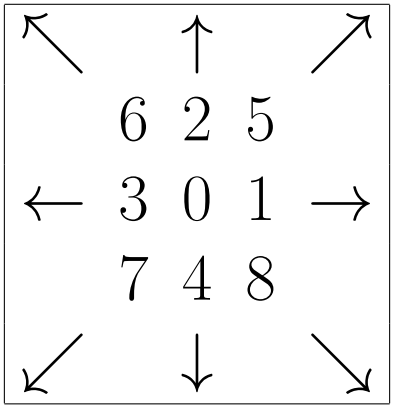
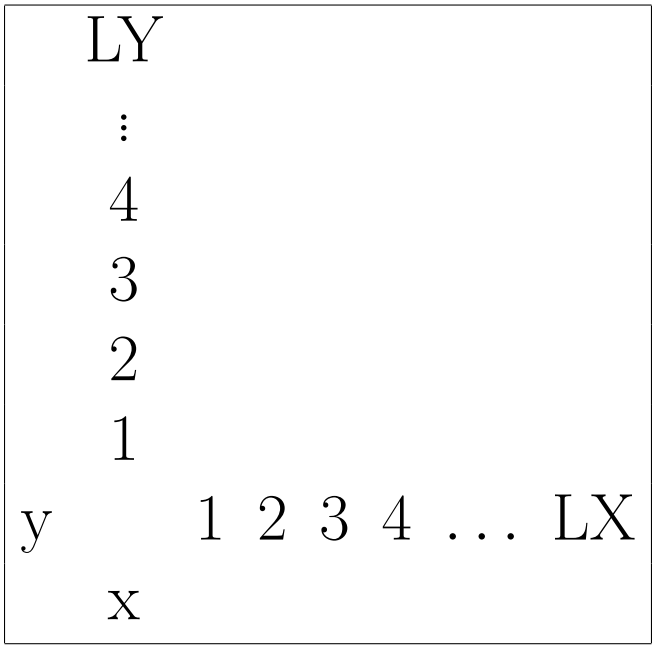
Geometry D2Q9

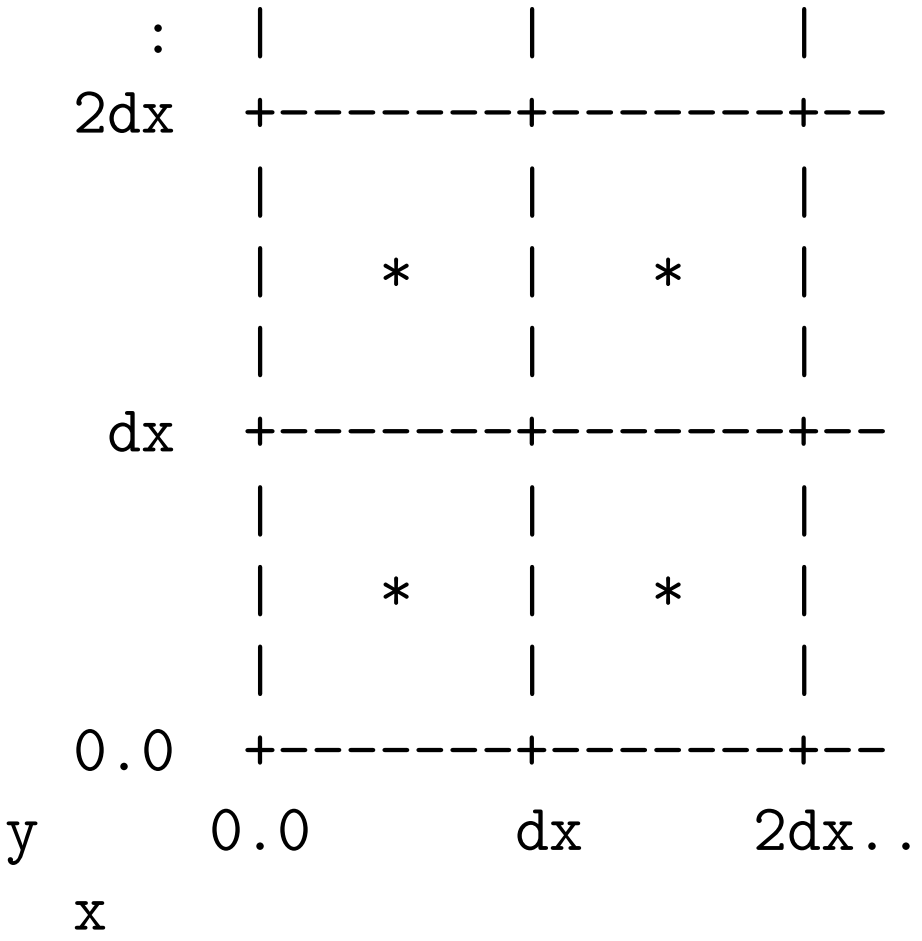


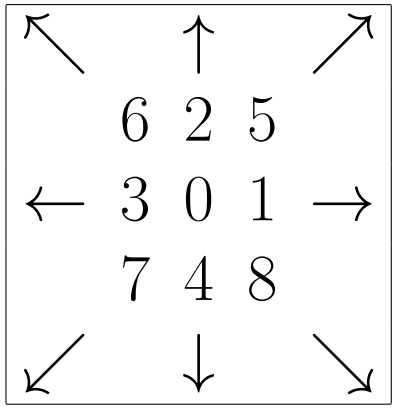
Lattice Boltzmann

- No explicit Calculus in the method.
- Straightforward to parallelize.

Grid

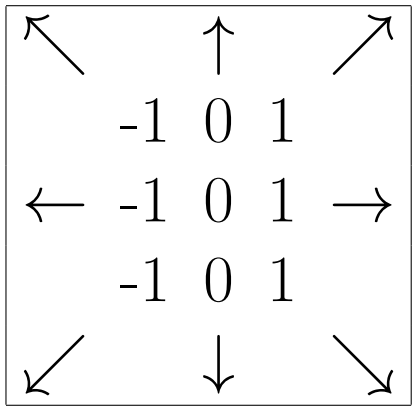



:
2dx
dx
0.0
0.0
dx
2dx..
y
x

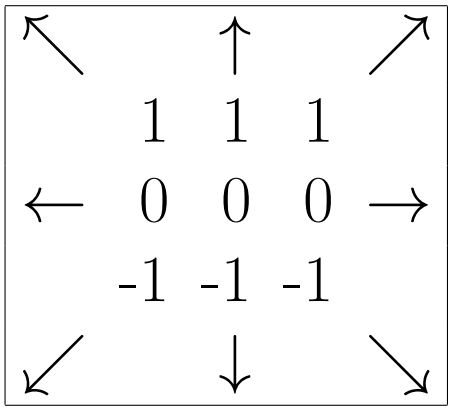

6 2 5
3 0 1
7 4 8

Vectors

x_i



y_i



Weights

w_i

$\nwarrow$		$\uparrow$	$\nearrow$
	1	4	1
$\leftarrow$	4	16	4 $\rightarrow$
	1	4	1
$\swarrow$		$\downarrow$	$\searrow$

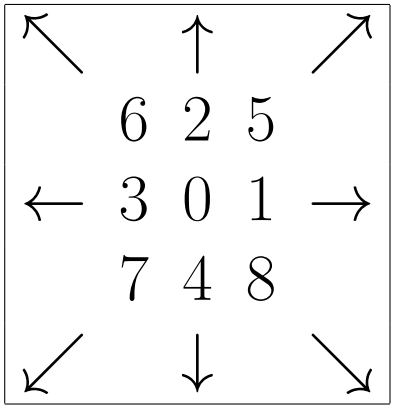
$\hat{w}_i$

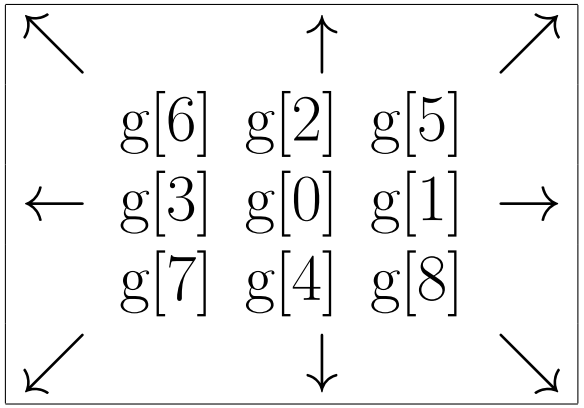
$\nwarrow$		$\uparrow$	$\nearrow$
	1/36	1/9	1/36
$\leftarrow$	1/9	4/9	1/9 $\rightarrow$
	1/36	1/9	1/36
$\swarrow$		$\downarrow$	$\searrow$

Parameters, for example

- $\Delta x = 0.004$
- $\nu = 0.0025$
- $\omega = 1.5$
-
- $\Delta t = \frac{(\Delta x)^2}{\nu} \cdot \frac{2-\omega}{6\omega}$
- $c = \Delta x / \Delta t$
- $\sigma = 5/12$
- $\lambda = 1/3$
- $\gamma = 1/12$

Distribution, g





- At first just read all the g's from our `gfield.txt` file.
- In this case the grid size $LX \times LY$ is 250×250.

Flow Field

- Velocity components sum over each g.

$$v_x = \sum_i (c x_i g_i)$$
$$v_y = \sum_i (c y_i g_i)$$

- Incompressible. Pressure also a sum.

$$p = \frac{c^2}{4\sigma} \cdot \left(\frac{1.5 \hat{w}_0 (v \cdot v)}{c^2} + \sum_{i \neq 0} g_i \right)$$