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CS561 – Prof Laurent Itti

Assignment 2: The Fruit Rage

*Approach for computing the Agent Move:*

GameEngine will call the findMove method defined in the agent's class to find the position of the fruit to be picked which will be determined as the Agent's move.

The straightforward approach is that to think greedy, which is to choose the maximum score at each step (at each move).

The problem with this approach is that, the agent will not know the state of the board after its current move and after choosing this move, the opponent might have better chance to score. Thus, we need to look at least one step ahead of opponent, so that choosing a fruit will not only get me high score, but upon that, the opponent score should be comparatively less.

*How to go about implementing this?*

We need to keep track of positions of the fruits and the score obtained by choosing that fruit. Now get the new board state after choosing each fruit in the list and explore the maximum score that can be obtained from the new board state.

We calculate the maximum score that can be obtained from the new board and will choose the minimum from this set of score. This is because, we need to minimize the opponent score and we do this by finding the maximum difference of my score with opponent score.

i.e we need to find  $\max(\text{my\_score} - \text{opponent\_score})$

*Won't this take too many calculations? How to cut down some tree explorations?*

Yes, this takes too many calculations if we try to expand each and every node for the opponent score calculation for the new board state.

To minimize the calculations, while expanding the node, if we find the opponent score "p" which turns out to be greater than my score, then we can simply break out of exploration, since we are certain that whatever fruit the opponent select, will be at least as good as "p". Thus, breaking this will save us some calculations. It can be the case that all my opponent scores are greater than my current score, in that case we will be making a trade-off as the minimum opponent score till now explored, which can actually change during opponent's chance.

*2a. Below table shows the observation of Agent v/s Greedy with 5 fruits and with time limit of 10 seconds on a system with core i7 processor, with Agent as second player.*

<b>Board Size</b>	<b>Agent</b>	<b>Greedy</b>
32x32	2223	1709
40x40	3645	3239
45x45	4807	4025
50x50	6162	5180
<b>55x55</b>	<b>6459</b>	<b>8116</b>
<b>58x58</b>	<b>6483</b>	<b>9344</b>
<b>60x60</b>	<b>6943</b>	<b>10275</b>

*Agent v/s Greedy with 5 fruits and 10 sec time limit with Agent as second player*

From the above table, we can see that our agent loses to Greedy convincingly when the board size is 55x55 and the time limit is 10 seconds.

*2b. Below table shows the observation of Agent v/s Greedy with 5 fruits and with time limit of 10 seconds on a system with core i7 processor, with Agent as first player.*

<b>Board Size</b>	<b>Agent</b>	<b>Greedy</b>
32x32	2352	1132
40x40	3921	3543
45x45	4912	3987
50x50	6245	5782
<b>55x55</b>	<b>6593</b>	<b>6812</b>
<b>58x58</b>	<b>6912</b>	<b>7802</b>
<b>60x60</b>	<b>7239</b>	<b>8834</b>

*Agent v/s Greedy with 5 fruits and 10 sec time limit with Agent as first player*

*3a. Below table shows the observation of Agent v/s Greedy with 5 fruits and with time limit of 10 seconds on a system with core i7 processor, with Agent as second player.*

<b>Board Size</b>	<b>Agent</b>	<b>Random</b>
32x32	3613	908
40x40	5440	1320
45x45	6783	1785
50x50	9142	2213
55x55	9523	4484
58x58	9723	6286
60x60	10720	7174
65x65	13116	7555
80x80	15284	15683
90x90	16232	16112
95x95	<b>Negative</b>	20993

*Agent v/s Random with 5 fruits and 10 sec time limit with Agent as second player*

Here we can observe that our agent wins convincingly till the board size 65x65, and have equal fight after 65x65 and the agent scores Negative for the board size of 95x95.

*3b. Below table shows the observation of Agent v/s Greedy with 5 fruits and with time limit of 10 seconds on a system with core i7 processor, with Agent as first player.*

<b>Board Size</b>	<b>Agent</b>	<b>Random</b>
32x32	3792	1123
40x40	5522	1834
45x45	6324	2422
50x50	9278	2698

55x55	9611	4823
58x58	9834	6512
60x60	10234	7812
65x65	10945	7922
80x80	12983	12456
90x90	<b>Negative</b>	16112
95x95	<b>Negative</b>	20993

*Agent v/s Random with 5 fruits and 10 sec time limit with Agent as first player*

Here from the table we can observe that the agent scores negative when the board size is 90x90, and wins convincingly till the board size is 65x65.