Name: ____

Admissible Heuristics **SOLUTIONS**

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:

G:

	1	2
3	4	5
6	7	8

J:

4		2
1	6	3
7	8	5

Consider the following heuristics. For each one (except perhaps the Sum of Euclidean distances), compute its value $h_i(J)$ 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	$h_i(J)$	Admissible?	Why or why not ?	Dominates...
$h_0(n)$ = Zero	0	Y	Can never overestimate true distance to G.	none
$h_1(n)$ = Hamming (number of tiles out of place)	7	Y	Any tile out of place will require more than 0 moves just for that tile.	h_0
$h_2(n)$ = Manhattan distance of tile 1 alone.	2	Y	If Tile 1 is out of place, it will require at least 1 move.	h_0
$h_3(n)$ = Sum of Manhattan distances for all 8 tiles.	11	Y	Shortest routes per tile are lower bounds on actual travel distances.	h_0, h_1, h_2, h_4, h_5, h_6
$h_4(n)$ = Sum of only the horizontal components of the Manhattan distance for all 8 tiles.	7	Y	$h_4(n)$ Is less than or equal to $h_3(n)$	h_0
$h_5(n)$ = Sum of only the vertical components of the Manhattan distance for all 8 tiles.	4	Y	$h_5(n)$ Is less than or equal to $h_3(n)$	h_0
$h_6(n)$ = Sum of Euclidean distances for all 8 tiles.	9.243	Y	$h_6(n)$ Is less than or equal to $h_3(n)$	h_0 , h_1, h_2, h_4, h_5