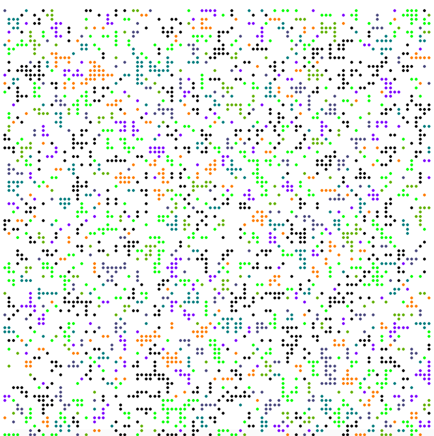
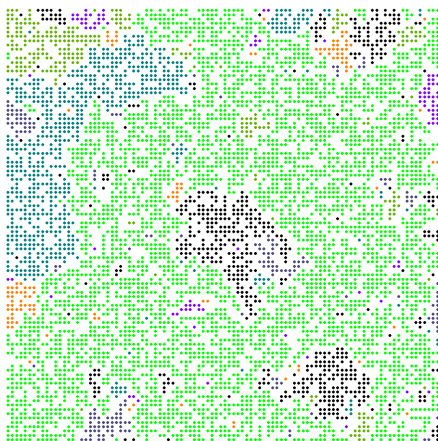
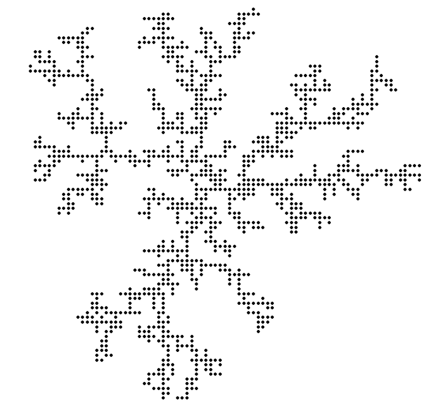
Assignment #4: Monte Carlo Simulation on a Lattice: Percolation simulation, DLA Crystal Growth







Understanding Lattice-Based Models, Percolation and DLA

Simulation Methods course

Fall 2018

Writing the Simulation

On the webpage I give you a code for the Percolation and the DLA Crystal growth. You can use these codes to generate the configurations you need for your plots.

If you want to rewrite the whole simulation, you should write the simulation in C/

C++ or something low level (a language that compiles) so that you can control it better (what happens with the cpu and memory usage). High level languages are not used in simulation because of the performance is more important than the ease of coding. Do not use Java or some high level language, or Matlab to write the simulation itself. You can use these tools or whichever tool you like to plot the results of the simulation. I give you a plot tool that uses OpenGl. You can also write your own plotting tool for this.

What you need to present:

- you ran the percolation simulation at different p values I will want to see some final configurations at different p (low, high and around critical)

- you ran the DLA Crystal growth at different p sticking probabilities. I will want to see some final configurations at different p (low p, dense crystals, and high p, branching fractal-like crystals)

- for the percolation I want to see the size of the biggest cluster <M> vs p (multiple realizations at the same p gives you the average <>). I also want to see the <P_sp> the probability of having a spanning cluster vs p. A spanning cluster is a cluster that percolates from one end to the opposite end. I want to see both these curves for 3 different system sizes (for example 50x50,100x100,150x150)

- for the crystal growth I want to see the fractal dimension , for this you need to plot the radius of gyration R_giration = 1/N Sum r_i (r_i is the distance of each filled cell from the center) vs time - you have to plot it on a log-log scale to get the exponent. The exponent should be between 1/1 and 1/2 (somewhere around 1/1.7) . Make the system larger than what I have given so you can run for a longer time and RUN MULTIPLE TIMES (100x).

- I will ask questions regarding the code to see if you understood it