A Probability Game

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◆INTRODUCTION◆

I DISCOVERED this simplified form of snakes and ladders in an informal publication some years ago (ATM(1966)).It has proved to be a useful starting point for an open ended statistical project for 16-17 year old pupils (i.e. those who are starting their A-level course). It fits in well with their developing knowledge of pure mathematics and of probability and statistics. Figure 1 shows the layout of the simplified snakes and ladders board.

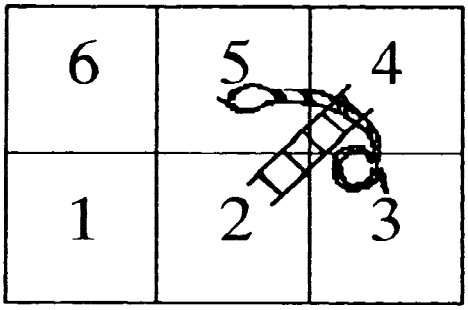

Fig 1. The simplified snakes and ladders board

As the starting point is one that is designed to initiate open ended enquiry, the players negotiate the rules that they use. The players need to be clear about the rules of their game, just as in pure mathernatics where there is a need to be precise about the axioms for mathematical structures. Rather unadventurously, many students choose to follow the normal rules of snakes and ladders with the usual type of dice. It's clearly unhelpful to require a six before a player starts! Perhaps the easiest rule for finishing is that a player needs to land on or past the square marked 6, otherwise further legislation about overthrows is needed. One group of students decided that the last player to finish, rather than the first, would be the winner.

The game provides an activity in which chance and probability can be experienced, in a situation where the theoretical probability of events is not immediately obvious. Probability experiments, involving dice and coins, done by the pupils when they were younger, may have had easily determined theoretical probabilities. Pupils often think and talk about these as being 'the right answer' and may form attitudes that devalue experimental probability based on data collected in the situation.

The game is an interesting application of pure mathematics work on series if probabilities are calculated theoretically given the assumption of a fair die. The calculation of, say, the probability of finishing in exactly 2 moves (for the case of normal rules and finishing by landing on or past the 6 square) is fairly straightforward:

p(finishing in exactly 2 moves) = $\frac{1}{6}\frac{2}{6} + \frac{2}{6}\frac{5}{6} + \frac{2}{6}\frac{4}{6} = \frac{5}{9}$

Generalising to finding the probability of taking exactly *n* moves is more difficult. In a two player game, the first player obviously has an advantage and the calculation of that advantage is a useful extension problem.

Extensions to the activity have included varying the dice used, modifying the board to have 4, 8 or 9 squares and devising similar modifications to other well known games (e.g. dominoes with a limited number of pieces).

The board shown in figure 2was devised to be one of the simplest games to analyse; a tetrahedron die was used.

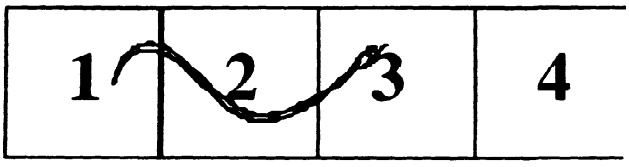

Fig 2.

A die with scores from 0 to 9 inclusive was used with the board shown in figure 3.

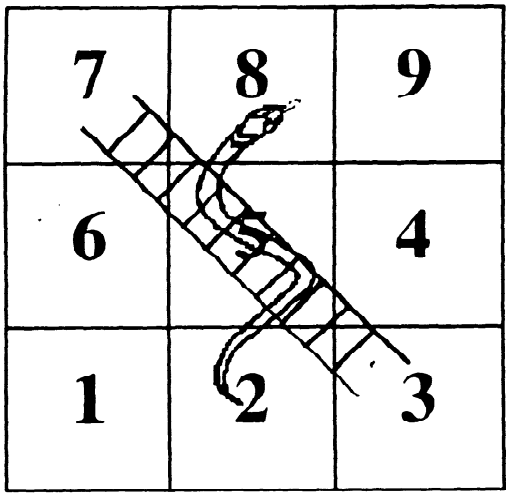

Fig 3.

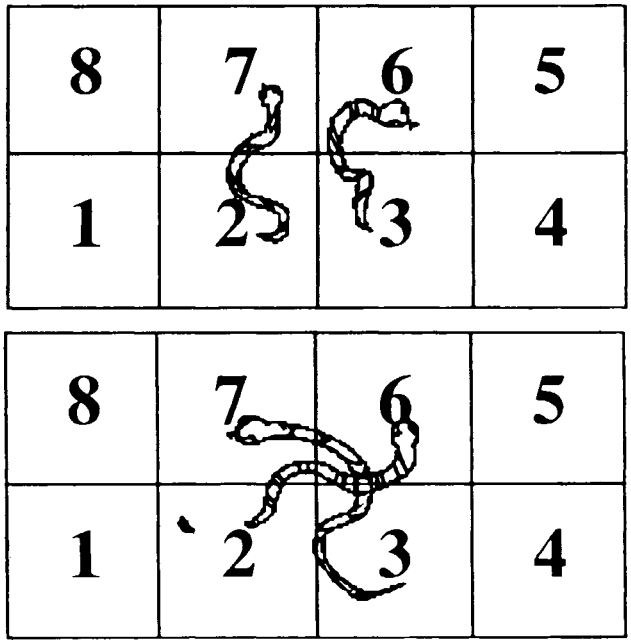

Fig 4.

One group of pupils became interested in investigating the similarities and the differences between the two boards shown in figure 4 and other such arrangements with nested rather than intersecting snakes,

Reference

ATM (1966) *The development of mathematical activity in children - The place of the problem in this development.* Association of Teachers of mathematics

Commercially produced polyhedra dice may be obtained from various sources including:
Tarquin publications, Stradbroke, Diss, Norfolk.