NAME – Priya lakra ROLL NO. CS21M047

Group no - 29

**REPORT**

**INTRODUCTION**

**What is Othello game ?**

Othello is a strategy board game played between 2 players. One player plays black and the other white.

## Game Components

## A square 8x8 board (you could use a chess board)

64 discs coloured black on one side and white on the opposite side.

## How to play

## Each player gets 32 discs and black always starts the game.is a Salesman living Then the game alternates between white and black until:

=> one player can not make a valid move to outflank the opponent.

=> both players have no valid moves.

When a player has no valid moves, he pass his turn and the opponent continues.

A player can not voluntarily forfeit his turn.

When both players can not make a valid move the game ends.

**Othello game using Alpha Beta .**

**Alpha Beta**

Alpha-beta pruning is a modified version of the minimax algorithm. It is an optimization technique for the minimax algorithm. Alpha-beta pruning can be applied at any depth of a tree, and sometimes it not only prune the tree leaves but also entire sub-tree.

The two-parameter can be defined as:

**Alpha:** The best (highest-value) choice we have found so far at any point along the path of Maximizer. The initial value of alpha is **-∞**.

**Beta:** The best (lowest-value) choice we have found so far at any point along the path of Minimizer. The initial value of beta is **+∞**.

**comparison with min max**

 For alpha beta we need to provide the min-max algorithm with some stopping criteria using which it would stop searching a region of the tree once it finds the guaranteed minimum or maximum at that level. This would prevent the algorithm from using additional computational time, making it much more responsive and fast.

The original min-max algorithm performs traversals of the tree in a left to right fashion while also going to the deepest possible depth of the tree. This essentially is a [depth-first](https://www.edureka.co/blog/breadth-first-search-algorithm/) approach. It then discovers values that must be assigned to nodes directly above it, without ever looking at other branches of the tree.

Thus, the addition of the stopping condition makes min-max take decisions like it used to previously but it optimizes the performance aspect of the algorithm.

.**METHODOLOGY**

Here we have used alpha beta algorithm.We have defined sumvalue ,play,Function\_beta,Function\_alpha functions and an eval 2D-array with heuristic values.

In Function\_alpha we have initialized alpha maximum value with -1000 and we iterated for all moves and copy\_board.makeMove(turn,\*it) is used to make a move.

With recursive call of Function\_beta we find alpha best value for our bot.

In Function\_beta with if else statement we will get to know who is playing now.We have initialized our min beta value with maximum value because we wanted beta to take as min as possible .Here also we iterates with all moves to find the beta best minimum value which other bot can take with recursive call to Function\_alpha.

In Function sumvalue we have used while loop to get scores of each bots by adding all the heuristic values when the game gets over.

**TIME COMPLEXITY**

Time complexity for alpha beta algorithm is O(b^d/2) where b is the branching factor and d is the depth of the tree.

**SPACE COMPLEXITY**

Space complexity for alpha beta pruning is O(bm) where b is the branching factor and m is the maximum depth of a tree.

**CONCLUSION**

From the above discussion, we can conclude the search algorithms like Alpha Beta Pruning are creating a revolution in the field of Artificial Intelligence and helping it pay a new and more efficient way of creating advanced approaches to solving such problems. Moreover, the alpha-beta pruning algorithm is a quality optimization over the min-max algorithm, and together with the minimax algorithm is becoming the foundation of the searching techniques.