Homework 2 : Advanced Robot Motion Planning

(a) $h_m()$ is an admissible heuristic for G_2.
Let's prove with Contradiction.
Let G be the goal
$\therefore h(G) = 0$; Manhatten distance of Goal from Goal is 0.

Let us assume, for some initial state i, optimal Cost $[v^*(i) < h(i)]$ — (1)
↳ Since only four actions are allowed, each action can reduce the manhatten distance h by at most 1.
↳ Since optimal cost of the path from i to G is v^*, goal can be reached in v^* steps.

$\therefore$ h(G) can be greater or (in the best case) equal to $h(i) - v^*$

$\therefore [h(G) \geq h(i) - v^*]$ — (2)

But from (1) ; $[h(i) - v^* > 0]$ — (3)

From (3), we can rewrite (2) as

$[h(G) \geq h(i) - v^* > 0]$

But $h(G) = 0$; hence Contradiction on assumption.
$\therefore$ Manhatten distance is the shortest path from any i to G. Other Paths are either equal to $h_m()$ or suboptimal. $\therefore$ $h_m()$ is ADMISSIBLE.

(b)

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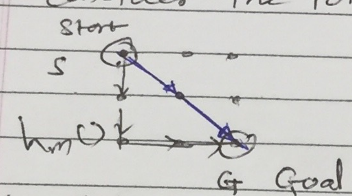
(b) The Heuristic $h_m()$ in case of $G8$, overestimates the diagonal cost.
$\therefore h_m()$ in case of $G8$ is <u>NOT ADMISSIBLE</u>.

$\rightarrow$ Consider the following case $\rightarrow$



$\star$ $h_m(s) = |x_G - x_s| + |y_G - y_s|$

$= 2 + 2 = 4$

$\star$ $V^*(s)$, optimal Path is shown in Blue.
$\therefore V^*(s) = \sqrt{2} + \sqrt{2} = 2\sqrt{2}$

Clearly, $h_m(s) > V^*(s)$
$\therefore$ we can see that, $h_m()$ in case of G_8 is
<u>NOT ADMISSIBLE</u>.