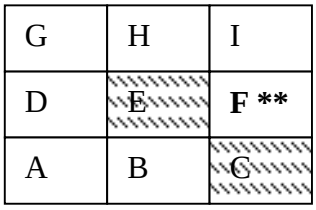
Question II.[17] Consider the following simple grid-search problem, that may be faced by a mobile robot navigating a room with obstracles. The cells in the grid are named from A to F. If a cell is shaded, that means there is an obstacle in that cell—and so the robot cannot get into that cell. The only moves available to the robot are to go right, left, up or down (as permitted by the gridcell topology). Each move is considered to have a unit cost. When making a move takes the robot into a cell with obstacles, that move is considered infeasible. Suppose the robot is in the cell named A, and wants to get to the cell named F.



Suppose we use the manhattan distance heuristic for this problem. (The manhattan distance heuristic is as you used it in project 1). For example, the manhattan distance between A and I is 4.

Part A.[4] Is the manhattan distance heuristic admissible for this problem? Will the admissibility be affectd by (a) prescence of additional obstacles (b) allowing diagonal moves.

Part B.[3] Is the manhattan distance heuristic ***monotonic*** for this problem?

Part C.[7] Show how A* search with the Manhattan distance heuristic will solve this problem (assuming only the up,down,left and right moves) and give you a path from A to F. You need to give enough details along with the search tree—e.g, the order of node expansion, the g,h and f values of all nodes etc-

- to convince me you understand A* . To make life simple, consider breaking ties between two nodes with same f-value in favor of a node that is alphabetically higher (i.e., if nodes n5:D and n7:H have the same f-value, we pick n7 for expansion first).

Part D.[3] On the search tree that you put up for A* in the previous question, draw the contours corresponding to the various iterations that IDA* search would take to solve the same problem (alternatively, write down the identities of the nodes that comprise each iteration of the IDA*)

Qn III.[5] Suppose we have a grid-based search space, such as the one shown in Qn II—except that the space is much larger. Suppose we have a choice between two other heuristics:

H1(s) = straightline distance between state s and the nearest goal state
(*Assume that the distance between two grid cells is the straightline distance between their left bottom corner points)*

H2(s) = Floor(H1(s))
(*Where the floor function gives the largest integer smaller than the given number*).

Part A.[2] Which heuristic, H1 or H2, should an A* search use for good performance on the average? Justify your answer.

Part B.[3] Which heuristic, H1 or H2, should IDA* use for good performance on the average? Justify your answer.