

NIM Winning Strategy

Fill in the blanks below so that you have a winning strategy for Nim.

1. Assume you start with **12 sticks** and the other person takes a turn.
 - a. If the person took 1 stick, then take _____ sticks
 - b. If the person took 2 sticks, then take _____ sticks
 - c. If the person took 3 sticks, then take _____ stick
 2. Now there are _____ sticks. The other person takes a turn.
 - a. If the person took 1 stick, then take _____ sticks
 - b. If the person took 2 sticks, then take _____ sticks
 - c. If the person took 3 sticks, then take _____ stick
 3. Now there are 4 sticks. The other person takes a turn.
 - a. If the person took 1 stick, then take _____ sticks
 - b. If the person took 2 sticks, then take _____ sticks
 - c. If the person took 3 sticks, then take _____ stick
 4. Now there are no sticks left!
-

Part 2. Wow, that was too many blanks. See if you can follow the shorter instructions below. Assume you start again with **12 sticks**.

1. Your opponent takes SOME_NUMBER of sticks.
 2. Fill in the blank with a number: You take _____ - SOME_NUMBER of sticks.
 3. If there are no sticks remaining, you have won! Stop.
 4. Go to step 1
-

Part 3. What if the game is played with some number of sticks that is *not* a multiple of 4. Could you follow the instructions below to win the game? Assume you are the first player.

1. The pile contains NUMBER_OF_STICKS
 2. Divide NUMBER_OF_STICKS by 4. Determine the REMAINDER.
 3. Take REMAINDER sticks.
 4. Now you can win the game!
-
- a. How many sticks would you need to take if the game starts with 13 sticks? _____
 - b. How many sticks would you need to take if the game starts with 19 sticks? _____