Green University of Bangladesh
Department of Computer Science and Engineering (CSE)
Faculty of Sciences and Engineering
Semester: (Fall, Year: 2023), B.Sc. in CSE (Evening)

Assignment (KSA-2)

Course Title: Artificial Intelligent
Course Code: CSE 315 Section: EA

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Lab Report Status
Marks: ………………………………… **Signature:.....................**
Comments:... **Date:..............................**

Assignment topic: Alpha beta pruning algorithm

Introduction:

The Alpha-Beta Pruning algorithm stands as a refined iteration of the minimax algorithm, a decision-making strategy widely employed in two-player, zero-sum games like chess or tic-tac-toe. While minimax ensures optimal decision-making, its computationally intensive brute-force approach has led to the development of Alpha-Beta Pruning, offering a more efficient alternative.

Overview:

What is Alpha-Beta Pruning?

Alpha-Beta Pruning serves as an optimization technique within the minimax algorithm, frequently utilized in decision-making processes for two-player, zero-sum games. The primary aim of Alpha-Beta Pruning is to curtail the number of nodes evaluated in the search tree, enhancing the efficiency of decision-making**.**

Working Principle:

How Does Alpha-Beta Pruning Work?

Alpha-Beta Pruning Components:

- Alpha (α): Signifies the best choice (maximum value) identified thus far for the maximizing player on the current path.

- Beta (β): Represents the best choice (minimum value) discovered thus far for the minimizing player on the current path.

- Utilizes the Alpha (α) - Beta (β): process to pinpoint the optimal path without assessing every node in the game tree.
- Max node incorporates Alpha, while Min node encompasses Beta bounds during the calculation.

- At both MIN and MAX nodes, the algorithm terminates when (α) ≥ (β), comparing only with its parent node.

- Both Minimax and Alpha (α) - Beta (β) :cut-off (prune) yield the same path.

- VII. Alpha (α) - Beta (β): Ensures an optimal solution, taking less time to compute the value for each node in the tree.

Example:

Here MAX= α and MIN= β to be consider, And Pruning node when (α) ≥ (β) satisfied

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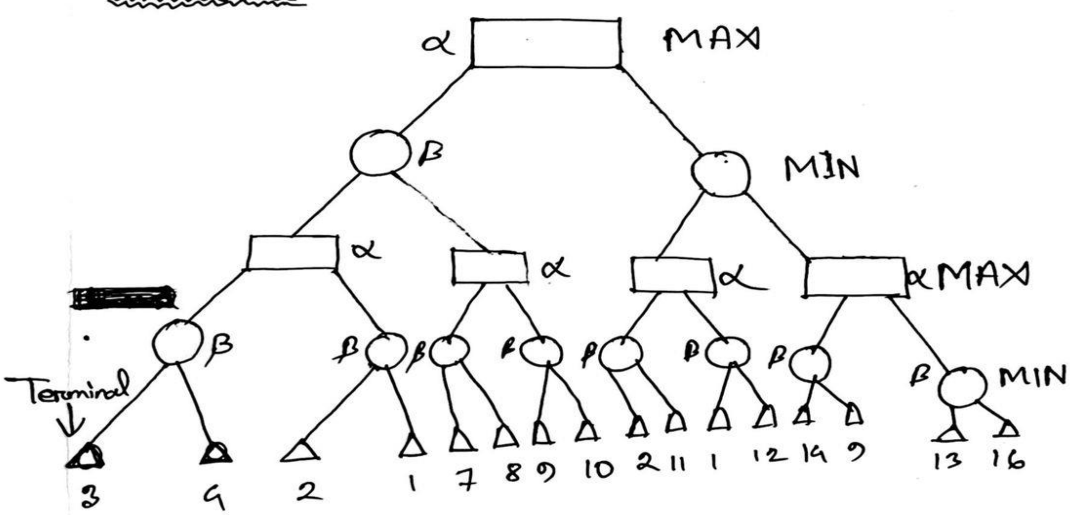
Alpha beta Pruning : [Cut off search by exploring less no of nodes]

If $\alpha \geq \beta$ = Prun Other

Here α = max

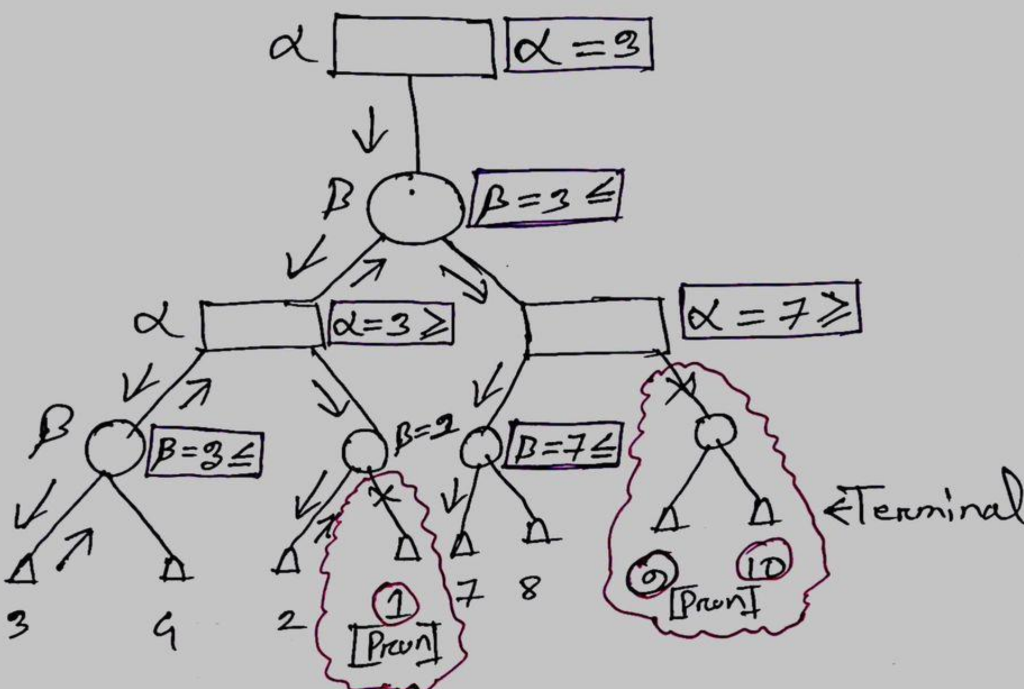
β = min

Example :

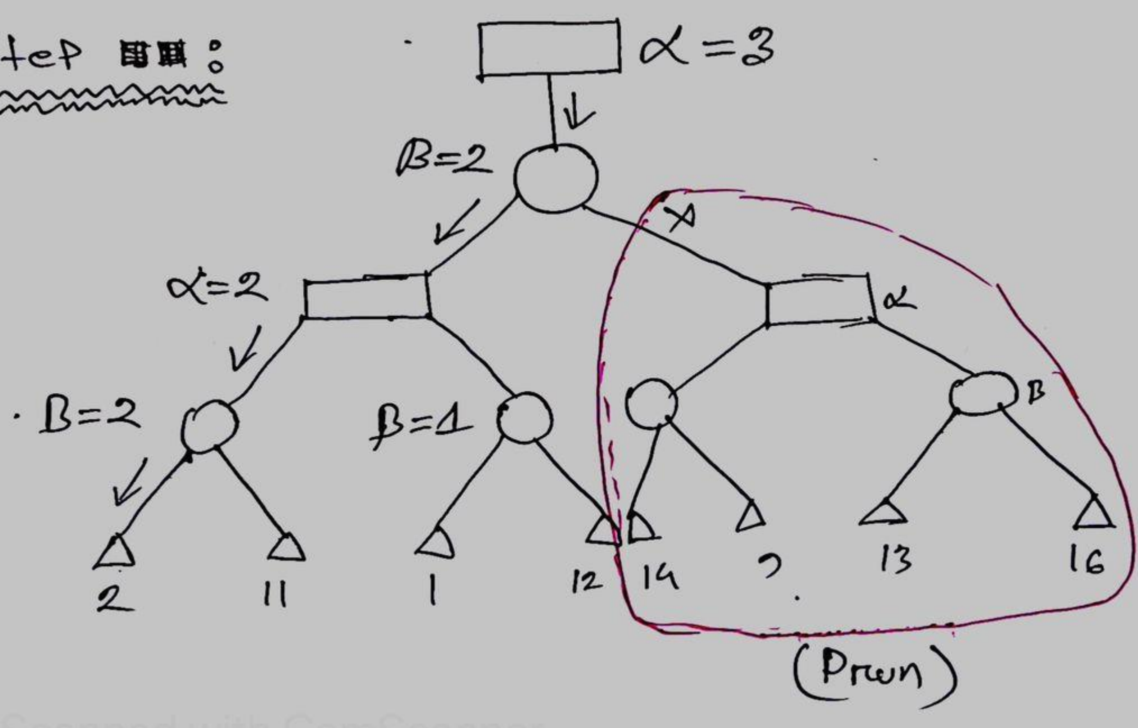


Here we apply dfs parent to child

Step [redacted]:



Step [redacted]:



Step 1 and Step 2 we see that, after Puning some of node reduce from the tree.

Here we see the step two three minimum value of 2 here and step one minimum value is 3. If max is choosing this path [step 1] then he knows that he will be getting profit of at least 3 and if he chooses this path [step 2] then I will be geting profit of 2 only.

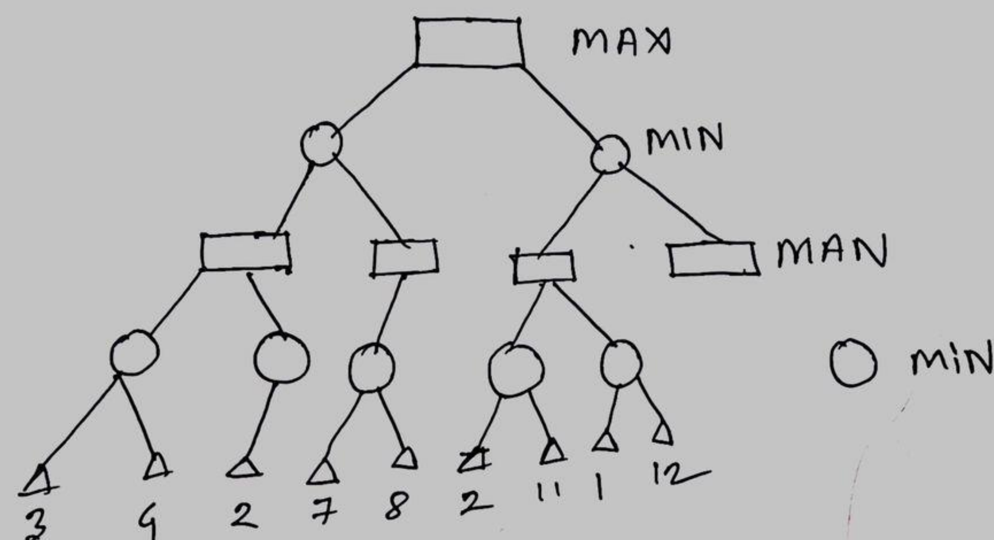
When already I have founded a path with more profit then I will not even explore the less profit path.

This is the actual summary of the Alpha Bata Pruning method.

So, befor pruning it's complexity is $=O(b^d)$

Now Pruning it's trun into $= O(b^{d/2})$

If we Consider best case Order of B raised to power D/2 $[O(b^{d/2}]$.



Conclusion:

Upon completion of this assignment, a profound understanding of the Alpha-Beta Pruning algorithm has been attained. Positioned as a significant stride in game tree search algorithms, it effectively tackles computational challenges in decision-making for two-player, zero-sum games. By strategically pruning subtrees through the introduction of alpha and beta concepts, Alpha-Beta Pruning significantly diminishes the number of nodes requiring evaluation. As an extension of the minimax algorithm, it not only enhances computational efficiency but also showcases effectiveness in navigating intricate decision spaces.