1 Results

1.1 2×2 lattice, analytical expressions

If we scale the value of β from $1/k_BT$ to $1/J$ (Scaling factor k_BT/J) in the analytical expression from section **??**, we will get a good benchmark for computer computations to come. These values are listed in table 1 below. Note that all values are divided by four, since we want the values per bond, and not for the entire lattice.

Mean energy, $\langle \mathbf{E} \rangle$	-1.9960
Mean absolute magnetization, $\langle \lvert \mathcal{M} \rvert \rangle$	0.9987
Specific heat capacity, $\mathbf{C_V}$	0.0321
Susceptibility, χ	3.9933

Table 1: Benchmark for material characteristics per bond for a 2×2 lattice

1.2 Ising model: simulation over temperature

We ran the program for different amounts of Monte Carlo cycles and plotted the error (analytical − simulated) in figure 9 below. Using 10^7 Monte Carlo cycles, we seem to be getting pretty accurate results.

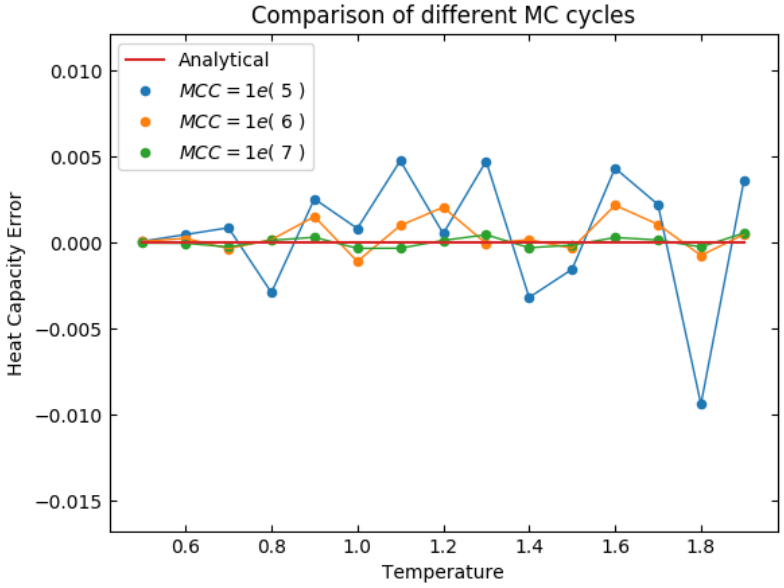

Figure 1: Shows the accuracy of different amount of MC cycles over temperature.

1.3 20×20 lattice

$T = 1.0$

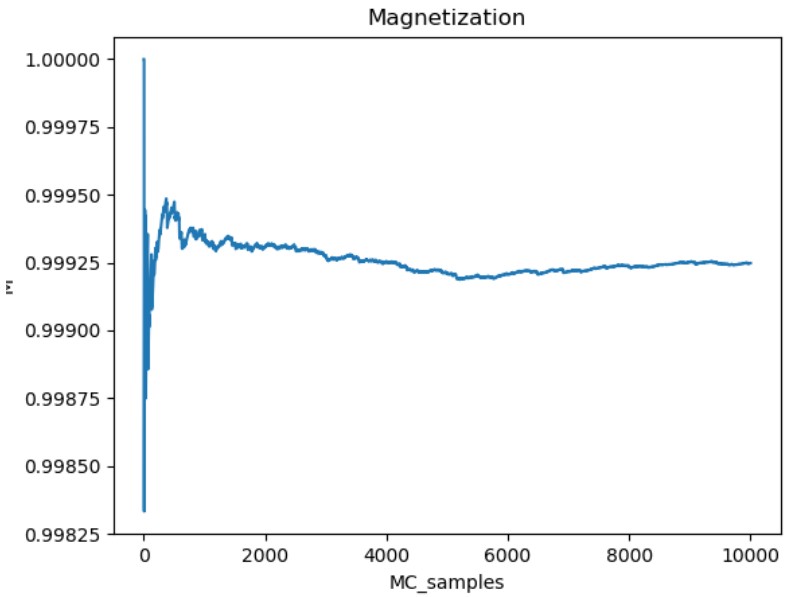

Figure 2: Shows the computed value for the mean magnetization, with ordered initialization, against the number of MC cycles. The scaled temperature is $T = 1.0$

Ordered spin orientation

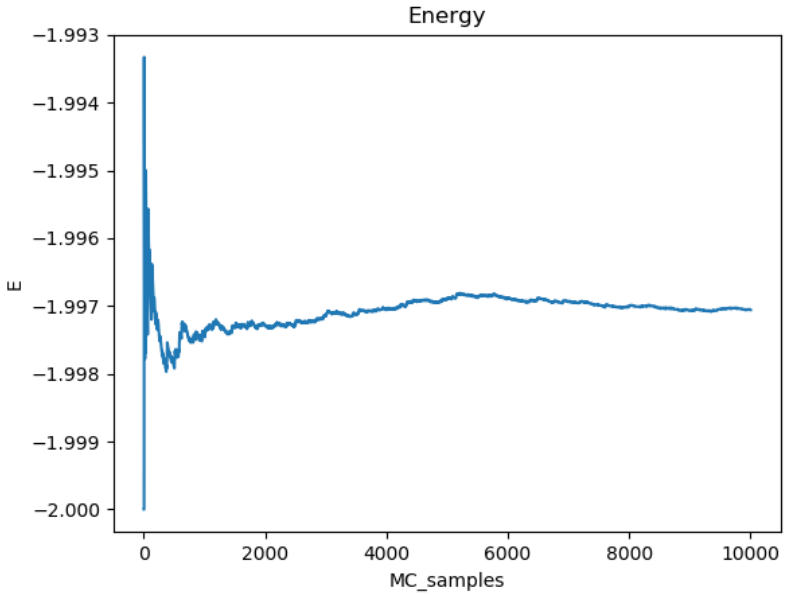

Figure 3: Shows the computed value for the mean magnetization, with ordered initialization, against the number of MC cycles. The scaled temperature is $T = 1.0$

Random spin orientation

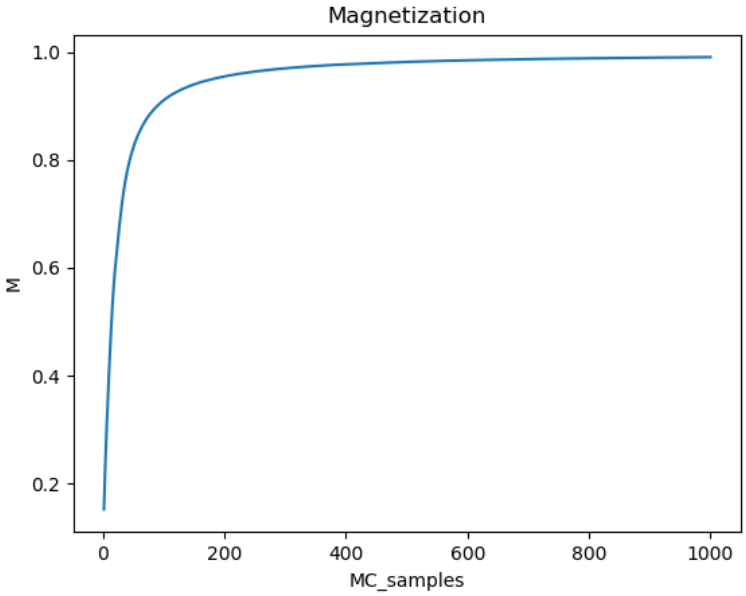

Figure 4: Shows the computed value for the mean magnetization, with random initialization, against the number of MC cycles. The scaled temperature is $T = 1.0$

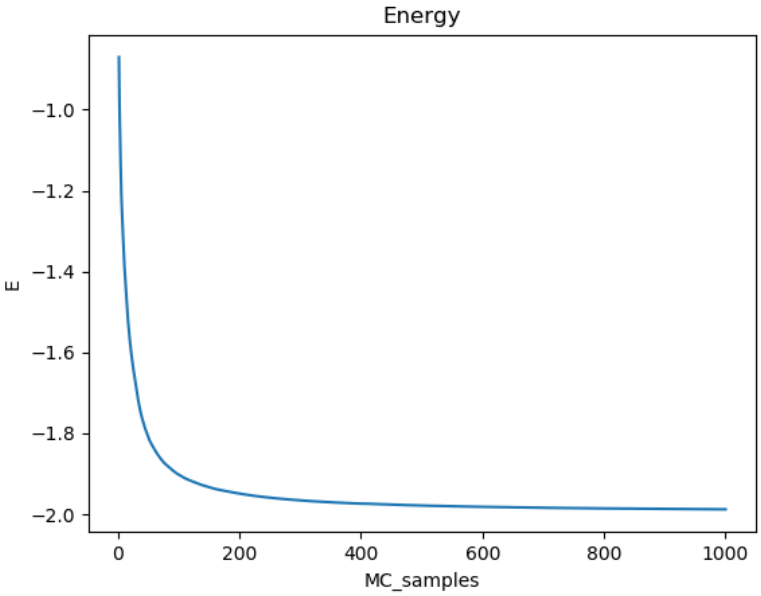

Figure 5: Shows the computed value for the mean magnetization, with random initialization, against the number of MC cycles. The scaled temperature is $T = 1.0$

Likevekt ved:

$T = 2.4$

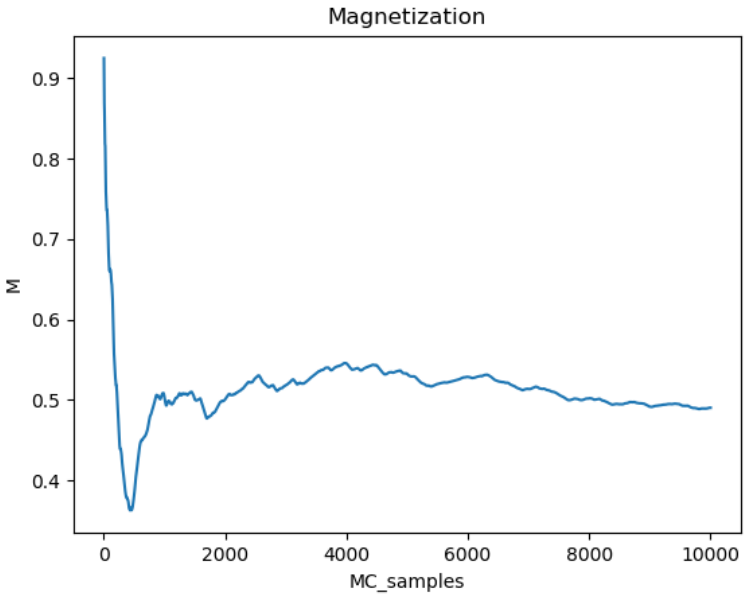

Figure 6: Shows the computed value for the mean magnetization, with ordered initialization, against the number of MC cycles. The scaled temperature is $T = 2.4$

Ordered spin orientation

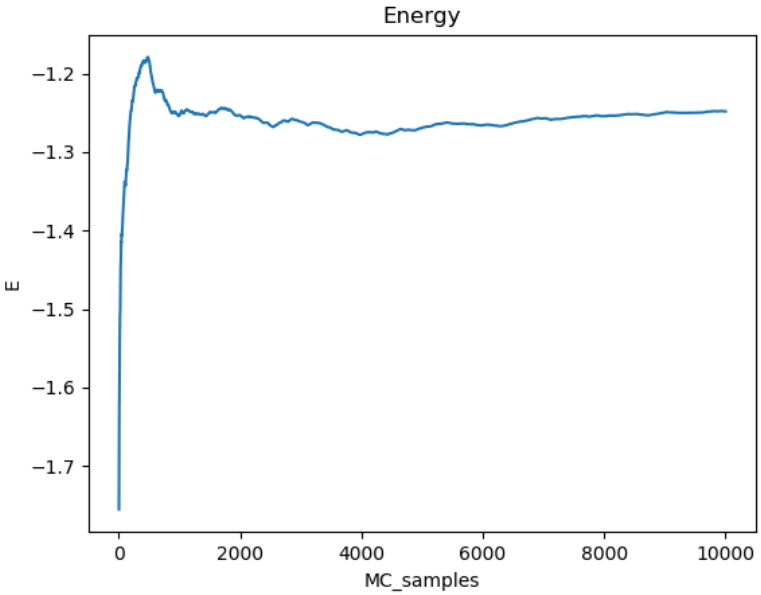

Figure 7: Shows the computed value for the mean magnetization, with ordered initialization, against the number of MC cycles. The scaled temperature is $T = 2.4$

Random spin orientation

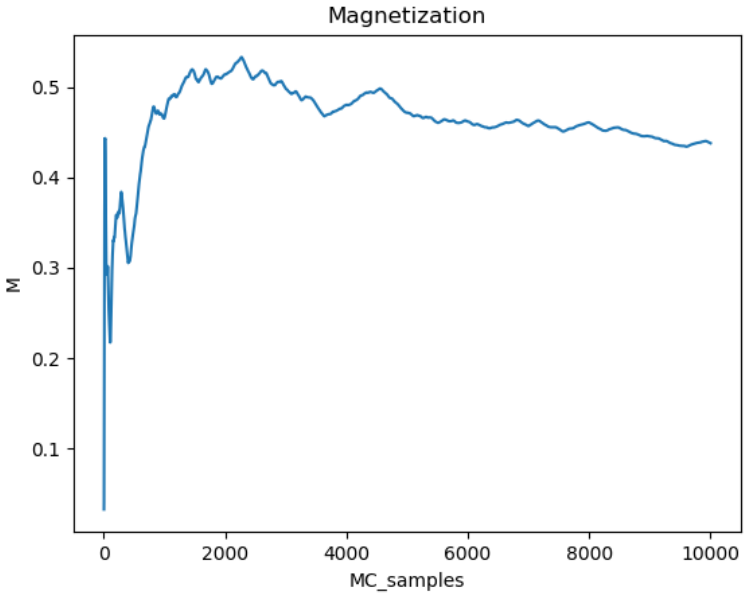

Figure 8: Shows the computed value for the mean magnetization, with random initialization, against the number of MC cycles. The scaled temperature is $T = 2.4$

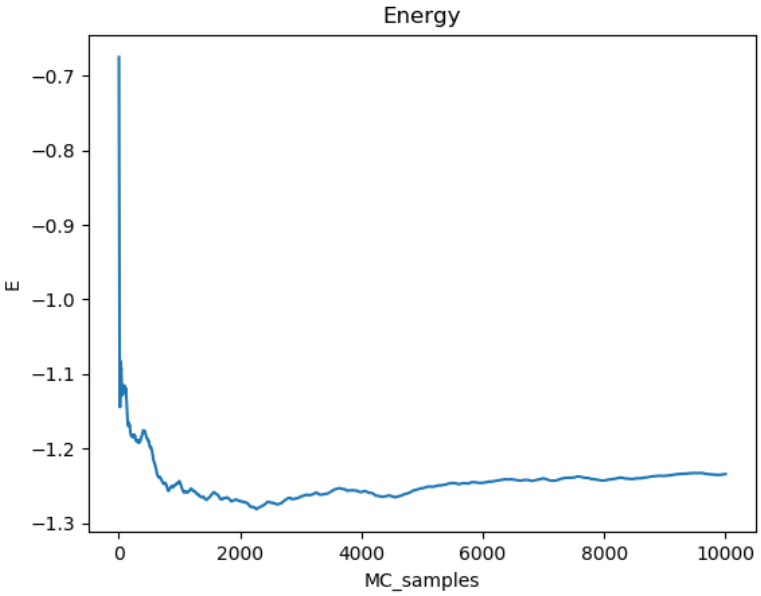

Figure 9: Shows the computed value for the mean magnetization, with random initialization, against the number of MC cycles. The scaled temperature is $T = 2.4$

Antall aksepterte spinn totalt etter et gitt antall mcs(100k maks): Set start point T = 1 Bilde :accepted$_s pinn_T 1_m cs_c umsum(y)_l og10.pngStabiliserersegvedmcd = 1E3.5(allespinnblirheretterakseptert)$

T = 2.4 Bilde: accepted$_s pinn_T 2_m cs_c umsum(y)_l og10.pngStabiliserersegvedmcd = 1E3.5, mendetermangefleresomblirakseptert(Seyaksen)$

Random start point: T = 1: Bilde: accepted$_s pins_T 1_r andom_c umsum(y)_m cs_l og10.pngT = 2.4Bilde : accepted_s pins_T 2_r andom_c umsum(y)_m cs_l og10.png$

Temperaturavhengighet(skal vi lage plot her også- eller holder det med kommentar i resultater?): Økt temperatur gjør at mange flere spinn aksepteres ved lavere antall mcs dvs tidligere.(sjekk prosenten på y aksen) Ved random vs ikke random: omtrent like mange som aksepteres, men i random så aksepteres flere spinn ved lavere mcs. Ved T1 random får man en liten økning ved 1E1.5, mens hos T1 set startpont så før vi ikke en økning i aksepterte spinn før ved 1E3.5

For T2 så får vi økningen på samme sted. 1E4 på både random og satt startpunkt.