;; Lab: *Adversarial Search*
;; CSC 261
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;; File
;; evaluation.pdf
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;; Summary
;; A short essay elaborating on our evaluation function used for adversarial searches

Mancala is a popular strategy game that originated from Africa. Two players play against each other to maximize the number of stones they have by the end of the game. Each of the two sides has six normal holes, and a special hole called mancala. Each player takes a turn to withdraw from their stones from one of the normal holes, and deposits the stones one by one, counterclockwise, into the neighboring holes until the stones run out. If the last stone lands on an empty hole on the player's side, they capture the stones from the opponent's hole adjacent to the hole landed and put them into their own mancala. Once a player runs out of stones on all holes on their side, the player with the most stones on their side and the mancala wins. Despite the simple rules, the game requires "sophisticated foresight to achieve successful play" (Weinman).

We considered the basic evaluation function that simply maximizes the stones in the mancala. The function proved imperfect because the opponent could win from hoarding many stones on their side without landing them into the mancala. We tried an evaluation function that maximizes only the number of empty holes on the player's side. After some experimentation, this function leads to a quick terminal state, but the opponent can still win with more stones both in their mancala and their holes even though the player emptied all holes. We then adjusted the algorithm to take into account the number of stones on the player's side of the board. This strategy works well against the simple-mancala evaluation function. We pitted our aforementioned evaluation functions against each other, and the steps each took to reach a goal state to evaluate their respective effectiveness. Then we improved the evaluation function by combining these three considerations to form a comprehensive evaluation function.

After several trials, we found that the function works best when we also minimize the total stones on the opponent's to further widen the gap between the player's stones and the opponent's. Finally, we explored the relative importance of each component of the evaluation function. We thought, for example, that having more stones in the mancala is preferred to simply have more stones on the player's holes. Each component, therefore, received a weight to demonstrate this preference (the number of stones in the mancala weighted twice as much as normal stones). Our experimentation disproved our speculation as the opponent took the win by having more stones on their side, as opposed to their mancala. We also tried to increase the weight of the other components, however, none of the increases improved the outcome of the gameplay in favor of the player. The evaluation function proved working best when they received similar weights against each other.