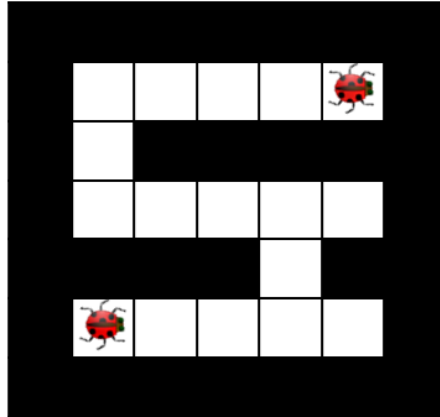


(b) (6 pt) Long Lost Bug Friends



You now control a pair of long lost bug friends. You know the maze, but you do not have any information about which square each bug starts in. You want to help the bugs reunite. You must pose a search problem whose solution is an all-purpose sequence of actions such that, after executing those actions, both bugs will be on the same square, regardless of their initial positions. Any square will do, as the bugs have no goal in mind other than to see each other once again. Both bugs execute the actions mindlessly and do not know whether their moves succeed; if they use an action which would move them in a blocked direction, they will stay where they are. Unlike the flea in the previous question, bugs *cannot* jump onto walls. Both bugs can move in each time step. Every time step that passes has a cost of one.

- i. (2 pt) Give a *minimal* state representation for the above search problem.

A list of boolean variables, one for each position in the maze, indicating whether the position could contain a bug. You don't keep track of each bug separately because you don't know where each one starts; therefore, you need the same set of actions for each bug to ensure that they meet.

- ii. (2 pt) Give the size of the state space for this search problem.

$$2^{MN}$$

- iii. (2 pt) Give a nontrivial admissible heuristic for this search problem.

h_{friends} = the maximum Manhattan distance of all possible pairs of points the bugs can be in.