Lab 1: Search

Aim

The aim of this lab is for you to understand how the search strategies work, in particular the A*-search strategy.

Preparation

Read Chapter 6 of the course book (Ertel). All parts of this chapter are not required for completing the lab, but it is recommended that you do this in any case.

About the lab

This lab consists of three parts, two practical and one theoretical. This lab can be done by at most three persons.

Lab examination: Demonstrate Task A and B during the lab hours, and email Task C to Elmira (elmira.zohrevandi@liu.se)

The 8-puzzle

Consider the 8-puzzle problem defined on the course textbook Introduction to Artificial Intelligence[1] by Ertel in Sect. 6.1 on page 84. For the 8-puzzle there are two simple heuristics:

- **h1** = the number of misplaced tiles; the number of squares that are not in the right place. The space is not a tile, so it cannot be out of place.
- **h2** = the Manhattan distance

h1 and h2 are defined on the course textbook in Sect. 6.3.4 on page 100.

TaskA

Implement the A*-search algorithm for the 8-puzzle that uses the heuristic h1. Explain the data structure that you used in your solution. It is important that you choose a good data structure for an efficient solution.

TaskB

Extend your program by implementing the heuristic h2.

TaskC (Theory)

Consider again the two heuristics h1 and h2. Answer the following questions. Explain your answer.

1. Are h1 and h2 admissible?
2. Which heuristic among h1 and h2 performs better, and why?
3. Which of the following heuristics are admissible?
   - h3 = (h1+h2)/2
   - h4 = 2 × h1
   - h5 = max(h1,h2)

Grading

Task	Grade
A	3
A+B	4
A+B+C	5

[1] Available at http://dellacqua.se/education/courses/tnm096/material/books/Ertel.pdf