

Nim Exercises

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1. Show that

17 1 1 1 1 1 1

Is an odd Board, by direct computation.

2. Show that the following Boards are Even

3 3 5 5 7 7 17 17
2 4 16 22

Generalize.

3. For people who have studied elementary combinatorics (Permutations and Combination) , how many distinguishable sub-boards are there of a 10x8 NIM Board ? Generalize to NxM
4. Consider the following NIM like game. We have only pile, but we have restrictions on the number of pieces that we can pick up. Suppose that we can only pick up 1,2, or 3 pieces.

What Boards are Winning Positions, and what is their Winning Moves, for both the Normal and the *Misere* form of the game.

[Note: A Board can simply a number M, and our moves consists of subtracting 1,2,... or N.]

You may it instructive to do a “Brute Force” Analysis of the game for small M. It is also a good programming exercise to write a “brute force” analysis. Here it is easy to represent the Boards; theya re just single positive integers.

You can generalize the(programming) problem by changing the game and stipulating a set of possible moves. For the game above, the set was {1,2,3, . . . N } If “1” is not an allowed move, then you may need to be more careful about specifying the rules.