Alpha beta-Pruning (module-3)

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Alpha-beta Pruning Assignment (module 3)

* 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

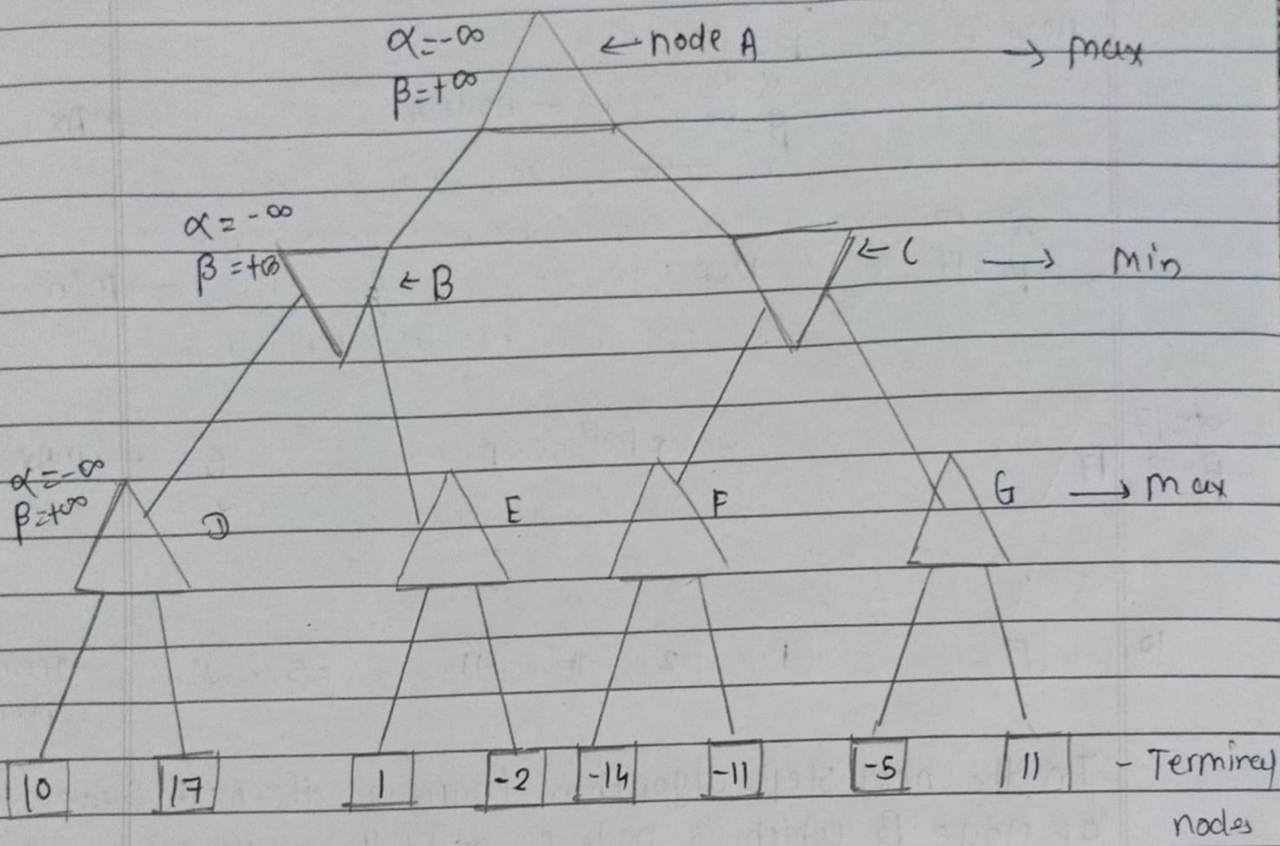
Alpha (α) = The best (highest-value)
= initial value of alpha is $-\infty$

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 algorim slow Hence by pruning these node, it make 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 nodes instead of values of alpha and beta.

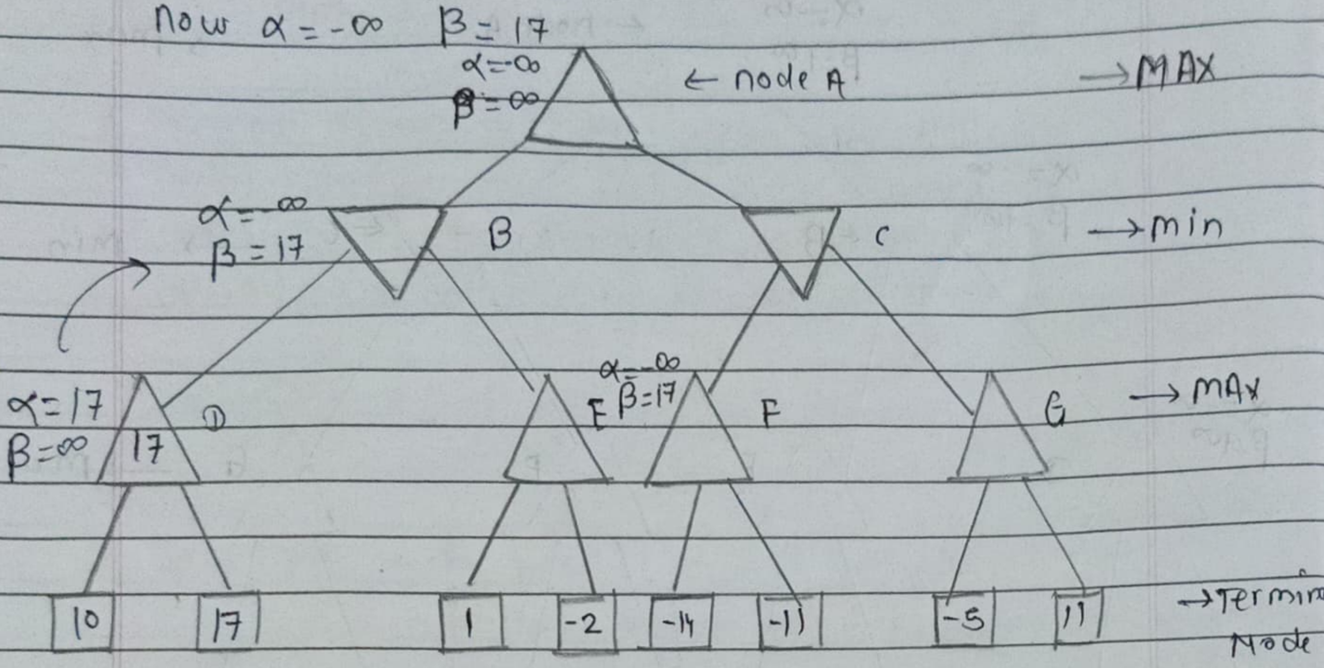
Condition to Prune = $\alpha \geq \beta$ or $\beta \leq \alpha$



Step1:- At the First step the, Max Player will start first move from node A where α=-∞ and β=+∞ these value of alpha, beta passed down to node β where again α=-∞ and β=+∞ and Node β passes same value to its child D

Step2:- At Node D, the value of α will be calculated as its turn for max. The value or α is compared with Firstly 10 and then 17 and the max(10,17)=17 will be the value of α at node D and node value will 17

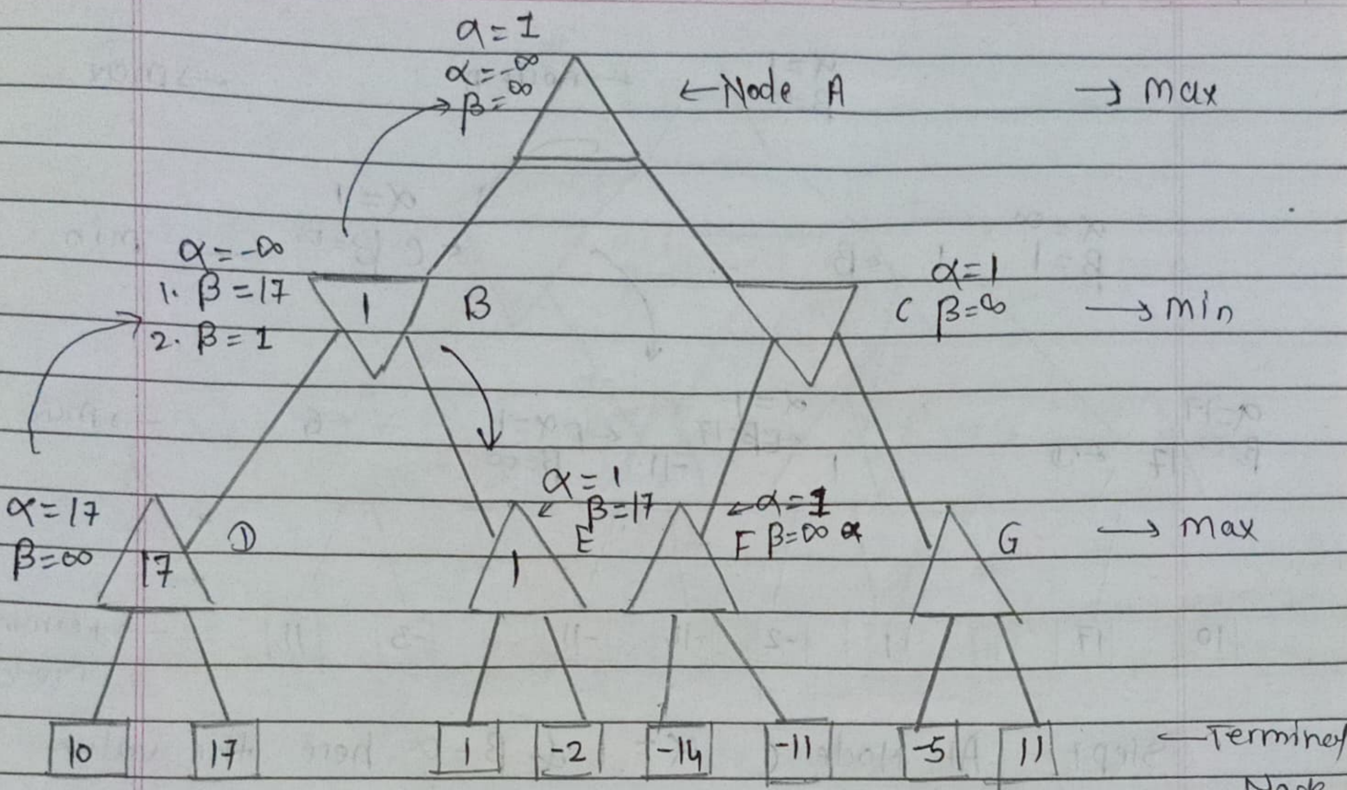
Step3:- Now algorithm backtracks to node B where the value of β will change as this is a turn of min, Now β=+∞, will compare with the available Subsequent nodes value i.e min(∞,17)=17 hence at node B



In the next step, algorithm tranverse the next Sucesso, Of Node B which is node E, and the values of α= -∞ and β=17 will also be passed

Step 4:- At node E, max will take its turn and the value of alpha will change the current value of α will be compored with 1 so max (-∞,1) = 1 hence at node E α = 1 and β = 17 the α will be compored with - 2 so max (1,-2) = 1 So the value of α = 1 and β = 17 so at node E value will be 1

For Node B. its min turn so the value of β will be changed. so early value of β was 17 now ~~β-E~~ · β = min(17,1) = 1 So the value at Node β will be 1

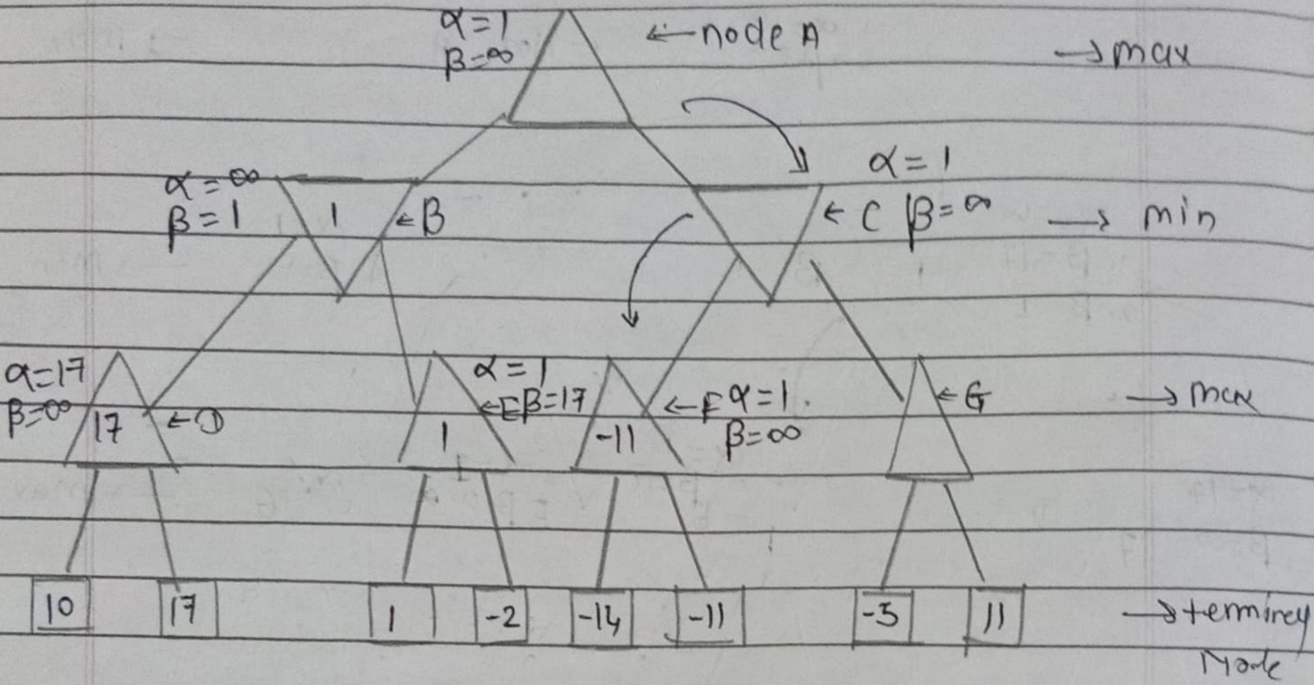


Steps :- At next step , algorithm again backtrack the tree from Node B to Node A
The valu, of α will be changed the max value will be

$$\alpha = \max(-\infty, 1) = 1$$
$$\beta = \infty$$

these two value Now Pass down to the right successor which is node C. at node C α=1 and β=∞ the same value will be passed on to node F

Step6 :- At node F again the value of α. will be compare with left child which -14 and max (-11, -14) = -11 So the node value will become -11

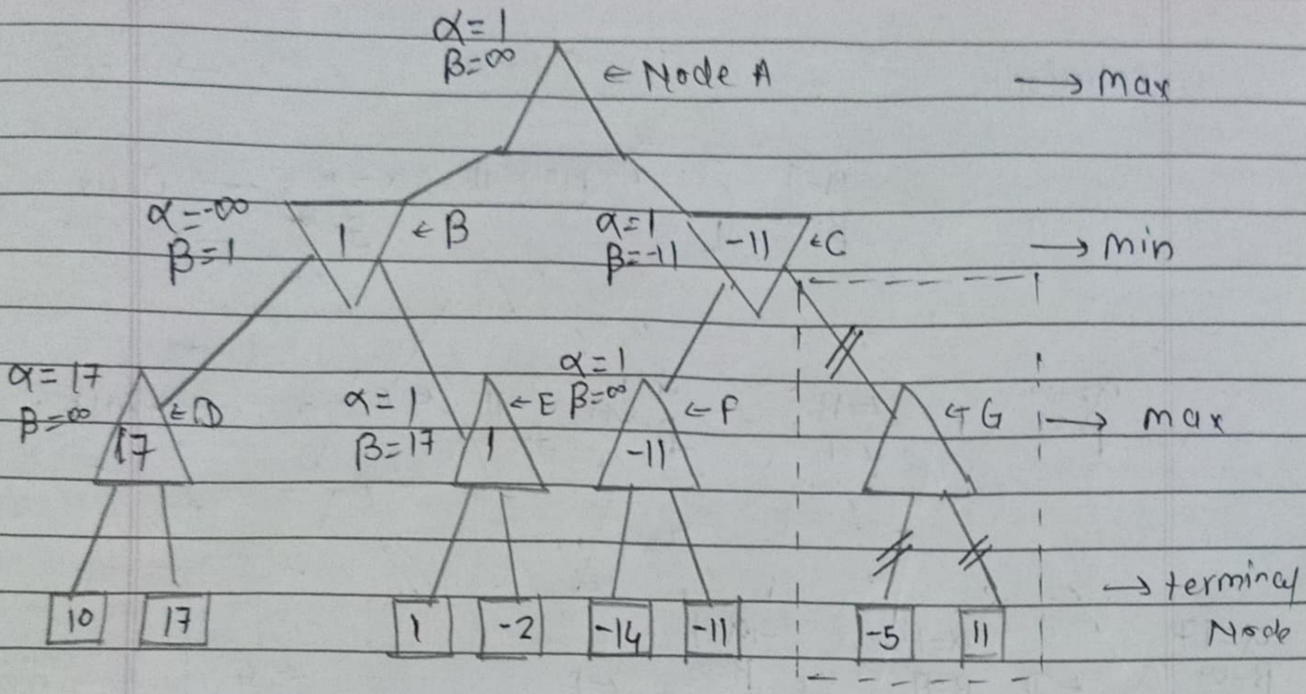


Step 7:- At Node C α = 1 & β = ∞ here the value of β will change it will compare with -11 so now

$$\beta = \min(\infty, -11) = -11$$

So now we have α = 1 and β = -11 Here the condition to prune i.e α ≥ β satisfies. So the next Right Node of the ~~valu~~. Node C will be pruned. and the Node value of C will become -11

∴ at C α = 1 β = -11



Step8 :- C Now return the value of -11 to A here the best value of A is

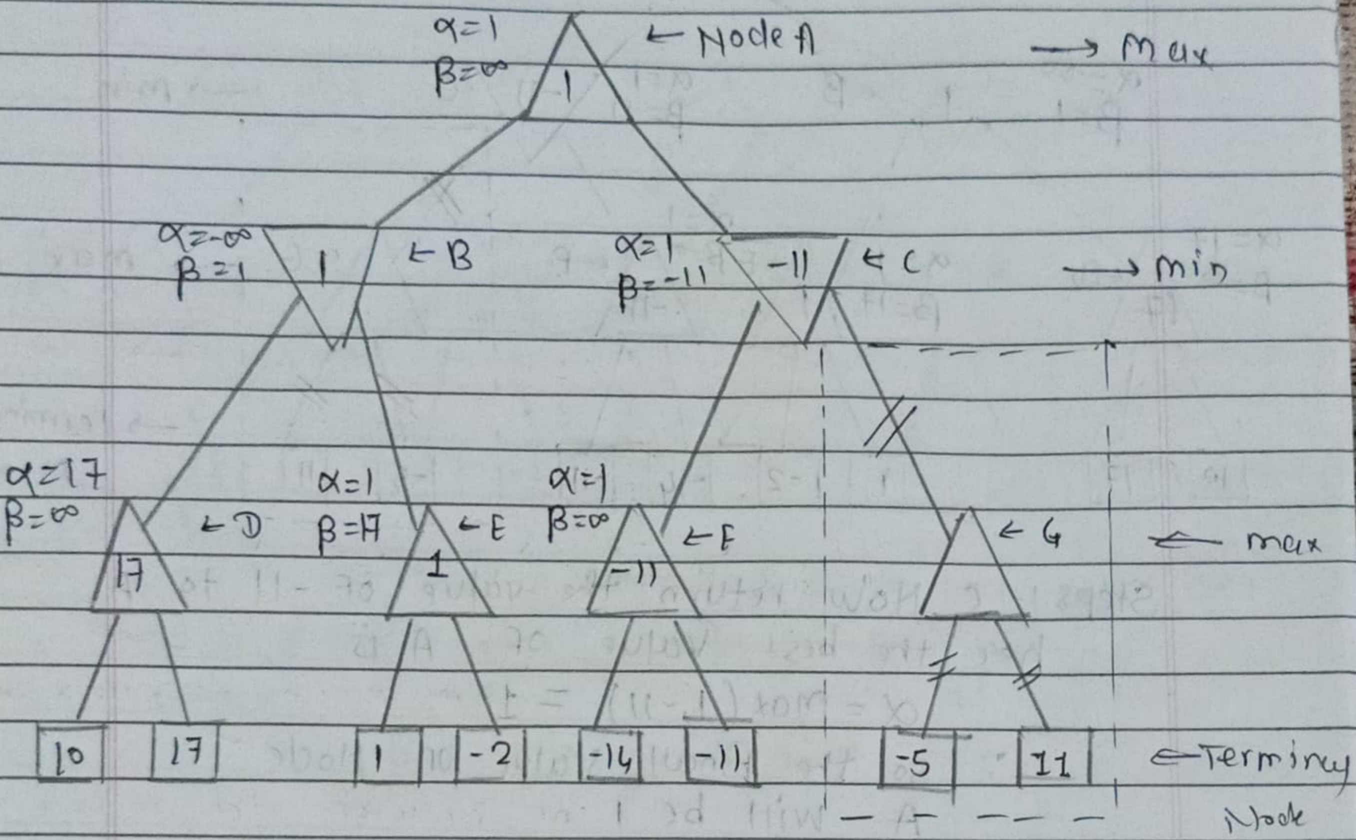
$\alpha = \max(1, -11) = 1$

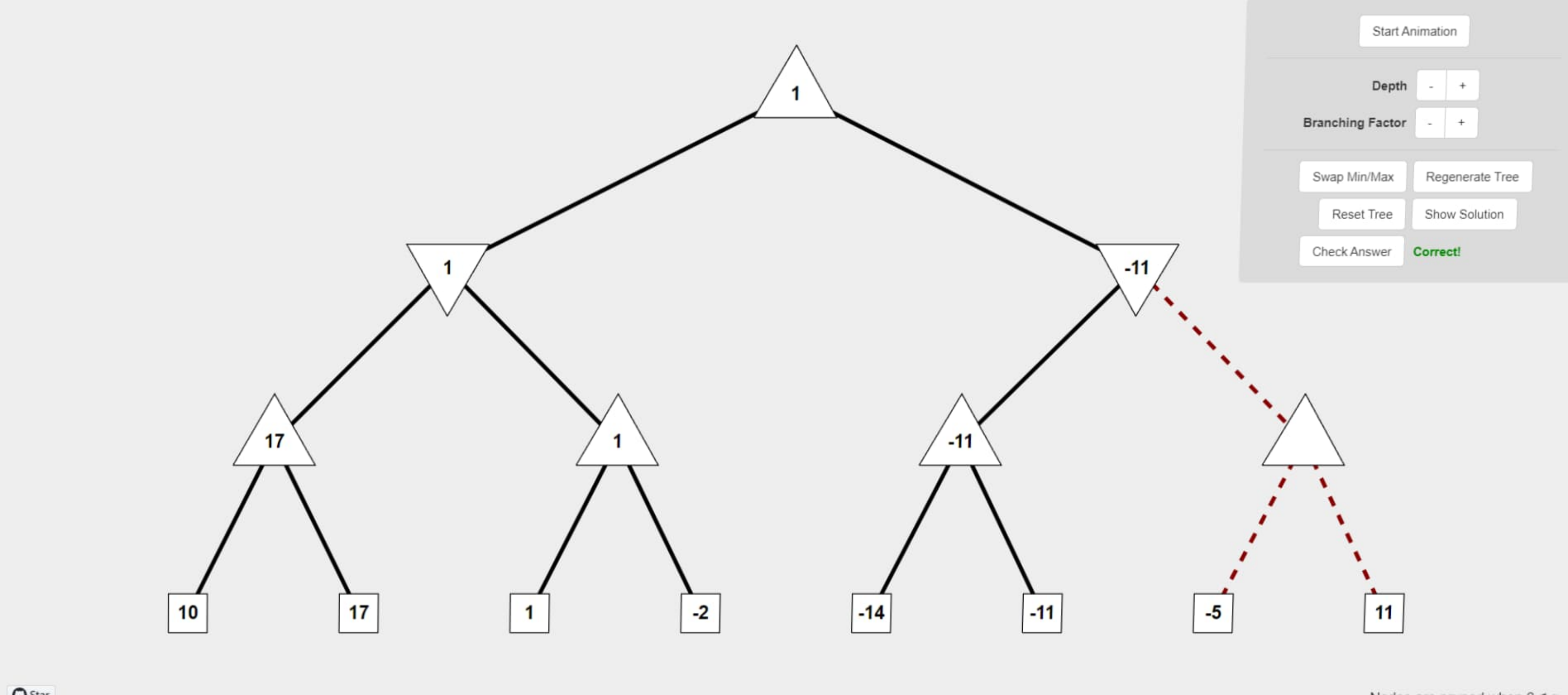
$\therefore$ So the final value of Node A will be 1

$\therefore \alpha = 1$
$\beta = \infty$ at A

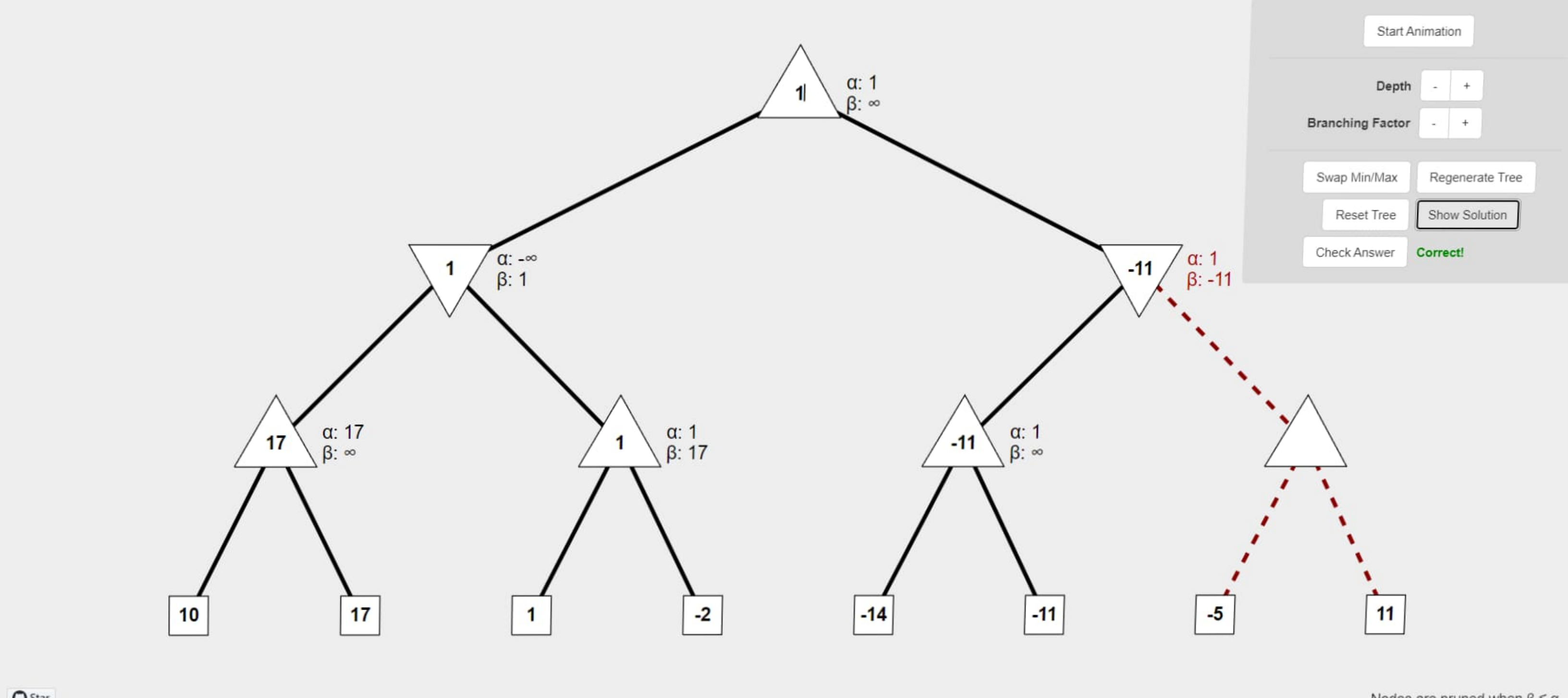
Following is the final game tree which showing the nodes which are compared & nodes which has never computed. Hence the optimal value for the maximizer is 1. for this tree

Solution:-


α=1
β=∞
1
← Node A
→ Max
α=-∞
β=1
1
← B
α=1
β=-11
-11
← C
→ min
α=17
β=∞
17
← D
α=1
β=17
1
← E
α=1
β=∞
-11
← F
← G
← max
10
17
1
-2
-14
-11
-5
11
← Terminal Node


1
1
-11
17
1
-11
10
17
1
-2
-14
-11
-5
11
Start Animation
Depth
-
+
Branching Factor
-
+
Swap Min/Max
Regenerate Tree
Reset Tree
Show Solution
Check Answer
Star

Correct!


1
α: 1
β: ∞
1
α: -∞
β: 1
-11
α: 1
β: -11
17
α: 17
β: ∞
1
α: 1
β: 17
-11
α: 1
β: ∞
10
17
1
-2
-14
-11
-5
11
Start Animation
Depth
-
+
Branching Factor
-
+
Swap Min/Max
Regenerate Tree
Reset Tree
Show Solution
Check Answer
Correct!
Star
Nodes are pruned when β ≤ α