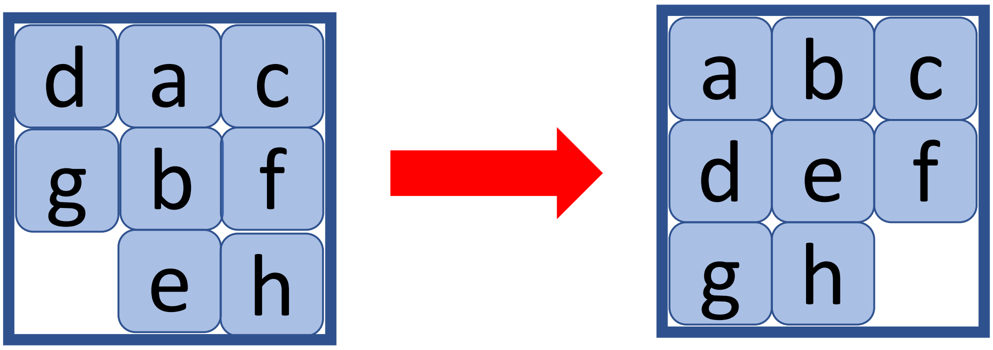
ELEC95005 Artificial Intelligence – Laboratory 1 – General Graph Search

In this laboratory exercise, the aim is to implement the General Graph Search (GGS) engine together with the A* search algorithm, and use it to solve the 8-puzzle.

The 'ah'-puzzle (aka 8-puzzle) is played on a 3x3 board with 8 tiles and 1 'hole' or 'blank' space, whereby one tile can slide into the hole/blank. The aim of the puzzle is to convert a starting arrangement into a particular goal arrangement, by finding a sequence of moves (sliding tiles):



Step 1. Formulate the State Space

Devise a Prolog data structure to represent the problem.

Think graphs...

Specify the goal state in this data structure.

Specify an initial state in this data structure.

You should ensure that the goal state is reachable from this initial state.

Specify the state change operator(s).

You should seek as general a specification as possible and this will depend on your choice of data structure. It is not necessary to spell out state change rules for each location. It is not even necessary to have 4 moves, for tiles shifting left, right, up or down. In fact, it can even be seen that there is only one general state change rule, if you think about it from the point of view of the gap moving, not the tiles…

Step 2. Specify Some Heuristics

Write a heuristic function that counts the number of tiles of place.

Write a heuristic function that counts the accumulated Manhattan distance of tiles out of place.

Are there any other heuristics that could be used?

Step 3. Implement the Problem Solver

Implement the GGS engine.

Implement the supplementary definitions for choose/3 and add_to_paths/3 for different graph search algorithms.

It is recommended that you ensure that GGS works, e.g. for simple problems such as the beer-glass filling problem, or the farmer-wolf-goat-cabbage problem, for basic algorithms such as depth first and breadth first search.

Implement the supplementary definitions for choose/3 and add_to_paths/3 for A* search.

Write a program that will solve the ah-puzzle using each of the two heuristics.

Which heuristic is ‘better’?