Assignment 2 - Applying the A* Algorithm
TDT4136 Introduction to Artificial Intelligence

Mads Adrian Simonsen

September 21, 2021

1 Introduction

We apply the A* algorithm to path finding in 2 dimensionial square grid where the legal moves are in cardinal directions (North, East, South, West). We will navigate through a 2d-world representation of Samfundet (see Figure 1).

We will consider four situations: In the two first situations, we consider Samfundet being completely flat, such that all legal tiles have equal cost. In the two next situations, we add a higher cost to the stairs, crowded stairs and crowded rooms. Table 1 shows the different costs.

The algorithm is taken from the *Essentials of the A* Algorithm* document, and the heuristic function used is the Manhattan distance.
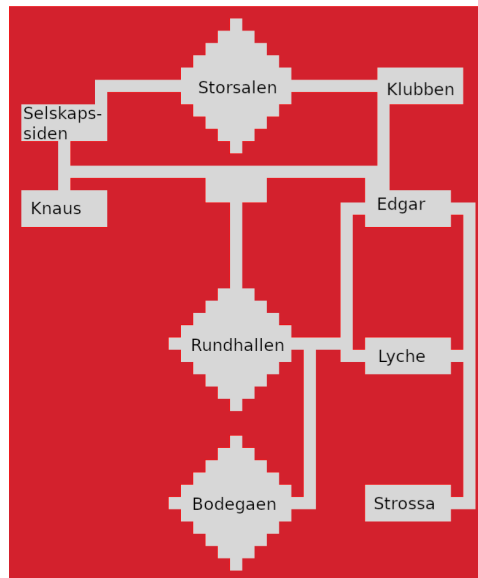

Figure 1: Samfundet represented in 2 dimensions.

Table 1: Description of cell costs.

Color	Description	Cost
⬜	Flat Ground	1
⬜	Stairs	2
⬛	Packed Stairs	3
⬛	Packed Room	4

2 Grid with obstacles

We start with Samfundet being completely flat, so the lowest cost problem is reduced to a shortest path problem.

2.1 Shortest path from Rundhallen to Strossa

We have arrived at Samfundet with our friend five minutes ago, and they have already disappeared. When calling our friend, we find that they are located at Strossa, so we attempt to find the shortest path from our location at Rundhallen to our friend.

The shortest path is shown in Figure 2 where a description of each color is shown in Table 2. We have considered 151 different nodes, where the shortest path has a cost of 37.
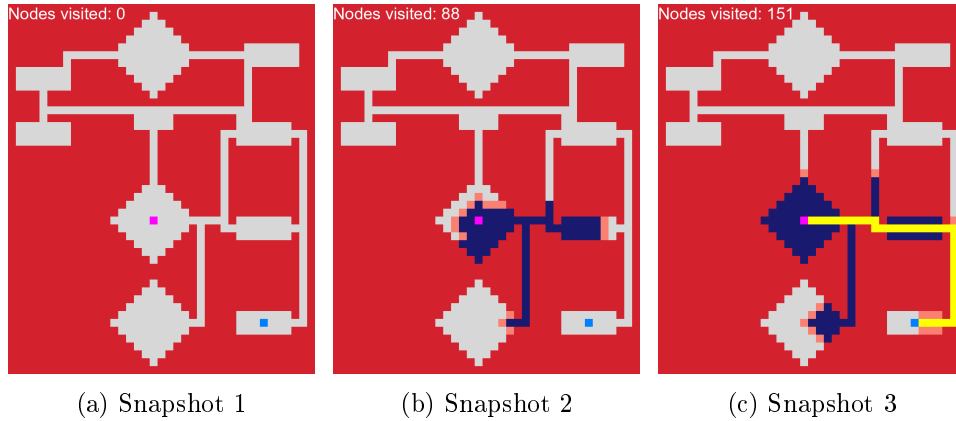

(a) Snapshot 1   (b) Snapshot 2   (c) Snapshot 3

Figure 2: A* search from Rundhallen to Strossa with all tiles at equal cost.

2.2 Shortest path from Strossa to Selskapssiden

When we reach Strossa, our friend is nowhere to be found, so we call them again. Now they are located at Selskapssiden, so we must find the shortest path there to reach our friend in time.

Table 2: Description of the remaining cell colors.

Color	Description
	Border
	Start
	Goal
	Open nodes
	Closed nodes
	Best path

The shortest path is shown in Figure 3. We have considered 222 different nodes, where the shortest path has a cost of 71.

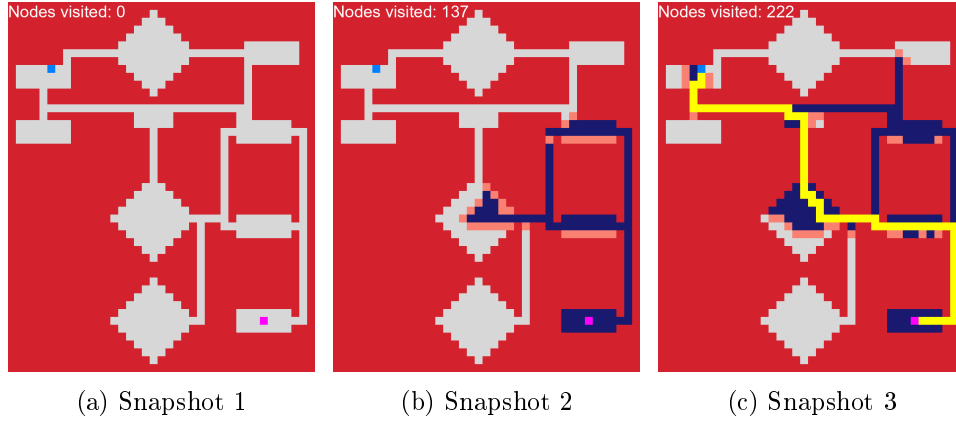(a) Snapshot 1   (b) Snapshot 2   (c) Snapshot 3

Figure 3: A* search from Strossa to Selskapssiden with all tiles at equal cost.

3 Grid with different cell costs

While maintaining the 2 dimensinal representation of Samfundet, we now add costs to the stairs, and locations packed with people.

3.1 Path from Lyche to Klubben with the least cost

We are going to a concert at Samfundet, specifically at Klubben. We are currently at Lyche with some friends, and should get going. As the stairs from Rundhallen to Edgar have become packed, this route might slow us down, so we find the path from Rundhallen to Klubben with the least cost.

The least cost path is shown in Figure 4, where we have considered 131 nodes and where the least cost path has a cost of 57.
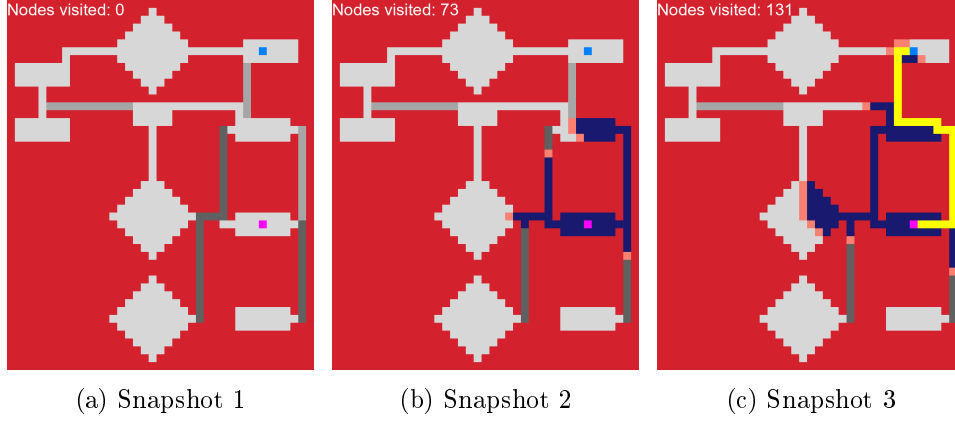
(a) Snapshot 1   (b) Snapshot 2   (c) Snapshot 3

Figure 4: A* search from Rundhallen to Klubben, with stairs cost and crowded stairs cost.

3.2 Path from Lyche to Klubben with the least cost with cake party at Edgar

As we start walking towards Klubben, we find a poster announcing a free chocolate cake party at Edgar this evening. Edgar is therefore packed with people, and when we take this into consideration, we must most likely take another path to Klubben.

The least cost path is shown in Figure 5, where we have considered 190 nodes and where the least cost path has a cost of 64, which unsurprisingly is a bit higher than the previous cost.

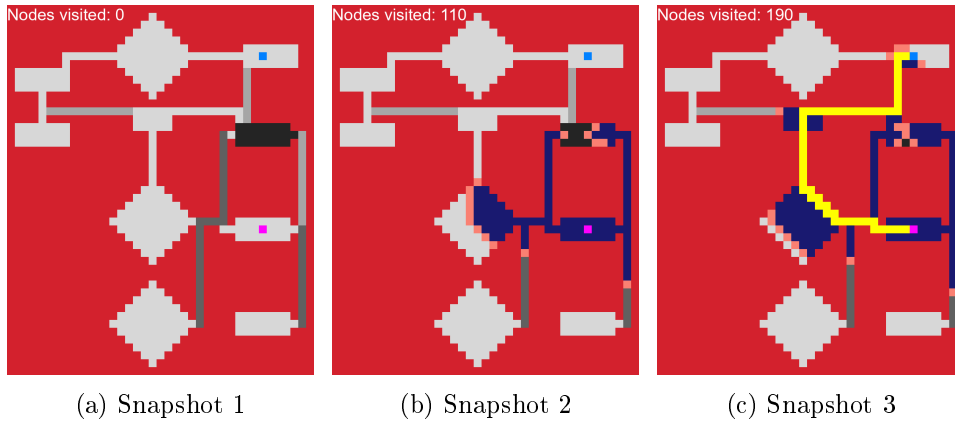(a) Snapshot 1   (b) Snapshot 2   (c) Snapshot 3

Figure 5: A* search from Rundhallen to Klubben, with stairs cost, crowded stairs cost and Edgar packed with people.