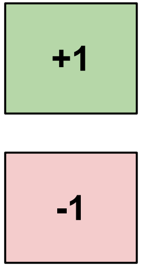
Exercise 3.3

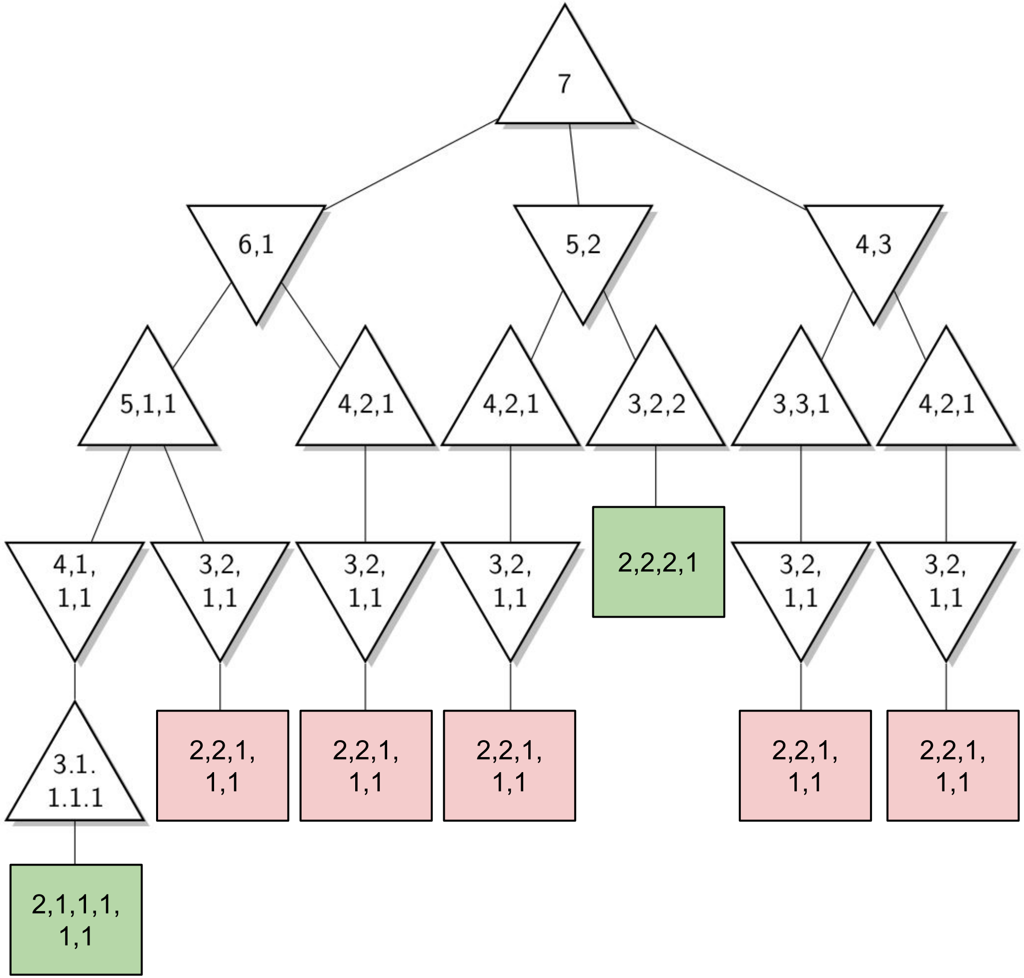
Consider the following two-player zero-sum game. The game begins with a pile of seven bricks. On your move, you must split one pile of bricks into two piles. You may not split a pile of bricks into two equal piles. If it is your turn and all the piles of bricks have either one or two bricks, you have lost the game.

1. Apply the minimax algorithm for finding the best action for the max player at the root.

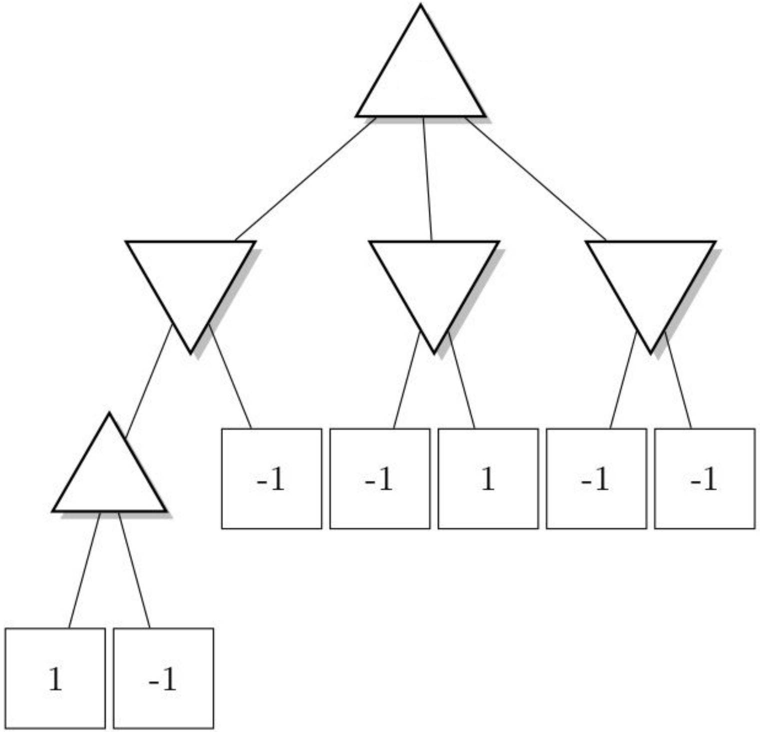
2. Apply the minimax algorithm with alpha-beta pruning for finding the best action for the max player at the root.

Exercise 3.3 - Game tree

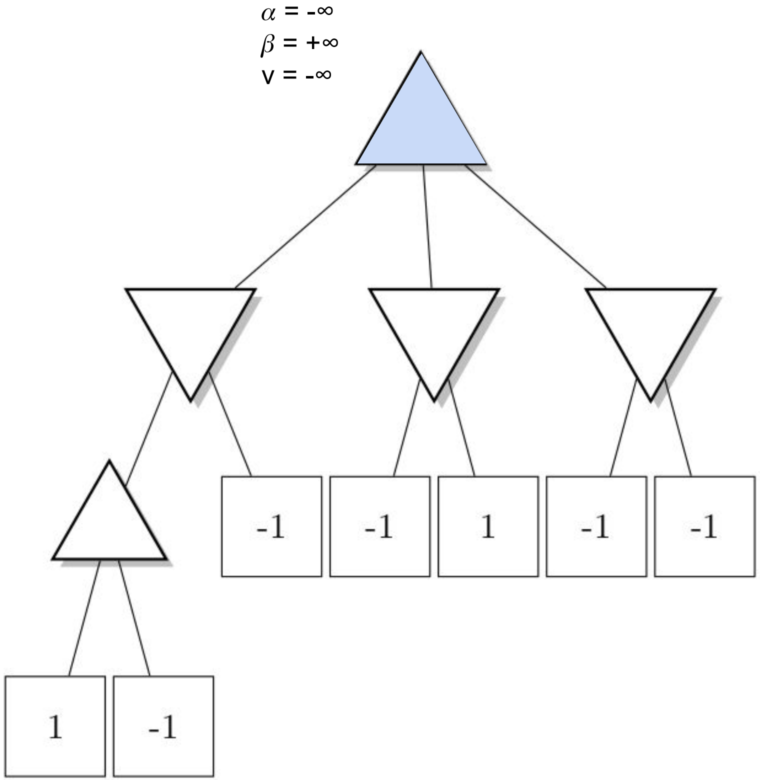




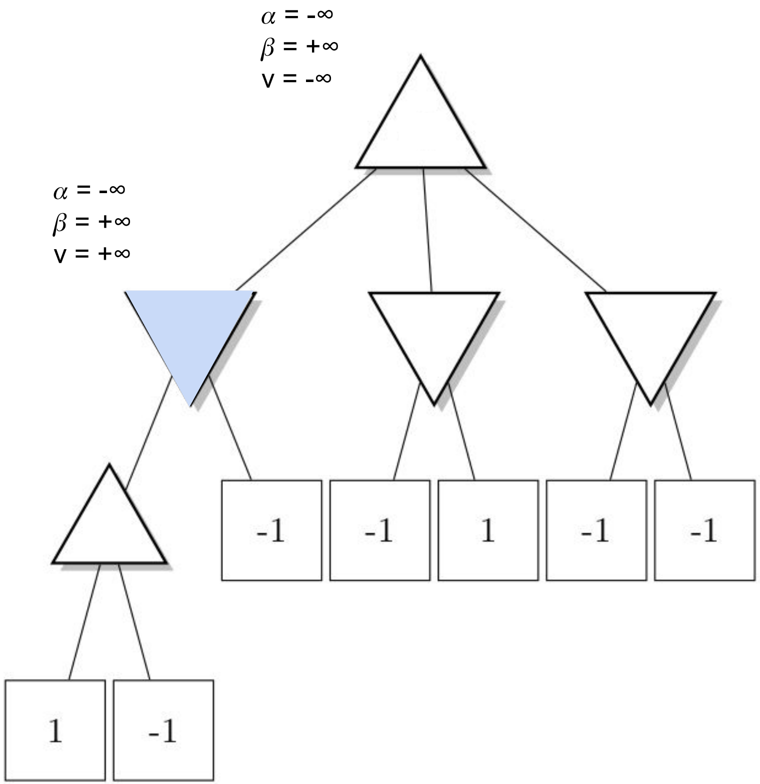
α-β Pruning with α = -∞ β = +∞ initialization



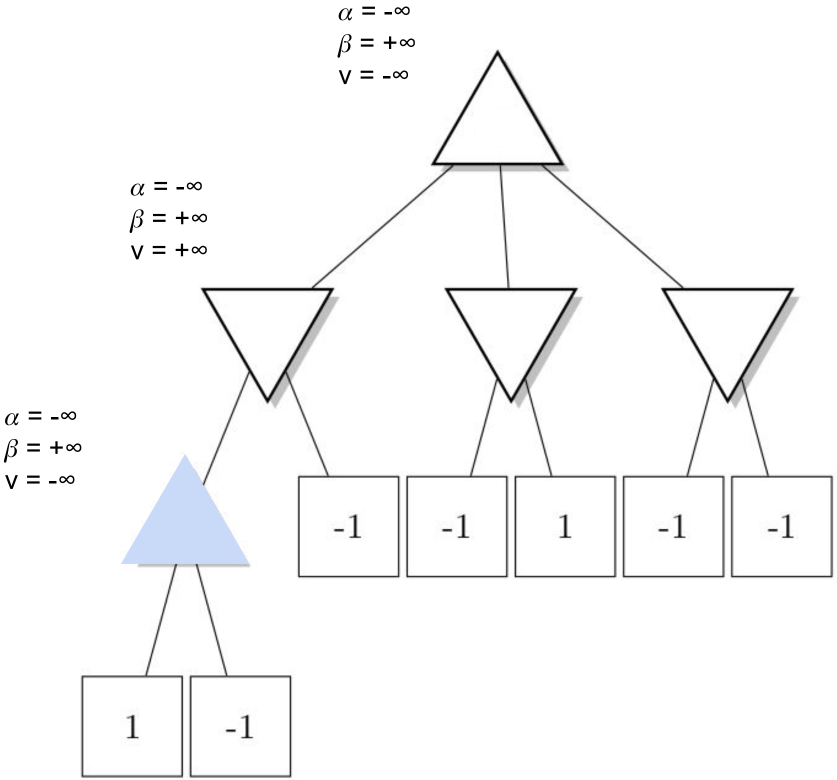
α-β Pruning



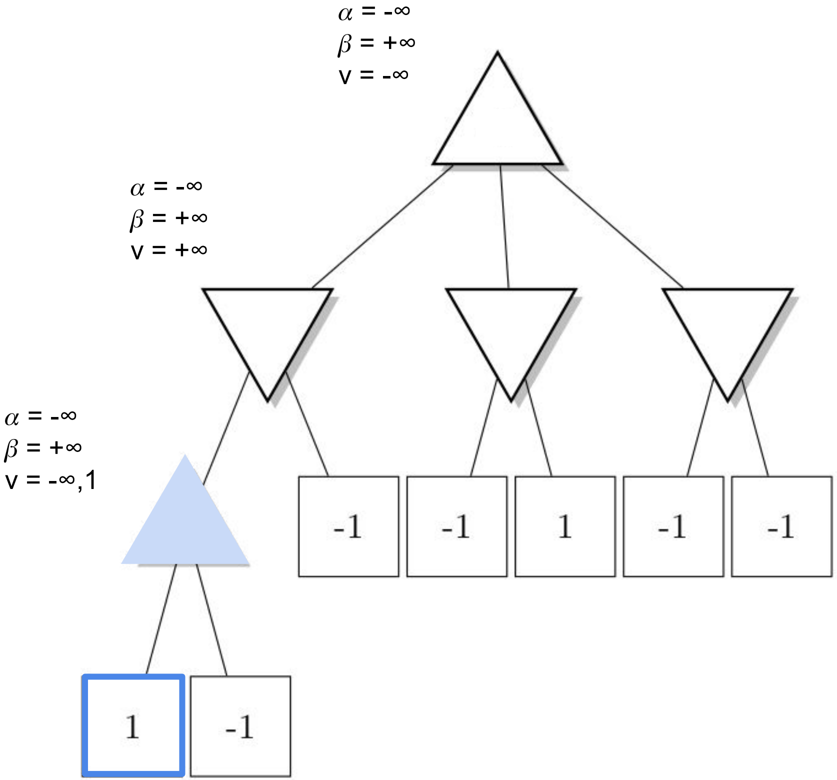
α-β Pruning



α-β Pruning

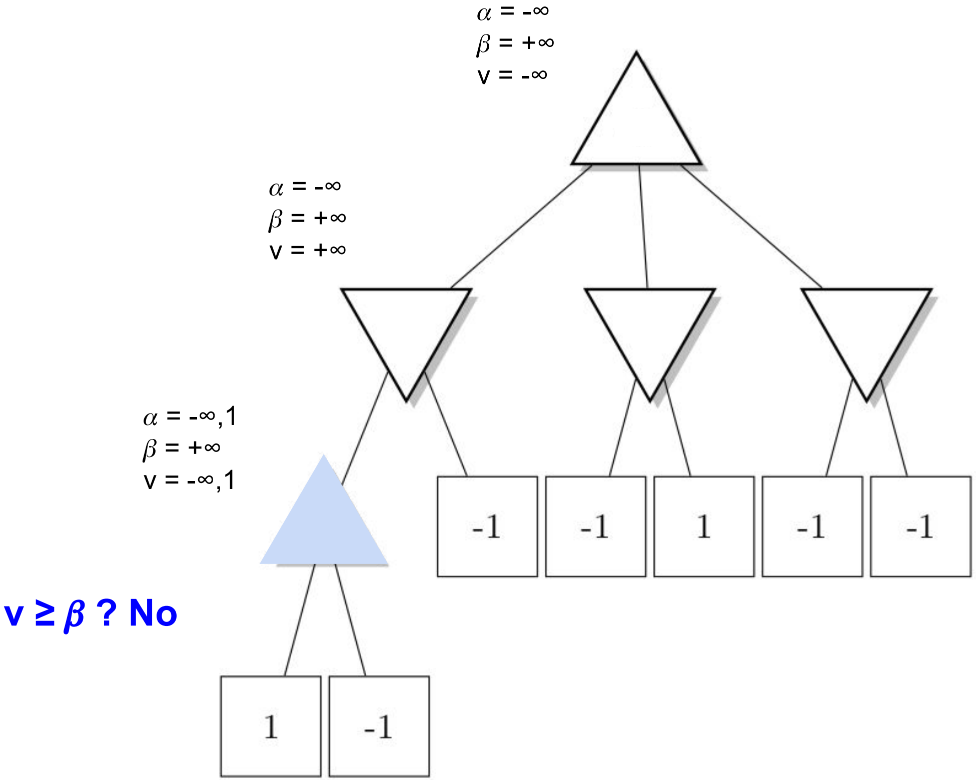


α-β Pruning

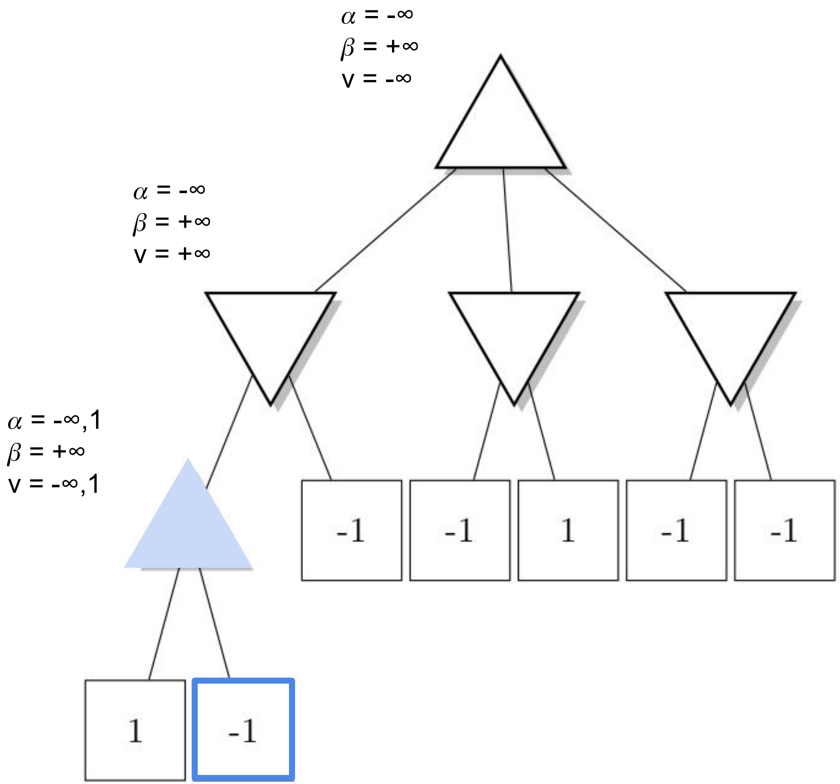


v ≥ β ?

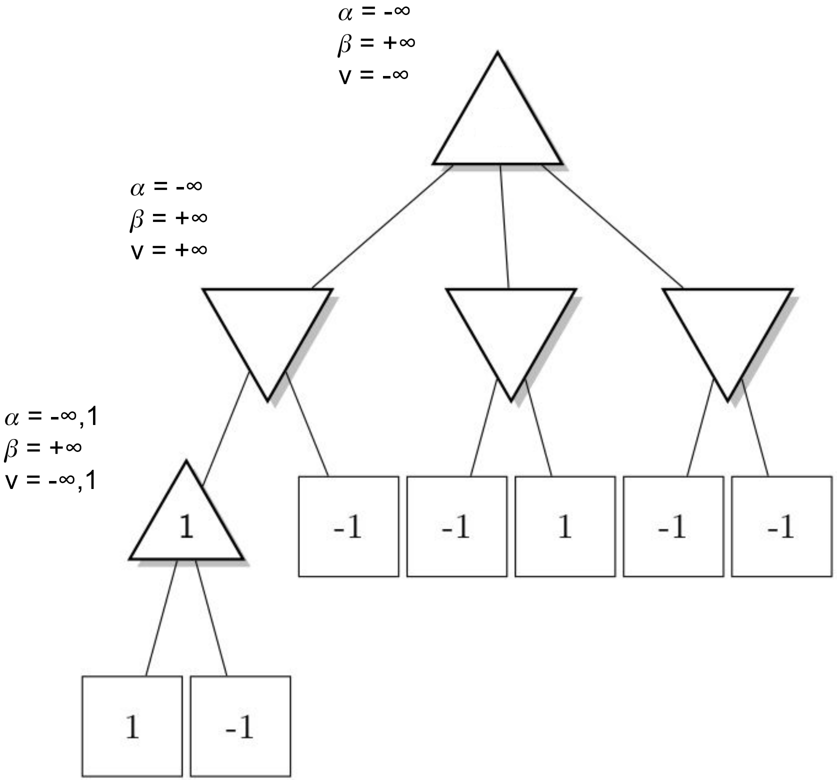
α-β Pruning



α-β Pruning

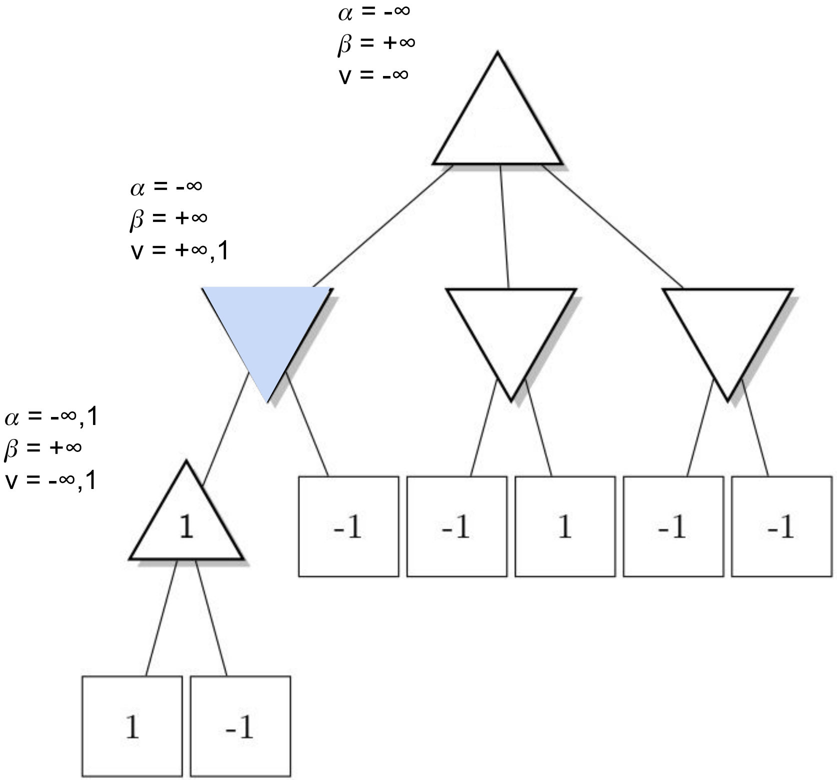


α-β Pruning



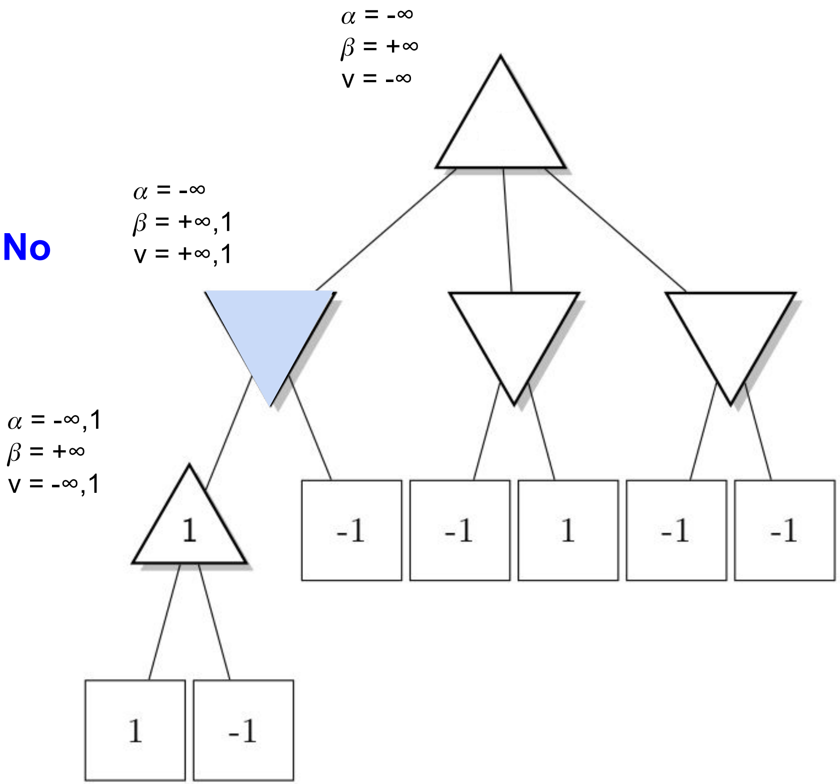
α-β Pruning

v ≤ α ?



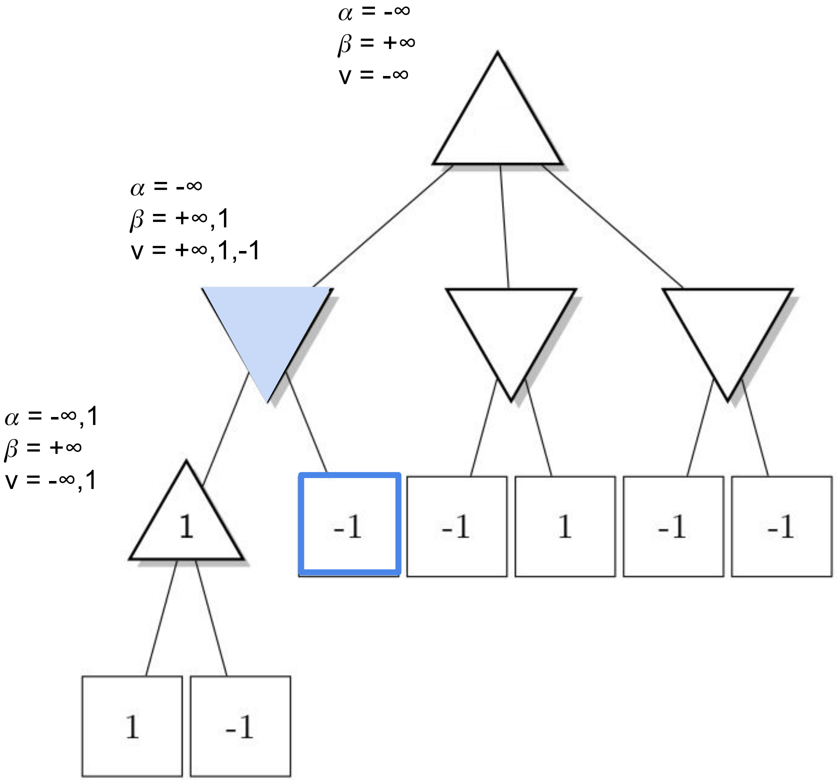
α-β Pruning

v ≤ α ? No



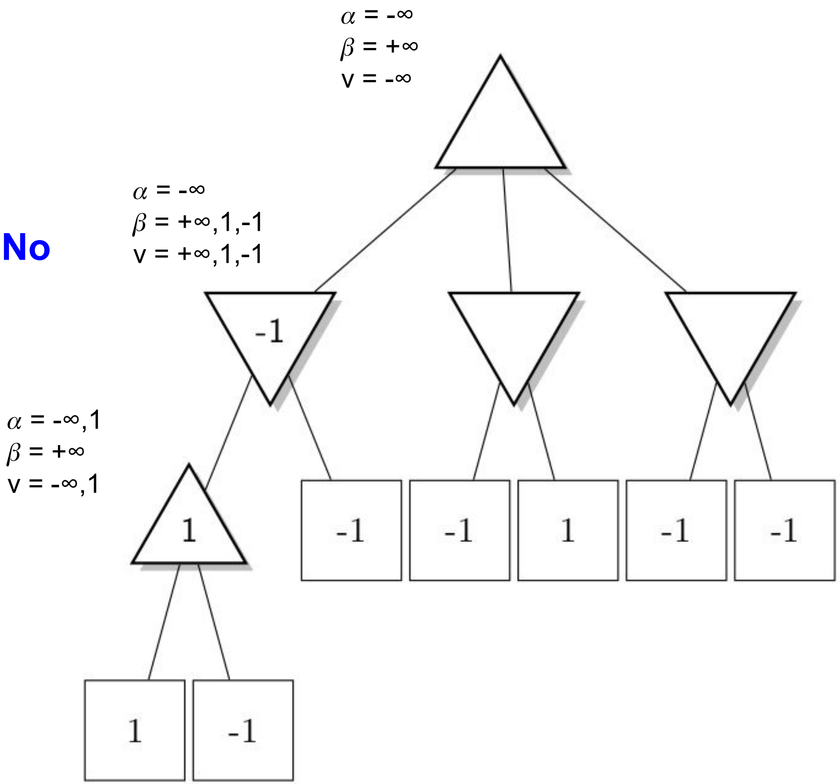
α-β Pruning

v ≤ α ?

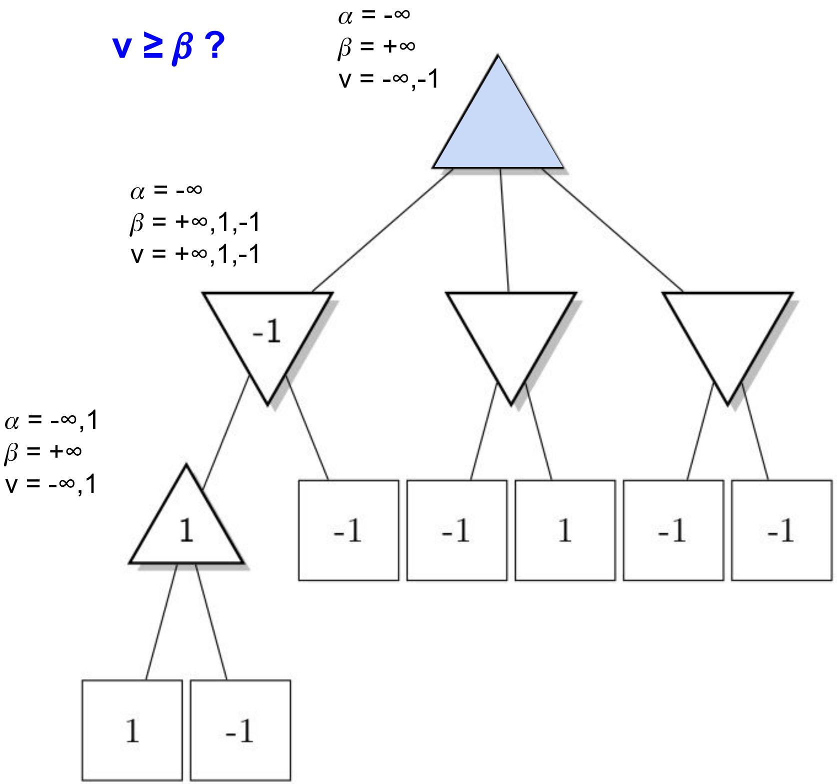


α-β Pruning

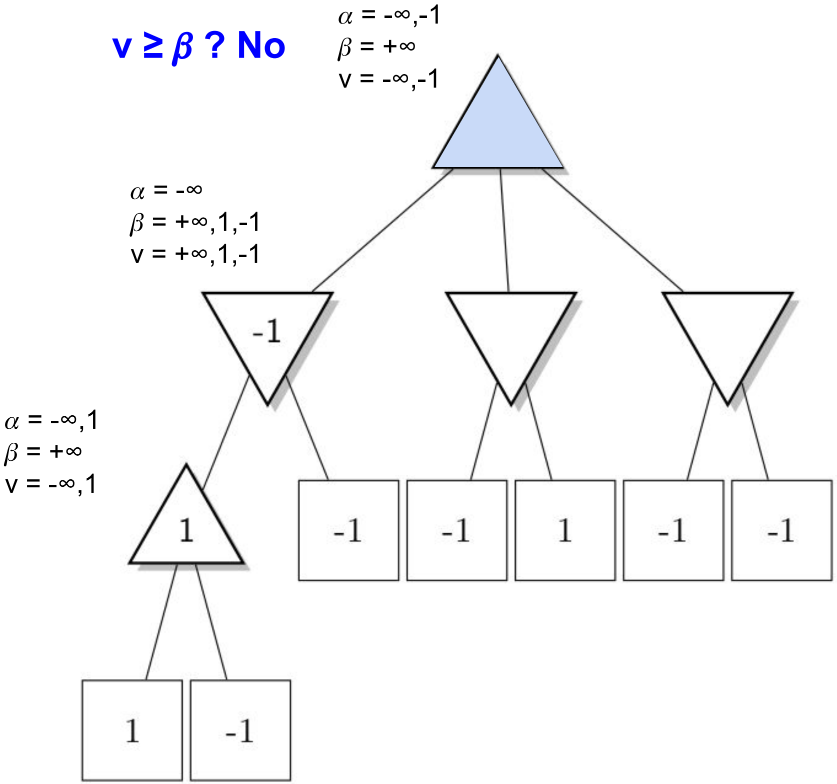
v ≤ α ? No



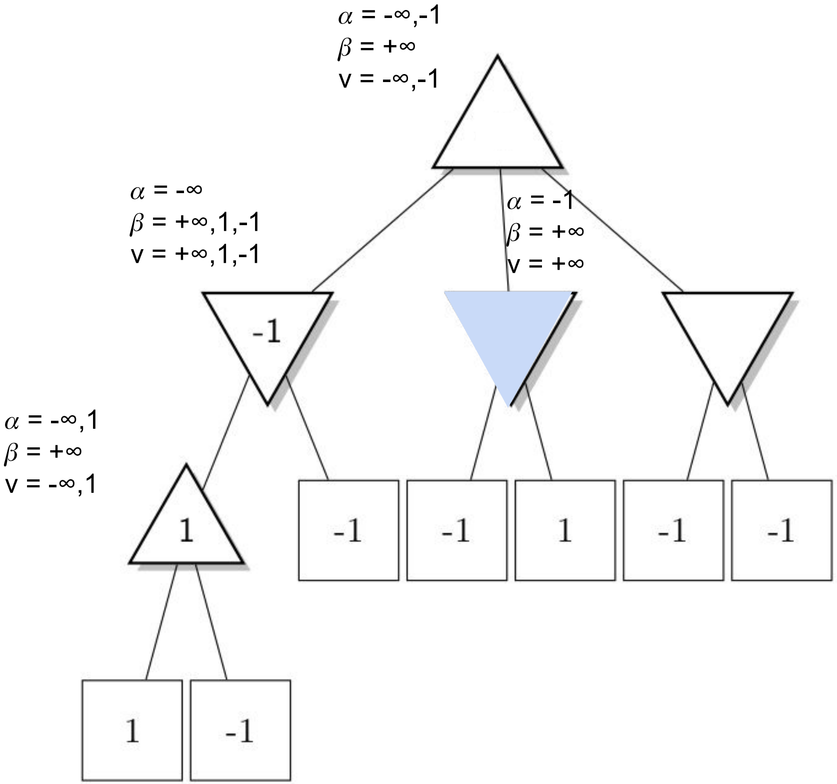
α-β Pruning



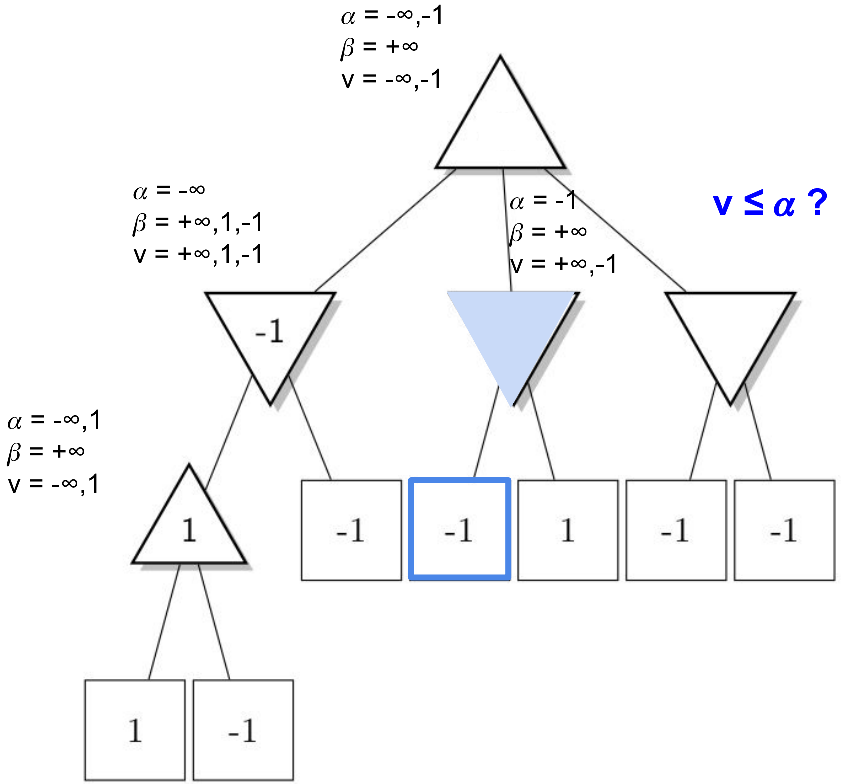
α-β Pruning



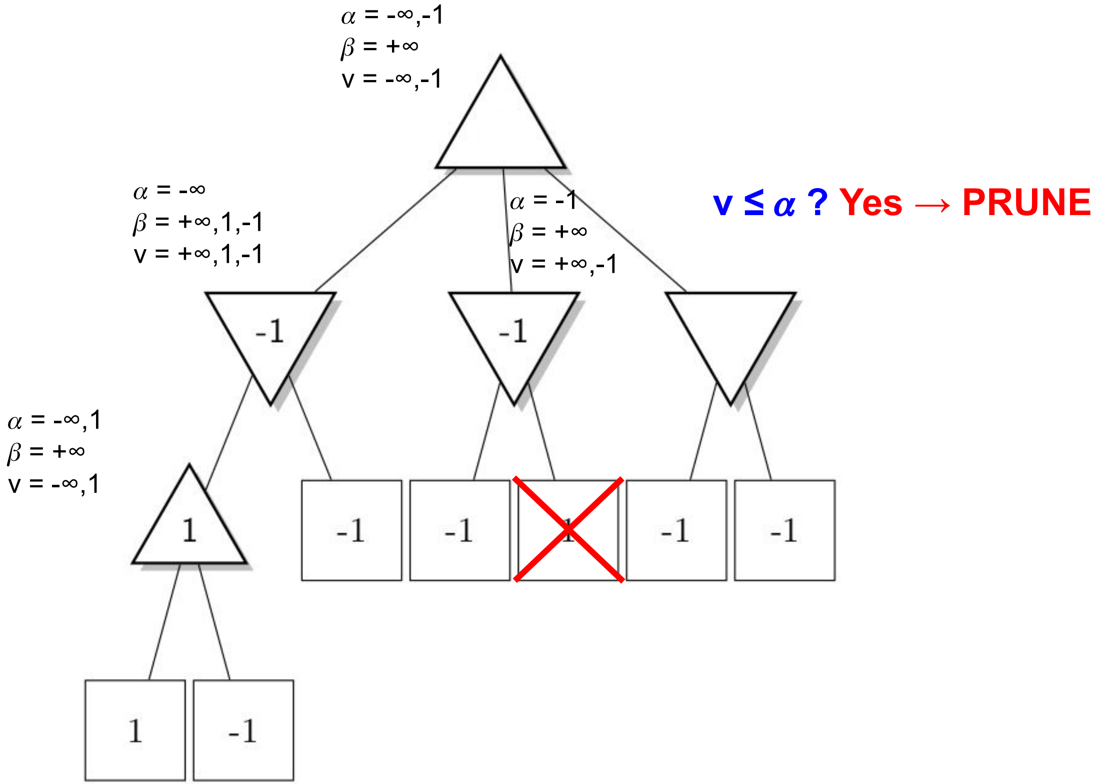
α-β Pruning



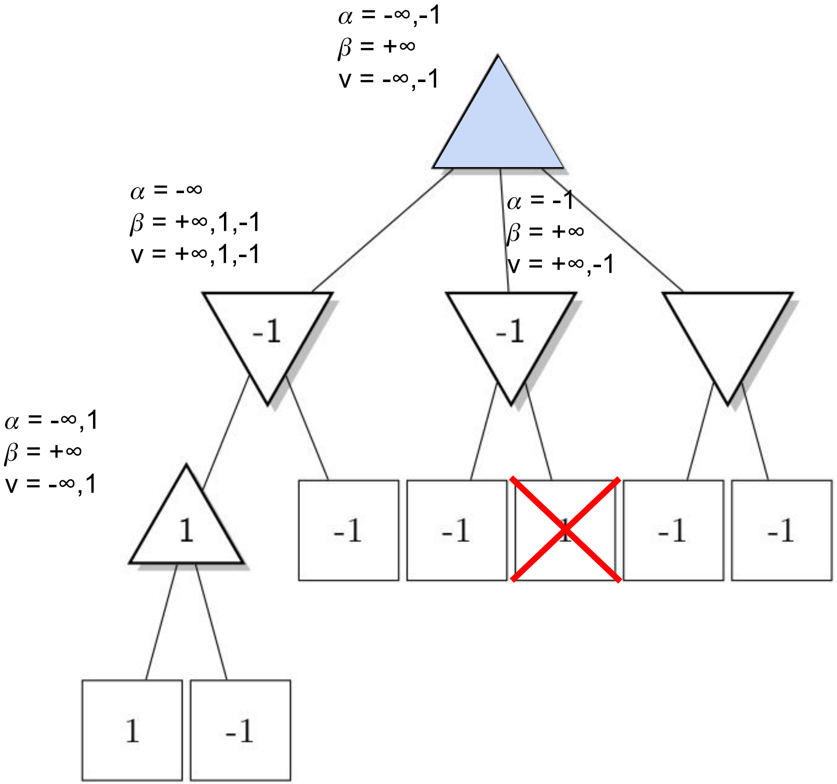
α-β Pruning



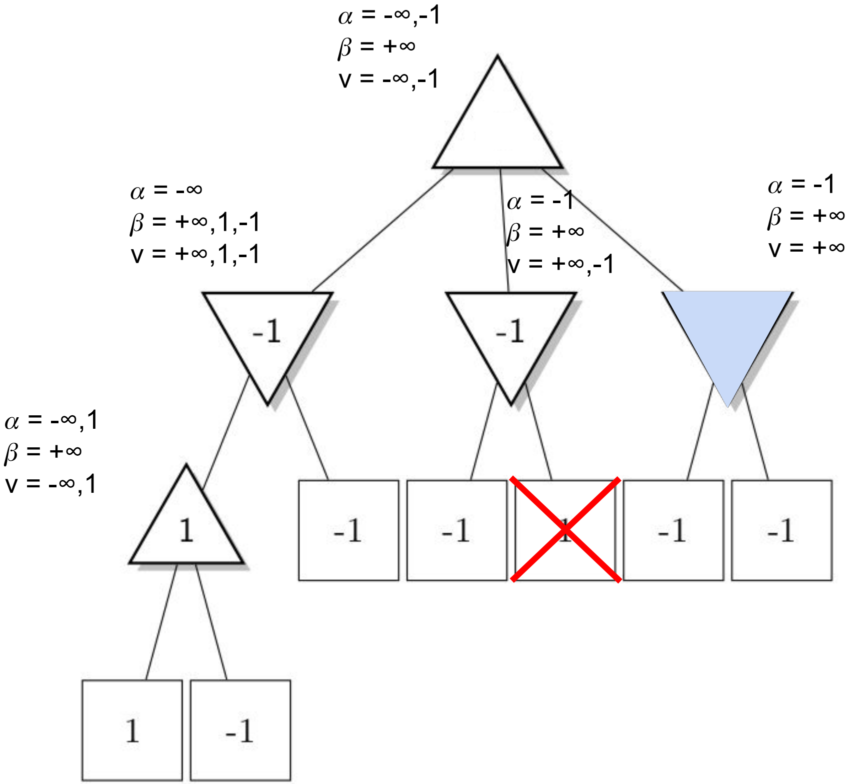
α-β Pruning



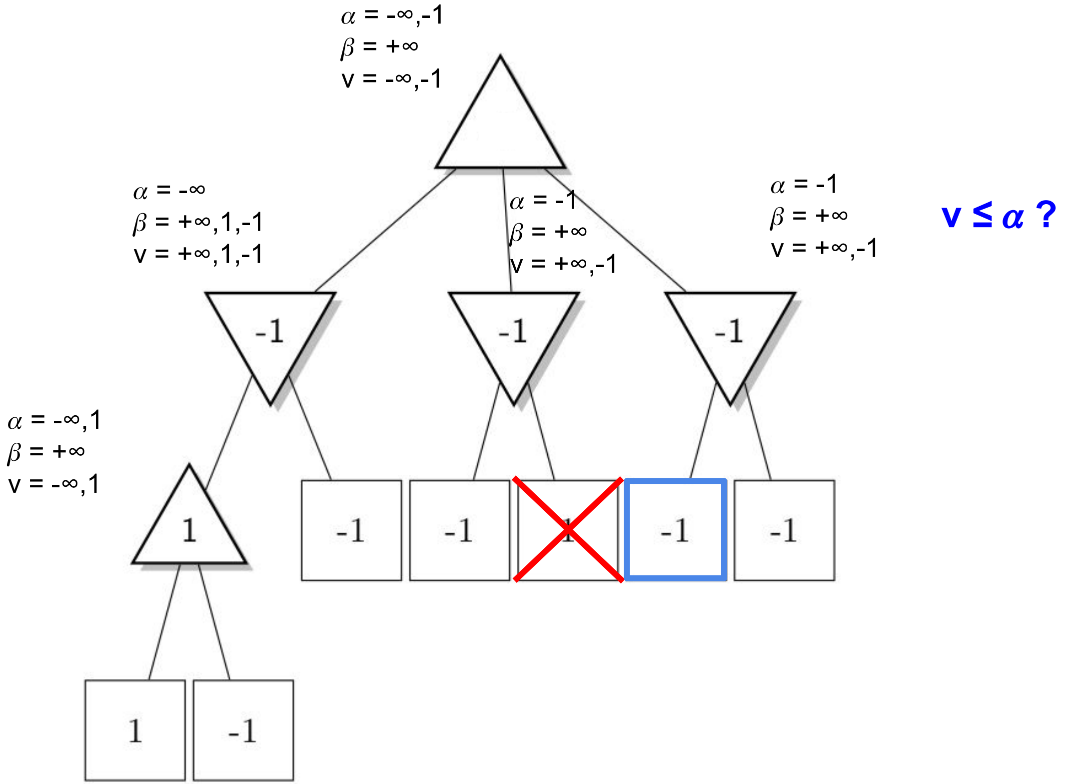
α-β Pruning



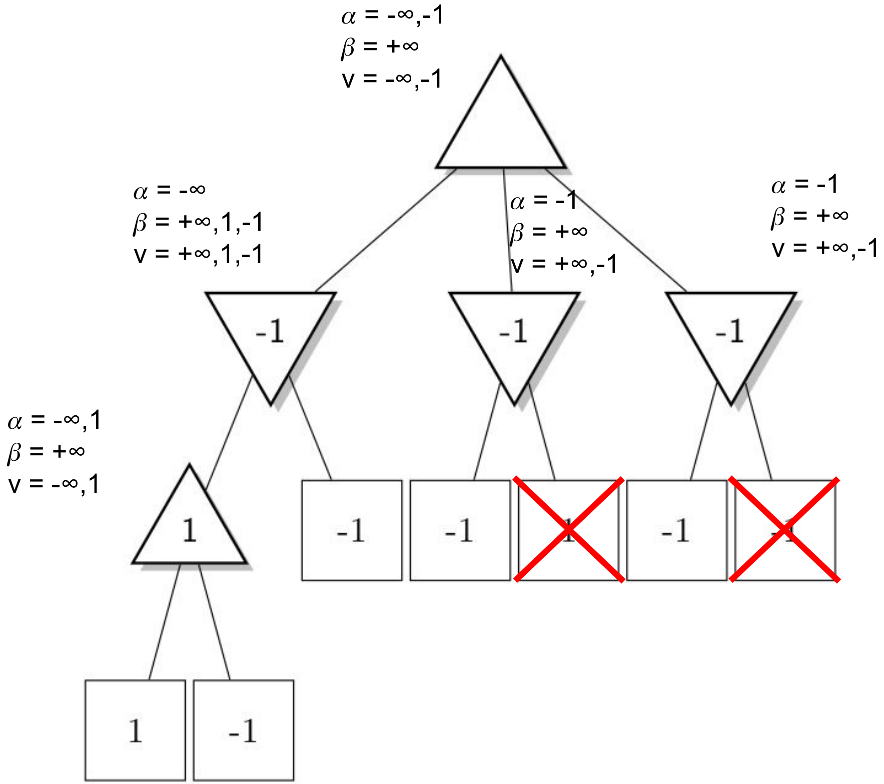
α-β Pruning



α-β Pruning

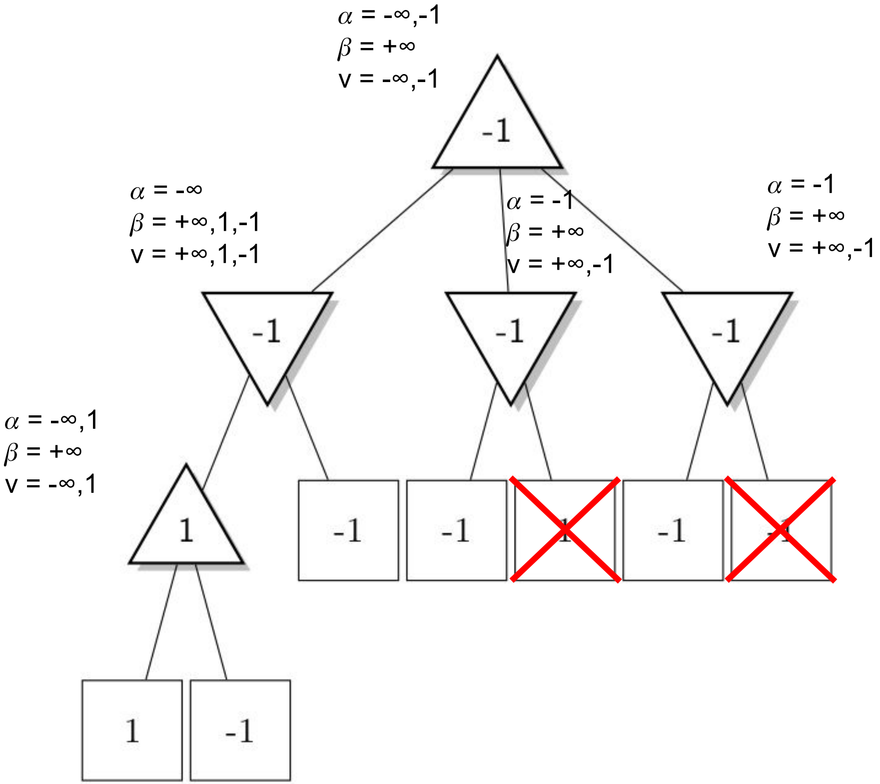


α-β Pruning

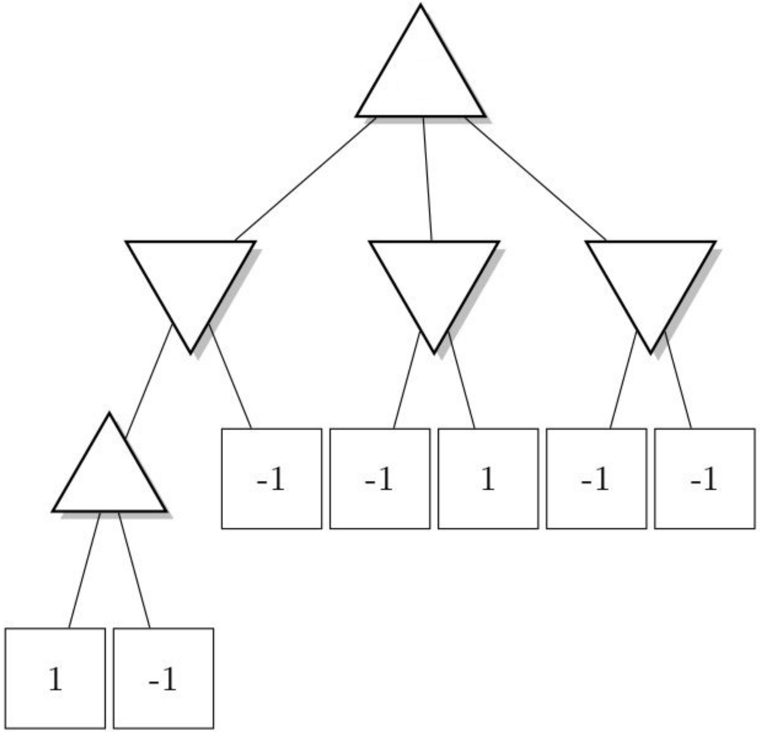


v ≤ α ? **Yes → PRUNE**

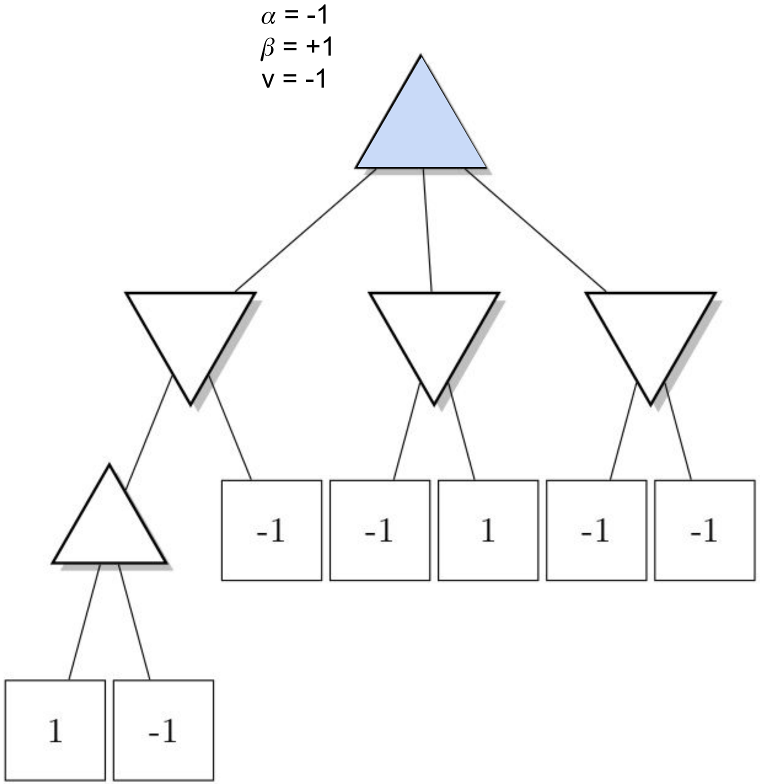
α-β Pruning



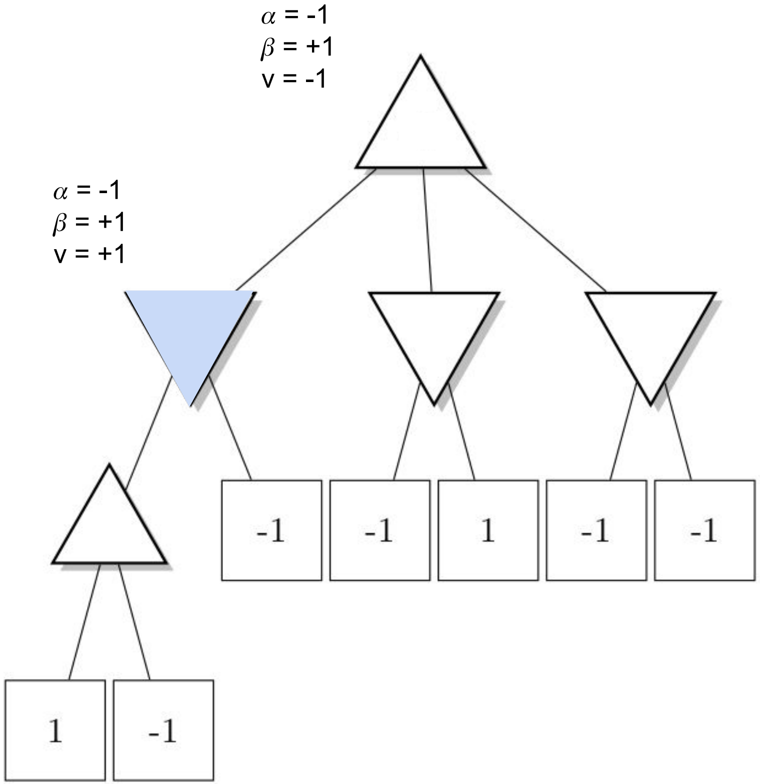
α-β Pruning with α = -1 β = +1 initialization



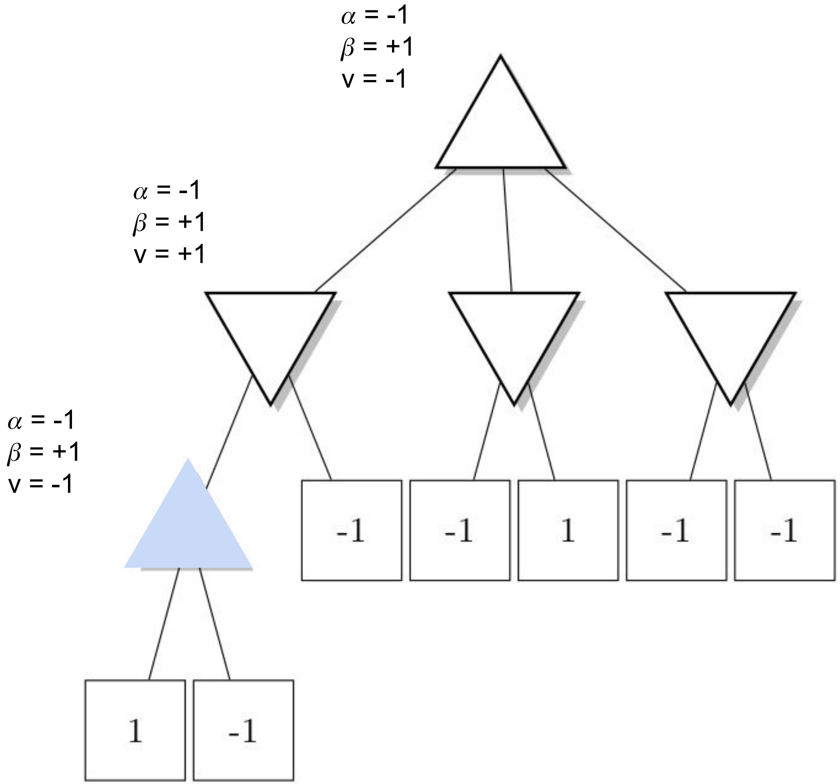
α-β Pruning



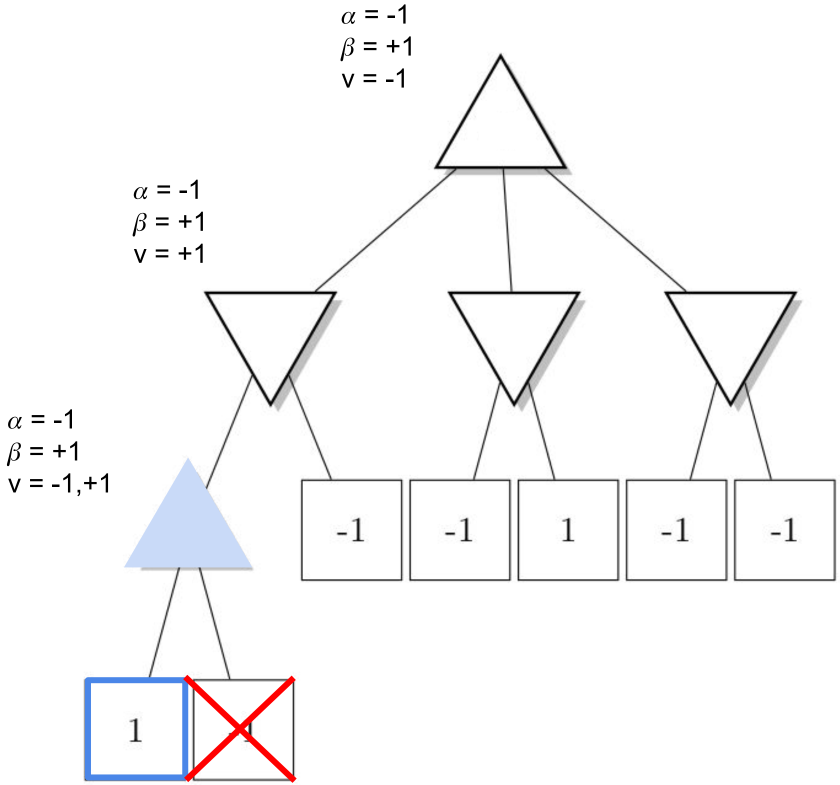
α-β Pruning



α-β Pruning

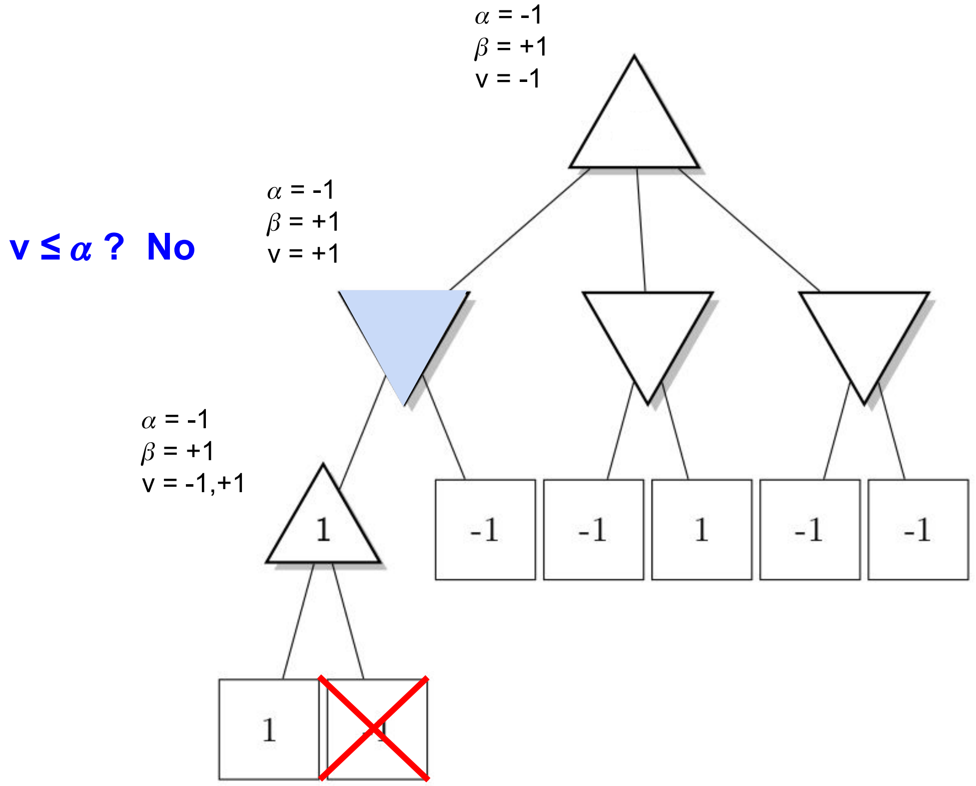


α-β Pruning



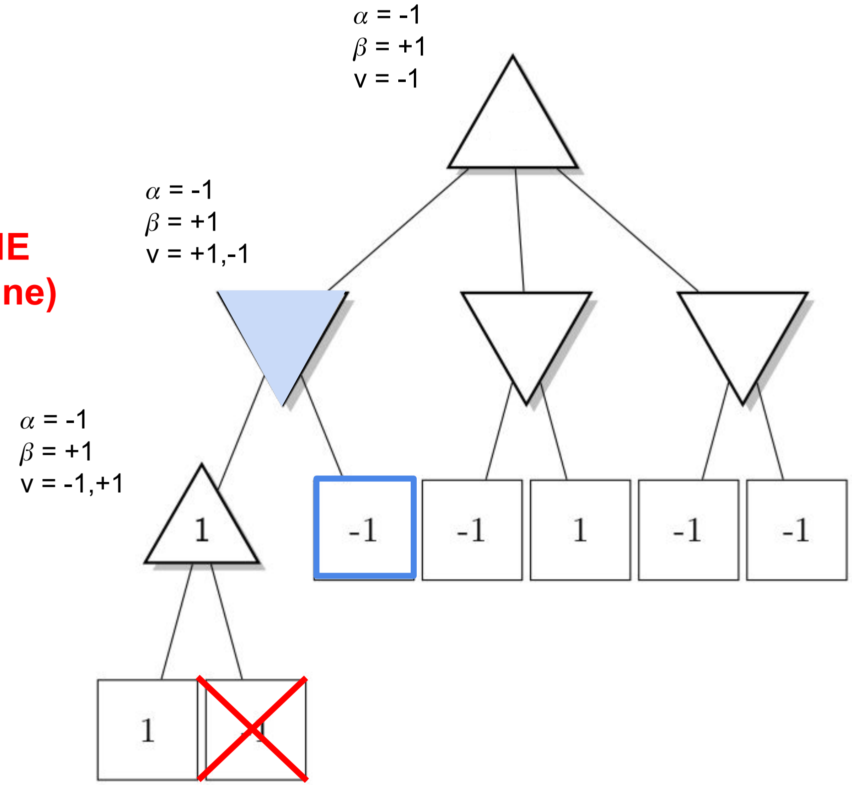
v ≥ β ? Yes → PRUNE

α-β Pruning

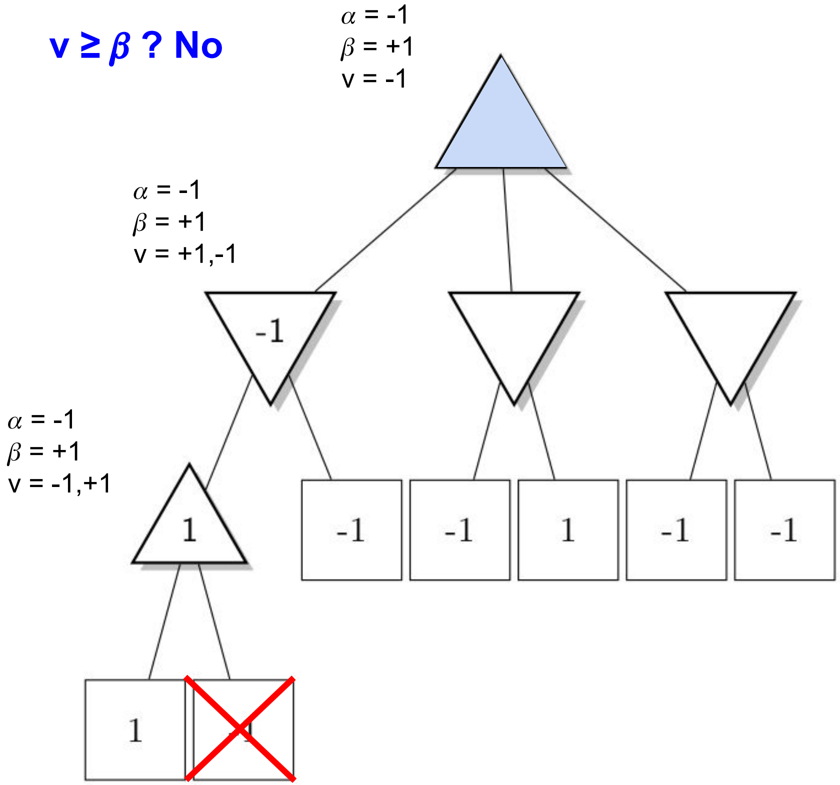


α-β Pruning

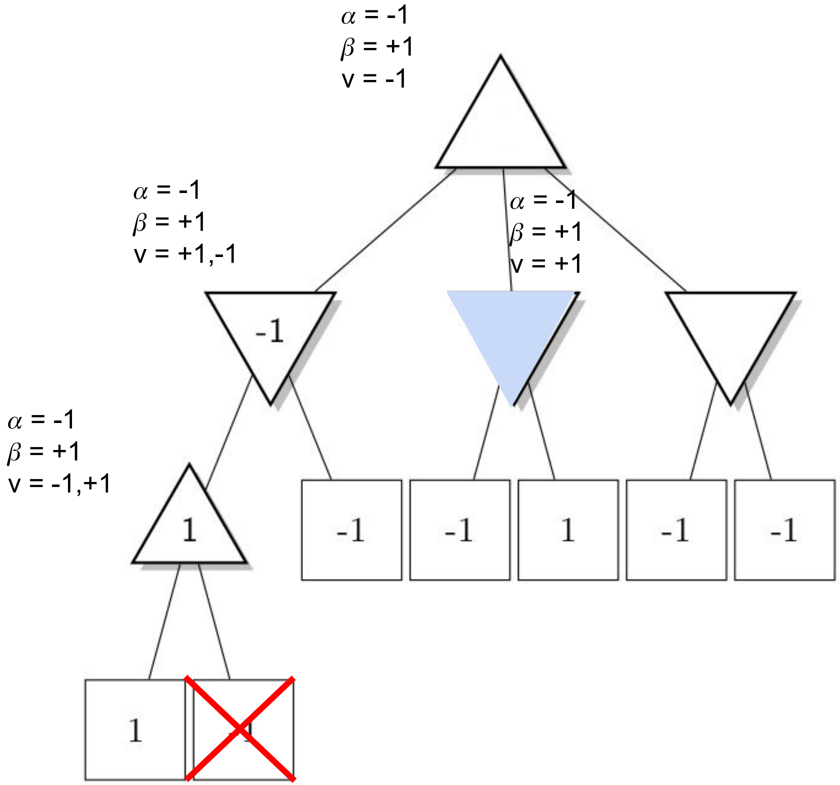
v ≤ α ? Yes → PRUNE (nothing to prune)



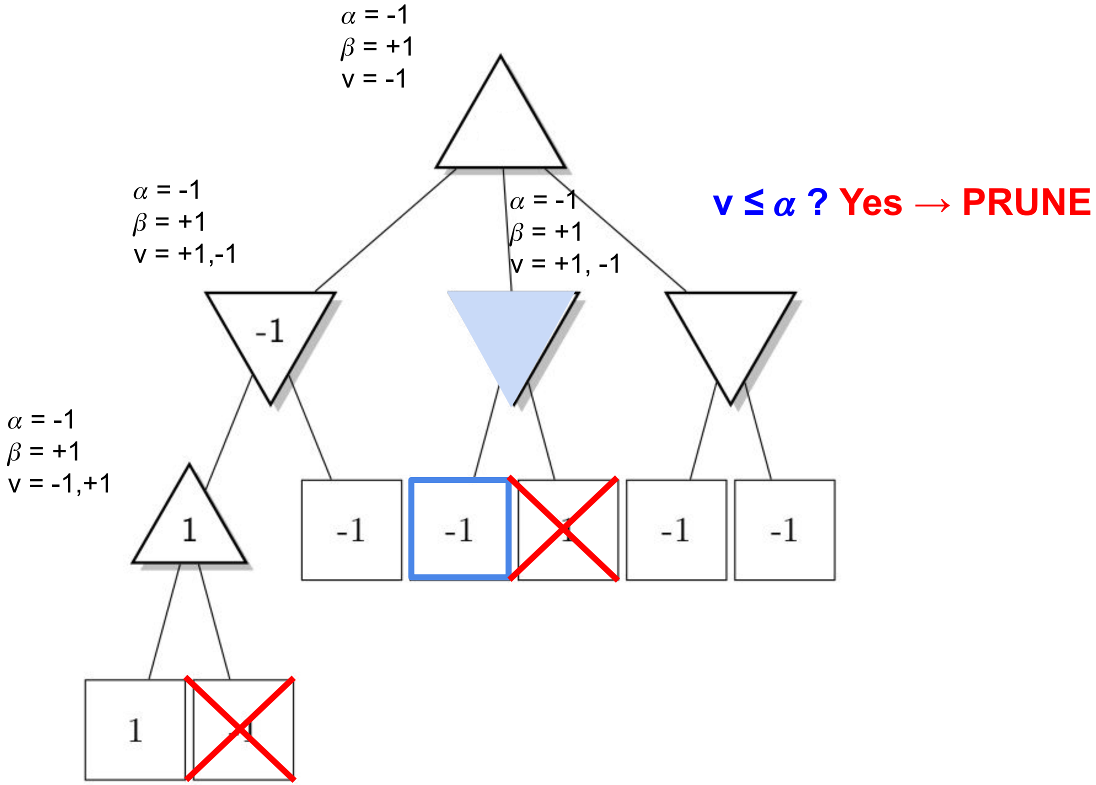
α-β Pruning



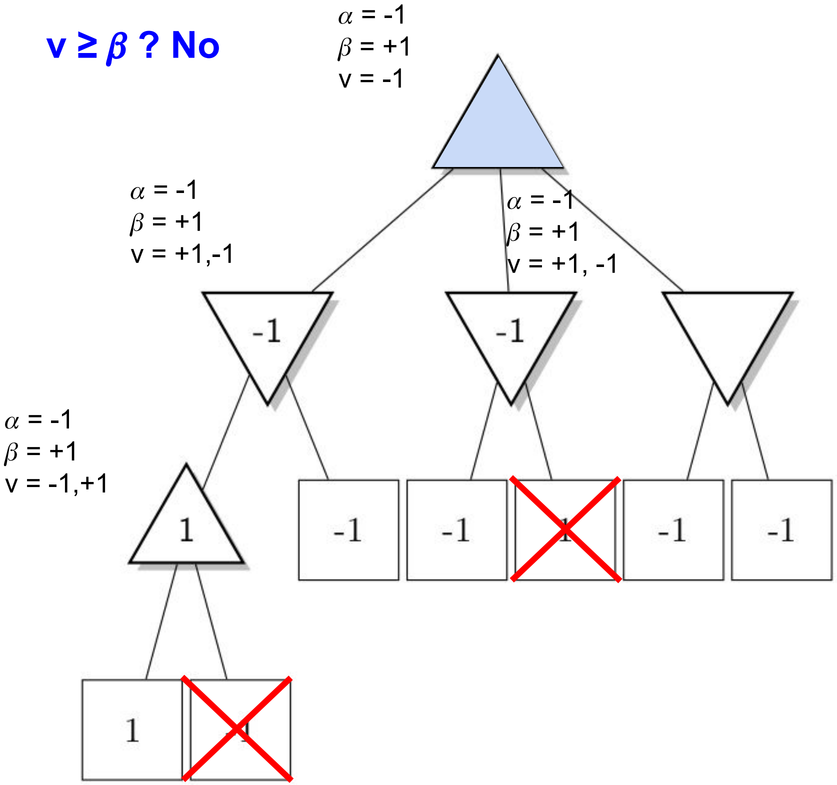
α-β Pruning



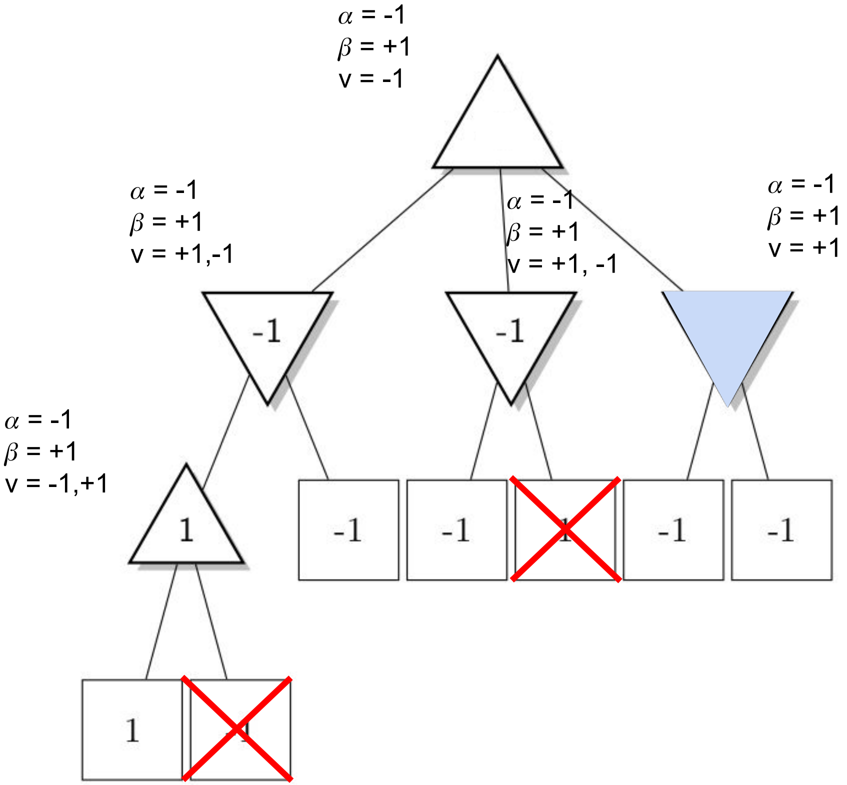
α-β Pruning



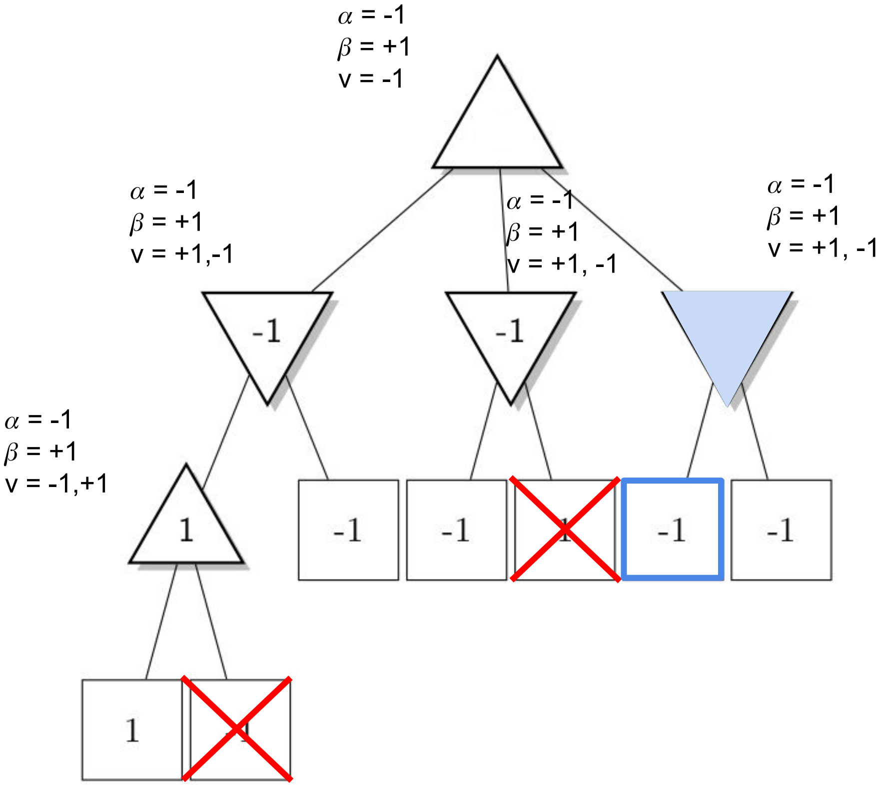
α-β Pruning



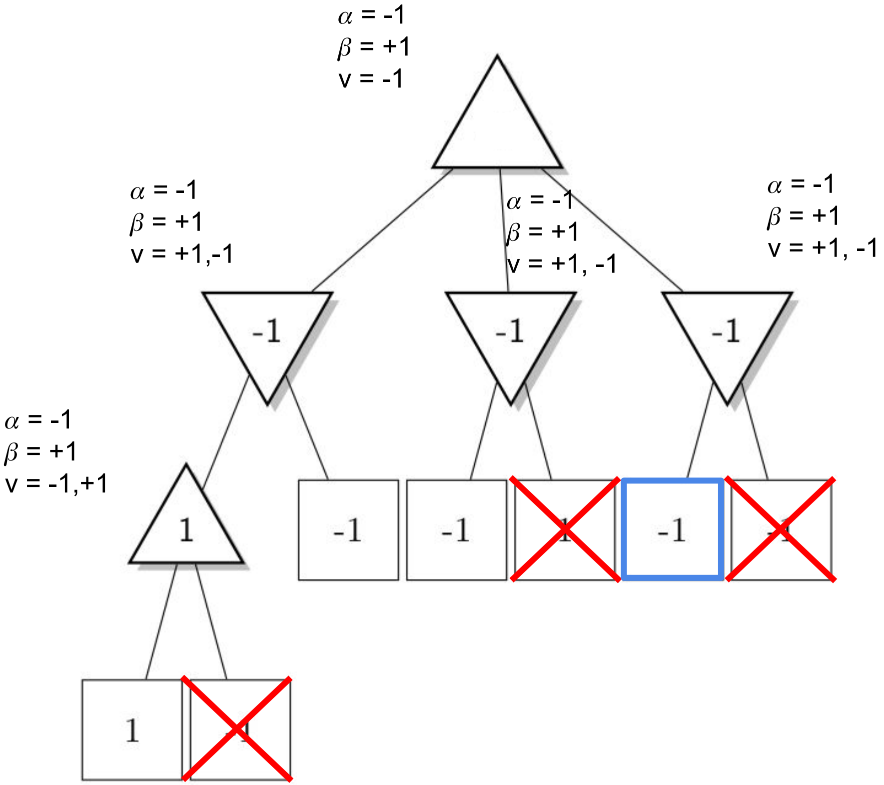
α-β Pruning



α-β Pruning



α-β Pruning



v ≤ α ? Yes → PRUNE

α-β Pruning