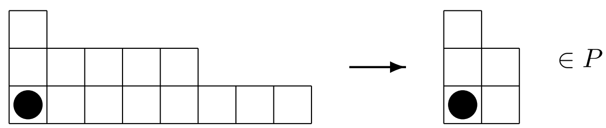
Stat 155 Fall 2009: Solutions to Homework 1

(was due September 10, 2009)

1. Chomp the square at (3,1), gobbling 9 pieces:



2. Using the binary expressions of the heap sizes,

$$9 = 1001, 10 = 1010, 11 = 1011, 12 = 1100$$

, and so the nim-sum of the heap sizes is:

$$9 \oplus 10 \oplus 11 \oplus 12 = 4.$$

Thus, the position is in N and a win for the next player. Since $4 = 0100$, the winning move would be to remove 4 chips from the heap of 12, so the nim-sum would reduce to 0. The new position would be $(9, 10, 11, 8)$.

3. The game of Nimble is just the game of Nim in disguise, if each coin is identified with a heap size, and the left-most slot is numbered 0. So a game with a single coin is single-heap nim, and if there are two coins on the same slot, this means that the corresponding nim game has two heaps of the same size, etc. If a coin moves to the left-most slot, that is equivalent to reducing that heap to 0. Now Bouton's solution can be applied to Nimble, and the starting P-positions are those in which the nim-sum of the initial coin positions is 0.