

The Game of Nim

Start with a pile of N stones. Players take turns removing 1, 2, or 3 stones from the pile on each turn. The player who ends up taking the last stone is the loser, so the goal is to force your opponent to have to take the last stone.

The complete minimax game tree for a game with 5 stones is shown below. Numbers in **red** show the static evaluation values for the terminal states from the point of view of "MAX" (the starting player). A -1 corresponds to a loss for MAX, and +1 to a win. Numbers in **blue** show the backed up minimax values for non-terminal states (those with more than 1 stone left). The backed up value of a node is just the minimum or maximum value of the node's children, depending on which level of the tree the node is on. A "maximizing" node corresponds to the starting player's turn. A "minimizing" node corresponds to the opponent's turn.

In the example below, all three moves from the root node result in -1, meaning that all possible moves from a state with 5 stones will lead to a loss for the starting player.

