# Admissible Heuristics

The Eight Puzzle consists of eight tiles, numbered 1 through 8, placed into a 3-by-3 board. Pieces are initially out of order, and they must be moved into standard 1-8 order by sliding one tile at a time into the empty square on the board. Let's assume the goal state is as shown here in G:

|  |  |  |
| --- | --- | --- |
|  | **1** | **2** |
| **3** | **4** | **5** |
| **6** | **7** | **8** |

|  |  |  |
| --- | --- | --- |
| **4** |  | **2** |
| **1** | **6** | **3** |
| **7** | **8** | **5** |

G: J:

Consider the following heuristics. For each one (except perhaps the Sum of Euclidean distances), compute its value hi(J) for the state J given above. (When computing sums over the tiles, do not include the blank space as if it were a tile.)

Determine whether the heuristic is admissible. Explain why or why not. Finally, if it is admissible, determine what other heuristics it dominates.

Heuristic hi(J) Admissible? Why or why not ? Dominates...

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| h0(n) = Zero | 0 | Y | Can never overestimate true distance to G. | none |
| h1(n) = Hamming (number of tiles out of place) | 7 | Y | Each tile out of place will have to move at least one times | h0 |
| h**2**(n) = Manhattan distance of tile 1 alone. | 2 | Y | Tile 1 have to move up and right | h0 |
| h3(n) = Sum of Manhattan distances for all 8 tiles. | 11 | Y | All eight tiles have to move at least 2 times each | h6, h5, h4, h3, h2, h1, h0 |
| h4(n) = Sum of only the horizontal components of the Manhattan distance for all 8 tiles. | 7 | Y | All tiles out of place will have to move at least 7 times | h2, h0 |
| h5(n) = Sum of only the vertical components of the Manhattan distance for all 8 tiles. | 4 | Y | All tiles out of place will have to move at least 4 times | h2, h0 |
| h6(n) = Sum of Euclidean distances for all 8 tiles. | 9.2 | Y | All tiles out of place need to move at least 9.2 distances in total | h5, h4, h2, h1, h0 |