Report: Othello Assignment

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Approaches Used:

- Greedy Strategy: The first approach tried was a greedy search for the next move in which the immediate next move which gave the highest value is returned as the next move. The value is calculated using a heuristic function. The heuristic function used is such that it gives highest weightage for a move in the corners, a slightly lower value for moves at the edges, while the least value for moves to other positions. This did not work very effectively as it did not take into consideration the number of pieces flipped or future moves.
- Minimax Algorithm: The next approach used was the minimax algorithm. In this approach, a finite k-ply lookahead was used and the move which gave the highest minimax value was returned. Different values of 'k' were tried for the k-ply lookahead, but only low k values were feasible as minimax explores each possible state leading to an exponential growth in explored states with increasing k.
- Alpha Beta Search: In order to reduce the exploration an alpha-beta pruning strategy was used. This reduced exploration of suboptimal nodes leading to more efficient exploration. This method gave the best results and was thus, used as the final solution.

Optimization:

- Evaluation Functions: The evaluation function used was such that it gave the highest weightage to the corner positions as they ensure that the given position and consequently a lot of other positions cannot be captured. Similarly, the edge positions a given a high weightage but lower than the corner positions. The positions adjacent to the corner are given a negative value as they allow the corner or edge positions to be captured. The score matrix is defined as follows:

1000	-10	10	10	10	10	-10	1000
-10	-10	1	1	1	1	-10	-10
10	1	1	1	1	1	1	10
10	1	1	1	1	1	1	10
10	1	1	1	1	1	1	10
10	1	1	1	1	1	1	10
-10	-10	1	1	1	1	-10	-10
1000	-10	10	10	10	10	-10	1000

Finally the evaluation value of the board is calculated as SUM(V_i)-SUM(V_j) over all i,j where Vi are the values of the positions held by me player and Vj are the values of the positions held by the opponent.

- Number of plies forward: Different values of ‘k’ were tested for the k-ply search. A 6 ply-search was found to give good results when used in conjunction with the above evaluation function. A lower value led to lower exploration and gave suboptimal results while a higher value did not yield much improvement.

Final Solution:

- The final solution used was the alpha-beta search algorithm
- A 6-ply lookahead was used to look into future moves
- The final evaluation function is the one given in the above table