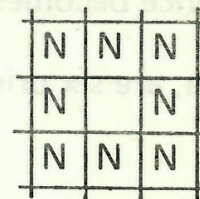


MATHEMATICAL GAMES

LIFE

The game "Life", invented by British mathematician John Conway, is, like Solitaire, a game you can play by yourself. It can be played using pencil and paper, but you may find it easier to use flat counters of two colours on a board laid out in squares. (We shall discuss the game as if this is what you are doing.)

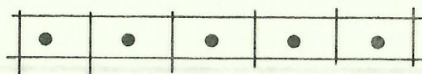
Rules of the game: The idea of the game is to start with a simple arrangement of counters, one to a square, and then to observe how this pattern changes according to the following laws. Note that each square of the board has eight neighbouring squares (marked N) and counters on neighbouring squares will be called neighbours of the original square.



- (1) *Survival:* Every counter with 2 or 3 neighbours survives to the next generation.
- (2) *Death:* Each counter with 4 or more neighbours dies (and is removed) from over-crowding, while each counter with fewer than 2 neighbours dies from isolation.
- (3) *Birth:* A birth occurs in any vacant square exactly 3 of whose neighbouring squares are occupied.

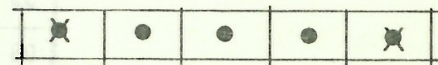
Note that all births and deaths occur *simultaneously*. Together they constitute a single generation in the life of the pattern.

To understand this last comment, it may help to study the life and growth of one particular pattern of five counters in a row using black counters marked •.

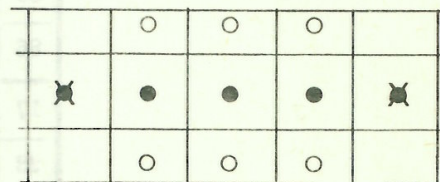


I

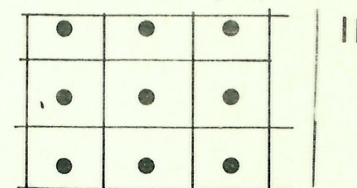
- (a) Locate all counters that will die, and identify them by putting another black counter on top of each of them (marked with ✕).



- (b) Locate all vacant squares where a birth will occur, and put a counter of the other colour (say white) in each of them (marked with o).



- (c) Remove all dead counters (piles of two), and replace all white counters with black counters. This gives the next generation (II).



II

Steps (a), (b), (c) are now repeated to give the next and subsequent generations.

