Nim is a simple math game that likely originated from the Chinese game 捡石子 (jiǎn-shízi, or picking up stones), which is hundreds of years old. You and a partner will take turns removing tokens from the playing field until one of you tricks the other into taking the last token. While the rules are simple, the strategy is complicated. Can you master the game of Nim?

MATERIALS

· 20 tokens (examples: coins, small stones, or scraps of paper)
· A friend to play with
· Science notebook or paper
· Something to write with

PROCEDURE

· Lay out tokens on a flat surface in a pyramid shape so that there is one in the first row, three in the second row, five in the third row, and seven in the fourth row.
· Play the game of Nim!
    – Two players will take turns picking up at least one token.
    – On your turn, choose a single row, and take as many tokens from it as you like.
    – Continue picking up tokens until all are gone.
    – The player who picks up the last token loses the game.
· Play several times, and see if you can begin to develop a strategy so that you win more often.

EXPLORE MORE

· Because this game is so old, there are many variations to it. One of these variations can be played by laying out 20 tokens in one single row.
· For this version of Nim, on your turn you can take one, two, or three tokens. Just like before, in order to win, get your opponent to take the last token. Try to develop a new strategy for this different version of Nim.
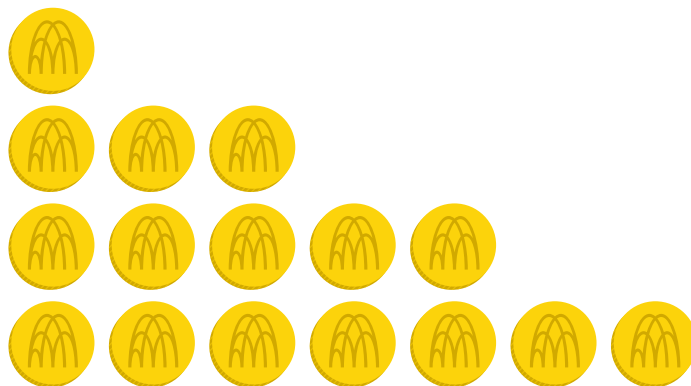
Example Game
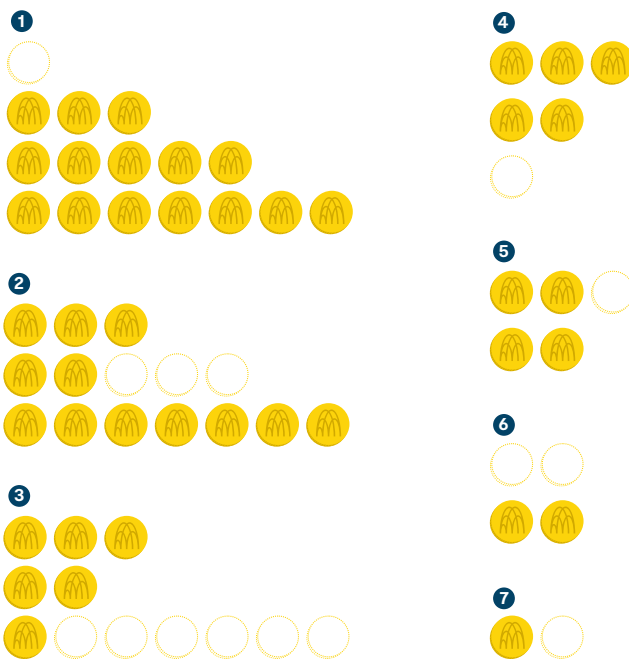
DID YOU KNOW?

At the 1939–1940 world's fair, a machine called the Nimatron wowed fairgoers with its excellent Nim strategy. Nimatron won the majority of the games it played against people. How was a machine able to defeat people? The Nimatron was an early version of a computer, and used electro-mechanical switches called relays to tell it which of a small set of pre-programmed moves to take at any time. If you can figure out the Nimatron's strategy, you can win almost every time.

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K–2 GRADE EXPLORATION

- When you take away tokens from the playing space, you are subtracting. In your science notebook, write an equation for how many tokens are left before and after your turn.

- Does the Nim board start with an odd or even number of tokens? How do you know?

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3–5 GRADE EXPLORATION

- Keep track of how many times the person going first wins the game out of the total number of games played. Write this number as a fraction in your science notebook.

- Write a fraction in your science notebook showing the number of times the person going second won.

- Looking at these fractions, would you rather go first or second?

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6–8 GRADE EXPLORATION

· Keep track of how many games are won by the player going first and how many are won by the player going second. Write this relationship as a ratio.

· When mathematicians want to develop a winning strategy for a game, they tend to break it down to the simplest version of the game. For our original ruleset for Nim, imagine that you have two rows left. One has one token and the other has three tokens. It is your move. What do you need to do to win?

· Now try increasing to three rows of one, three, and five tokens each. It is your turn to move. How do you win?

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