Prof. Dr. Wolfhard Janke WS2025/26

Introduction to Computer Simulation I

Homework 13

Due: Tuesday, 03 February 2026

25. **Conserved dynamics**

    Use your computer code of problem 17 for simulations of the evolution of the 2D Ising model with *conserved* order parameter, i.e., constant magnetization (Kawasaki dynamics). Consider here a square lattice of size $L^2 = 16^2$ with periodic boundary conditions. As in problem 24 start again with an initial configuration where the spins s_i take the values ± 1 with probability 0.5 such that the total magnetization approximately vanishes.

    a) Run your simulations at temperature $T = 0.5T_c$ up to 10^5 Monte Carlo sweeps (MCS) and plot snapshots of the spin configurations at times $t = 10, 10^2, 10^3, 10^4$, and 10^5 MCS. What does one observe here?

    b) As in problem 20, repeat now the simulations 4 more times drawing each time a different initial configuration and using an independent time evolution by choosing a different random-number seed. Estimate the mean domain length $\ell(t)$ like in problem 24 and plot both $\ell(t)$ and the energy of the system as a function of time (= MCS). Do these functions follow again a power law? As a check of the update procedure, confirm in another plot that the magnetization stays constant as a function of time.

26. **Metropolis simulations of the 2D Potts model**

    Replace in your simulation program for the 2D q-state Potts model of problem 14 ($q = 8$, square lattice, periodic boundary conditions) the heat-bath update by the Metropolis update and compare with your previous results (that is as in problem 14 for a small 10×10 lattice as a function of the inverse temperature $\beta = J/k_BT$).