Name: ID:

1. (3 points) In class, it was suggested that if one had an ensemble of heuristics h_1, h_2, ..., h_N, one can define a new heuristic h_{max} that gives for any node n:

$$h_{\max}(n) = \max_i h_i(n)$$

a) (1 point) Show that h_{max} is an admissible heuristic.

b) (2 point) Show that h_{max} dominates all of the other h_i's.

2. (4 points) Recall the 8-puzzle problem discussed in class.

a) (1 point) Show that the "misplaced tiles" heuristic is admissible.

b) (1 point) Show that the “sum of Manhattan distances” heuristic is admissible.

c) (2 points) Explain why the “misplaced tiles” heuristic is not as good as the “sum of Manhattan distances” heuristic for the 8-puzzle.

3. (8 points) Consider the relaxed 8-puzzle problem where any tile can be swapped with the blank space, not just tiles directly adjacent to the blank space. The distance to the goal state in this relaxed problem is an admissible heuristic to the original 8-puzzle problem.

   a) (2 points) Explain why this heuristic is at least as good as the “misplaced tiles” heuristic.

b) (3 points) Give an example state where this heuristic gives a better value than the “sum of Manhattan distances” heuristic. (draw figure and compute the heuristic)

c) (3 points) Describe an algorithm for how to compute this heuristic. (pseudo code)