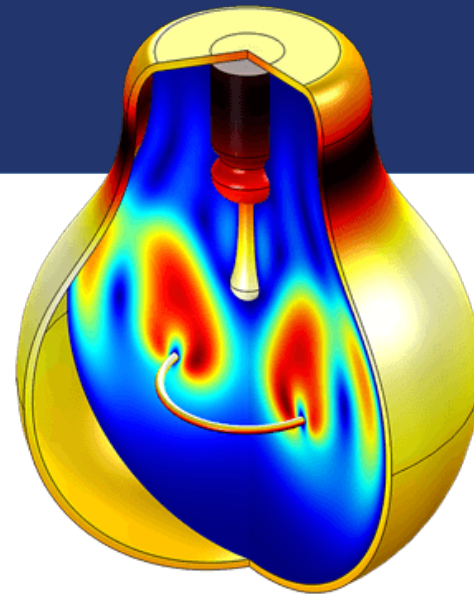


Parallel programming

3. Individual seminar assignment Simple 2D Heat diffusion simulator



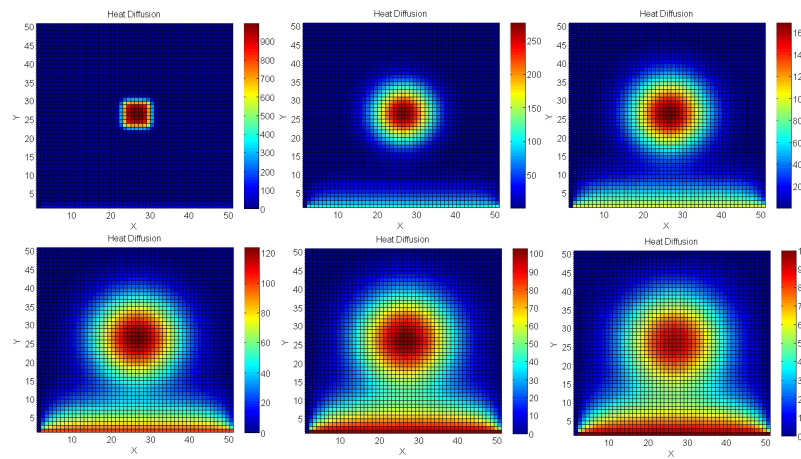
Jan Dvořák a Libor Bukata





What is a heat diffusion

- Heat diffusion/transfer
 - exchange of thermal energy between physical systems
 - rate of heat transfer is dependent on the temperatures of the systems





Simplified model

- The temperature in the given coordination is equal to the average of all surrounding spots.
 - with exception of spots with permanent temperature
 - it results in 2D discrete convolution with convolution core

$$H_1 = \frac{1}{9} \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix}$$

- thus, we are repeatedly performing the convolution until there is no easily observable change (it means that the deviation between two consecutive iterations is negligible)



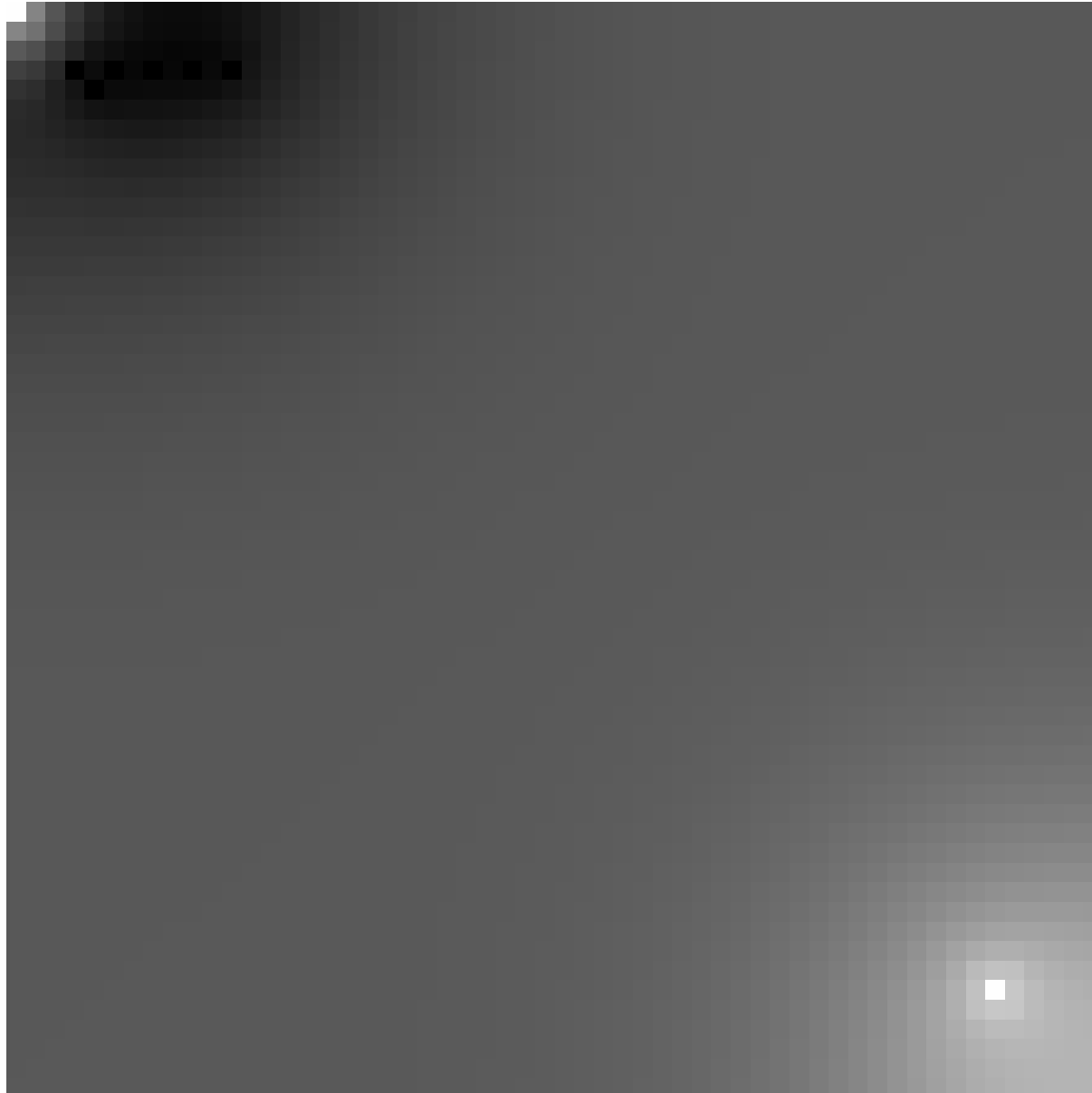
Input instance description

```
64 // array parameters
64 // width of the array
64 // height of the array
0 0 255 // spot parameters (each line specify a new spot)
20 55 255 // x-coordination, y-coordination, temperature
21 51 0
63 1 143
3 3 0
```

- temperature
 - represents permanent temperature of the spot (pixel)
 - an integer number in interval $\langle 0, 255 \rangle$

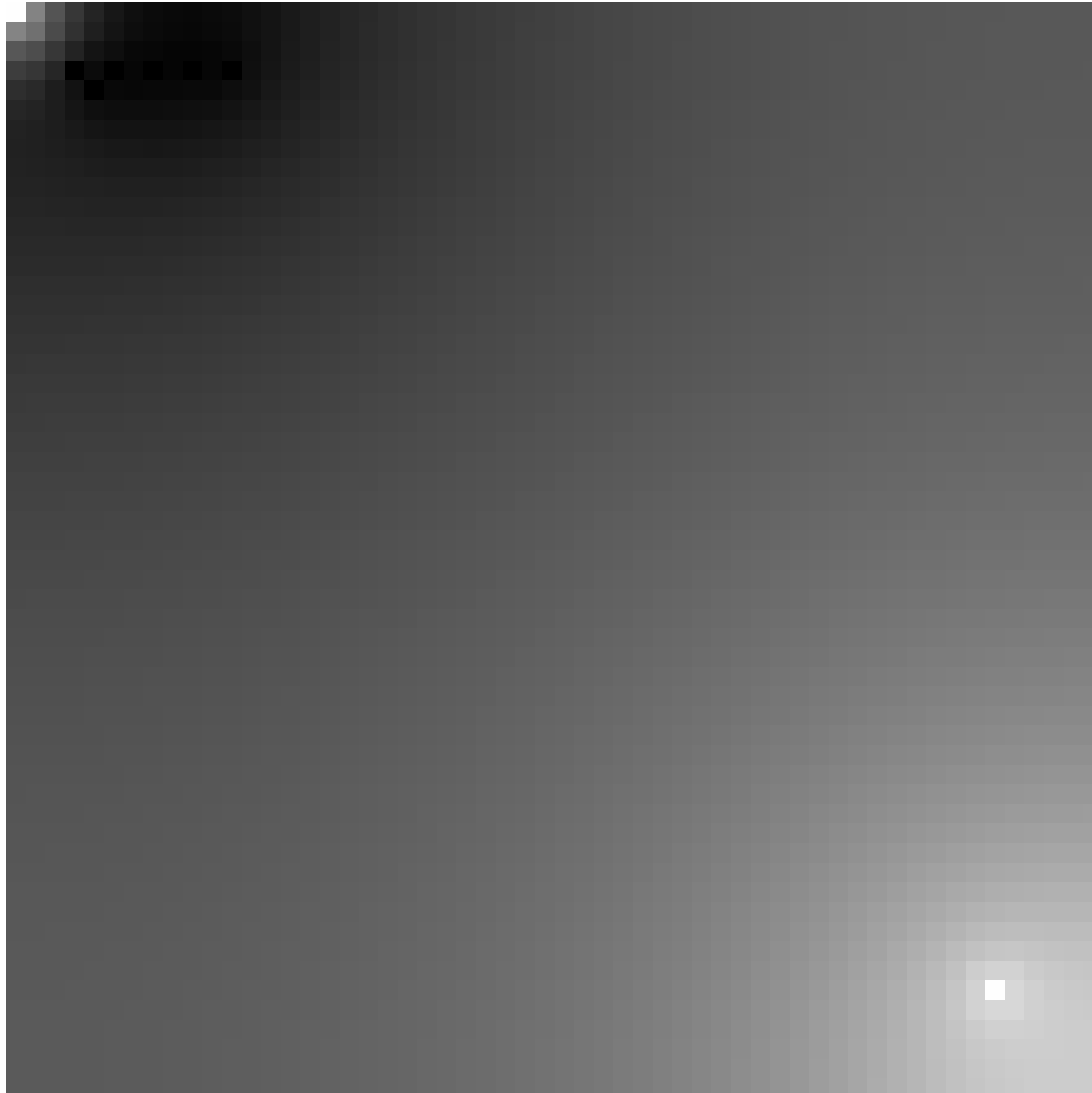


Example of evolution - 1



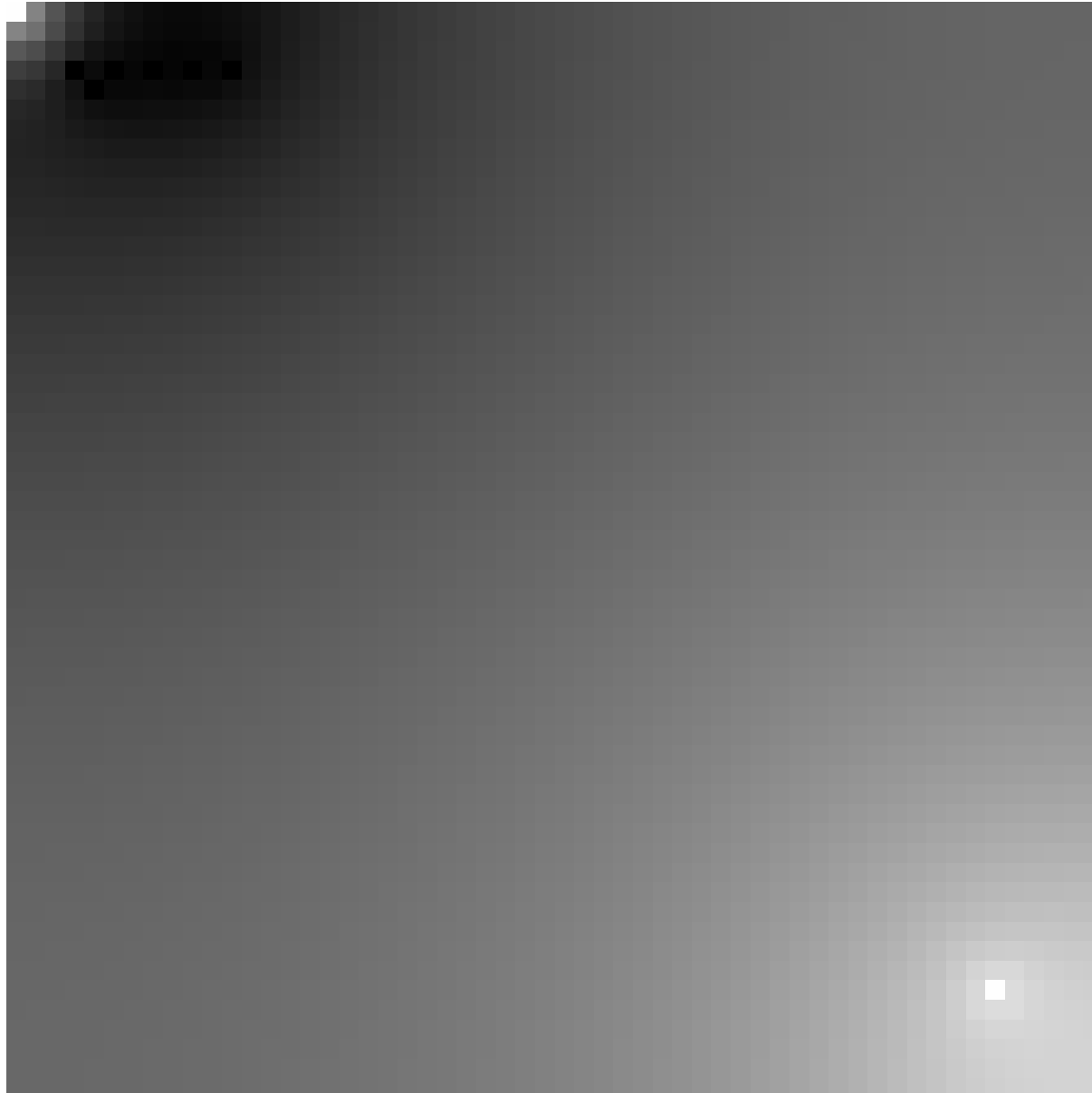


Example of evolution - 2



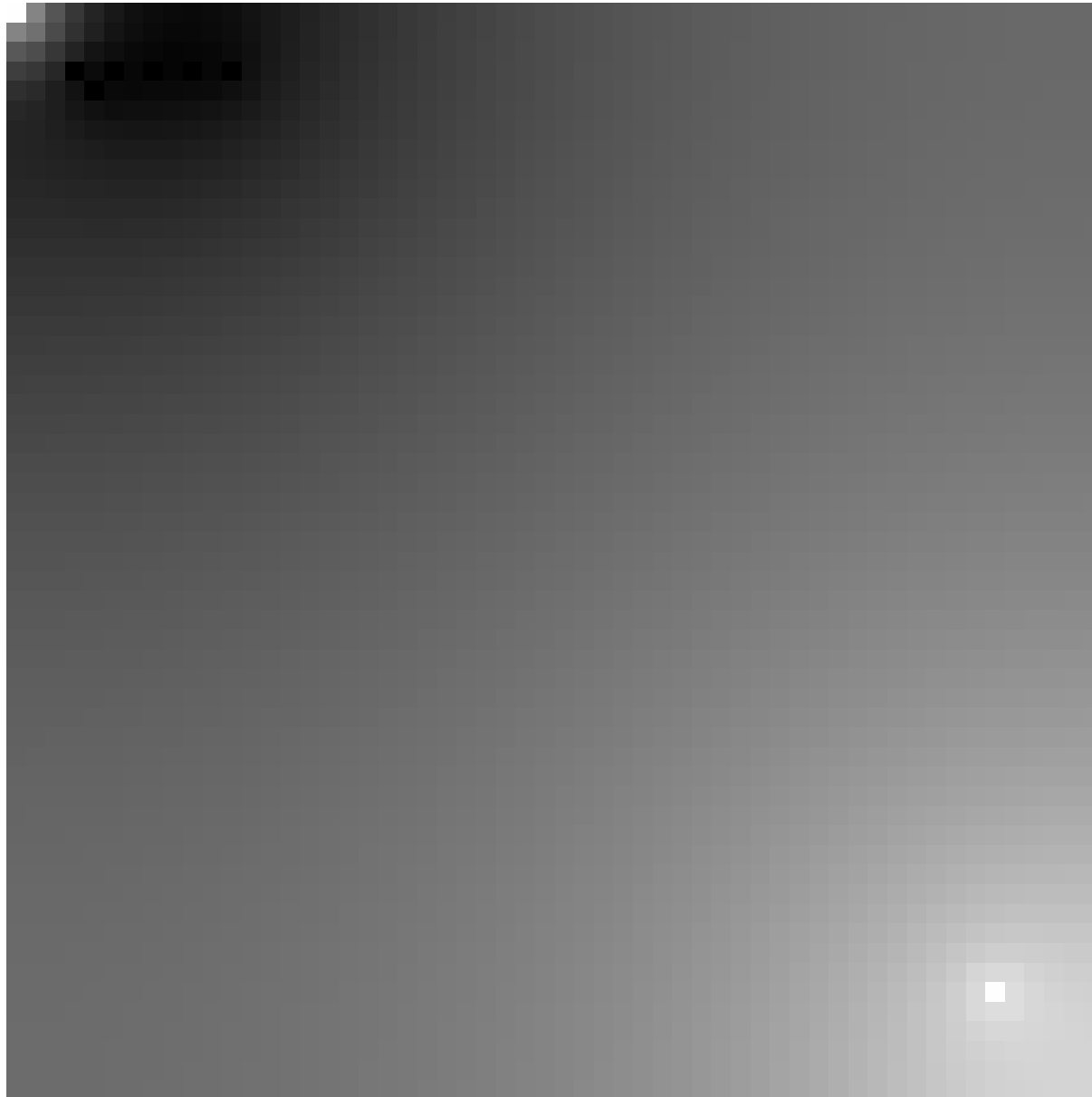


Example of evolution - 3



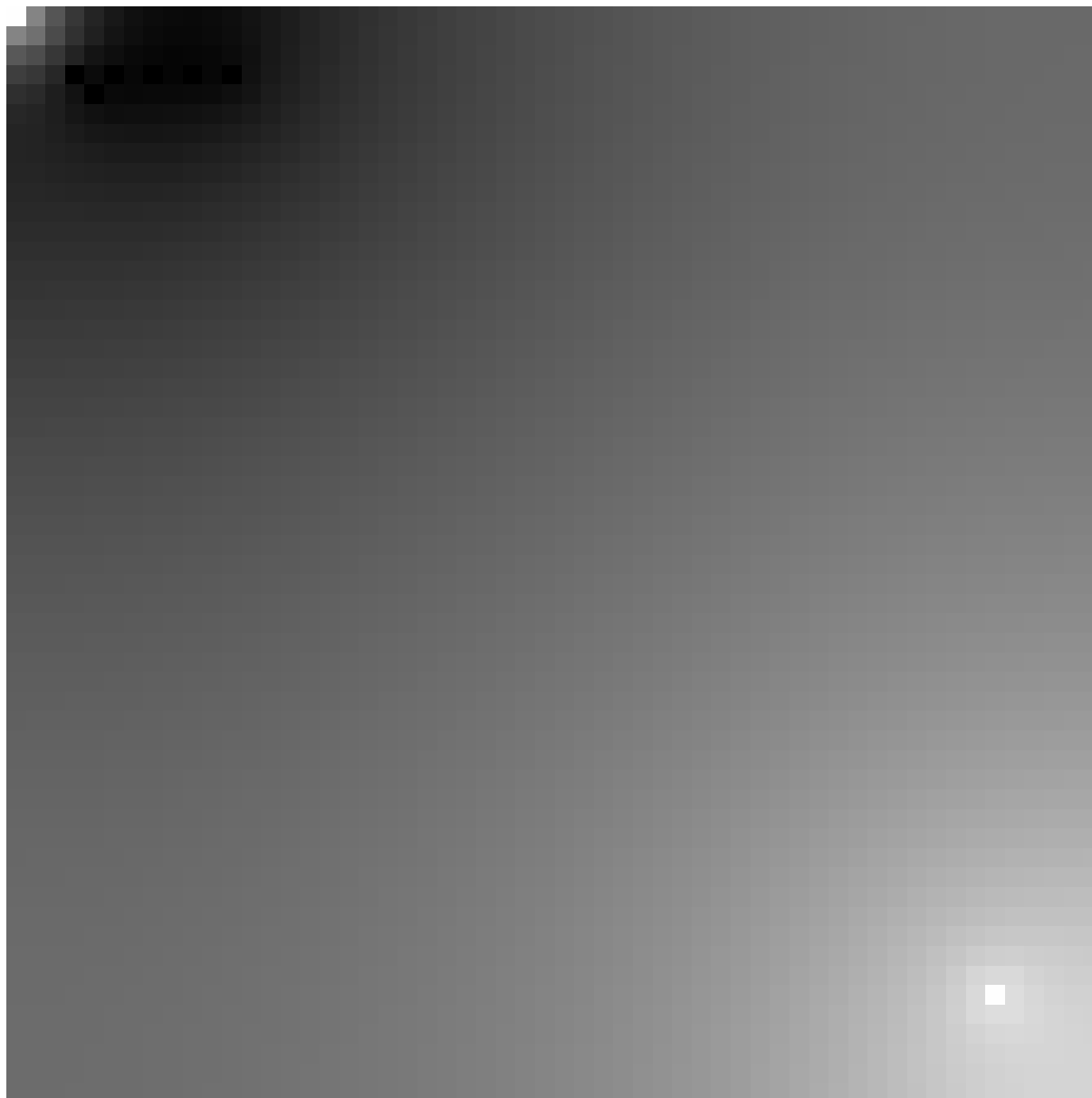


Example of evolution – 4





Example of evolution – 5





Individual assignment

- Task
 - Implement the Simple 2D Heat Diffusion simulator, as described here, in OpenMPI
 - Export resulting images in Netpbm format
 - Hint: https://en.wikipedia.org/wiki/Netpbm_format
 - already part of the skeleton