Artificial Intelligence (COMP111)

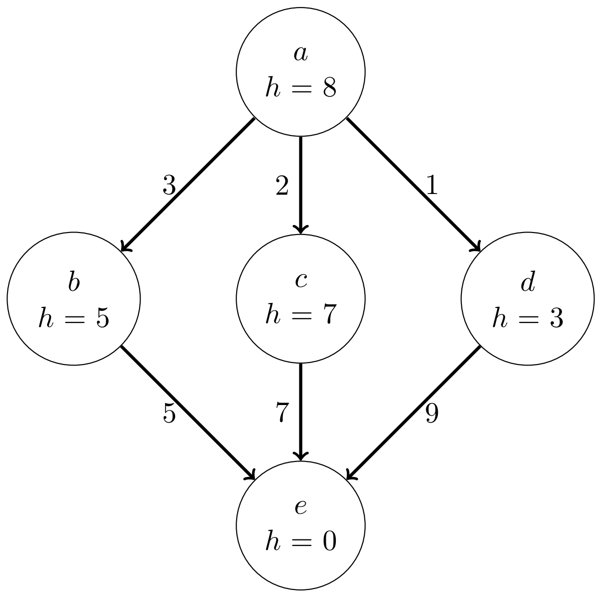
Exercise 3

Your answer to Questions 2 and 3 should be submitted on canvas for assignment *Exercise 3* either as a text entry, a text file (txt), a pdf file, or a photo of the handwritten solution. The deadline is Monday, 2nd of November of October, at 6pm. You should also attempt to answer the other questions before your tutorial (but not submit them).

You obtain 1 point (1 percent of the final mark) if you make a reasonable attempt to answer Questions 2 and 3 *and* actively participate in your tutorial in the week starting Monday 2nd of November.

We would like to encourage you to discuss the questions with your fellow students, but do not copy your answer from anybody else.

Consider the following search graph with states $\{a, b, c, d, e\}$, start state $s_{\text{start}} = a$, and a single goal state e. The heuristic value for each state is expressed within the state underneath the state name, and the cost of each action is shown next to the arrow representing the action.



1. Assume a uniform cost algorithm is applied to the search graph. Give

a sequence of frontiers that could be computed by the algorithm, the returned path and its cost.

2. Assume a greedy algorithm is applied to the search graph. Give a sequence of frontiers that could be computed by the algorithm, the returned path and its cost.

3. Assume an A* algorithm is applied to the search graph. Give a sequence of frontiers that could be computed by the algorithm, the returned path and its cost.

Consider the following search problem, based on the 8-puzzle, with the initial state, s_0,

1	7	5
2	6	
3	4	8

goal state, s_{goal}

1	6	7
2	5	8
3	4	

and operations

- o_1: move any tile to the left of an empty square to the right;
- o_2: move any tile to the right of an empty square to the left;
- o_3: move any tile above an empty square down;
- o_4: move any tile below an empty square up.

A cost of 1 is assigned to each operation. Some of the states generated are given below.

$s_1 =$

1	7	5
2		6
3	4	8

$s_2 =$

1	7	
2	6	5
3	4	8

$s_3 =$

1	7	5
2	6	8
3	4	

$s_4 =$

1	7	5
2	6	8
3		4

$s_5 =$

1		7
2	6	5
3	4	8

$s_6 =$

1	6	7
2		5
3	4	8

$s_7 =$

1	6	7
2	5	
3	4	8

4. Consider the heuristic h_1, number of displaced tiles, and h_2, total Manhattan distance. Compute their values for the states $s_0, \ldots, s_7, s_{\text{goal}}$.

5. Show that using the heuristic h_1 it is possible that a greedy search algorithm never terminates.

6. Assume a greedy algorithm is applied to the search problem where heuristic h_2 is used. Give a sequence of at least four frontiers that could be computed by the algorithm.

7. Assume an A* algorithm is applied to the search problem where heuristic h_2 is used. Give a sequence of at least three frontiers that could be computed by the algorithm.