TDT4136 - Assignment 3

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Using the A* Algorithm

Part 1: Grids with Obstacles

Visualizations of the shortest path for the four boards are given below (figure 1,2,3,4).

Figure 1: Board 1-1

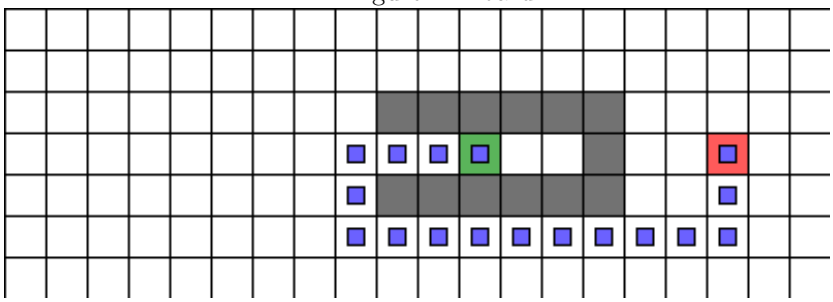


Figure 2: Board 1-2

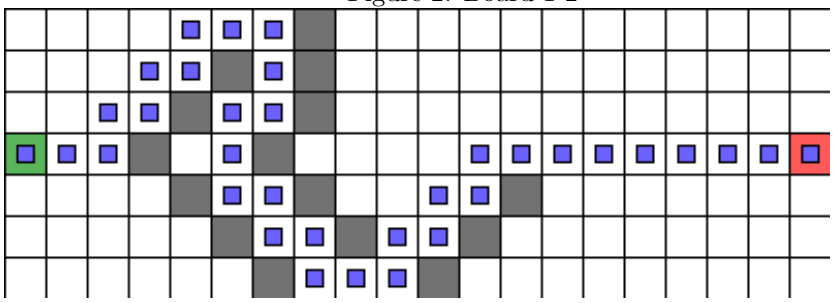


Figure 3: Board 1-3

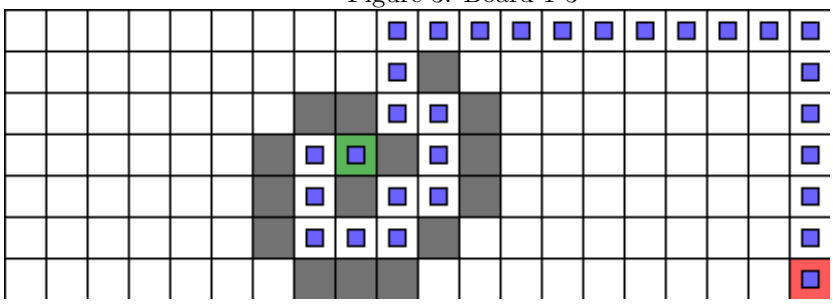
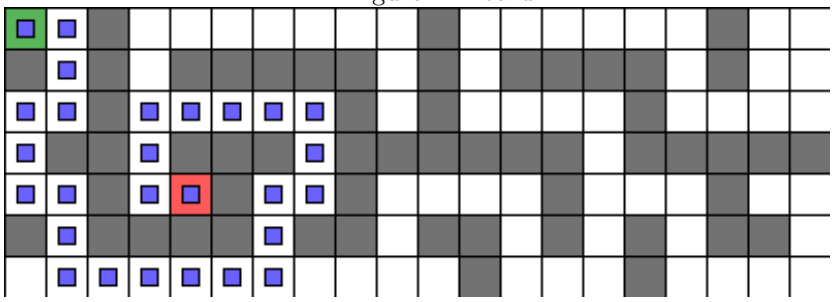


Figure 4: Board 1-4



Part 2: Grids with Different Cell Costs

Visualizations of the shortest path for the four boards are given below (figure 5,6,7,8).

Figure 5: Board 2-1

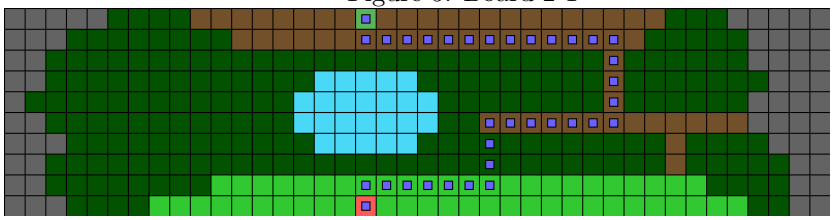


Figure 6: Board 2-2

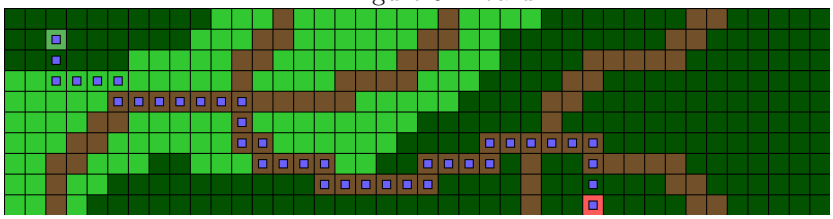


Figure 7: Board 2-3

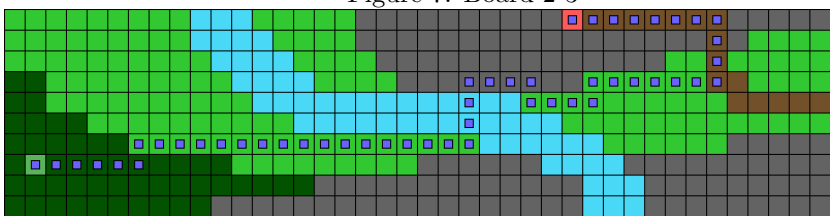
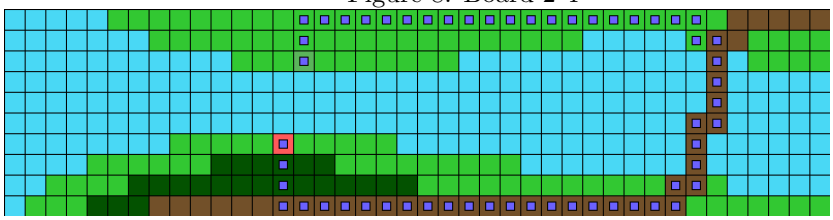


Figure 8: Board 2-4



Part 3: Comparison with BFS and Dijkstra's

Visualizations with nodes which belong to the open list (in yellow on the figures below) and to the closed list (in red on the figures below) using A*, BFS and Dijkstra for the boards 1-2 and 2-4 (figure 9 to 14).

We can see on the boards below, that for the boards from the part 1 (the squares of the game have the same cost), that all the alogorithms manage to find the shortest path, but for the board from the part 2 (with different costs), only Dijkstra and A* find the shortest path for all the boards and BFS does not find the shortest path most of the time (it finds the shortest path only for the board 2-2).

There is also some differences in the number of open and closed nodes between the different algorithms. If A* and Dijkstra always find the shortest path for the eight boards, we can see that Dijkstra has always more closed nodes (especially for the board from the first part). This means that it explores more nodes and it takes more time to converge than A*. So A* is more efficient than Dijkstra. For the boards from part 1, Dijkstra and BFS have almost the same number of closed nodes (BFS seems to have a little less closed nodes than Dijkstra but not so much). For the boards from part 2, depending of the boards, BFS can have less closed nodes than the others algorithms (figure 14) so it can converge faster but it does not find the shortest path.

Figure 9: A* - Board 1-2

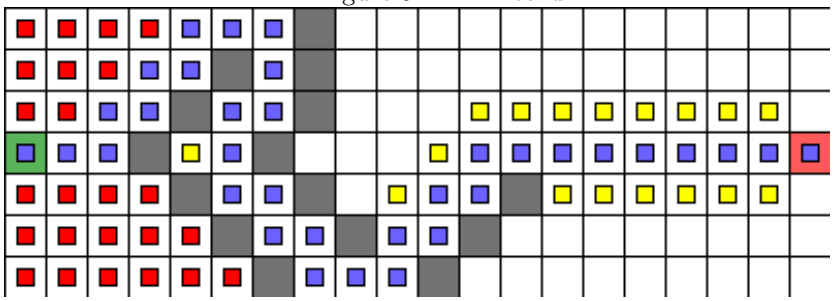


Figure 10: BFS - Board 1-2

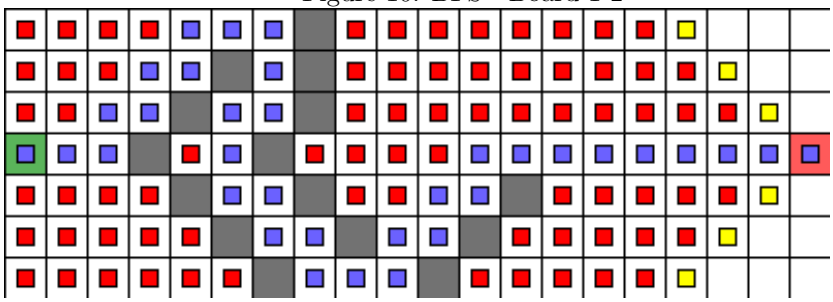


Figure 11: Dijkstra - Board 1-2

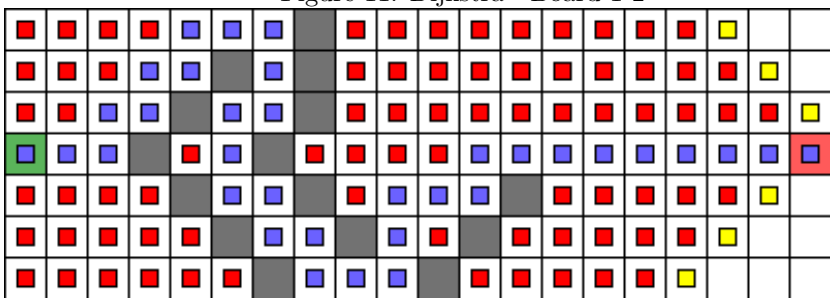


Figure 12: A* - Board 2-4

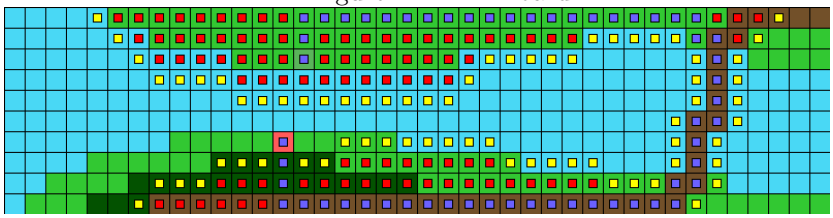


Figure 13: Dijkstra - Board 2-4

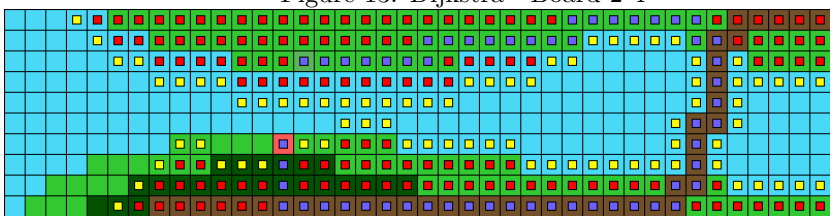


Figure 14: BFS - Board 2-4