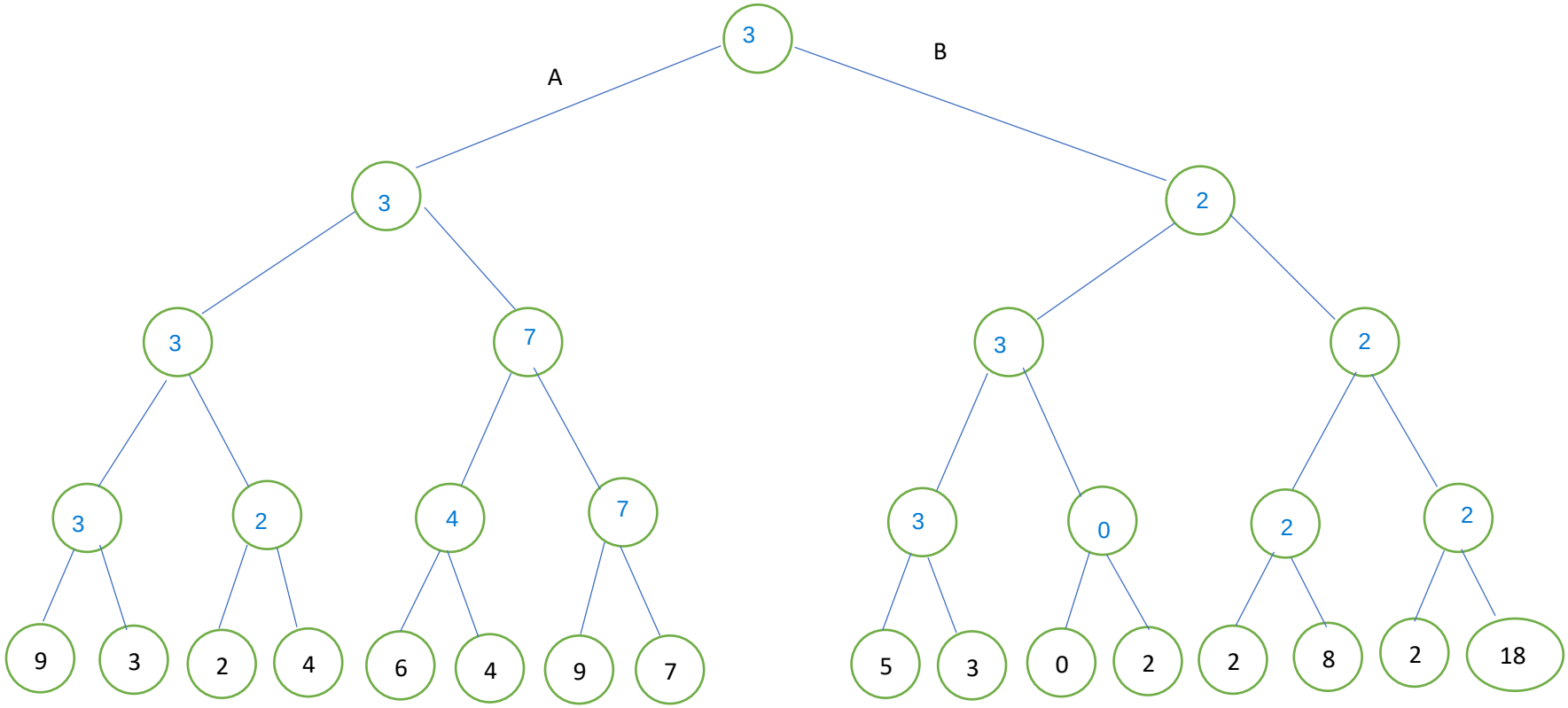
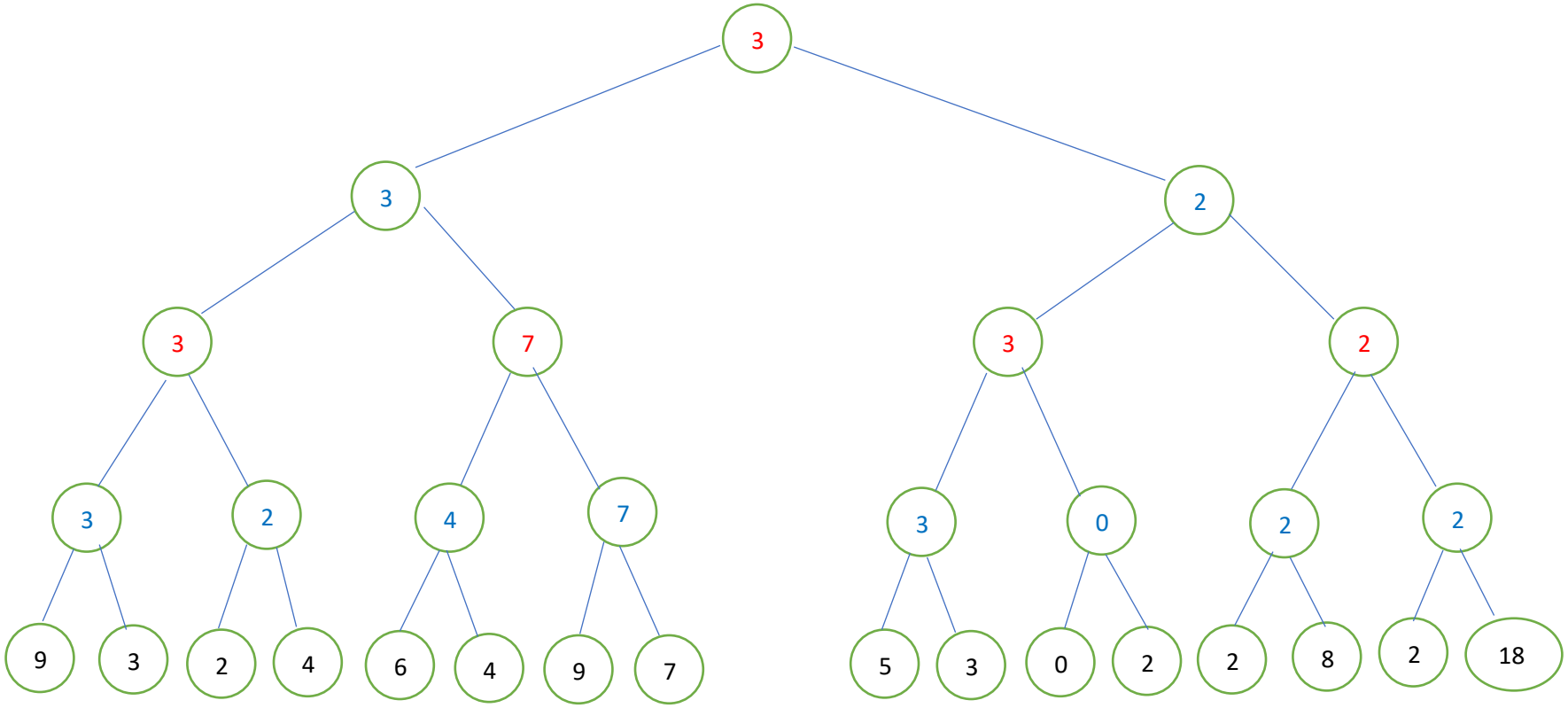
In a two-player zero-sum game where the players take alternating turns, you will be the first player. You can choose action A or B, so to decide which action to take, you draw the game tree and write the value you will get at each leaf node. The game tree looks as follows:



Q1) Find the **Minimax** value of the tree.

Red nodes are max nodes blue nodes are min nodes.



Minimax value = 3

Min Nodes:

Min(value, child)

Min(value, beta)

If value <= Alpha break

Max Nodes:

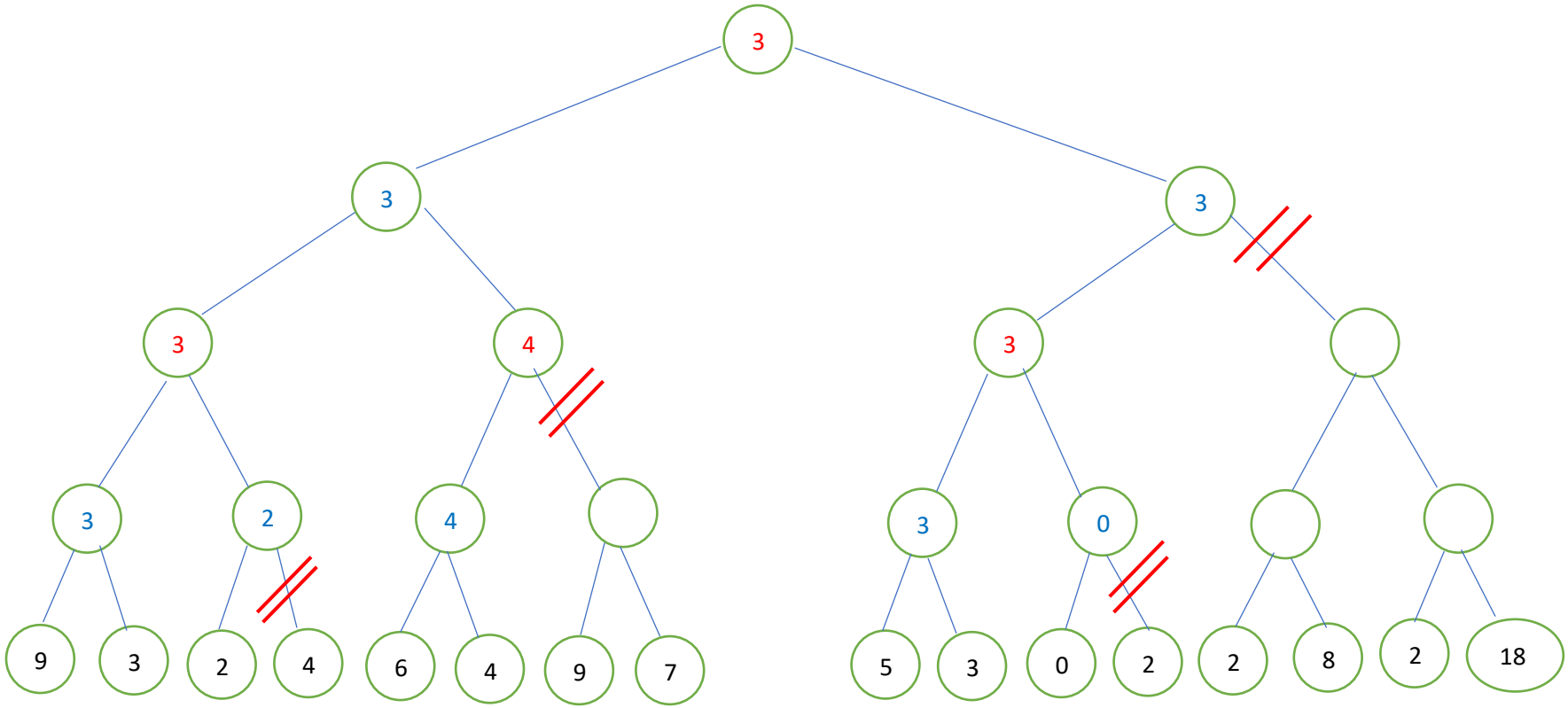
Max(value, child)

Max(value, alpha)

If value >= Beta break

Q2) Apply **Alpha-Beta pruning**.

1) Clearly show the nodes that will not be evaluated.

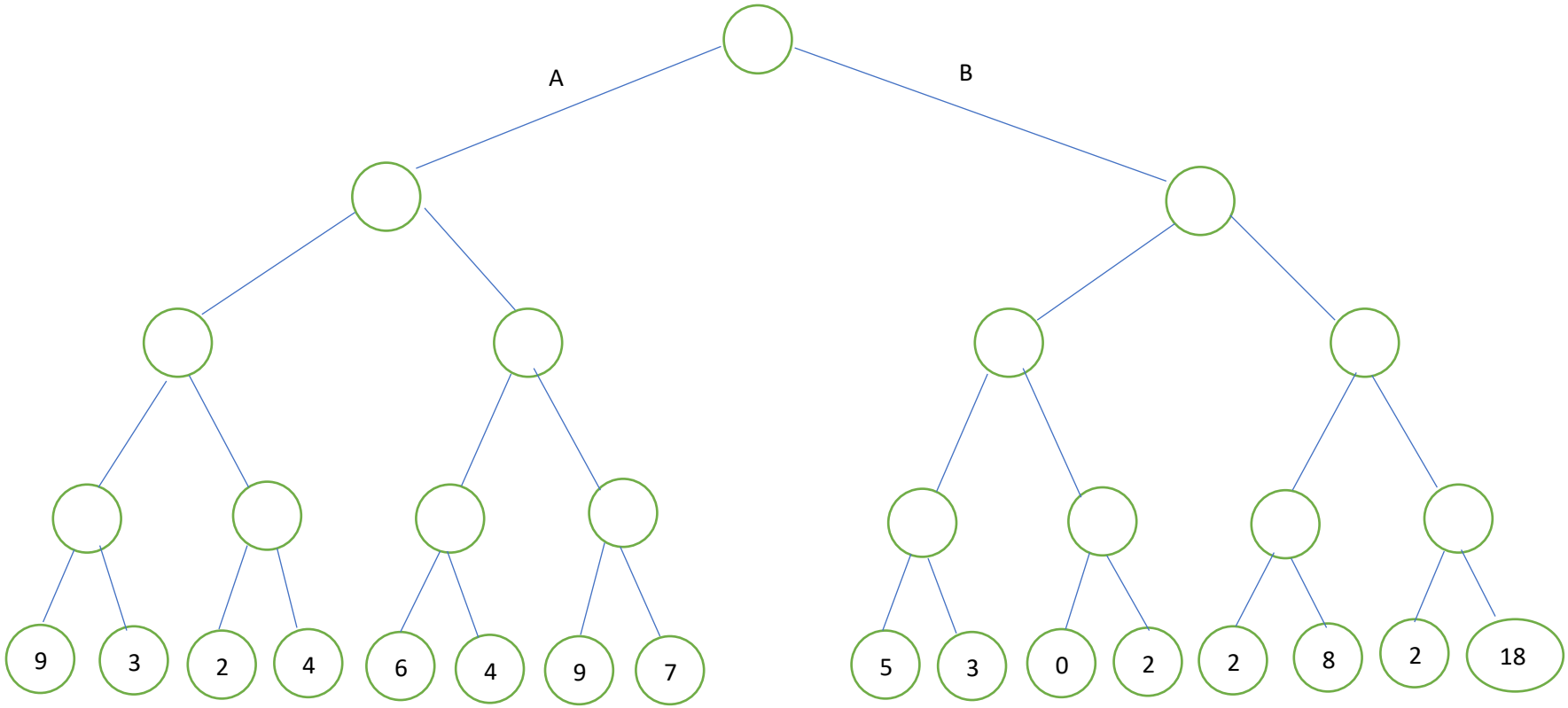


2) What is the optimal action at the root state (Select **all** the correct answers)? Justify your answer.

☑ A ☐ B

TA Salma said to decide the answer according to the minimax tree, and there the optimum choice would be the left subtree (3) and not the right subtree (2) as it does not give the optimum choice.

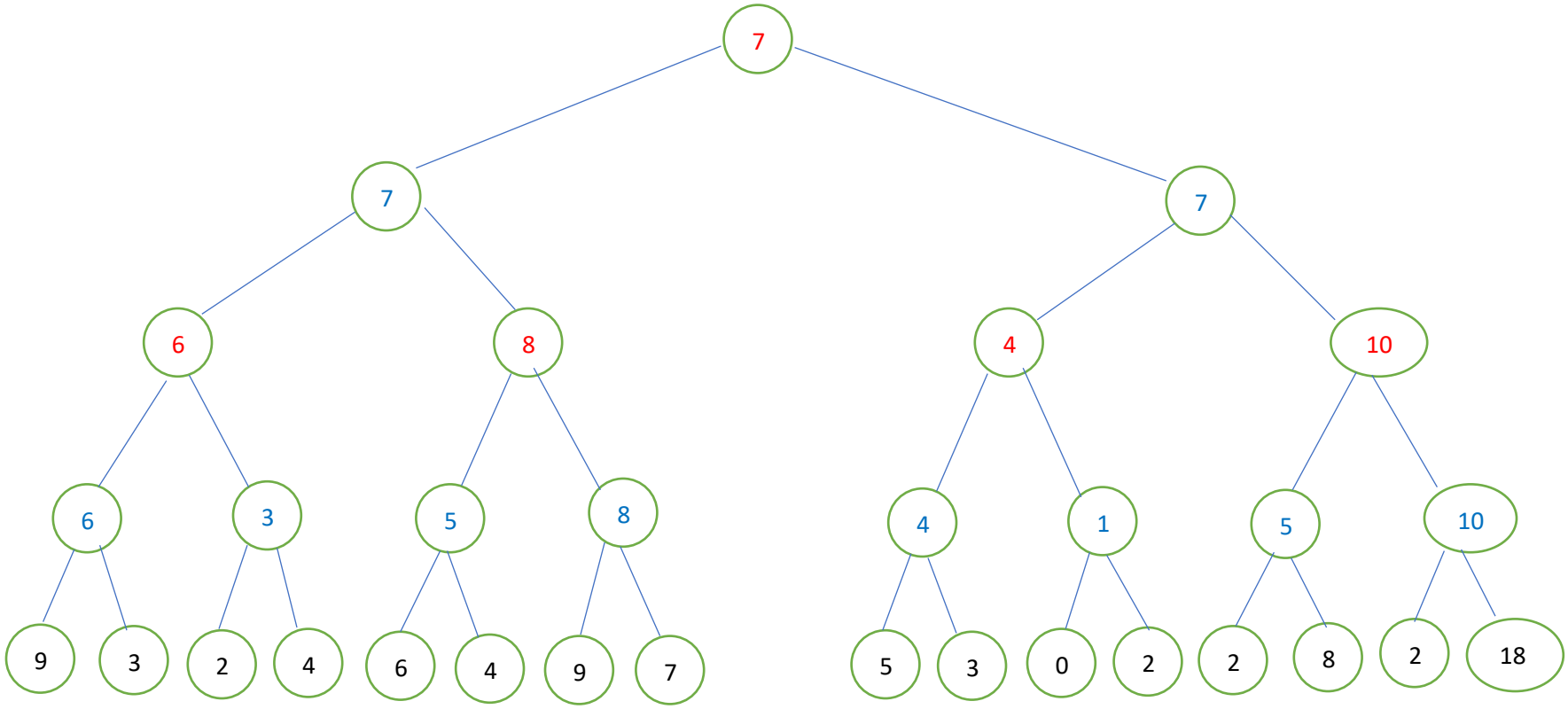
Q3) Your opponent decided that they will not play, so you will replace them with a random agent which will pick an action randomly with equal probability.



1. In this case, what is the optimal action at the root state (Select **all** the correct answers)? Justify your answer.

   ☐ A ☐ B

2. What is the expected value at the root state if you act optimally?



Expectimax value = 7

Optimal action at the root state = A and B, since both of them yield the expectimax value (7)