Nimx

Basic 10-Liner for the NOMAM 2014 Competition

by Cliff Hatch

The Game

Nimx plays the traditional game of Nim.

Nim is a children's game. It's a stepping stone to richer games of strategy like draughts and chess. It is also an interesting case study in the development of game theory because it has a very neat mathematical solution.

The rules are simple:

- The game starts with rows of counters.
- The players take turns to remove one or more counters from a single row.
- The player who removes the last counter wins.

The Program

Nimx is written in Turbo-Basic XL 1.5, see file NIMX.BAS on the accompanying disc.

It plays from a starting position with 3 rows of 3, 4 and 5 counters.

You play against the computer.

The program randomly chooses who moves first.

Move Notation

Nimx inputs and displays moves as 2 numbers separated by a comma, e.g.:

- **1,2** operates on row 1 and removes 2 counters.

If the program cannot interpret your move it asks you to enter it again.

Mathematical Solution

In 1901 Charles Leonard Bouton, associate professor of mathematics at Harvard University, published an algorithm for playing Nim rationally. [1, 2]

Nimx uses this algorithm. It never misses an opportunity to win. However, you may beat it if your first move of the game is from a favourable position and you too play rationally.

Bouton's algorithm works for any starting position, with unlimited numbers of counters and rows.

New Start Positions

Line 0 of Nimx contains a DATA statement which defines the number of rows followed by the number of counters in each row. You may alter this to set up new start positions.

The disc contains some examples:

- NIM356.BAS (3 rows of 3, 5 and 6 counters)
- NIM456.BAS (3 rows of 4, 5 and 6 counters)
- etc.

The program's display can cope with 20 rows of 34 counters. However, there is really no incentive to approach these limits.

History

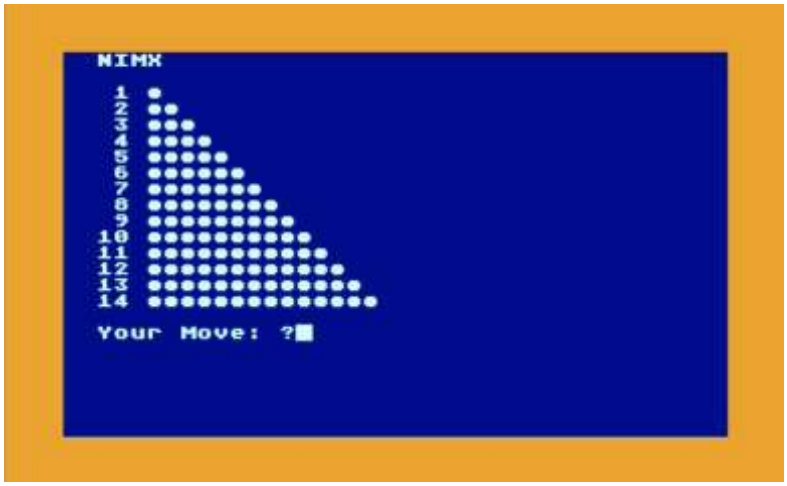
The first Nim playing machine was the Westinghouse Nimatron, built in 1940; followed in 1941 by a machine designed by Raymond M. Redheffer; and the Ferranti Nimrod in 1951. These all used Bouton's algorithm.

The Nimatron and Nimrod created great excitement because they provided some of the earliest public demonstrations of machines apparently outperforming humans at intellectually demanding tasks.

When Nimrod was exhibited at the Berlin Trade Fair in 1951 it was reported to be so popular that the visitors *"entirely ignored a bar at the far end of the room where free drinks were available".* [2]

Nimx gives some inkling why there was so much interest.

Although Nim is a children's game, it becomes difficult when it is scaled up. The Nimatron and Nimrod both illustrated this clearly using 4 rows of up to 7 counters. Nimx can take the illustration further by supporting even larger positions, such as the one shown below (NIM14T.BAS on the disc):



It is almost impossible for humans to play rationally from such positions, but it is no problem whatsoever for machines.

There may be some Nim prodigies who could win this game (just as there are Chess and Rubik's Cube prodigies), but for most of us the contest is over – and the machines have won! In the 1940's and 50's this was a startling realisation.

References

1. Wikipedia: http://en.wikipedia.org/wiki/Nim
2. "Mathematical Puzzles and Diversions", Martin Gardner, Pelican, 1966.