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Assignment 1 Search

Q1. Describe the possible states, initial state, and transition function of the KTH fishing derby game.
Possible states: All different configurations of the game board (positions of the hooks, fishes (and their respective value), the current score, and lastly if a current player has caught a fish).

Initial state (s0): The starting configuration of the game state. This includes both players having a score of 0 and both players catching a fish as -1 (not currently capturing a fish). The hook positions are also set at the coordinates (5,12) for player 0 and (11,17) for player 1 in test_0. The fish values and positions are randomized depending on the specific game.

The transition function (μ): Defines the legal moves for each player given the current state, determining the possible states that a player can reach with one legal move. Meaning for example moves like the boating crossing each other is not possible. When fish is caught the player has to go straight up to get points. When the player reaches the correct index the fish is removed and the fish score is added to the player score.

Q2. Describe the terminal states of the KTH fishing derby game.
The terminal state can be divided into two different categories for this game. The first is when the actual game is over which happens when there is no fish left on the board. The second termination category is when one of the players' hooks has the last fish. When this happens the player that has caught the fish will have to go straight up and the other player is left to do nothing.

Q3. Why is v(A,s) = Score(Green boat) − Score(Red boat) a good heuristic function for the KTH fishing derby (knowing that A plays the green boat and B plays the red boat)?
It is a good approximation of the utility function because it captures the relative advantage of player A over player B in terms of their score. The heuristic function reflects the current state's desirability for player A by considering the score difference. Since the objective is to maximize the score, a positive value of v(A, s) indicates that player A is in a favorable position.

Q4. When does v best approximate the utility function, and why?
First off the closer the game state is to a terminal state the more accurate the value best approximates the utility function. Secondly, the better the utility function is designed the better we can get an approximation to the value of the current game. This means that we want to, in an as good as possible way, calculate the current state of the game. This might not just include the current score or how close fishes are but also moves that sabotage the other player.

Q5. Can you provide an example of a state s where v(A,s) > 0 and B wins in the following turn? (Hint: recall that fish from different types yield different scores).

If player A (green boat) has a higher score than player B (red boat), but player B is in a position to catch a high-scoring fish, player B might win in the next round. In this case, $v(A, s) > 0$ but can be turned into $v(A, s) < 0$ if B makes a strategic move.

Q6. Will η suffer from the same problem (referred to in Q5) as the evaluation function v? If so, can you provide an example? (Hint: note how such a heuristic could be problematic in chess, as shown in Figure 2.2).

Yes, it might suffer from a similar problem, as it measures the difference between the number of winning and losing terminal states reachable from a given state. This does not accurately represent the overall advantage in the game, as the heuristic does not consider the strategic positions and potential moves that the opponent might make. For example, in the given figure we can see that poor decisions might lead to losing a queen or missing a checkmate opportunity. An example of this in the fishing game is when a boat might be aiming for a lower-level fish rather than a higher-level fish.