

CS 441/541

Artificial Intelligence

Fall, 2008

Homework 2: Problem-Solving as Search
Due: Monday Oct. 13

Important: For this assignment, e-mail me the code you used and instructions on how to run it. **Please do not give me hard copy of code!** But please do give or send me a computer-formatted (spell-checked) write-up as described below.

Implement both the best-first and the A* search algorithms to search for a solution to the 8-puzzle, as described in the textbook. You may use the code given in the book / CD or adapt it to your own favorite programming language. The input to your program should be a configuration of the 8 puzzle, e.g.,

(4 5 b 6 1 8 7 3 2) (where b = “blank”) corresponds to:

4	5	
6	1	8
7	3	2

The goal state is (1 2 3 4 5 6 7 8 b).

Implement three different heuristics—the two described in the textbook plus one of your own devising—for evaluating states in the state space. Run your search algorithms (stopping it after some maximum number of steps if the solution is not found) using each of these three heuristics on each of five different initial states. Your program should output the solution path it found (if one was found), e.g.,

(4 5 b 6 1 8 7 3 2) → (4 b 5 6 1 8 7 3 2) → ... → (1 2 3 4 5 6 7 8 b).

In your write-up, describe the three heuristics, and, for each of the heuristics, give the solution path discovered for each initial state, and the average number of steps in the path over the five trials. I.e., your data should look something like this:

Best-first search:

Heuristic 1:

- [solution path1]
 - [solution path2]
 - [solution path3]
 - [solution path4]
 - [solution path5]
- Average number of steps: [average]

Heuristic 2:

- [solution path1]
 - [solution path2]
 - [solution path3]
 - [solution path4]
 - [solution path5]
- Average number of steps: [average]

Heuristic 3:

- [solution path1]
 - [solution path2]
 - [solution path3]
 - [solution path4]
 - [solution path5]
- Average number of steps: [average]

A* search:

Heuristic 1:

- [solution path1]
 - [solution path2]
 - [solution path3]
 - [solution path4]
 - [solution path5]
- Average number of steps: [average]

Heuristic 2:

- [solution path1]
 - [solution path2]
 - [solution path3]
 - [solution path4]
 - [solution path5]
- Average number of steps: [average]

Heuristic 3:

- [solution path1]
 - [solution path2]
 - [solution path3]
 - [solution path4]
 - [solution path5]
- Average number of steps: [average]

Write a paragraph describing the conclusions you draw from your results.

Extra credit: Produce the same data for the 15-puzzle (you don't need to give the actual solution paths, just the average number of steps for each heuristic).