

hw3_games_q8_shallow_search

Question 8: Shallow Search

8/8 points (ungraded)

In this question, we will investigate shallow search, also known as depth-limited search. Depth-limited search is not guaranteed to find the optimal solution to the original problem. The point of this question is to explore some of the (potentially undesirable) behavior of depth-limited search, and to illustrate that the quality of the evaluation function can play a big role in how well depth-limited search performs.

Consider the following Pacman configuration, in the board below. At each time step, Pacman can move either West (left) or East (right) and is using limited-depth minimax search (where the minimizing agent does not really do anything) to choose his next move. Pacman is 3 East moves away from the food, and chooses from the following state evaluation functions:

- $F1(\text{state}) = -\text{Number of food pellets left}$
- $F2(\text{state}) = -\text{Number of food pellets left} + 0.5/(\text{distance to closest food pellet} + 1)$; distance to closest food pellet is taken as 0 when no food remains.

The search depth referred to in this question corresponds to the depth in a search tree that only considers the maximizer's actions. For example, if the search considers sequences of up to 2 actions by the maximizer, it'd have a search depth of 2.

In the questions below, optimality means that the action is an optimal **first** action according to the search tree with the specified depth and the specified evaluation function. In each of these questions, there are 5 different search trees under consideration: one of depth 1, one of depth 2, ... , and one of depth 5.

Note that there can be more than one optimal action for a given search tree (this can happen whenever there are ties). Also, note that a search does not finish when the dots are eaten.



Using F1 as the state evaluation function, for what search depths will East be an optimal action?

☒ 1

☒ 2

☒ 3

☒ 4

☒ 5



Using F1 as the state evaluation function, for what search depths will West be an optimal action?

☒ 1

☒ 2

☐ 3

☐ 4

☒ 5



Using F2 as the state evaluation function, for what search depths will East be an optimal action?

☒ 1

☒ 2

☒ 3

☒ 4

☒ 5



Using F2 as the state evaluation function, for what search depths will West be an optimal action?

☐ 1

☐ 2

☐ 3

☐ 4

☒ 5



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✓ Correct (8/8 points)

Note this is a challenging question, so we have provided an optional hint. It will benefit you most if you first think about this problem on your own, and then if stuck, use the hint to guide you. To read the hint click on the hint button. [Hint](#)