Alpha - beta - pruning

Module-3

Name:- Bhavesh Santosh Ainkar

Roll NO:- 1

Sub:- IS-LAB

Class :- BE - IT

Sem :- VII

Alpha-beta pruning
Assignment
Module 3

PAGE No.
DATE / /

* MinMax algorithm with alpha-beta pruning

→ —

Alpha-beta pruning :- Alpha beta pruning is a Modified version of the Minimax algorithm. It is an optimization technique for the Minimax algorithm.

Alpha(α) = The best (highest value)
= initial value of alpha is $-\infty$

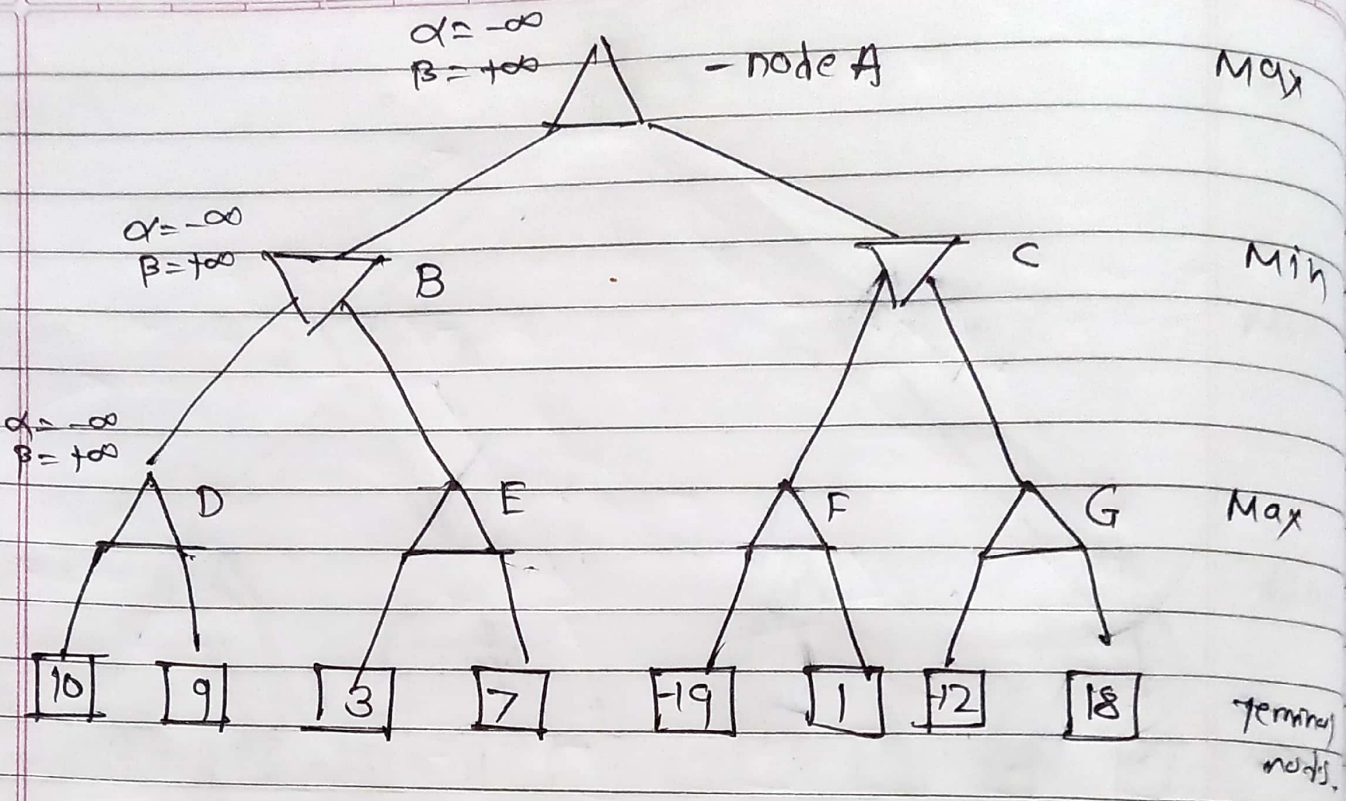
Beta (β) = The best (lowest value)
= initial value of Beta is $+\infty$

The alpha-beta pruning to a standard minimax algorithm returns the same move as the standard algorithm does, but it removes all the nodes which are not really affecting the final decision but making algorithm slow. Hence by pruning these nodes, it makes the algorithm fast.

Rules & Conditions

- The Max player will only update the value of alpha
- The Min player will only update the value of beta.
- we will only pass the alpha, beta values to the child nodes.
- node values will be passed to upper node instead of values of alpha and beta.

condition to prune : $\alpha \geq \beta$ or $\beta \leq \alpha$

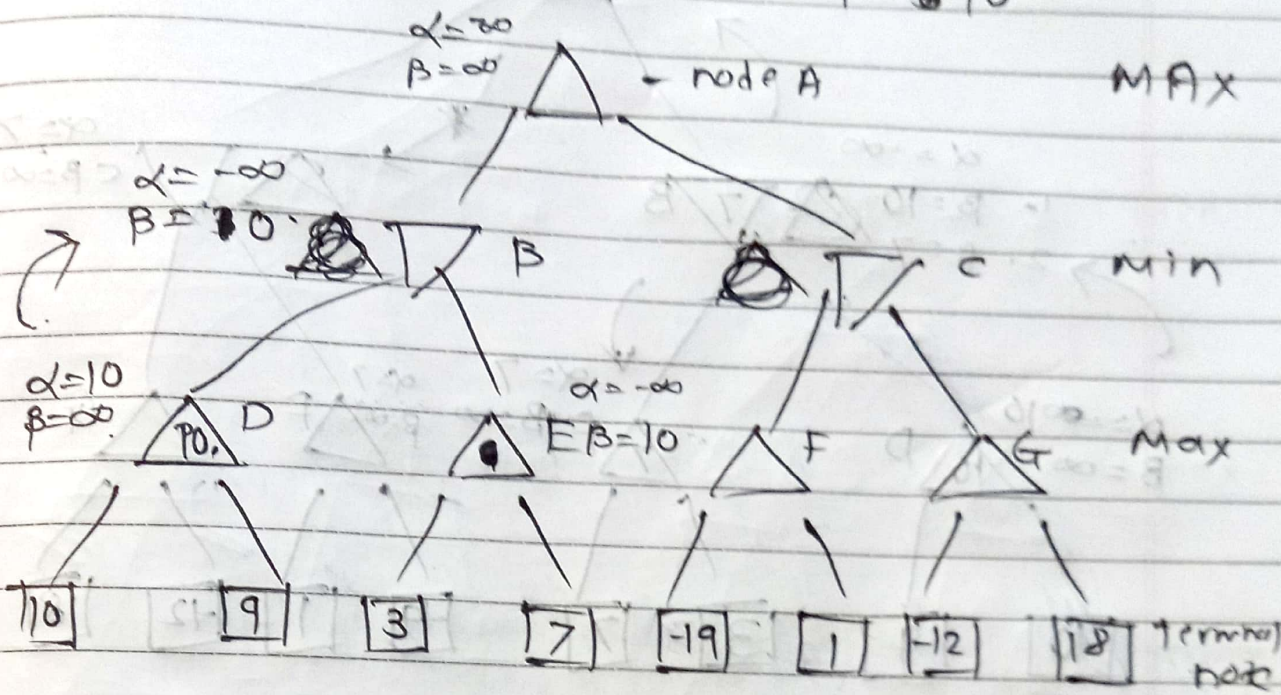


Step 1:- At the first step the, Max player will start first move from node A where $\alpha = -\infty$ and $\beta = +\infty$ these value of alpha, beta passed down to node B where again $\alpha = -\infty$ and $\beta = +\infty$ and Node B passes same value to its child D.

Step 2:- at Node D, the value of α will be calculated as its turn for max. The value of α is compared with firstly 10 and then 9 and the $\max(10, 9) = 10$ will be the value of α at node D and node value will 10

Step 3:- Now algorithm backtracks to node B where the value of β will change as this is a turn of min, Now $\beta = +\infty$, will compare with the available subsequent nodes value i.e. $\min(\infty, 10) = 10$ hence

at nod B now $\alpha = -\infty$ $\beta = 10$



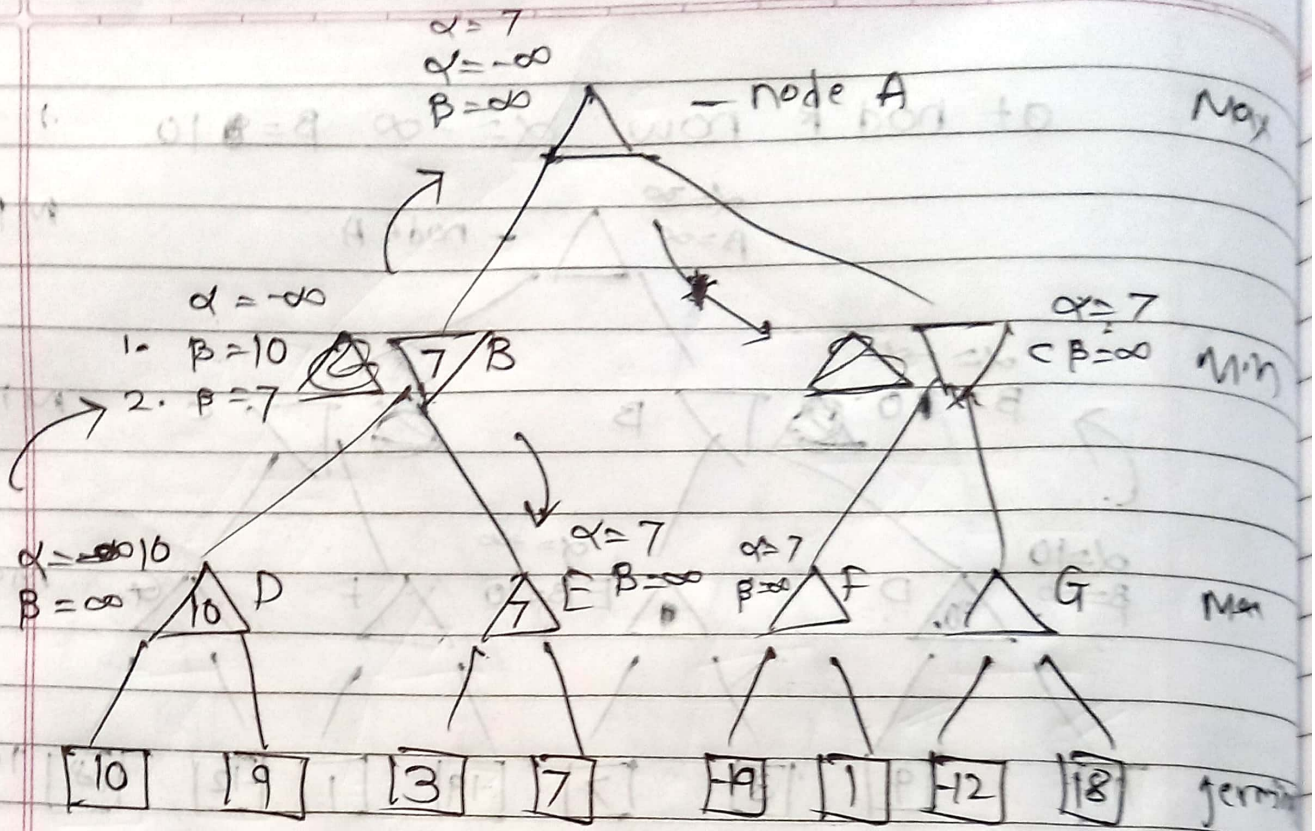
In the next step, algorithm traverse the next successor of Node B which is node E, and the values of $\alpha = -\infty$ and $\beta = 10$ will also be passed

Step 4:- At node E, Max will take its turn and the value of alpha will chang the Current value of α will be compared with 3 so $\max(-\infty, 3) = 3$ hence at node E $\alpha = 3$ and $\beta = 10$ then α will be compared with 7 so $\max(3, 7) = 7$

So the value of $\alpha = 7$ and $\beta = 10$ so at node E value will be 7

For Node B. its Min's turn So the value of β will be changed. So early value of β was 10 now $\beta = \min(10, 7) = 7$

So the value at Node B will Be 7



Step 5:- At next step, algorithm again backtrack the tree from Node B to Node A.

The value of α will be changed the max. value will be

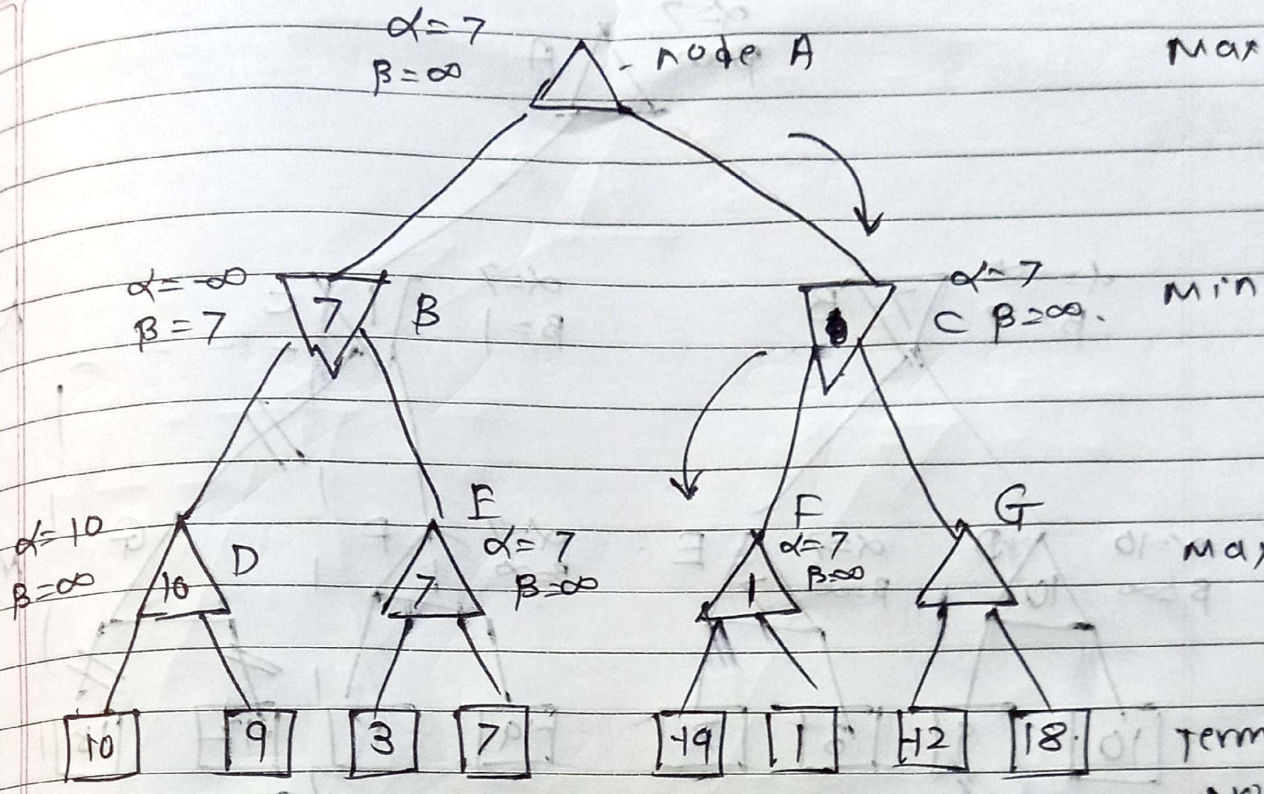
$\alpha = \max(-\infty, 7) = 7$

$\beta = \infty$

these two value Now pass down to the node C right successor which is node C: at node C α=7 and β=∞ the same values will be passed on to node F

Step 6: At node F again the value of α. will be compared with left child which -19 and $\max(7, -19) = 7$

So the node value will become 7

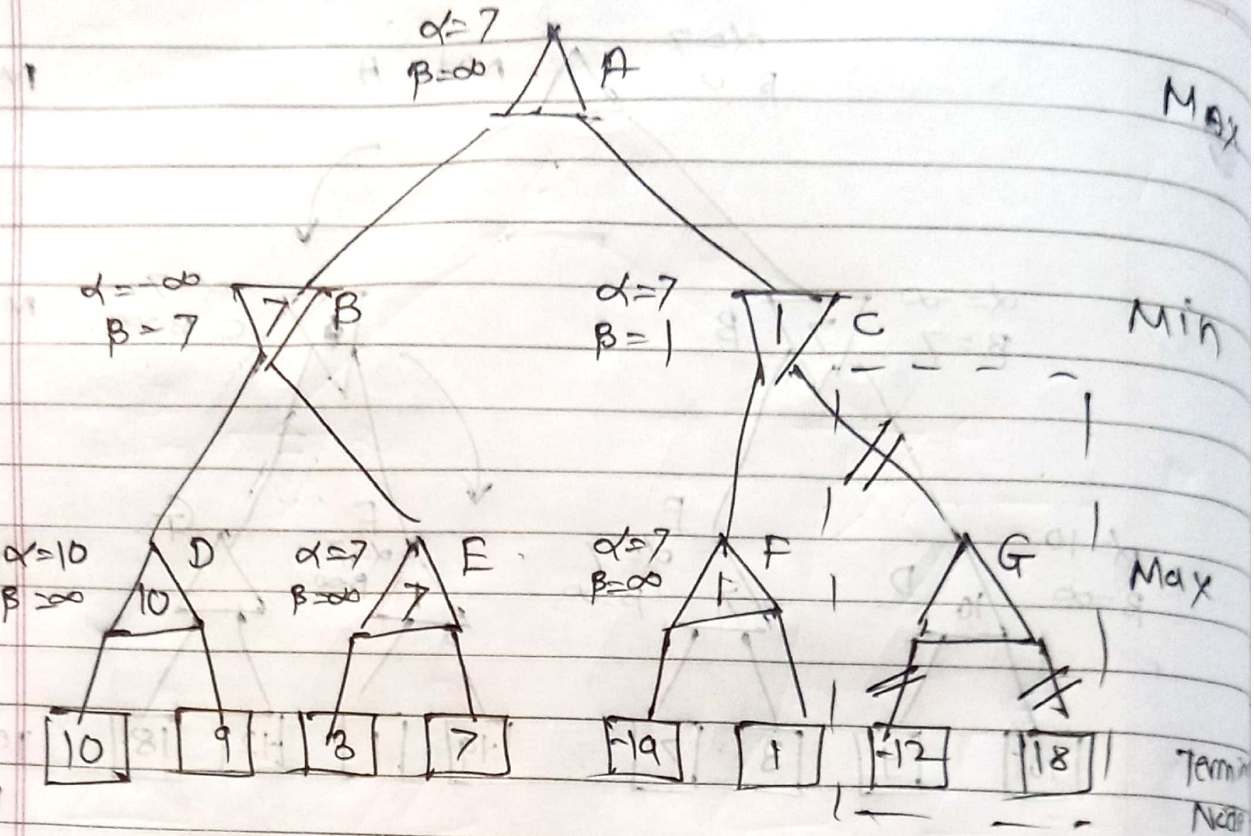


Step 7 :- At Node C $\alpha = 7$ & $\beta = \infty$ here the value of β will change. it will compare with 1 so Now

$\beta = \min(\infty, 1) = 1 = \beta$

So now we have $\alpha = 7$ and $\beta = 1$ Here the condition to prune i.e. $\alpha \geq \beta$ Satisfies. So the next Right Node of the Node C will be pruned. and the Node value of C will become 1

∴ at C $\alpha = 7$ $\beta = 1$



Step 8:- G Now returns the value of 1 to A here the best value of A is

$\alpha = \max(7, 1) = 7$.

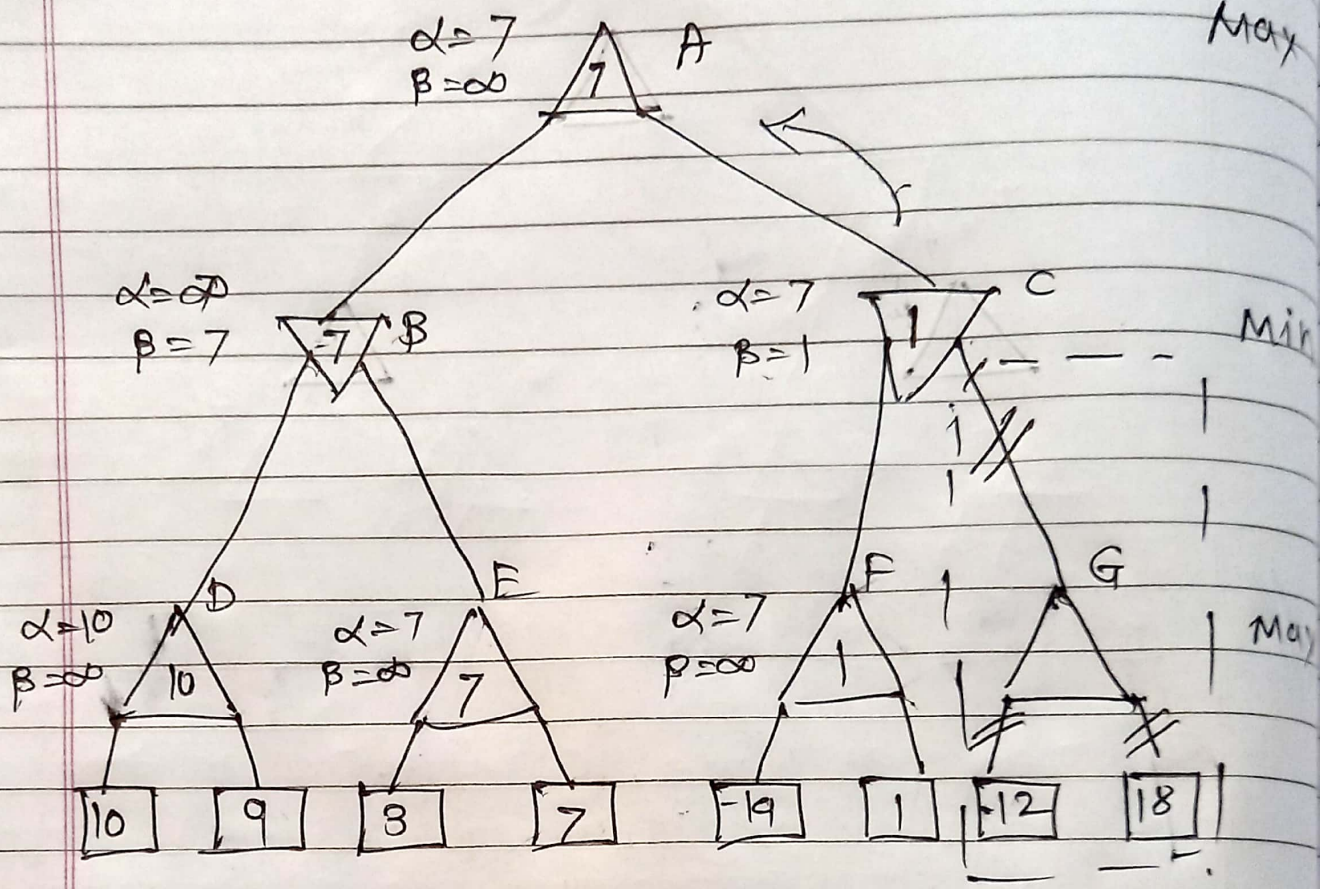
∴ So the final value of Node A will be 7

∴ $\alpha = 7$

$\beta = \infty$. at A.

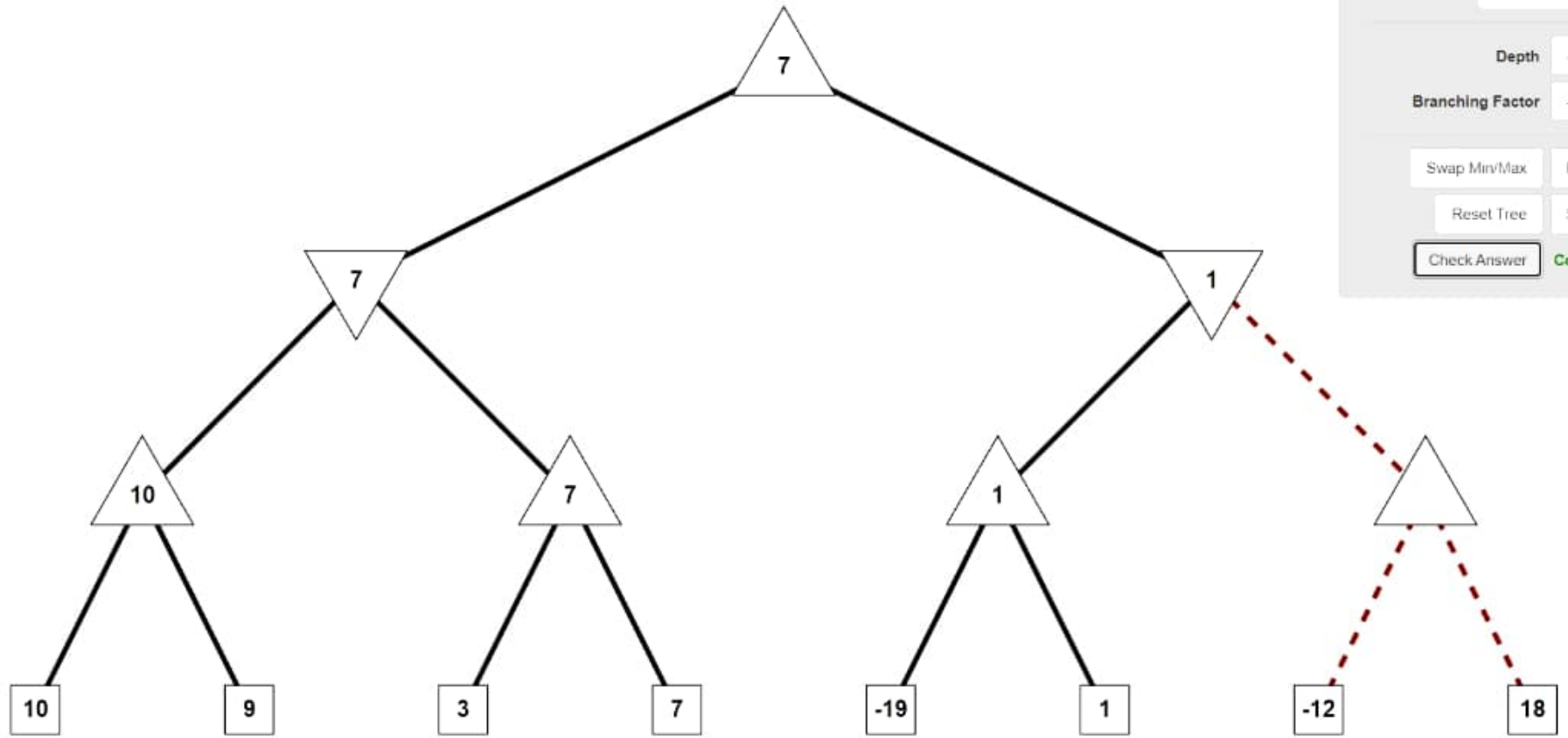
Following is the final game tree which is showing the nodes which are computed and nodes which has never computed. Hence the optimal value for the Maximizer is 7. for this tree.

Solution:-


α=7
β=∞
A
7
Max
α=-∞
β=7
B
7
α=7
β=1
C
1
Min
D
E
F
G
α=10
β=∞
10
α=7
β=∞
7
α=7
β=∞
Max
10
9
8
7
-19
1
-12
18

Alpha-Beta Pruning Practice

αβ Cutoff



Start Animation

Depth - +

Branching Factor - +

Swap Min/Max

Regenerate Tree

Reset Tree

Show Solution

Check Answer

Correct!

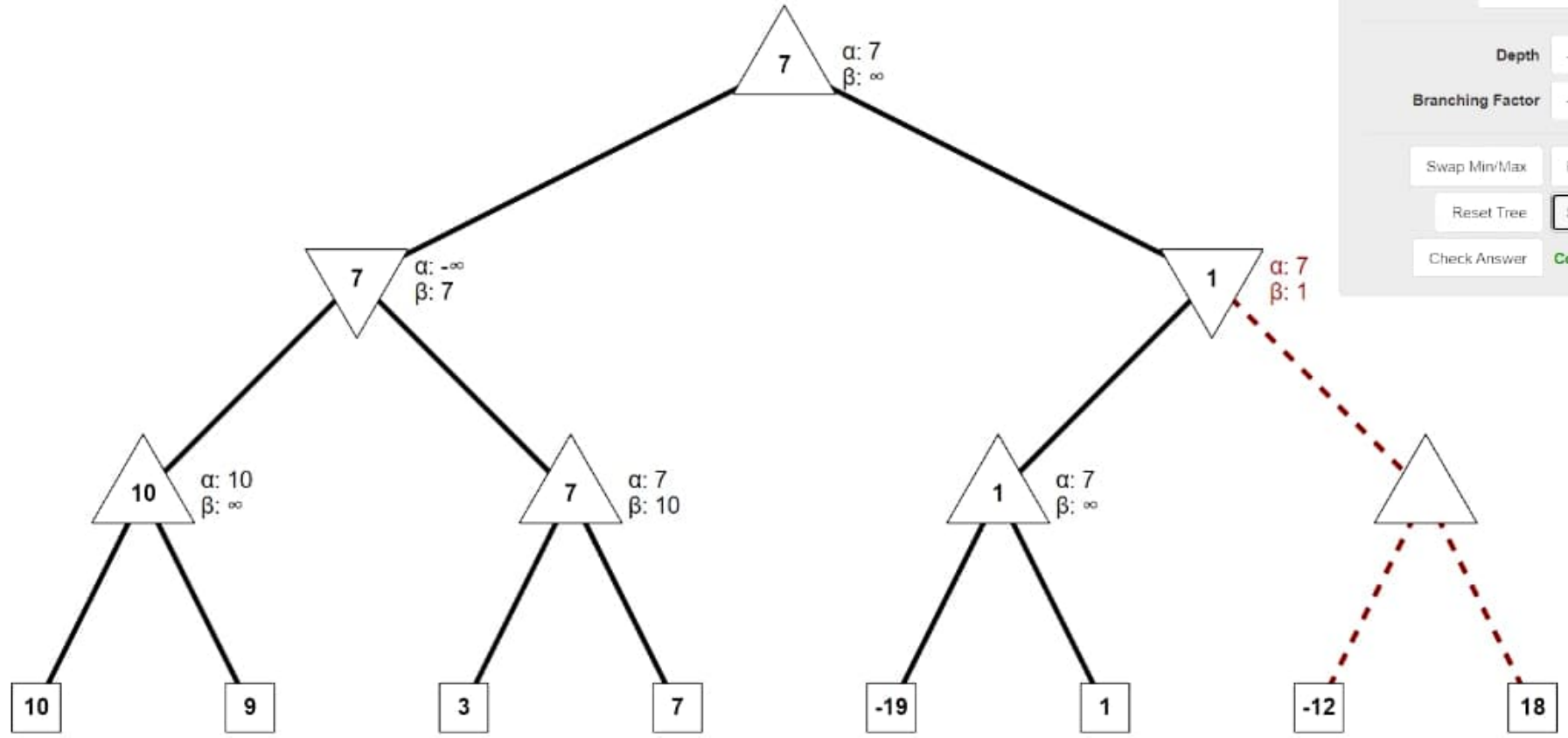
Star

Developed by Aleks Kamko for UC Berkeley CS61B

Nodes are pruned when $\beta \leq \alpha$.

Alpha-Beta Pruning Practice

αβ Cutoff



Start Animation

Depth - +

Branching Factor - +

Swap Min/Max | Regenerate Tree

Reset Tree | Show Solution

Check Answer Correct!

Star Developed by Aleks Kamko for UC Berkeley CS61B

Nodes are pruned when $\beta \leq \alpha$.