Alpha-beta-Pruning
Module-3

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Sem: VII

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Alpha-beta Pruning Assignment

Module 3

* MinMax algorithm with alpha beta pruning

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Alpha-beta pruning :- Alpha beta pruning is a modified version of the minimax algorithm. It is an optimization technique for the minimaxalgorithm.

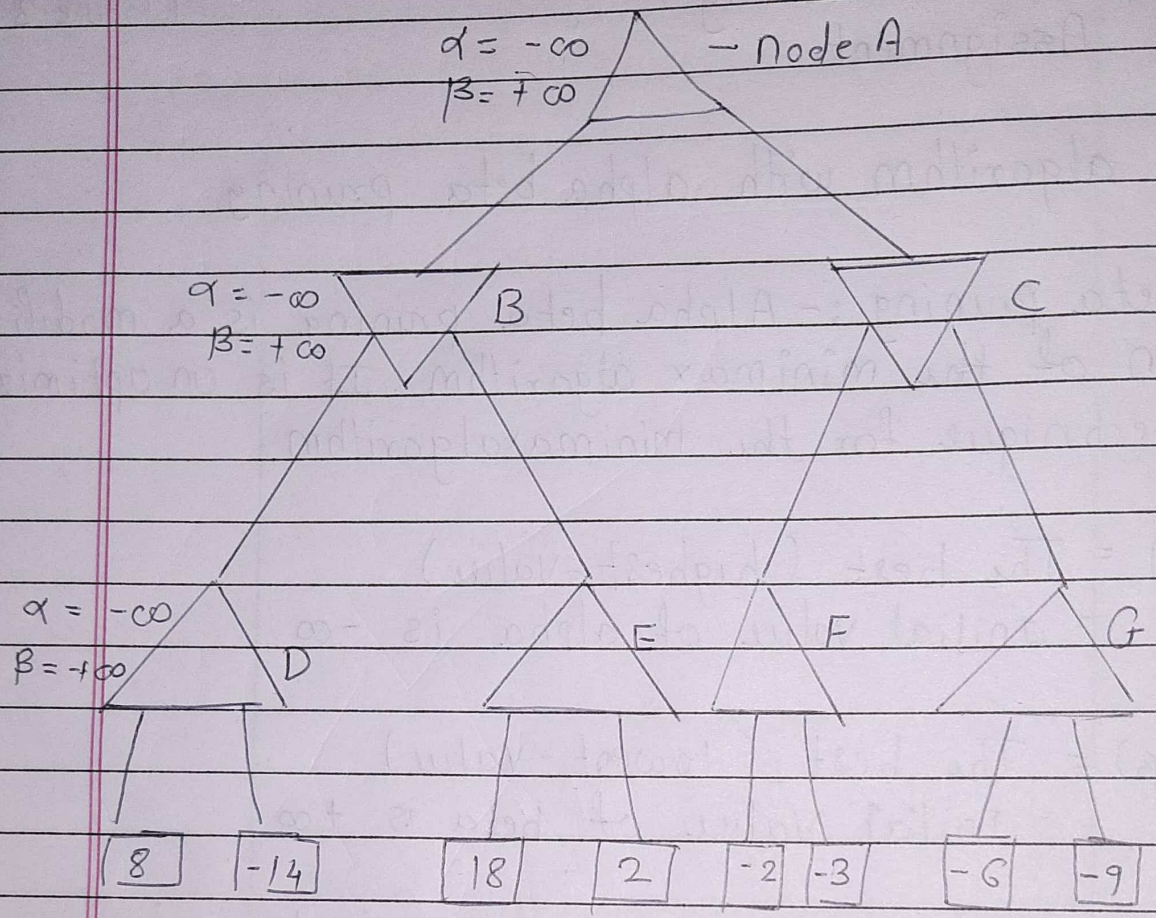
Alpha (α) = The best (highest-value)
= Initial value of alpha is $-\infty$

Beta (β) = The best (lowest-value)
= Initial value of beta is $+\infty$

The alpha-beta pruning to a standand minimax algorithm returns the same move as the standard algorithm does, but it removes all the nodes as 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 nods instedd of values of ~~data~~ alpha and beta

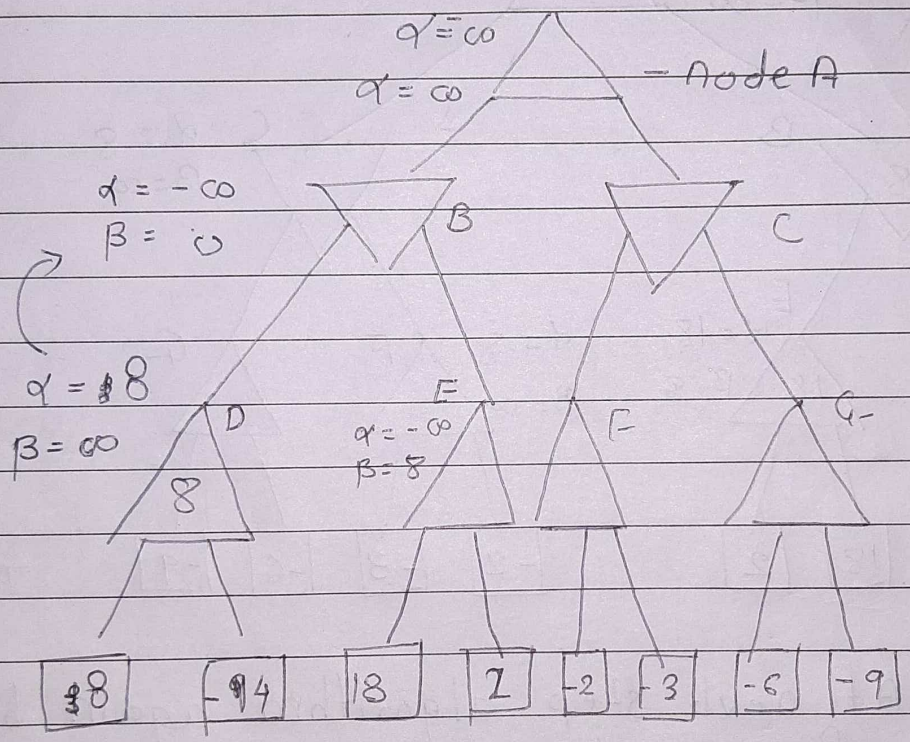
condition to Prune = $\alpha \geq \beta$ or $\beta \leq \alpha$



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 of 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 compared with firstly ~~to~~ to 8 and the -14 and the $\max(8, -14) = 8$ will be the value of α at node D and node value will 8

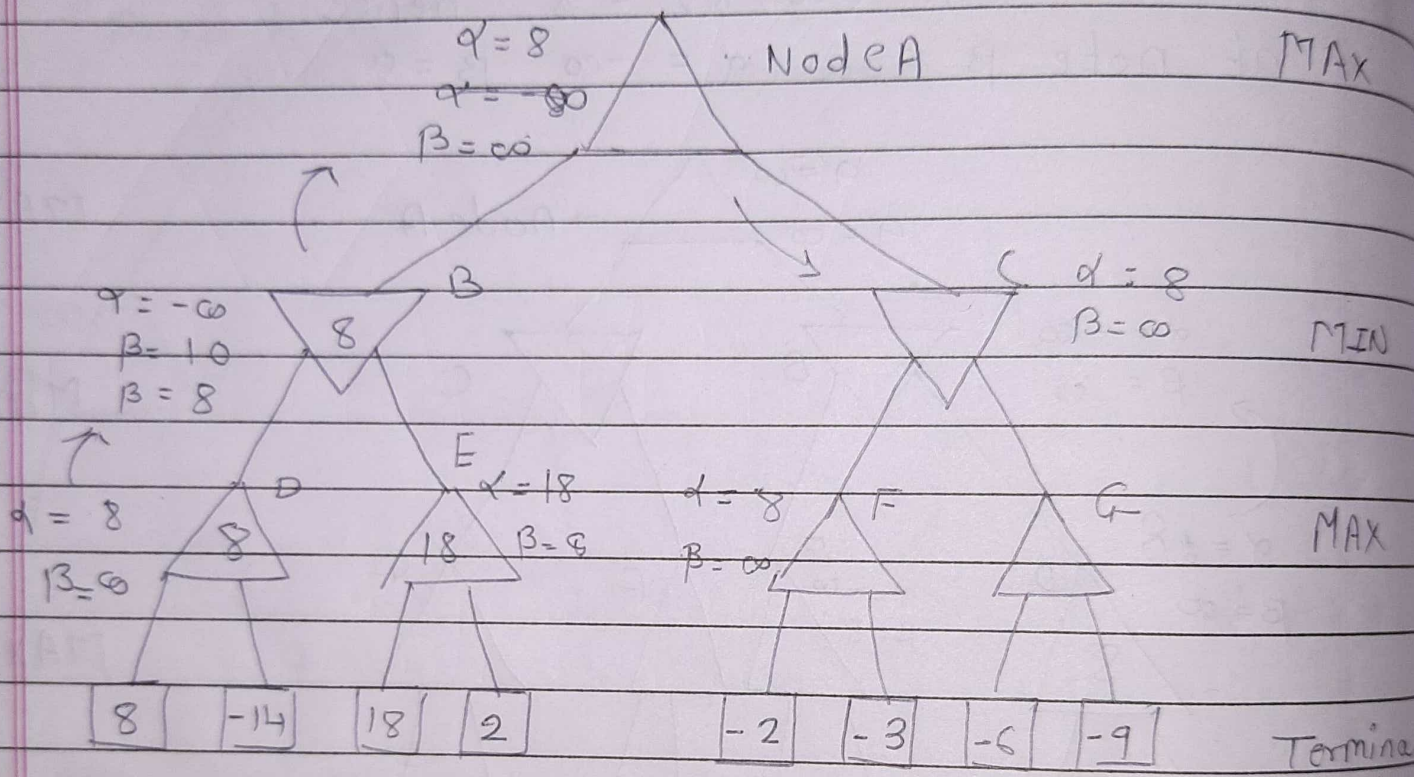
step 3 :- Now algorithm backtracks to node B where the value of β will changes as this is a turn of min, now β = +∞, will compare with the available subsequent nodes value i.e : min (∞, 8) = 8 hence at note B now α = -∞ β = 8



In the next step, algorithm traverse the next successor of node B which is node E, and the values of α = -∞ and β = 8 will also be passed.

step 4 : At node E, max will take its turned the value of alpha will change the cumenet value of α will be compared with 18 so $\max(-\infty, 18) = 18$ hence at node E α = 18 and β = 8 the α will be compared with 2 so $\max(18, 2) = 18$ so the value of α = 18 and β = 8 the α will be so at node E value will be 18

For node B its Min turn so the value of B will be changed. So early value of β was 18 now $\beta = \min(8, 18) = 8$ so the value at Node B will be 8



Step 5:- At next step algorithm again backtra the tree from Node B to Node A The value of α will be changed the max value will be

$\alpha = \max(-\infty, 8) = 8$

$\beta = \infty$

these two value Now pass down to the right successor which is node C at the node C α = 8 and β = ∞ the same values will be passed on to node F

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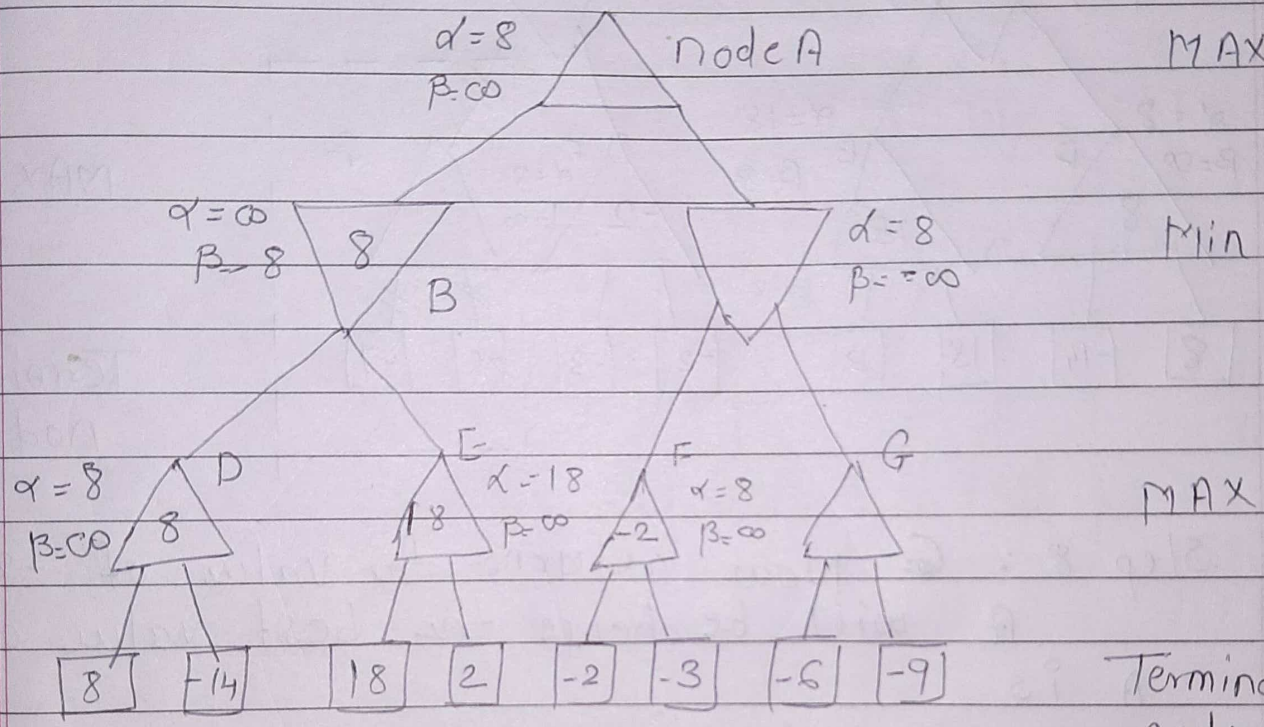
Step 6: At node F again the value of α will be compare with left child which -2 and max(-2, -3) = -2 so the node value will become -2

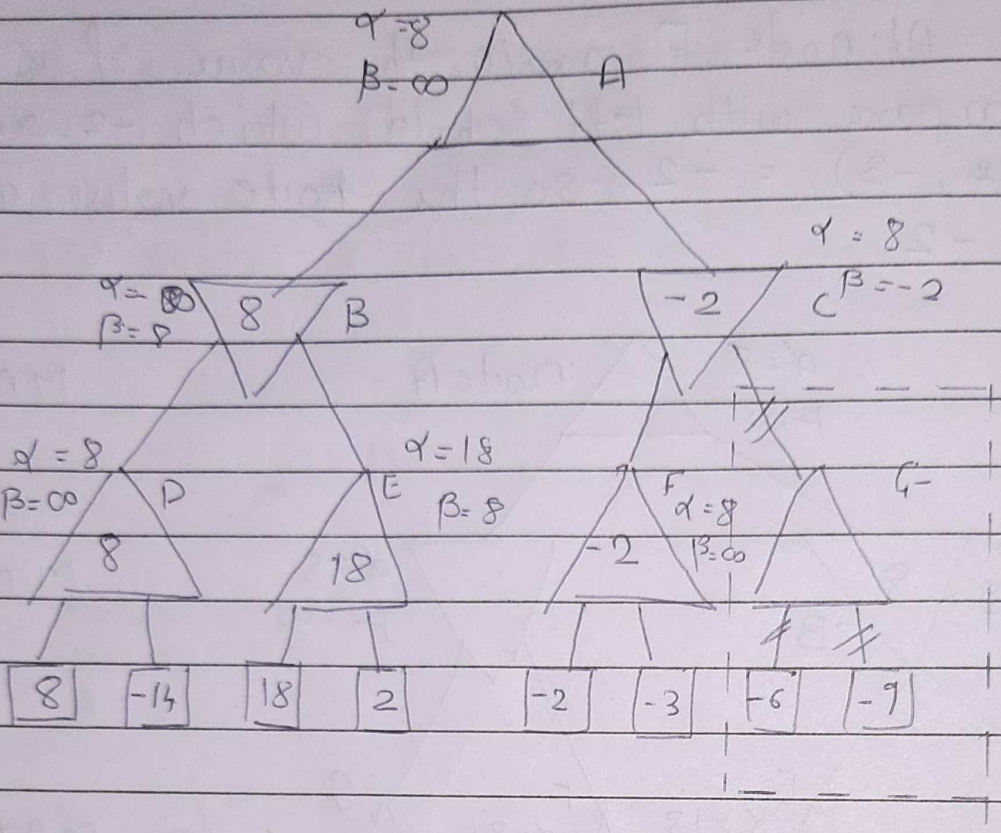


Step 1: At node C $\alpha = 8$ & $\beta = \infty$ here the value of β will change it will compare with -2 so now

$\min(\infty, -2) = -2 = \beta$

So now we have $\alpha = 8$ and $\beta = -2$ Here the condition to prune ie $\alpha \geq \beta$ satisfies so the next Right Node of the Node C will be pruned and the Node Value of C will becom -2

∴ at C $\alpha = 8$, $\beta = -2$



Step 8: G now returns the value of -2 to F will be hence the best value of A is

$\alpha = \text{Max}(8, -2) = 8$

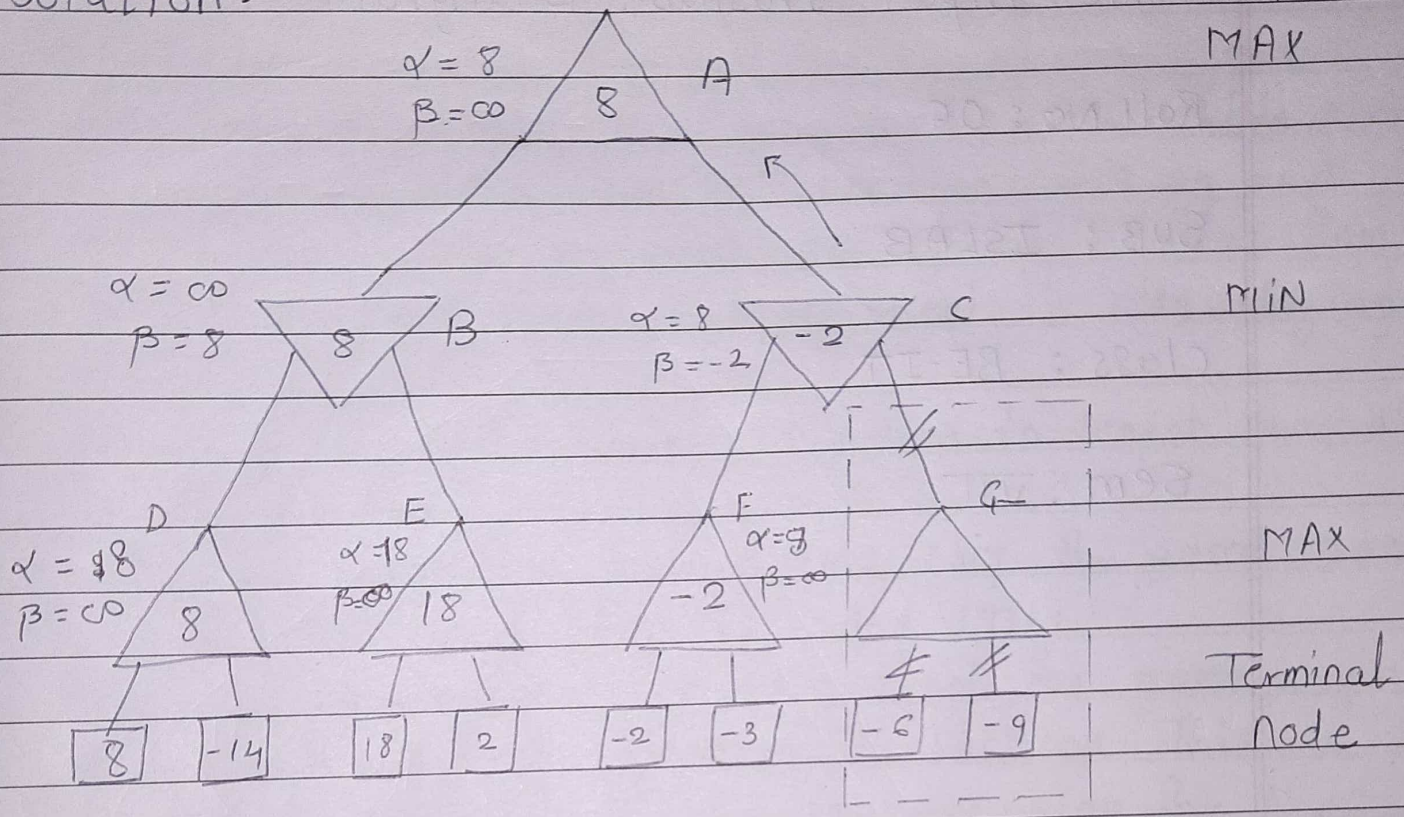
∴ So the final value of node A will be 8

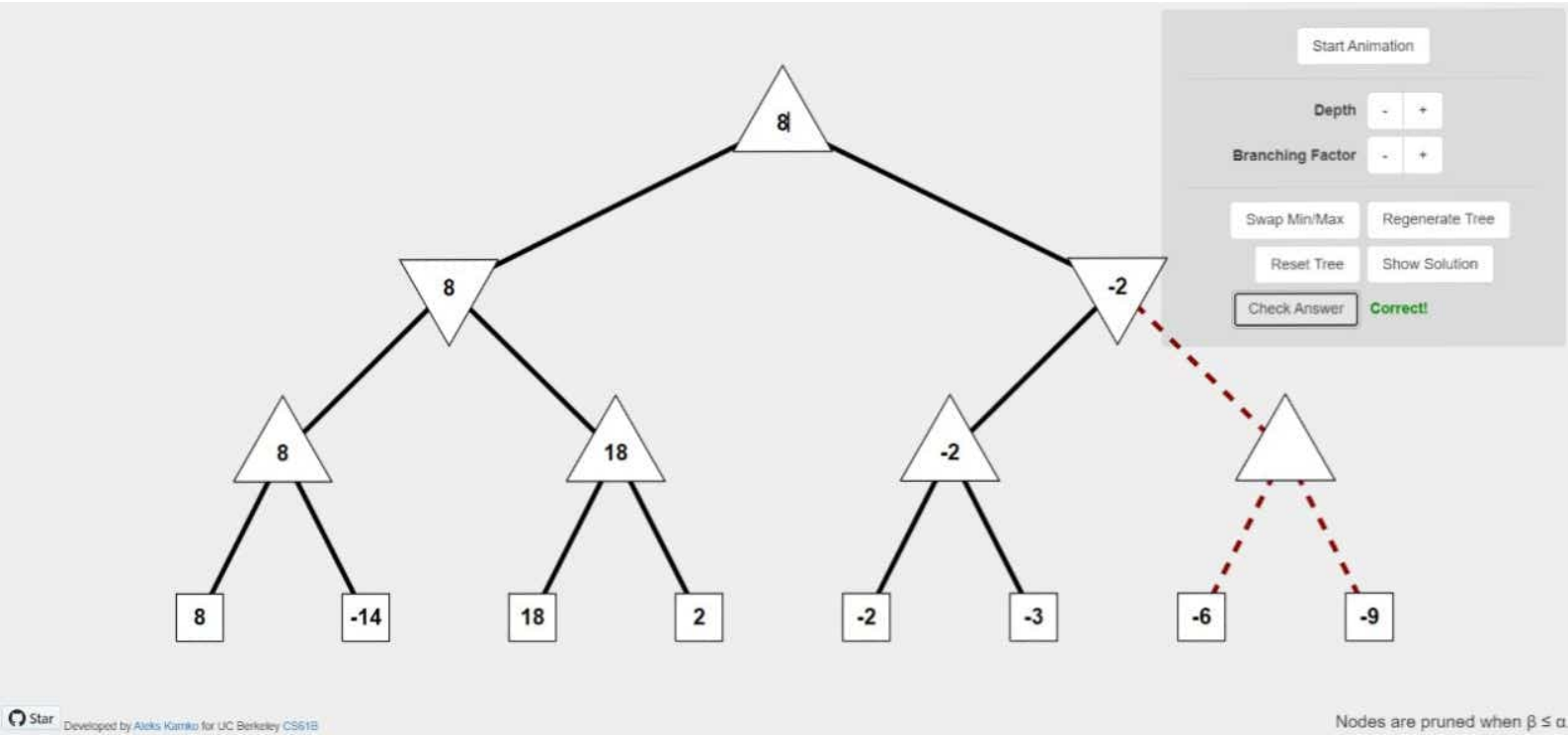
$\alpha = 8$

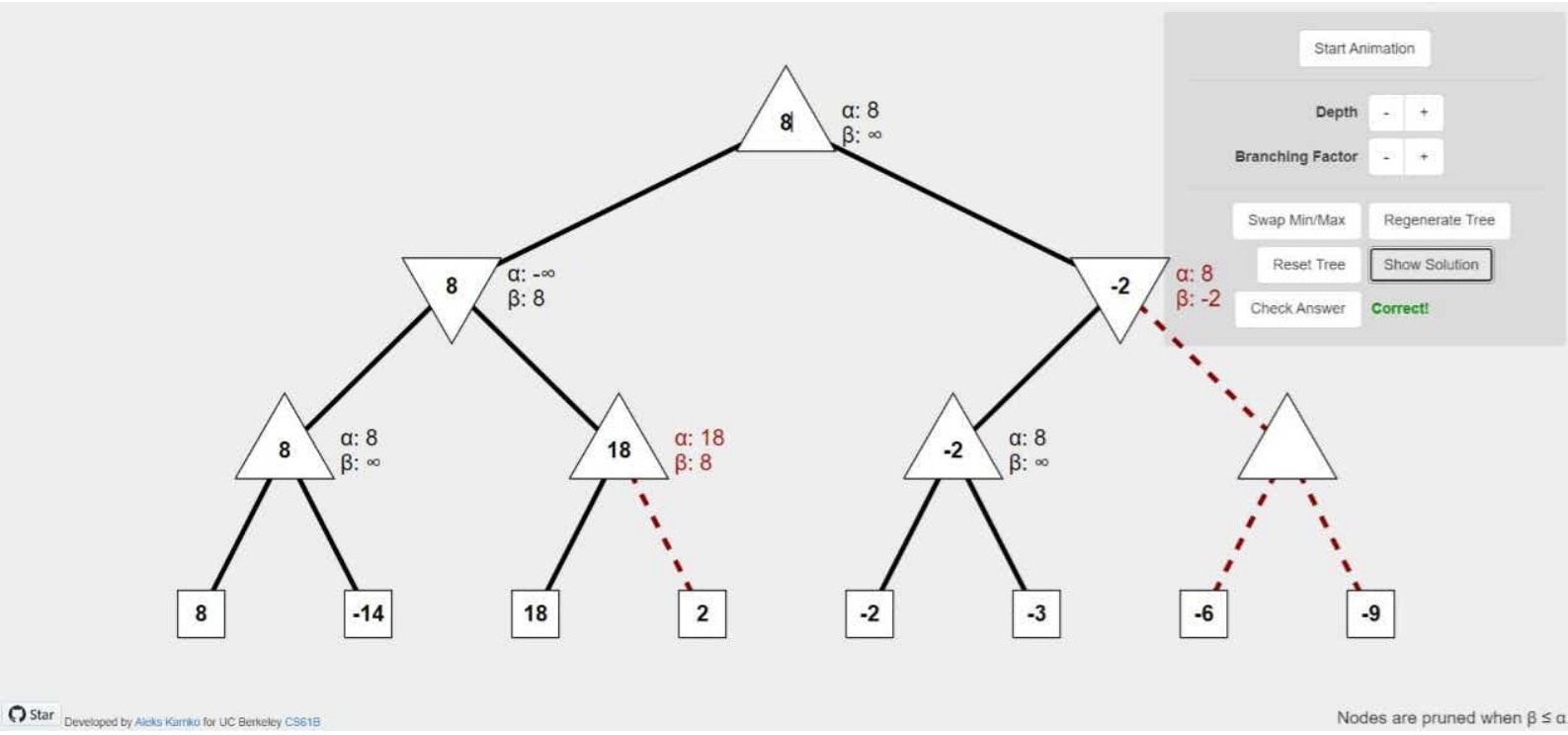
$\beta = \infty$ at A

Following is the final game tree which is showing the nodes which are compound and nodes which has never computed Hence the optimal value for the maximize is 8. For this tree.

Solution:


MAX
α = 8
β = ∞
8
A
MIN
α = ∞
β = 8
8
B
α = 8
β = -2
-2
C
MAX
D
α = 18
β = ∞
8
E
α = 18
β = ∞
18
F
α = 8
β = ∞
-2
G
Terminal Node
8
-14
18
2
-2
-3
-6
-9


Start Animation
Depth
-
+
Branching Factor
-
+
Swap Min/Max
Regenerate Tree
Reset Tree
Show Solution
Check Answer
Correct!
8
8
-2
8
18
-2
8
-14
18
2
-2
-3
-6
-9
Star
Developed by Aleks Kamko for UC Berkeley CS61B
Nodes are pruned when β ≤ α


Start Animation
Depth
-
+
Branching Factor
-
+
Swap Min/Max
Regenerate Tree
Reset Tree
Show Solution
Check Answer
Correct!
8
α: 8
β: ∞
8
α: -∞
β: 8
-2
α: 8
β: -2
8
α: 8
β: ∞
18
α: 18
β: 8
-2
α: 8
β: ∞
8
-14
18
2
-2
-3
-6
-9
Star
Developed by Aleks Kamko for UC Berkeley CS61B
Nodes are pruned when β ≤ α