

Ri Off the Shelf Masterclass: Modelling Forest Fires

Worksheet 1 – Spreading Dye

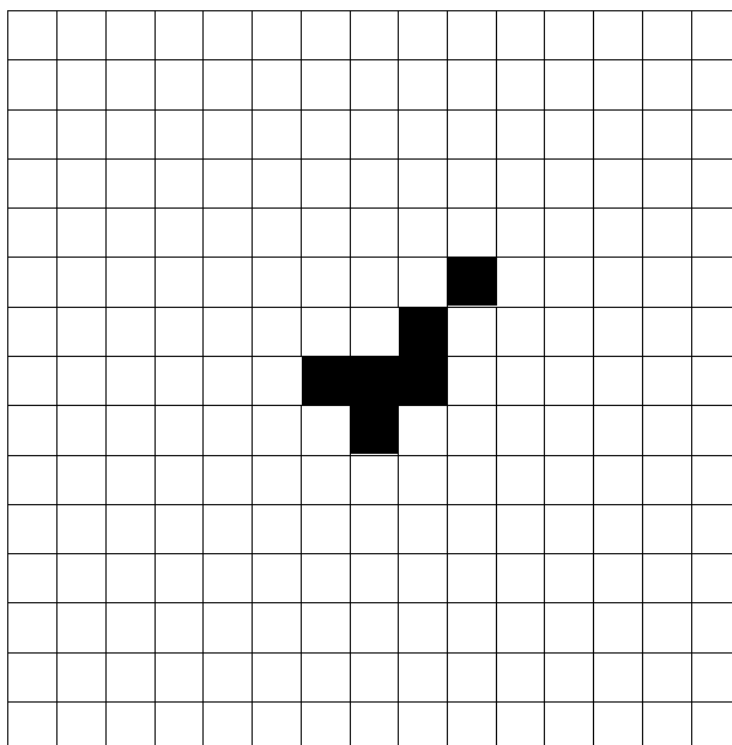
The black squares are stained with a dye. Empty cells (squares) which have **three or more** dyed neighbours become dyed. Cells which become dyed stay dyed. The dye spreads in time-steps, with all changes happening **once per time-step**. Model the spread of the dye on the diagram below. *It is easiest to use a new colour/pattern for each time-step so that you can mark the spread of the dye as you go along.*

For **each** time-step:

1. Choose a new colour.
2. Work out which cells have any dyed neighbours. Mark these with a dot.
3. For each dotted cell, work out whether it will become dyed – it must have 3 or more neighbours that became dyed **before this time-step**. If yes, colour in the cell.

Top tip: don't forget the diagonals, and make sure you are not counting cells dyed in this time-step (i.e. coloured in using your current colour).

4. Once you have worked out all the cells which will become dyed it is the end of the current time-step. The cells you have just coloured in are now classed as dyed.

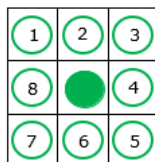


How does the dye spread? Does the speed change as more cells become dyed (ignoring step 0, which is the starting configuration)? Fill in the table. If you have time, keep going for more steps, or turn over to look at Conway's Game of Life.

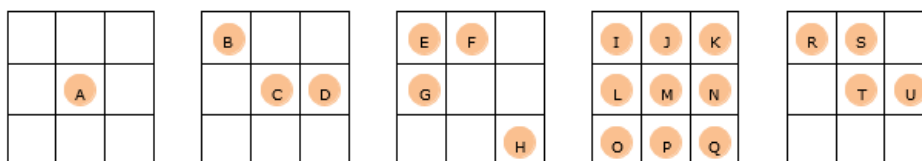
Time-step	0	1	2	3	4	5	6	7	8
Colour used									
# <u>new</u> cells dyed	6								

Counting Neighbours: Game of Life

Each live cell (green dot) can have **up to** eight neighbours in the squares immediately next to it and immediately diagonal to it:



Look at the following arrangements. **Live cells are shown with a dot** and have been given a letter. We will assume that there are no live cells outside the grid.



1. How many **live** neighbours does each counter have? Fill in the table:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U

Live cells are like living creatures. We can look at each generation to see how populations change. At the end of each generation:

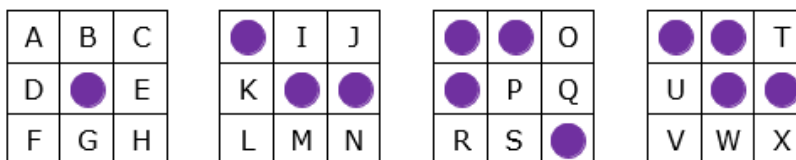
- A creature with no live neighbours or only one live neighbour will get lonely and die.
- If a creature has four or more live neighbours it will die due to overcrowding.
- If a creature has two or three live neighbours it will stay alive.

2. In the above arrangements, which live cells will die from loneliness?

3. Which live cells will die from overcrowding? _____

4. Which live cells will stay alive? _____

Now look at the **empty** squares. These have been given letters; the **live cells are dotted**. An empty cell with **exactly three neighbouring live cells** will be filled by a new birth.



5. How many neighbouring live cells does each empty cell have? Fill in the table:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X

6. Where will there be a new birth? _____