Problem: Simulation of forest fires in the square lattice

The goal

To simulate forest fires using randomly occupied square lattices and to determine the percolation threshold from burning time.

Details

Write a program which generates many configuration of a square lattice of various sizes $n \times n$ for $n = 32, 64, 128, \ldots$ with randomly occupied sites for probabilities $0 < p < 1$ and which, for these configurations, determines average burning time $\bar{t}_{\mathrm{b}}(p)$ as a function of the occupation probabilities p.

To simulate a fire in a lattice, set on fire the top row of the lattice and then do sweeps row by row during which a current site which is occupied by a tree ignites if at least one tree in the nearest neighboring site is on fire. If you do sweeps from top to bottom and from left to right, then all trees which are in one cluster and which are connected with some burning tree by going first to the right and then down, or first down and then to the right, will be set to fire in one sweep. Burning time $t_{\mathrm{b}}(p)$ is then defined as a number of sweeps which are necessary to set to fire all trees which are connected to the burning trees in the first row.

Estimate the threshold probability p_c for which the infinite cluster appears in the infinite lattice from the maximum of the average burning time $\bar{t}_{\mathrm{b}}(p)$.

Output

To fulfill the task, provide your own code which calculates $\bar{t}_{\mathrm{b}}(p)$ for a square lattice of the size $n \times n$ together with output files containing dependence $\bar{t}_{\mathrm{b}}(p)$ for several sizes of the lattice and a plot of these functions around the threshold probability p_c.