Introduction To AI - Assignment 2

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December 2022

1 The heuristics

For simplicity, let us call the max player MX and the min player MN.

1. **MODE 1.** In mode number one we use the heuristic $MX.score - MN.score$.

   Using this heuristic, we will enable the min-max alpha-beta pruning algorithm to run the Maximum player and always prefer get more people and 'steal them' from the Minimum player while the opposite is true for the Minimum player.

2. **MODE 2.** In mode number two we use the next heuristics: 1) for MX if $MX.score == MN.score$ then prefer the greater good and return $MX.score + MN.score$ else, return $MX.score$. 2) for the MN player return the $MN.score$.

   Using those heuristics rules we are helping to adapt the min-max -alpha-beta algorithm to the second game mode by allowing the Maximum player to prefer moves without looking at the Minimum agent and vice versa. When its tie, we break it by giving a stronger result for the common goal.

3. **MODE 3.** In mode number three we always return the sum of the players scores. That way, we enable the player to prefer steps that are for the greater good.

To adapt the minimum in modes 2,3, we use (-) sign for the Minimum player and absolute values in the min-max algorithm to adapt to the different modes and players.

2 Modes results comparison

In what follow, we will elaborate on two experiments that appear in the work 'readme.txt'. Full instructions for running those codes are in the readme.txt file.

2.1 MODE 1 to MODE 2 Comparison.

Graph Layout   The graph layout is:
Vertices: (V1 P1) (V2 P1) (V3 P1) (V4)
Edges: (E1 1 2 W1), (E2 1 3 W1), (E3 2 4 W1)

Players Initial Positions   The player initial positions are:
Max agent: 2 Min agent: 3

Play and Score MODE 1   The Max player will move to vertex number 1 and collect the last people and end the game. The final score will be in favor of the Max player where he will win with a score of 2 against 1.

Play and Score MODE 2   This time, the agents are in tie in the begging of the game. Thus, by the instructions of the mode, we will be in favor of the Min player. That means that the Max player will first move to vertex number 4 and then the Min agent will move to vertex number 1. Thus, the final score will be in favor of the Min agent. Min agent will have a score of 2 where the Max agent will have a score of 1. In this example we can see the difference between MODE 1 and 2.

MODE 3 . Playing the third mode will produce different end score but will have the same order of moves like MODE 1.

2.2   MODE 1 to MODE 3 Comparison.

Graph Layout   The graph layout is:
Vertices: (V1 P1) (V2 B) (V3 P2) (V4) (V5 P1)
Edges: (E1 1 2 W1) (E2 2 3 W1) (E3 3 4 W1) (E4 3 5 W1)

Players Initial Positions   The player initial positions are:
Max agent: 2 Min agent: 4

Play and Score MODE 1   First, the Max player will move to vertex 3 (vertex 2 is brittle thus vertex 1 is not reachable anymore), then the Min player will move to vertex 3 as well. Then the Max player will move to Vertex 5. The Min player will move back to 4 and the game will be over because we will revisit a seen state. The Max player collected two peoples in vertex 3 and one in vertex 5 and thus the final score will be 3:0 for the Max player. We can observe that the max player choose to go first to vertex 3 and not 1. If he would go to 1 first, he will be stuck there and lose the game 1:3.

MODE 2   MODE 2 will be the same as MODE 1 since we don't have a tie in this game.

Play and Score MODE 3   . First, the Maximum player will move to vertex 1 this time. Because vertex 2 is brittle, it will prefer to do it for the greater good. If it would went to vertex 3 first like in MODE 1, then the person in vertex 1 would be never saved. Then, the Minimum player will move to vertex 3, then the Max agent will do no-op and then the Minimum agent will arrive to vertex 5 and collect the last peoples. In this example we can see the differences between MODE 1 and 3 and the final score is 4 where the Maximum agent collected 1 people and the Minimum agent collected 3 people.