

INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

Department of Physics

PH415: Simulation Techniques in Physical Systems

Test-3: Percolation

Problem.1: Consider site percolation problem on a 2d square lattice of different sizes $L \times L$. Populate the lattice varying the occupation probability p from 0.50 to 0.70 in steps of 0.002 for each L starting from $L = 40$ to $L = 160$ in steps of 20. Apply Hoshen-Kopelman algorithm to identify different clusters and their sizes (s). Calculate the order parameter $P_\infty(p, L)$, average cluster size (or fluctuation in order parameter) $\chi(p, L)$ and Binder cumulant $U(p, L)$.

(a) Plot $U(p, L)$ against p for different L and determine the percolation threshold p_c for a system of infinite size. Determine the value of ν .

(b) Plot $P_\infty(p, L)$ against p for different L and determine the value of β/ν . Verify the scaling form by plotting the scaled $P_\infty(p, L)$ versus the scaled variable z .

(c) Plot $\chi(p, L)$ against p for different L and determine the value of γ/ν . Verify the scaling form by plotting the scaled $\chi(p, L)$ versus the scaled variable z .

(d) Verify the scaling relation between β/ν , γ/ν and the space dimension d .