

10. Percolation

Present your solutions to the following problems using latex, if you have figures make sure they are publication quality, include your code in the solutions. Print your pdf files and bring them to class.

1. Implement percolation on a 2d $N \times N$ square grid.

(i) determine the analytic percolation probability as a function of p for $N=2$.

(ii) accurately determine the critical probability, p_c , for percolation. You will need to extrapolate in N .

(iii) Call the number of squares in a percolating cluster, n and define $F = n/N^2$. Near the critical probability F obeys the following *scaling law*:

$$F = F_0(p - p_c)^\beta$$

where β is a *critical exponent*. Determine β for the 2d square grid. Remarkably, β does not change if you use a triangular or hexagonal lattice. This is an example of *universality*.