Phase Transitions and Critical Phenomena

Exercise Sheet 9

Problem 1 Percolation problems on square lattice

Consider two percolation problems on a square lattice – site percolation and bond percolation. Find which of these has critical probability $x_c = 1/2$. Is the critical probability of the other model bigger or less than $1/2$?

Problem 2 Granular superconductors

Consider granular superconductor with variations of T_c

$$T_c(i) = \overline{T}_c + \delta T_c(i). \tag{1}$$

If superconducting grains are connected, the material is superconductive. In which direction is the transition temperature of the granular superconductor shifted relative to a homogeneous sample with critical temperature $\overline{T}_c$? How does the answer depend on the number of dimensions?