

1 Search and Heuristics

As an example: if the agent shown were initially stationary, it might first turn to the east using (*right*), then move one square east using *fast*, then two more squares east using *fast* again. The agent will of course have to *slow* to turn.

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3. Is the Manhattan distance from the agent's location to the exit's location admissible? Why or why not?

4. State and justify a non-trivial admissible heuristic for this problem which is not the Manhattan distance to the exit.

5. If we used an inadmissible heuristic in A* tree search, could it change the completeness of the search?

6. If we used an inadmissible heuristic in A* tree search, could it change the optimality of the search?

7. Give a general advantage that an inadmissible heuristic might have over an admissible one.

2 Expanded Nodes

Consider tree search (i.e. no closed set) on an arbitrary search problem with max branching factor b . Each search node n has a backward (cumulative) cost of $g(n)$, an admissible heuristic of $h(n)$, and a depth of $d(n)$. Let c be a minimum-cost goal node, and let s be a shallowest goal node.

For each of the following, you will give an expression that characterizes the set of nodes that are expanded before the search terminates. For instance, if we asked for the set of nodes with positive heuristic value, you could say $h(n) \geq 0$. Don't worry about ties (so you won't need to worry about $>$ versus \geq). If there are no nodes for which the expression is true, you must write "none."

1. Give an expression (i.e. an inequality in terms of the above quantities) for which nodes n will be expanded in a breadth-first search.
2. Give an expression for which nodes n will be expanded in a uniform cost search.
3. Give an expression for which nodes n will be expanded in an A* search with heuristic $h(n)$.
4. Let h_1 and h_2 be two admissible heuristics such that $\forall n, h_1(n) \geq h_2(n)$. Give an expression for the nodes which will be expanded in an A* search using h_1 but not when using h_2 .
5. Give an expression for the nodes which will be expanded in an A* search using h_2 but not when using h_1 .