

Who Is Nimatron?

TCU Math Circle

Sept 7, 2019

Ice Breaker

Notakto The game starts with a tic-tac-toe board. 2 players play Rock-Paper-Scissors to determine who goes first (the winner of R-P-S gets to choose whether they go first or second).

Unlike in normal tic-tac-toe, both players use the same symbol (“X”), and the goal is to NOT get three-in-a-row. The player who creates the first three-in-a-row loses.

Questions to think about:

- Tic-tac-toe can sometimes end in a draw. Does Notakto ever end in a draw?
- Can you find a strategy that always allows you to win?
- Is it better to go first or second?
- Try the 2-board version - draw 2 tic-tac-toe boards. On each turn, players can add an X to whichever board they choose. Once a board has three-in-a-row, that board is dead and cannot be used any longer. The player who kills the last board loses.

Using these rules, you actually play with as many boards as you want!

- Is it better to go first or second in the 2-board version?

Nim and Nim-Type Games

1. **Nim:** The game starts with several piles of coins in front of two players.

Players take turns removing coins from the table. They do this by choosing a pile, and taking as many coins as they want from this pile.

A player must take at least one coin on every turn, and they can only draw from one pile per turn. However, they can draw from any pile they want.

The player who takes the last coin from the table wins!

2. **Misère Nim:** Misère Nim is played in the same way as classic Nim described above, except that the player who takes the last coin from the table **loses!**
3. **The 100 Game:** Starting at 0, two players take turns adding any whole number from 1 to 10 to a common sum. The player who causes the sum to reach 100 wins!

4. **Pots of Gold:** Several stacks of gold pieces are lined up in front of two players. (Both players must sit on the same side.) There is also a bank with a extra gold that may be added to the pots.

Taking turns, each player selects one pot and removes exactly one gold piece from it. If they so desire, they may also add any finite amount of gold to any pot(s) to the LEFT of the one they drew from.

The player who takes the last gold piece wins!

5. **Chomp:** The game starts with a grid representing a bar of chocolate divided into squares. On each turn, a player chooses any square of chocolate on the bar, and chomps the chocolate bar to eat the square. However, in order to get to that square, they must also eat any squares above it or to its right.

Both players also know that the bottom left square of chocolate has been poisoned, so of course they want to avoid that square. The player who eats the poisoned square loses!

Other Games

1. **Sprouts:** The game starts with a 2-3 spots drawn on the board.

Players take turns drawing on the board. On each turn, a player draws a line or curve connecting two spots (or a loop connecting one spot to itself), and then draws a new spot somewhere along their line. However, the new line cannot cross itself or any previously drawn line, the new spot cannot lie on top of a previously drawn spot, and no spot can have more than three line segments connected to it.

The last player able to draw a valid line wins!

2. **Borsenco:** Start with a large grid. Each player chooses a different color of marker, and the players take turns filling in spaces on the grid. As soon as a player fills in any four spaces that form the four corners of a square, that player wins!
3. **Strings and Coins:** The game starts with several spots (“coins”) drawn on the board, with several lines or curves (“strings”) connecting spots to each other. Every spot must be connected to at least one other spot.

Players take turns ”cutting the strings“ by erasing an edge. If that leaves a coin free with no strings attached to it, then the player gets to keep that coin and take another turn.

4. **Jo’s Pennies and Paperclips:** Start with a 6×6 checkerboard, two coins, and 17 paperclips. Determine which player will play as Pennies, and which will play as Paperclips.

Pennies starts by placing the pennies on any two squares of the board. Paperclips then uses paperclips to cover the rest of the board, with each paperclip covering 2 squares. Paperclips wins if they can successfully cover the board. If not, then Pennies wins.

- What happens if the board has different sizes or shapes?

5. **Domineering:** Start with a 6×6 checkerboard and 18 paperclips. Players take turns placing a paperclip on the board so that each paperclip covers two squares. However, the first player must place their paperclips horizontally, and the second player must play their paperclips vertically. The last player who is able to make a move wins!

- What happens if the board has different sizes or shapes?
- What happens if players are free to play a paperclip in either direction?

6. **Fox and Geese:** Start with an 6×6 checkerboard, three small coins (the Geese) and one big coin (the Fox). Determine which player will play as the Geese, and which will play as the Fox.

The Geese start lined up on the shaded squares along the bottom edge of the board. The Fox starts on any shaded square. Players alternate turns moving their checkers, with Geese moving first.

On the Geese's turn, one goose moves one square diagonally up, away from their starting line. The Geese can never retreat down toward the starting line - they can only move up!

On the Fox's turn, the fox moves one square diagonally in any direction.

The pieces must stay within the board, and two pieces cannot occupy the same square. The first player who is unable to make a move loses. Therefore, the Fox's goal is sneak below all of the Geese, and the Geese's goal is to corner the Fox so it cannot move!

7. **Get Bit:** This game is for 4-6 players.

The game starts with each player choosing a color, and taking a swimmer and a stack of numbered cards in that color. The numbers should go from 1 to one more than the number of people playing. (For example, for 5 players, the cards should go from 1 to 6.) The players put their swimmers in a line in a random order (so one swimmer is in the lead, the next swimmer behind them, and so on).

There is a shark in the water behind the swimmers, and they are all trying to swim away as fast as they can!

Each player chooses a numbered card from their hand and places it face down on the table. When each player has chosen a card, everyone reveals their cards at once. If two players chose the same number, then they do not get to move their swimmers this round. The player with the lowest untied number moves their swimmer to the front of the line, then the player with the next lowest untied number moves, and so on. Once everyone with an untied number has moved, the shark bites a limb (either an arm or a leg) off of the last swimmer in line. This swimmer then moves to the front of the line. That player picks up their card(s) from the table; all other players leave their used cards on the table (unless they are out of cards in their hand).

Repeat these three steps each round - everyone plays a card, players with untied numbers move up in the line, and the swimmer in the back gets bit.

Once a swimmer has lost all 4 limbs, that player is out. As soon as there are only 2 swimmers left, the shark immediately eats the one in the back, and the one in the front wins!

