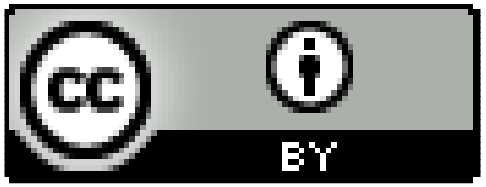
Program Design

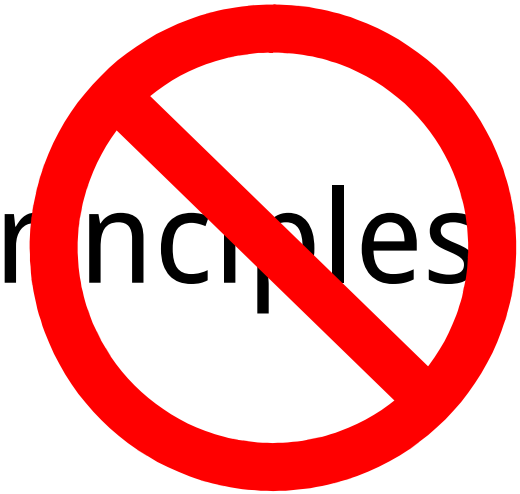
Invasion Percolation: Background



Program Design

principles of

Program Design



principles of Program Design

examples of

Program Design

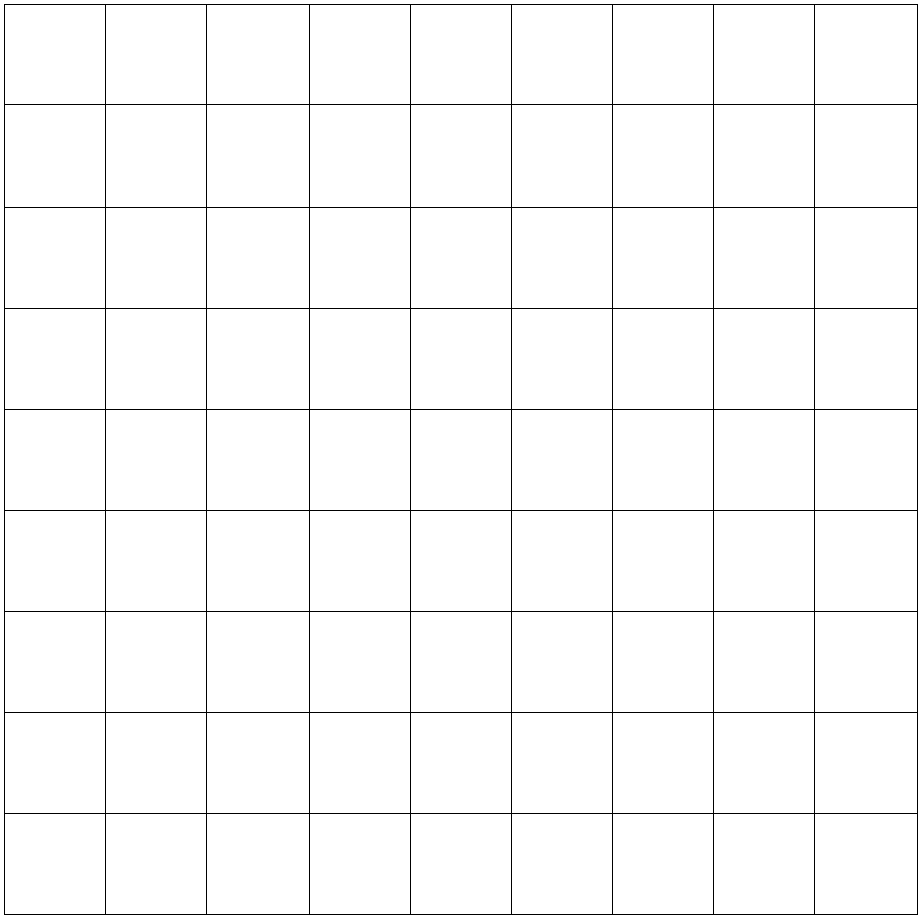
examples of

Program Design

invasion percolation

fractured rock

How far will pollution spread?



- 2D grid

5	3	7	2	6	1	1	3	4
8	5	6	5	7	2	3	6	2
2	5	8	7	5	5	6	5	9
5	2	6	4	9	3	9	6	5
4	6	8	8	5	9	7	3	9
7	6	4	5	1	2	6	8	5
5	4	2	5	8	5	5	5	8
5	7	5	1	5	3	8	5	5
4	5	1	9	7	8	6	5	1

- 2D grid
- Random values

5	3	7	2	6	1	1	3	4
8	5	6	5	7	2	3	6	2
2	5	8	7	5	5	6	5	9
5	2	6	4	9	3	9	6	5
4	6	8	8	5	9	7	3	9
7	6	4	5	1	2	6	8	5
5	4	2	5	8	5	5	5	8
5	7	5	1	5	3	8	5	5
4	5	1	9	7	8	6	5	1

- 2D grid
- Random values
- Fill center cell

5	3	7	2	6	1	1	3	4
8	5	6	5	7	2	3	6	2
2	5	8	7	5	5	6	5	9
5	2	6	4	9	3	9	6	5
4	6	8	8	5	9	7	3	9
7	6	4	5	1	2	6	8	5
5	4	2	5	8	5	5	5	8
5	7	5	1	5	3	8	5	5
4	5	1	9	7	8	6	5	1

- 2D grid
- Random values
- Fill center cell
- Examine neighbors

5	3	7	2	6	1	1	3	4
8	5	6	5	7	2	3	6	2
2	5	8	7	5	5	6	5	9
5	2	6	4	9	3	9	6	5
4	6	8	8	5	9	7	3	9
7	6	4	5	1	2	6	8	5
5	4	2	5	8	5	5	5	8
5	7	5	1	5	3	8	5	5
4	5	1	9	7	8	6	5	1

- 2D grid
- Random values
- Fill center cell
- Examine neighbors
- Fill lowest valued

5	3	7	2	6	1	1	3	4
8	5	6	5	7	2	3	6	2
2	5	8	7	5	5	6	5	9
5	2	6	4	9	3	9	6	5
4	6	8	8	5	9	7	3	9
7	6	4	5	1	2	6	8	5
5	4	2	5	8	5	5	5	8
5	7	5	1	5	3	8	5	5
4	5	1	9	7	8	6	5	1

- Repeat

5	3	7	2	6	1	1	3	4
8	5	6	5	7	2	3	6	2
2	5	8	7	5	5	6	5	9
5	2	6	4	9	3	9	6	5
4	6	8	8	5	9	7	3	9
7	6	4	5	1	2	6	8	5
5	4	2	5	8	5	5	5	8
5	7	5	1	5	3	8	5	5
4	5	1	9	7	8	6	5	1

- And repeat

5	3	7	2	6	1	1	3	4
8	5	6	5	7	2	3	6	2
2	5	8	7	5	5	6	5	9
5	2	6	4	9	3	9	6	5
4	6	8	8	5	9	7	3	9
7	6	4	5	1	2	6	8	5
5	4	2	5	8	5	5	5	8
5	7	5	1	5	3	8	5	5
4	5	1	9	7	8	6	5	1

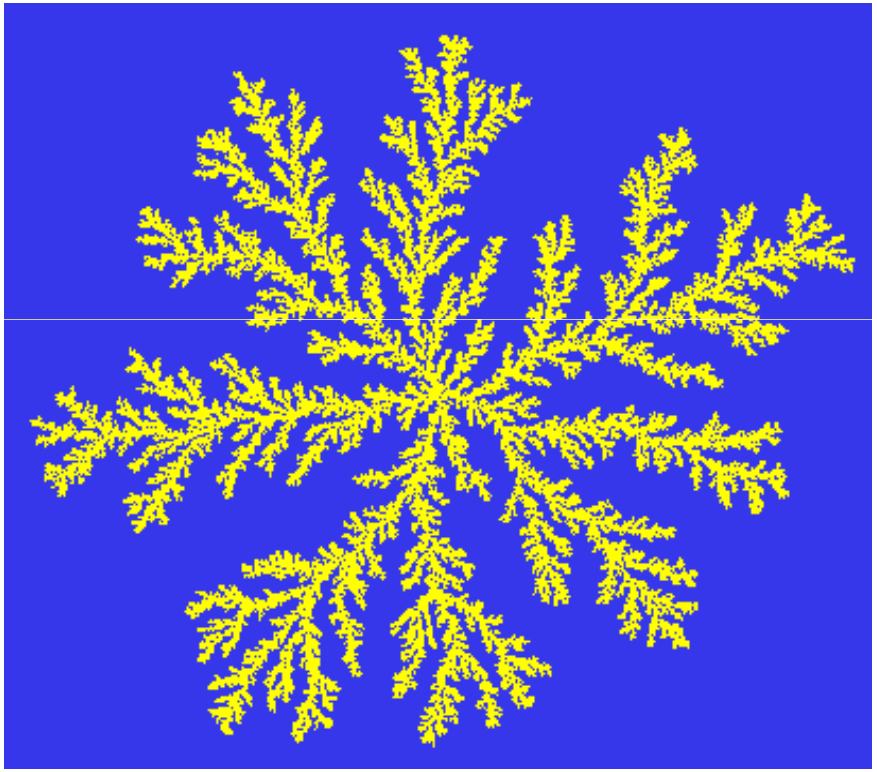
- In case of tie...

5	3	7	2	6	1	1	3	4
8	5	6	5	7	2	3	6	2
2	5	8	7	5	5	6	5	9
5	2	6	4	9	3	9	6	5
4	6	8	8	5	9	7	3	9
7	6	4	5	1	2	6	8	5
5	4	2	5	8	5	5	5	8
5	7	5	1	5	3	8	5	5
4	5	1	9	7	8	6	5	1

- ...pick one at random

5	3	7	2	6	1	1	3	4
8	5	6	5	7	2	3	6	2
2	5	8	7	5	5	6	5	9
5	2	6	4	9	3	9	6	5
4	6	8	8	5	9	7	3	9
7	6	4	5	1	2	6	8	5
5	4	2	5	8	5	5	5	8
5	7	5	1	5	3	8	5	5
4	5	1	9	7	8	6	5	1

- Stop at edge of grid



Statistical properties of the fractals produced answer the original question about how far pollution will spread.

Need to do lots of simulations...

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...on large grids

Need to do lots of simulations...

...on large grids

→ Program has to be *fast*

- How do we do it at all?

- How do we do it at all?
- How do we tell that it's correct?

- How do we do it at all?
- How do we tell that it's correct?
- How do we make it fast?

created by

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