Simulation methods in physics

Homework 5
Return before 13.00 on Tue 25.3., to Ari Hietanen's mailbox (C-wing 3rd floor), or by e-mail ari.hietanen@helsinki.fi

1. Check how well the low- and high-temperature expansions for the 2-dim. Ising model work. Expand the *energy* (or equivalently, the nearest-neighbour expectation value $\langle s_x s_y \rangle$ (at least) to order $e^{-6\beta}$ and β^5 (the latter has been calculated to β^3 in the lectures; remember to use the "character expansion" method! Also note that the 'β' is defined differently in low- and high-T expansions in the lectures (different H)!).

   Measure the energy using Monte Carlo simulations at a few values of β using a lattice of size $\sim 64^2$, and compare with the expansions at different orders. Plot the results (with errors) and the expansions as functions of β. Where the expansions appear to fail significantly?

   Hints:

   Note that you should use a local update, since you are not at β_c. This is also the reason why a single large volume should be sufficient to obtain effectively infinite volume results.

   Start the simulations at, for example, at $\beta_c/2$ and $2\beta_c$. Check how the results match, and adjust the β's correspondingly.