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HW1 – Mancala Write-up
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Score Function:

In designing my score function, I began with research into how to play mancala. This game was completely new to me, so not only did I have to learn how to play, but how to play well in a fairly short amount of time. I used my bus commute time to play game after game of mancala on my phone. The things I identified as important from my game play were verified by my online research into the best strategies for playing mancala. The key strategies for increasing score that I found, were capturing, ending in your own mancala, and not sending stones to your opponent's side. While these were great for analyzing the potential for moves on a board, I realized they were not enough to determine what made a move a good choice. The best determiner should be one that tells me whether or not I am achieving my goal, and my goal is to have my score be higher than my opponents at the end of the game. I decided to use the difference between my current score and my opponent's current score as the foundation for my score function. When the score function is positive, my score is higher than my opponent's and therefore a good choice. If it turns out negative, then my opponent's score is higher than mine and therefore a bad choice. The things I had identified at the beginning of my search (capture, extra turn …) became tie breakers for boards with equal or similar scores. If my ply did not reach the end of the game, theses would give me an idea of which board configuration gave me the best option for profitable moves.

My score for a given board is the difference between my current score and my opponent's current score, plus the sum of the possible points gained from all of the moves on the board. Ending in the mancala is worth +2, one point above the actual score to account for the extra turn. Landing on the opponent's side of the board gives a score of +1, because it will put a stone in my mancala, but will also give my opponent stones to work with. Landing on my side, gives a score of +0, unless a capture is possible, then the score is the value captured.

Alpha-Beta Pruning Example:

Line meaning:
Update has occurred: Function, value, move
Abort has occurred: Function, A or B, score, move
Min aborts occur only when score >= Beta
Max aborts occur only when score <= Alpha

X12
3O5
678

max, Alpha = 100.0 move = 6
max, score = 100.0 move = 6
min, Beta = 0.0 move = 6
min, score = 0.0 move = 6
min, Beta = 0.0 , Score = 0.0 . Aborted on move 8
max, Alpha = 100.0 , Score = 100.0 . Aborted on move 8
min, score = 100.0 move = 5
min, score = 0.0 move = 6

min, Beta = 0.0 , Score = 0.0 . Aborted on move 7
min, Beta = 0.0 , Score = 0.0 . Aborted on move 8
max, score = 0.0 move = 3
max, score = 50.0 move = 8
min, score = 50.0 move = 7
min, Beta = 0.0 , Score = 50.0 . Aborted on move 8
max, score = 50.0 move = 6
max, Alpha = 100.0 , Score = 50.0 . Aborted on move 7
max, Alpha = 100.0 , Score = 50.0 . Aborted on move 8
min, score = 50.0 move = 3
min, Beta = 0.0 , Score = 50.0 . Aborted on move 6
min, Beta = 0.0 , Score = 50.0 . Aborted on move 7
min, Beta = 0.0 , Score = 50.0 . Aborted on move 8
max, score = 50.0 move = 5
max, Alpha = 100.0 , Score = 50.0 . Aborted on move 6
max, Alpha = 100.0 , Score = 50.0 . Aborted on move 7
max, Alpha = 100.0 , Score = 50.0 . Aborted on move 8
min, score = 50.0 move = 2
min, Beta = 0.0 , Score = 50.0 . Aborted on move 3
min, Beta = 0.0 , Score = 50.0 . Aborted on move 5
min, Beta = 0.0 , Score = 50.0 . Aborted on move 6
min, Beta = 0.0 , Score = 50.0 . Aborted on move 7
min, Beta = 0.0 , Score = 50.0 . Aborted on move 8
move, Score = 50.0 move = 1
move, Beta = 0.0 , Score = 50.0 . Aborted on move 2
move, Beta = 0.0 , Score = 50.0 . Aborted on move 3
move, Beta = 0.0 , Score = 50.0 . Aborted on move 5
move, Beta = 0.0 , Score = 50.0 . Aborted on move 6
move, Beta = 0.0 , Score = 50.0 . Aborted on move 7
move, Beta = 0.0 , Score = 50.0 . Aborted on move 8
chose move 1 with value 50.0

XX2
3O5
678

min, Beta = 0.0 move = 6
min, score = 0.0 move = 6
max, Alpha = 100.0 move = 6
max, score = 100.0 move = 6
max, Alpha = 100.0 , Score = 100.0 . Aborted on move 8
min, Beta = 0.0 , Score = 0.0 . Aborted on move 8
max, score = 0.0 move = 5
max, score = 100.0 move = 6
max, Alpha = 100.0 , Score = 100.0 . Aborted on move 7
max, Alpha = 100.0 , Score = 100.0 . Aborted on move 8
min, score = 100.0 move = 3

min, score = 50.0 move = 8
max, score = 50.0 move = 7
max, Alpha = 100.0 , Score = 50.0 . Aborted on move 8
min, score = 50.0 move = 6
min, Beta = 0.0 , Score = 50.0 . Aborted on move 7
min, Beta = 0.0 , Score = 50.0 . Aborted on move 8
max, score = 50.0 move = 3
max, Alpha = 100.0 , Score = 50.0 . Aborted on move 6
max, Alpha = 100.0 , Score = 50.0 . Aborted on move 7
max, Alpha = 100.0 , Score = 50.0 . Aborted on move 8
min, score = 50.0 move = 5
min, Beta = 0.0 , Score = 50.0 . Aborted on move 6
min, Beta = 0.0 , Score = 50.0 . Aborted on move 7
min, Beta = 0.0 , Score = 50.0 . Aborted on move 8
move, Score = 50.0 move = 2
move, Beta = 0.0 , Score = 50.0 . Aborted on move 3
move, Beta = 0.0 , Score = 50.0 . Aborted on move 5
move, Beta = 0.0 , Score = 50.0 . Aborted on move 6
move, Beta = 0.0 , Score = 50.0 . Aborted on move 7
move, Beta = 0.0 , Score = 50.0 . Aborted on move 8
chose move 2 with value 50.0

XXO
3O5
678

max, Alpha = 100.0 move = 6
max, score = 100.0 move = 6
min, Beta = 0.0 move = 6
min, score = 0.0 move = 6
min, Beta = 0.0 , Score = 0.0 . Aborted on move 8
max, Alpha = 100.0 , Score = 100.0 . Aborted on move 8
min, score = 100.0 move = 5
min, score = 0.0 move = 6
min, Beta = 0.0 , Score = 0.0 . Aborted on move 7
min, Beta = 0.0 , Score = 0.0 . Aborted on move 8
move, Score = 0.0 move = 3
max, score = 50.0 move = 8
min, score = 50.0 move = 7
min, Beta = 0.0 , Score = 50.0 . Aborted on move 8
max, score = 50.0 move = 6
max, Alpha = 100.0 , Score = 50.0 . Aborted on move 7
max, Alpha = 100.0 , Score = 50.0 . Aborted on move 8
min, score = 50.0 move = 3
min, Beta = 0.0 , Score = 50.0 . Aborted on move 6
min, Beta = 0.0 , Score = 50.0 . Aborted on move 7
min, Beta = 0.0 , Score = 50.0 . Aborted on move 8

move, Score = 50.0 move = 5
move, Beta = 0.0 , Score = 50.0 . Aborted on move 6
move, Beta = 0.0 , Score = 50.0 . Aborted on move 7
move, Beta = 0.0 , Score = 50.0 . Aborted on move 8
chose move 5 with value 50.0

XXO
3OX
678

min, Beta = 50.0 move = 8
min, score = 50.0 move = 8
max, Alpha = 50.0 move = 7
max, score = 50.0 move = 7
min, score = 50.0 move = 7
min, score = 50.0 move = 6
max, Alpha = 100.0 move = 6
max, score = 100.0 move = 6
max, Alpha = 100.0 , Score = 100.0 . Aborted on move 8
min, Beta = 50.0 , Score = 50.0 . Aborted on move 8
move, Score = 50.0 move = 3
move, Score = 100.0 move = 6
move, Beta = 50.0 , Score = 100.0 . Aborted on move 7
move, Beta = 50.0 , Score = 100.0 . Aborted on move 8
chose move 6 with value 100.0

XXO
3OX
O78

O wins!

Custom Player:

For my custom player, I implemented a standard Alpha-Beta Prune with my custom scoring function.