

1 Ising Model with Markov Chain Monte Carlo for a grid of side N

Hamiltonian:

$$H = -J \sum_i S_i S_j - \sum_i h S_i$$

1.1 Some Results

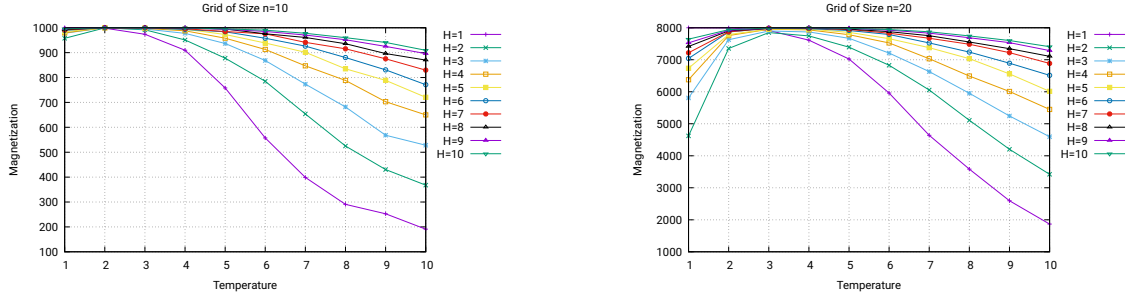


Figure 1: Magnetization v. Temperature for different grid sizes

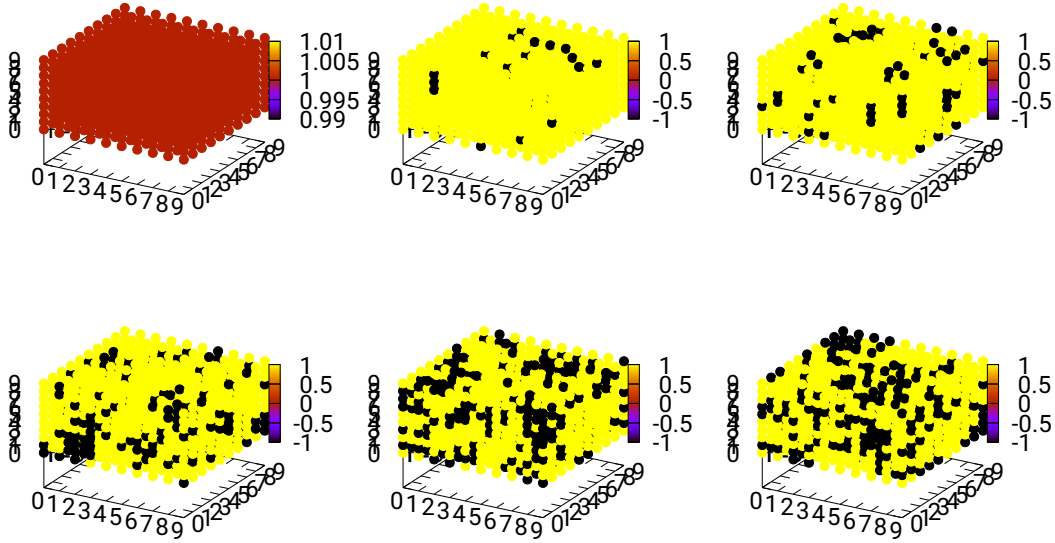


Figure 2: Configurations at different temperature values with h constant

2 Updated Ising Model

- Hamiltonian

$$\mathcal{H} = - \sum_n \left(J_n \sum_i S_i S_{j(n)} \right) - \sum_i B S_i$$

with $n = 2$, $J_n = 1.0, 0.5$ and $B = 1.0$

- Magnetic Susceptibility, \mathcal{X}

$$\mathcal{X} = \beta [\langle M^2 \rangle - \langle M \rangle^2]$$

with $\beta = 1.0/T$

- Heat Capacity, C_v

$$C_v = \beta^2 [\langle E^2 \rangle - \langle E \rangle^2]$$

- The random number generator used is the Mersenne Twister as found in the C++ std libraries.
- The magnetization time autocorrelation function is computed using the FFT method, employing the FFTW library version 3.3.6.

2.1 Results for $N=20$

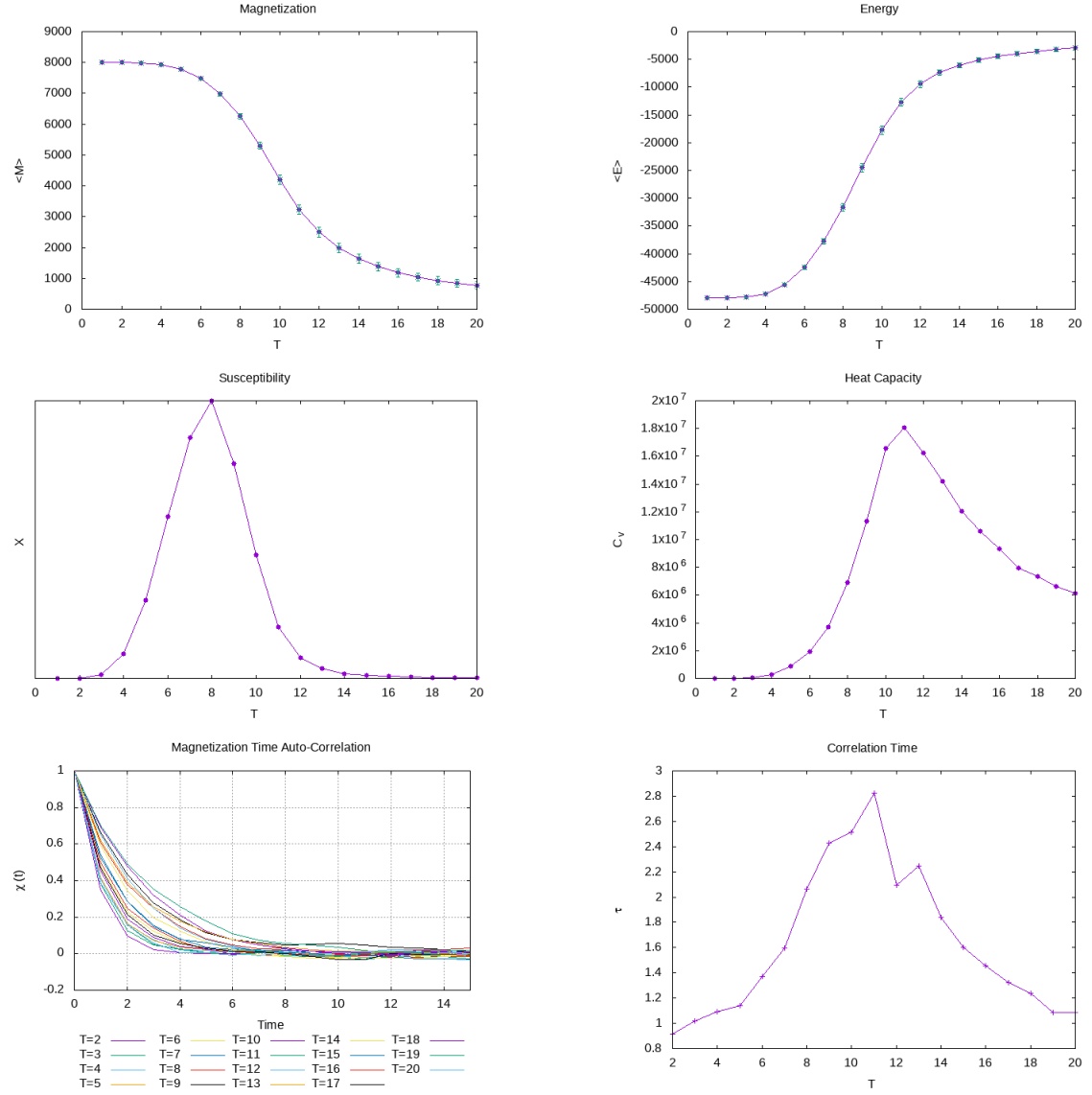


Figure 3: Calculated quantities for $N = 20$

2.2 Results for $N=30$

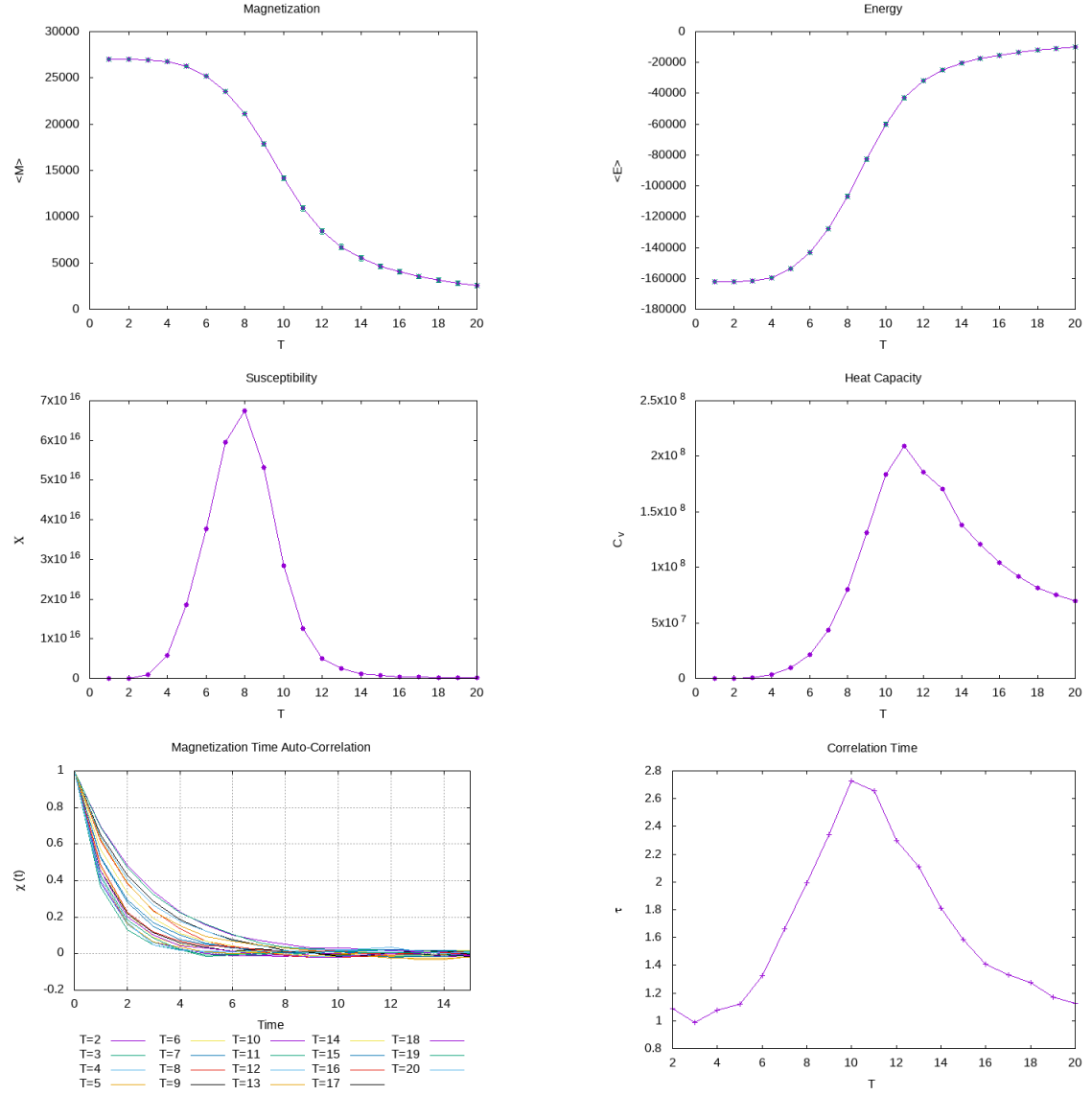


Figure 4: Calculated quantities for $N = 30$

2.3 Results for $N=35$

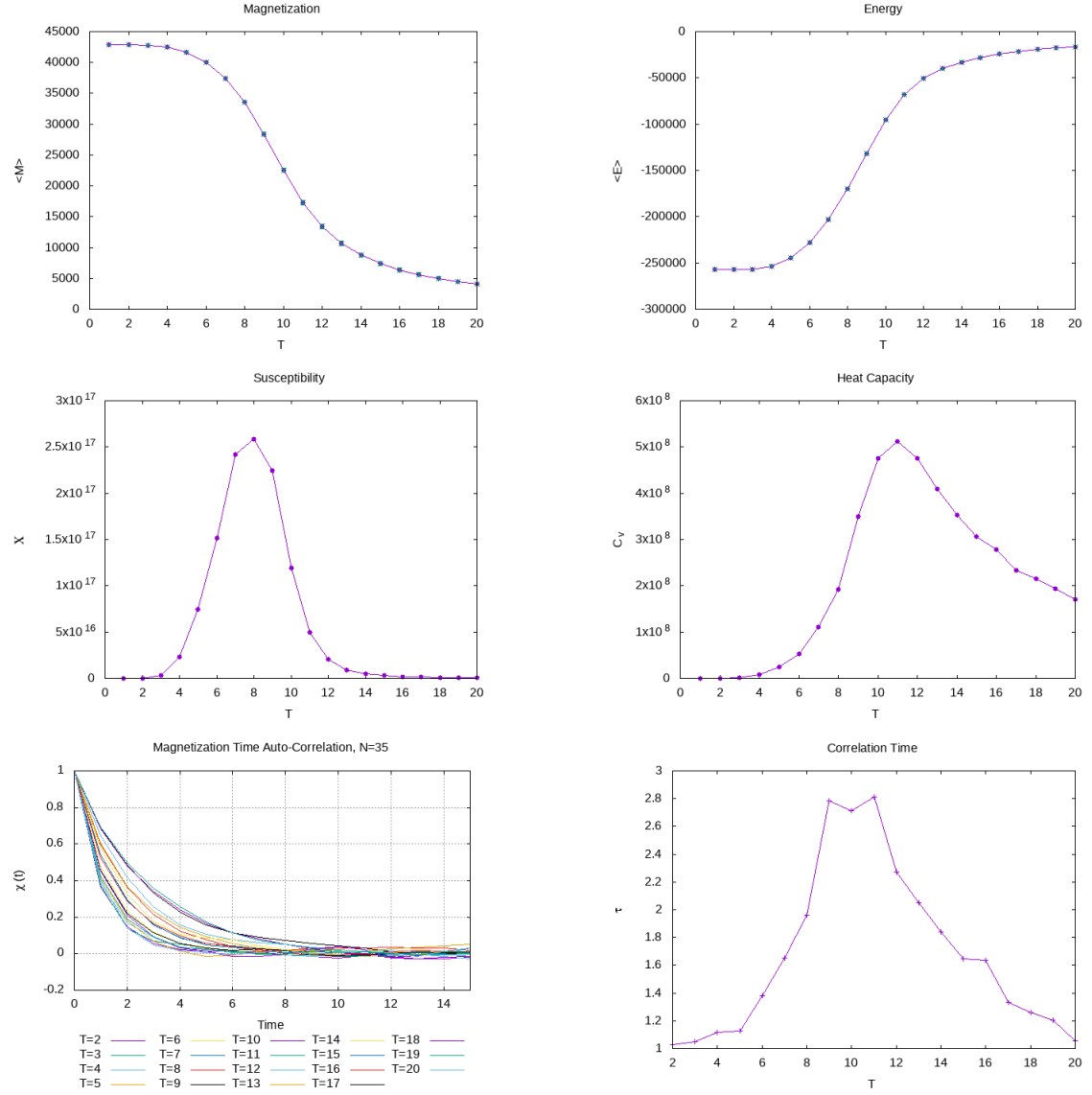


Figure 5: Calculated quantities for $N = 35$