Math 3P40 Assignment 4: percolation

Due date : March 28, 2017 at the beginning of class.

Problem 1

You were shown in class how to find the critical probability for *site* percolation on Bethe lattice for $z = 3$. Using the same method, compute p_c and β for *bond* percolation on Bethe lattice with $z = 3$. *Note: this problem does not require any computer programming.*

Problem 2

Write a program simulating directed bond percolation on a lattice of L sites with periodic boundary conditions, assuming that the probability of open bond is p.

Assume that the first row is entirely immersed in water. You program should output percentage of wet sites in the bottom row. Assume that the number of rows is also L.

Once you have the program running and debugged, put your simulation inside a loop over p, and vary p fro 0.1 to 0.9 in increments of 0.01 or smaller. Output the results to a data file with two columns, p in the first column and fraction of wet sites in the second column. Do it first for small lattice size, and once you know it works correctly, use as large lattice size as possible.

Using this data, estimate the critical probability p_c for directed bond percolation. Devise a method for doing this. Write a detailed report showing how you estimated p_c. You report should include a graph of percentage of wet sites in the last row versus p.

Problem 3

Repeat the above for directed site percolation.