Portland State UNIVERSITY

CS 441/541: Artificial Intelligence, Summer 2024

Programming Assignment #1

A. Rhodes

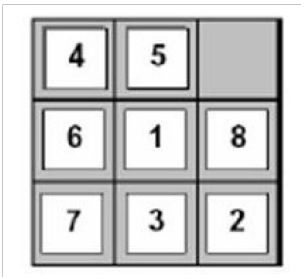
Note: This assignment is **due by Monday 7/15 @ 10pm**; you will turn in the assignment by email to our TA, as instructed below.
Each student will turn in an individual assignment (so that we have something upon which to base your individual grade). However, you are encouraged to discuss and work through any issues related to this assignment with your instructor, TA and above all, other students in our class. Bottom line: you will code the assignment yourself; the assignment results/code will be the product of your individual work.

Problem-Solving as Search

Important: For this assignment, e-mail our TA the code you used and instructions on how to run it. Please provide 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. 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:



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 (+10%): 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).