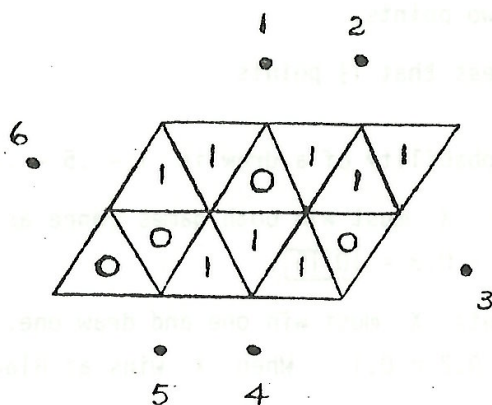# A NEW GRID PUZZLE

BY

ANDREW JENKINS[*]

I have recently discovered a diversion which may be of interest to readers.

This puzzle begins with 0's and 1's arranged in a grid shaped as below. Each move consists of flipping two rows of this array so that every 0 in the chosen rows becomes a 1 and every 1 in the chosen rows becomes a 0. The only other rule is

that the two lines along which the elements are flipped must intersect at one of the numbered points. The moves can be recorded by a notation such as f4, for example, which means that all the elements on the two lines intersecting at 4 are to be flipped. Here is an example of two moves starting from the position shown above.

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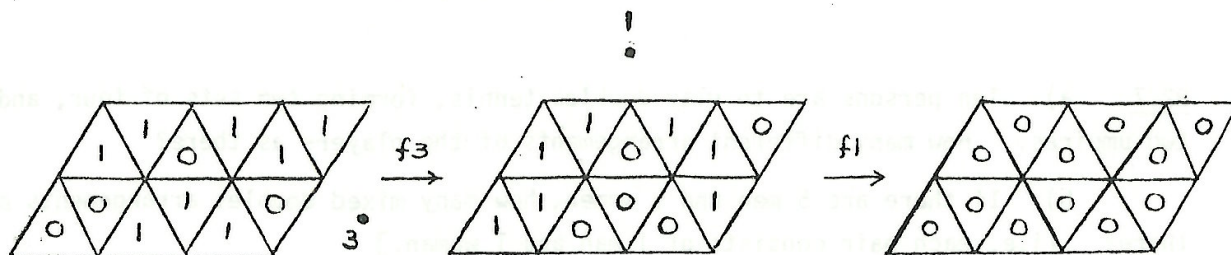
* Andrew Jenkins is a Year 9 student at North Sydney Boys' High.

The object of the game is to find a sequence of moves so that all the elements on the grid become 0's. Thus the moves f3 and f1 solve the puzzle for the initial position shown above.

Readers may like to consider the following questions.

1. Is it possible to solve the puzzle starting from any initial position?
For example, is it possible to change a grid on which all elements are 1 to one on which all elements are 0?
Can you solve the puzzle if the initial position has just one 1?

2. What initial position requires the longest sequence of moves for its solution (assuming you use the most efficient method).

3. Is it possible to solve the puzzle using only the lines intersecting at 1, 2, 4 and 5?

4. Investigate sequences of moves which start from the position with all elements 0, disorganise the array, and then return to the position with all elements 0, but such that the second half of the sequence is not just the reverse of the first half.
Find out how to produce interesting patterns of 0's and 1's.

When you have solved all these problems, try the same questions for a grid with elements 0,1 and 2 and flips which change 0 to 1, 1 to 2 and 2 to 0. Or you could consider parallelograms with different dimensions and, if you finish that, how about 3, 4, 5, 6, ... dimensional arrays.

It would be quite easy to make an electronic version of this puzzle using LED's for the 0's and 1's and driving them with multivibrators.

EDITOR'S NOTE.

Can you devise a game for two players based on Andrew's puzzle? Perhaps it should incorporate some of the features of noughts and crosses or "Othello". Keen computer programmers might like to program the game for a computer.

Let us know how you get on.

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