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Assignment - 4

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Aim: Implementation of Min-Max search procedure with alpha-beta pruning for finding the solutions of the game.

Objective:

1. Study & learn about Min-Max search procedure.
2. Implementation Min-Max search algorithm with alpha-beta pruning in games for finding the solutions.

Theory:

Min-Max Algorithm:-

It is recursive or backtracking algorithm which is used in decision-making and game theory. It provides an optimal move for the player assuming that opponent is also playing optimally.

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Min-Max algorithm uses recursion to search through the game tree. Min-Max algorithm is mostly used for game playing in AI. Such as chess, checkers, tic-tac-toe, go & various two players game. This algorithm computes the minimax decision for the current state.

In this algorithm 2 players play the game one is called max & other is called min. Min-max algorithm performs DFS algorithm for the explanation of the node of complete game tree.

It proceeds all the way down to terminal node of the tree then back-tracks the tree as recursion.

Properties :-

1.) Complete :

Min-Max algorithm is complete. It will definitely find solution in finite search tree.

2.) Optimal :

Optimal if both opponents are playing.

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3.) Time Complexity :
Performs DFS so T.C. is $O(b^m)$
where b → branching factor
m → max depth of tree.

Limitations :
Slow for complex games such as chess, go, etc. This types of games has a huge branching factor & tree players has lots of choices to decide.

Properties :

1.) Max player will only update the value of alpha.
2.) Min player will only update the value of Beta.
3.) While backtracking the tree, the node values will be passed to upper nodes instead of values of alpha & beta.
4.) We will only pass the alpha, beta values to the child nodes.

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Time Complexity :

1.) Worst Ordering : $O(b^m)$
2.) Ideal Ordering : $O(b^{m/2})$

Conclusion :

In this way we learned & implemented the minmax search procedure & also implemented the alpha-beta pruning in games.

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