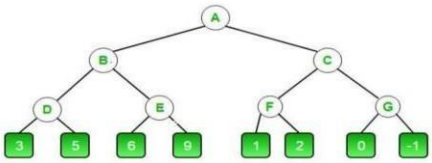
TASK:4

Implementation of **Mini-Max algorithm** using recursion to search through the Game - tree using python by applying following constraints.

Aim: To create a program for searching problem using Mini-max algorithm with Alpha-Beta pruning approach.



Algorithm:

Step 1: At the first stop the, Max player will start first move from node A where α=-infinity and beta = +infinity, these values of alpha and beta passed down to node B. Node B transmitting the identical value to its off spring D.

Step2: As Max's turn at Node D approaches, the value of α will be decided. when the value of α is compared to 3 then 5 the value at node D is max (3,5) = 5. Hence the node value is also 5

Step 3: The algorithm returns to node B, where the value of beta will change since this a turn of min

Step 4: Max will take over at node E and change alpha's value.

Step 5: We know traverse the tree backward, from node B to node A

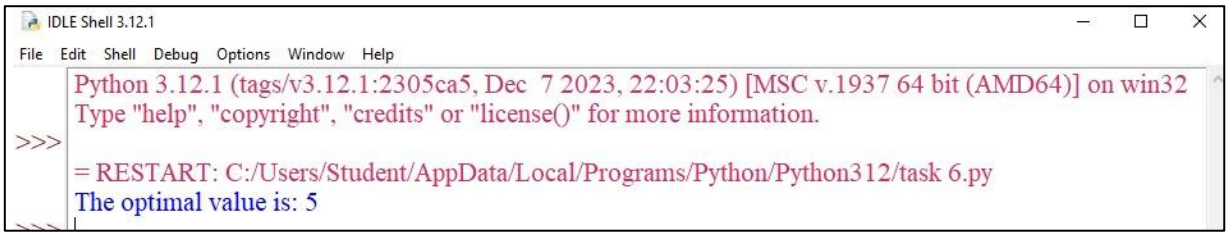
Step 6: As a result, in this case, the ideal value for the maximizer is 5.

Program:

```
# Initial values of Alpha and Beta
MAX, MIN = 1000, -1000
# Returns optimal value for current player
# (Initially called for root and maximizer)

def minimax(depth, nodeIndex, maximizingPlayer, values, alpha, beta):
    # Terminating condition. i.e. leaf node is reached
    if depth == 3: return values[nodeIndex]

    if maximizingPlayer:
        best = MIN
        # Recur for left and right children
        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)

            # Alpha Beta Pruning
            if   beta   <=   alpha:
            break

        return best
    else:
        best = MAX
        # Recur for left and right children 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)

            # Alpha Beta Pruning
        if beta <= alpha: break
        return best

# Driver Code 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 :



Result:

Thus creating a program for searching problem using Mini-max algorithm with Alpha-Beta pruning approach was successfully executed and output was verified.