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| **EX.N0 : 9** | **ALPHA-BETA PRUNING** |
| **DATE:24.04.2024** |

**AIM:**

To implement the Alpha-Beta Pruning using python Program.

**ALGORITHM:**

Step 1: Start with the current game state, player, depth, alpha (initially negative infinity), and beta (initially positive infinity).

Step 2:  If the game is over, return the utility value.

Step 3: For the maximizing player, explore moves and update alpha while pruning when beta is less than or equal to alpha.

Step 4: For the minimizing player, explore moves and update beta while pruning when alpha is greater than or equal to beta.

Step 5: Make an initial call with the current player, depth 0, -∞ for alpha, and +∞ for beta to find the best move.

Step 6: Recursively explore and prune branches based on the alpha and beta values to optimize the search.

Step 7: Return the utility value of the best move for the current player at the initial call.

**PROGRAM:**

MAX, MIN = 1000, -1000

def minimax(depth, nodeIndex, maximizingPlayer, values, alpha, beta):

    if depth == 3:

        return values[nodeIndex]

    if maximizingPlayer:

        best = MIN

        for i in range(0, 2):

            val = minimax(depth + 1, nodeIndex \* 2 + i, False, values, alpha, beta)

            best = max(best, val)

            alpha = max(alpha, best)

            if beta <= alpha:

                break

        return best

    else:

        best = MAX

        for i in range(0, 2):

            val = minimax(depth + 1, nodeIndex \* 2 + i, True, values, alpha, beta)

            best = min(best, val)

            beta = min(beta, best)

            if beta <= alpha:

                break

        return best

if \_\_name\_\_ == "\_\_main\_\_":

    values = [3, 5, 6, 9, 1, 2, 0, -1]

    print("The optimal value is:", minimax(0, 0, True, values, MIN, MAX))

**OUTPUT:**

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**RESULT:**

Thus the program to implement the Alpha-Beta Pruning using python has been done and  executed successfully.