SRM INSTITUTE OF SCIENCE & TECHNOLOGY

DEPARTMENT OF NETWORKING & COMMUNICATIONS

18CSC305J-ARTIFICIAL INTELLIGENCE

SEMESTER –6

BATCH-2

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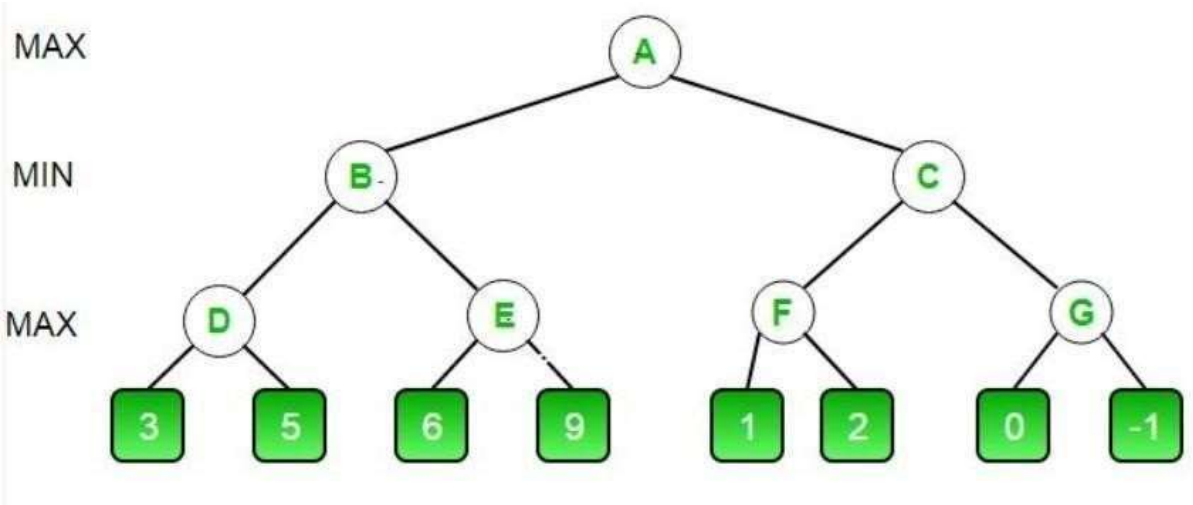
1	07/03/22	**Min-Max Algorithm**		

Experiment No: 6

MINIMAX ALGORITHM

AIM : Developing a mini max algorithm for real world problems.

PROBLEM : Find the optimal value in the given tree of integer values in the most optimal way possible under the time complexity O(B^D).



ALGORITHM MINIMAX APPROACH :

1. Start traversing the given tree in top to bottom manner.
2. If node is a leaf node then return the value of the node.
3. If isMaximizingPlayer exist then bestVal = -INFINITY
4. For each child node, value = minimax(node, depth+1, false, alpha, beta)
5. bestVal = max(bestVal, value) and alpha = max(alpha, bestVal)
6. If beta <= alpha then stop traversing and return bestVal
7. Else, bestVal = +INFINITY

8. For each child node, value = minimax(node, depth+1, true, alpha, beta)
9. bestVal = min(bestVal, value) and beta = min(beta, bestVal)

10. if beta <= alpha the stop traversing and return bestVal

OPTIMIZATION TECHNIQUE :

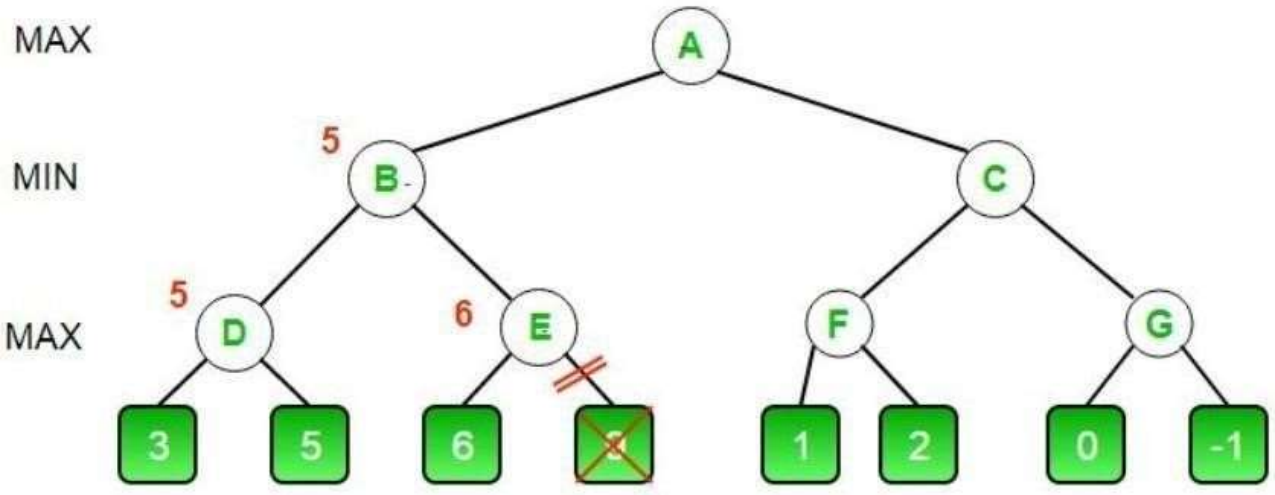
Alpha-Beta pruning is not actually a new algorithm, rather an optimization technique for minimax algorithms. It reduces the computation time by a huge factor. This allows us to search much faster and even go into deeper levels in the game tree. It cuts off branches in the game tree which need not be searched because there already exists a better move available. It is called Alpha-Beta

pruning because it passes 2 extra parameters in the minimax function, namely alpha and beta.

Let's define the parameters alpha and beta.

Alpha is the best value that the **maximizer** currently can guarantee at that level or above.

Beta is the best value that the **minimizer** currently can guarantee at that level or above.

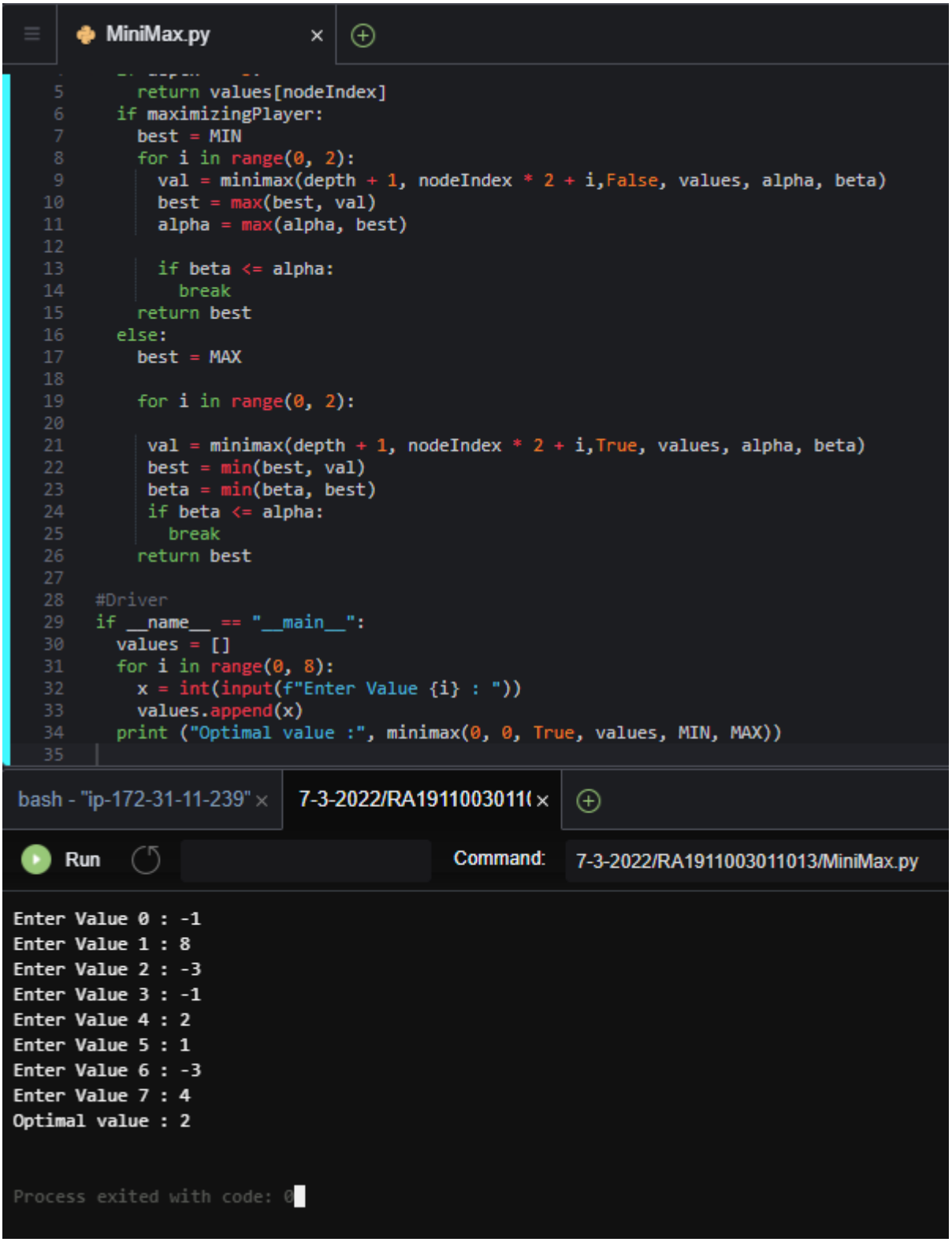


CODE (MINIMAX ALGORITHM) :

```
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

#Driver
if __name__ == "__main__":
  values = []
  for i in range(0, 8):
    x = int(input(f"Enter Value {i} : "))
    values.append(x)
  print ("Optimal value :", minimax(0, 0, True, values, MIN, MAX))
```

OUTPUT :


MiniMax.py
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
#Driver
if __name__ == "__main__":
values = []
for i in range(0, 8):
x = int(input(f"Enter Value {i} : "))
values.append(x)
print ("Optimal value :", minimax(0, 0, True, values, MIN, MAX))
bash - "ip-172-31-11-239"
7-3-2022/RA1911003011(
Run
Command:
7-3-2022/RA1911003011013/MiniMax.py
Enter Value 0 : -1
Enter Value 1 : 8
Enter Value 2 : -3
Enter Value 3 : -1
Enter Value 4 : 2
Enter Value 5 : 1
Enter Value 6 : -3
Enter Value 7 : 4
Optimal value : 2
Process exited with code: 0

RESULT : The Optimal value of the given tree successfully found using Minimax Algorithm with Alpha Beta Pruning in time complexity O(B^D).