Prof. Dr. Wolfhard Janke, Fabio Müller   SS2025

Introduction to Computer Simulation II

Homework 2

Due: Tuesday, 29 April 2025

3. **Spin configurations of the 2D Ising model**

   Write a computer program for a graphical presentation of the spin configurations of the 2D Ising model. Study the cases $T = 3.0, 2.5, T_c, 2.0,$ and 1.5, where $T_c = 2/\ln(1 + \sqrt{2}) = 2.269185\ldots$ is the critical temperature. Choose for the lattice size $L = 64$. Start for $T \geq T_c$ with a random and for $T < T_c$ with an ordered (all spins $= +1$) spin configuration and plot the resulting configuration after $10\,000$ Metropolis sweeps.

4. **Single-cluster algorithm for the 2D Ising model**

   Implement the (nonlocal) Wolff single-cluster algorithm for the 2D Ising model. Test your program by comparison with the exact results for the energy and specific heat (see the module homepage). Estimate close to the critical point and for various lattice sizes the autocorrelation times *approximately* (e.g., by means of the binning method) and compare *approximately* with the corresponding results for the local update algorithms. A more accurate quantitative comparison will be the content of one of the next problems.