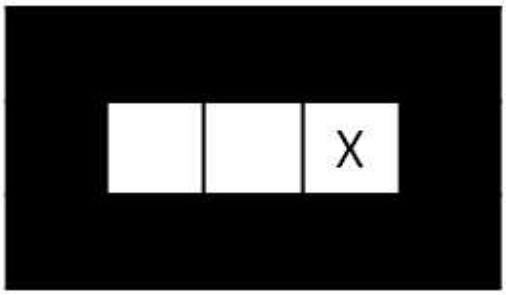
hw1_search_q9_hive_minds_lost_at_night

Question 9: Hive Minds: Lost at Night

0.0/9.0 points (graded)

It is night and you control a single insect. You know the maze, but you do not know what square the insect will start in. You must pose a search problem whose solution is an all-purpose sequence of actions such that, after executing those actions, the insect will be on the exit square, regardless of initial position. The insect executes the actions mindlessly and does not know whether its moves succeed: if it uses an action which would move it in a blocked direction, it will stay where it is. For example, in the maze below, moving right twice guarantees that the insect will be at the exit regardless of its starting position.



Which of the following state representations could be used to solve this problem?

- A tuple (x, y) representing the position of the insect.
- A tuple (x, y) representing the position of the insect, plus a list of all squares visited by the insect.
- An integer t representing how many time steps have passed, plus an integer b representing how many times the insect's motion has been blocked by a wall.
- A list of boolean variables, one for each position in the maze, indicating whether the insect could be in that position. ✔

- ○ A list of all positions the insect has been in so far.

Goal test: $\forall (x, y)$, if $(x, y) = Goal : bool\,[x]\,[y] = True$; else $bool\,[x]\,[y] = False$
Successor: Actions available to us are {NORTH, SOUTH, EAST, WEST}. The action WEST, for example, will move us from a state $bool$ to a new state $bool_{next}$ such that $\forall (x, y)$, if $bool\,[x + 1]\,[y] = True$ or $(x - 1, y)$ is a wall $: bool_{next}\,[x]\,[y] = True$; else $bool\,[x]\,[y] = False$.

What is the size of the state space?

- ○ MN
- ○ MNT
- ◉ 2^{MN} ✔
- ○ $(MN)^T$
- ○ e^{2MN}
- ○ The state space is infinite.

There are MN total booleans, and 2 values for each boolean, so there are 2^{MN} total possible states.

Which of the following are admissible heuristics?

- ☐ Total number of possible locations the insect might be in.
- ☑ The maximum of Manhattan distances to the exit square from each possible location the insect could be in. ✔
- ☑ The minimum of Manhattan distances to the exit square from each possible location the insect could be in. ✔

Option 1: Consider the maze above. From the beginning state, we are 2 moves away from the exit square. However, the heuristic would suggest 3, which is not admissable.
Option 2: Our all-purpose solution must work for the possible insect location that is furthest from the exit square, so the solution must be cost at least as much as the cost from that location, so this heuristic is admissable.
Option 3: Admissable, for the same reason as above.

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Answers are displayed within the problem