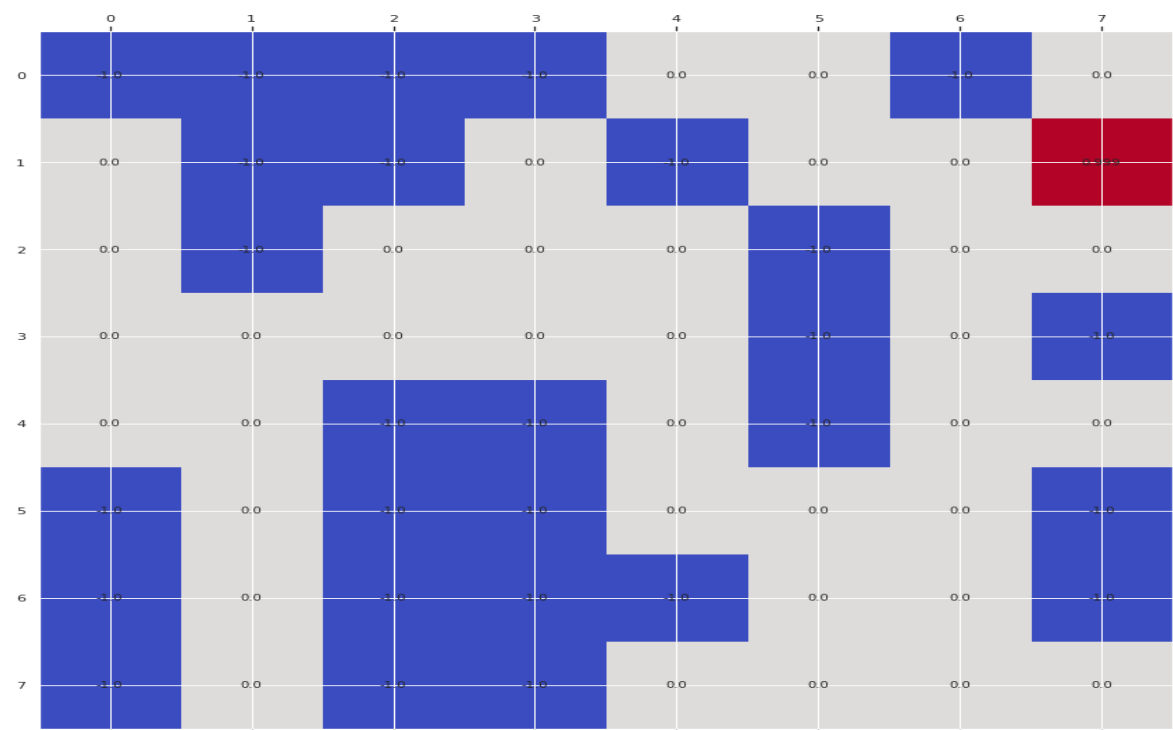
We will select the action with least $f(x)$ value and break the ties at random.

Our search completes when there is only one cell with a probability of 1.

Sample Grid (Red - empty, Blue - Blocked)



Sample Output (Red converged to one cell)



Length of Sequence: 151