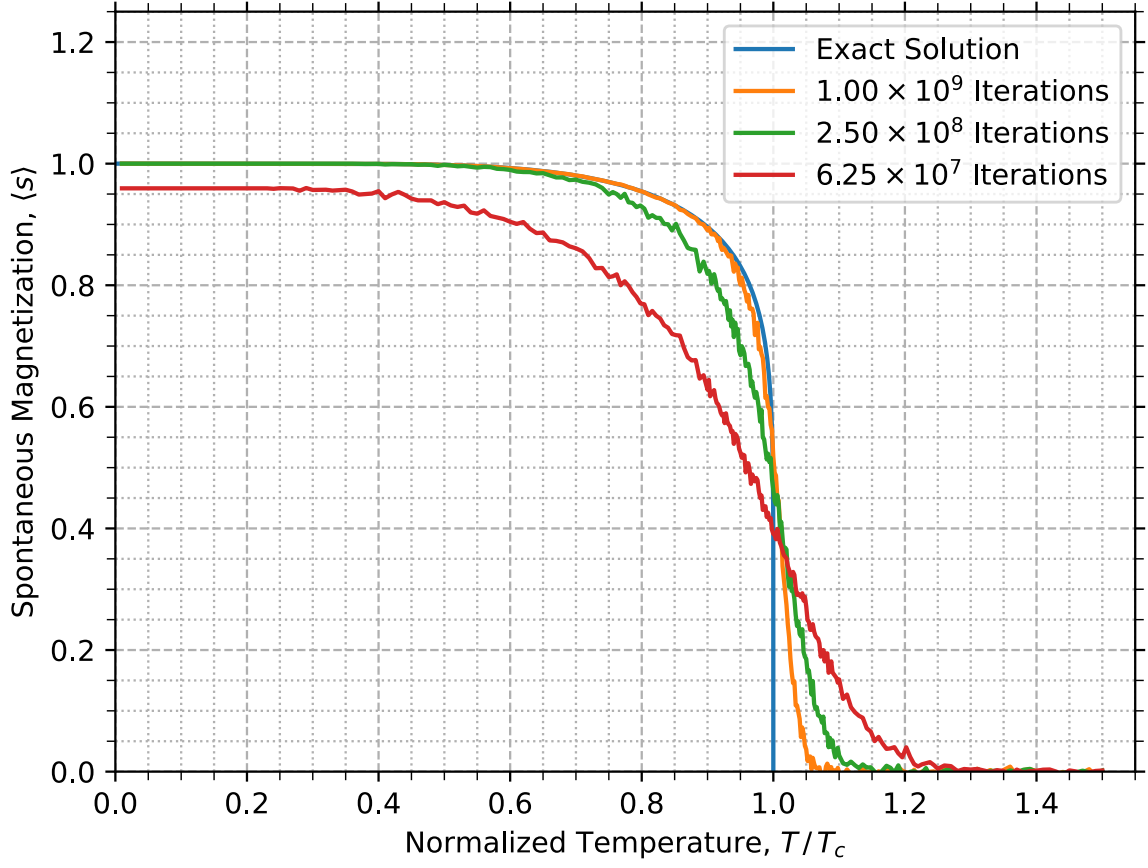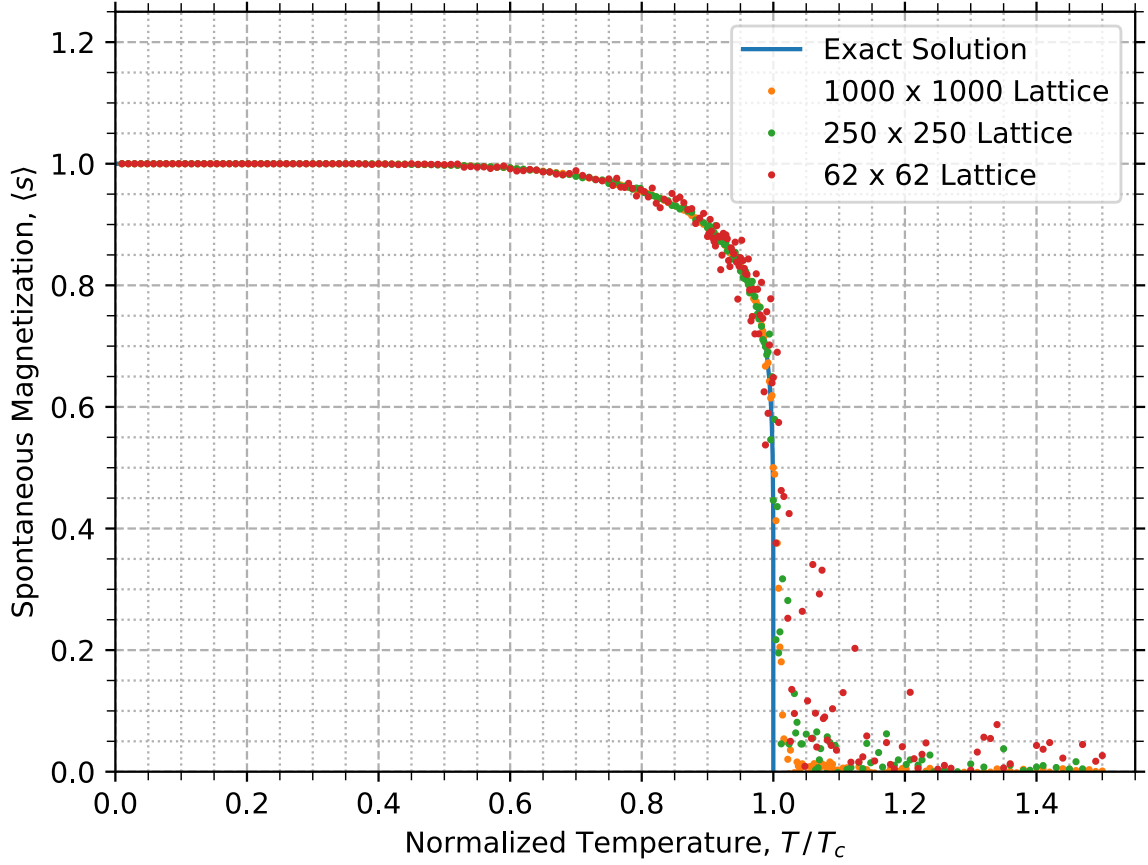Results from Monte Carlo simulation of the Ising model using metropolis algorithm. The default lattice size is 1000×1000 and the default number of iterations is 10 billion, unless otherwise stated.
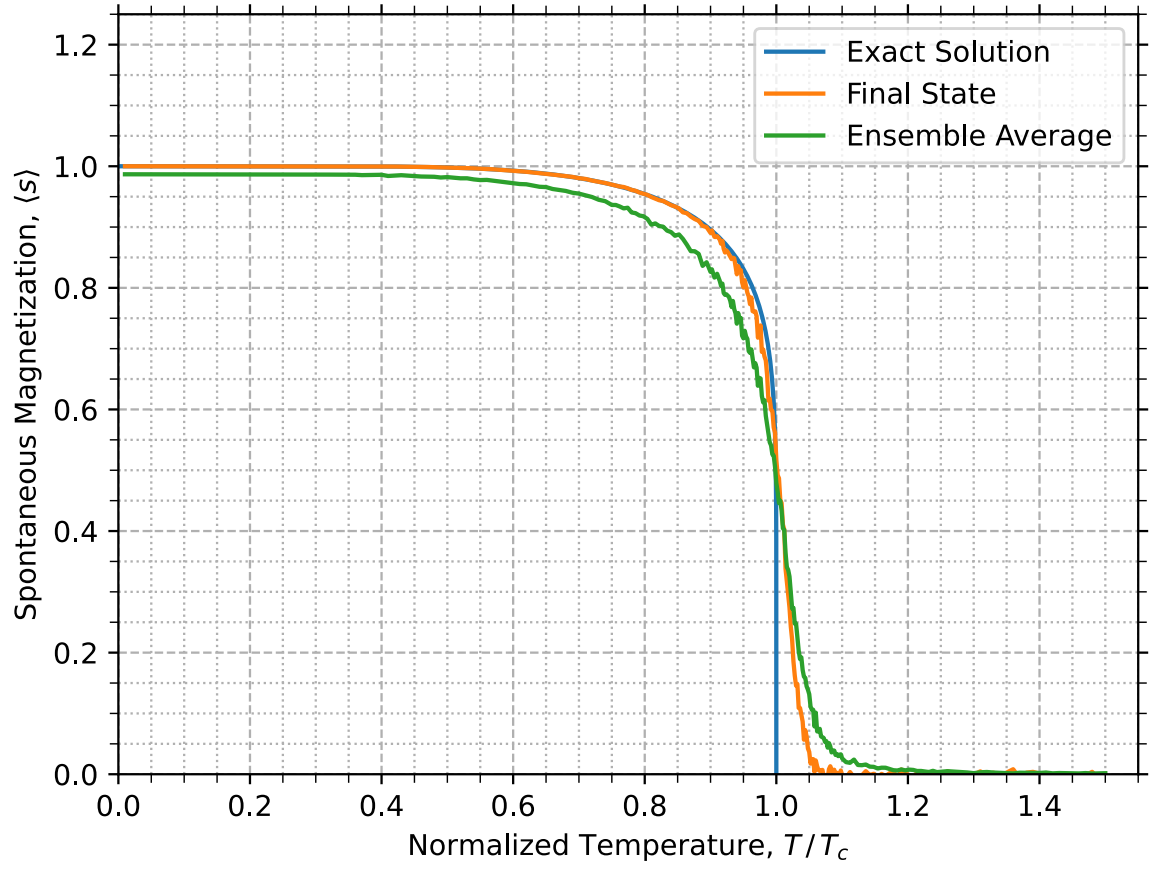
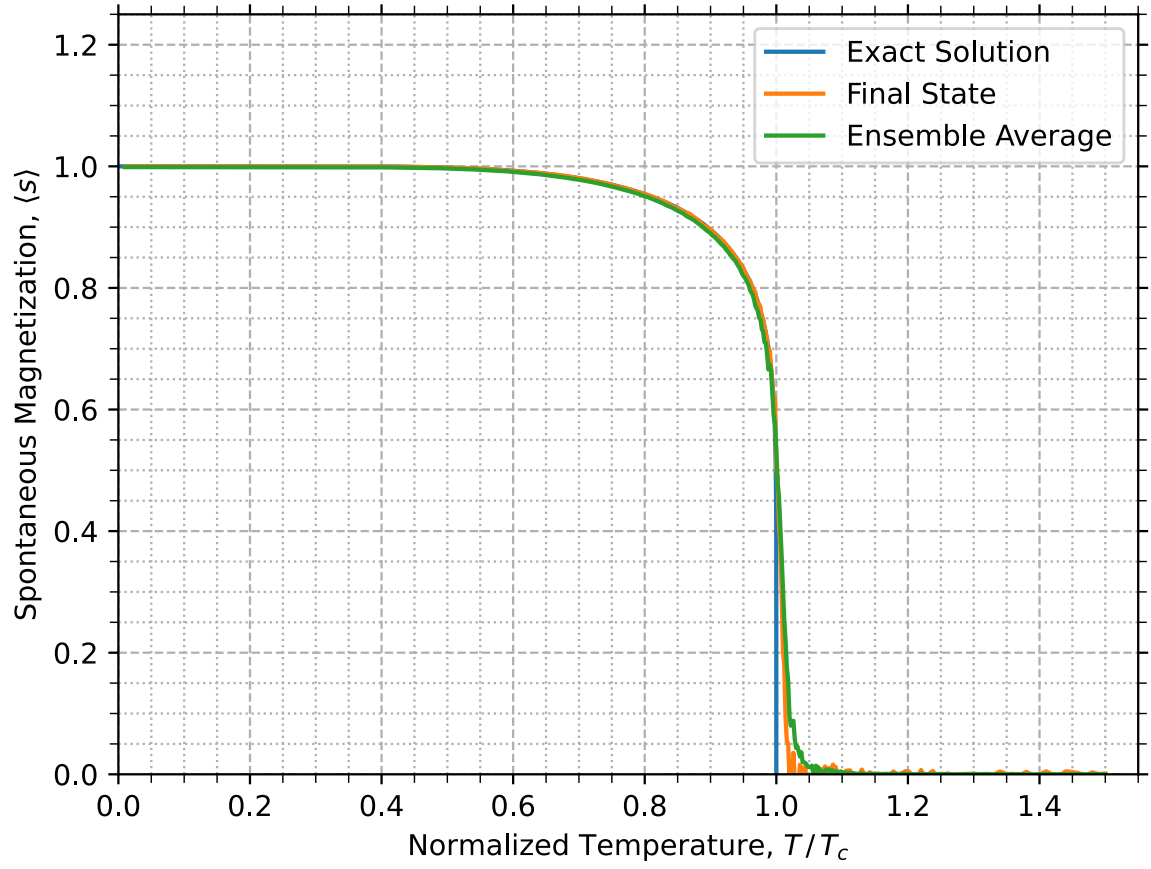(a) Convergence for Infinite Iterations.

(b) Convergence for Infinite Lattice (fluctuations decrease for bigger lattice). Iterations per Lattice Point is Kept Constant.

Figure 1: Convergence of Spontaneous Magnetization.
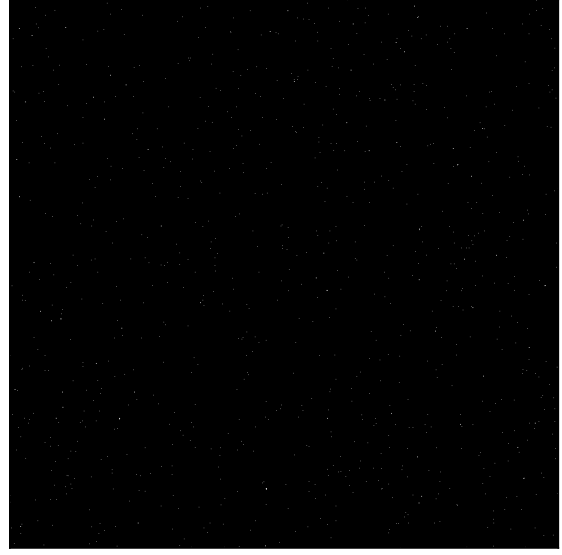
(a) 1 billion Iterations.
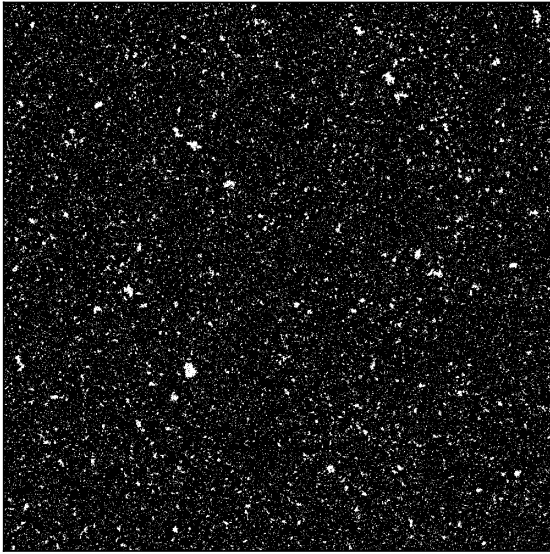

(b) 10 billion Iterations.

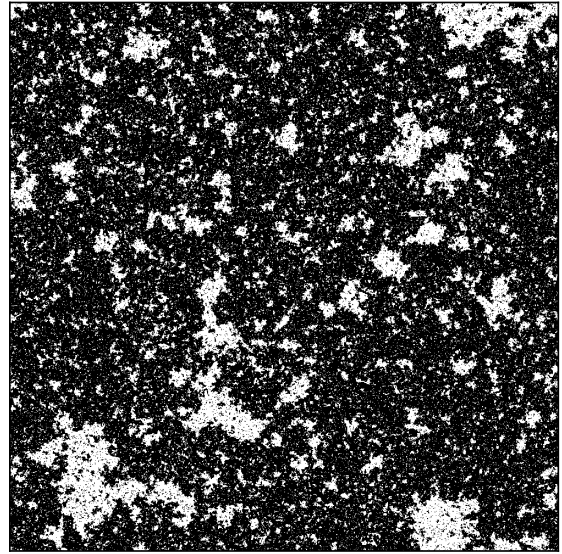Figure 2: Convergence of Ensemble Average.

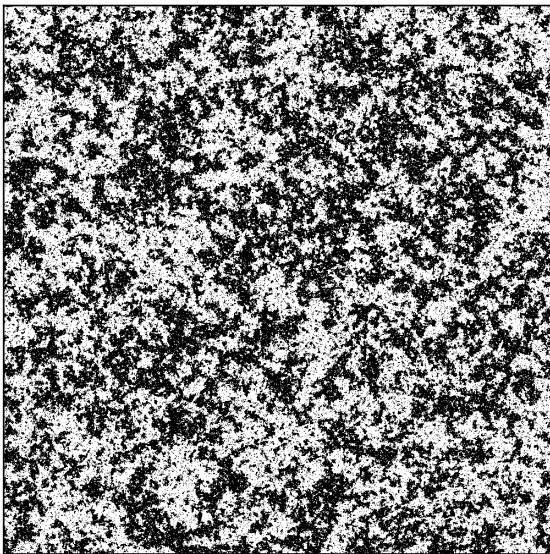(a) $T/T_c = 0.01$ $\langle s \rangle = 1.00$

(b) $T/T_c = 0.50$ $\langle s \rangle = 1.00$
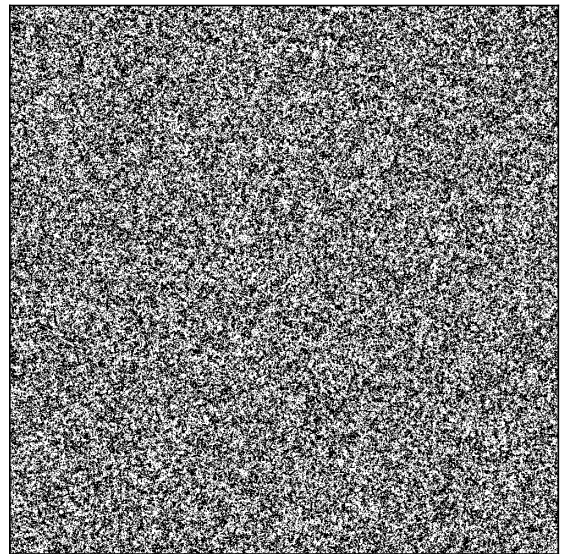
(c) $T/T_c = 0.95$ $\langle s \rangle = 0.83$

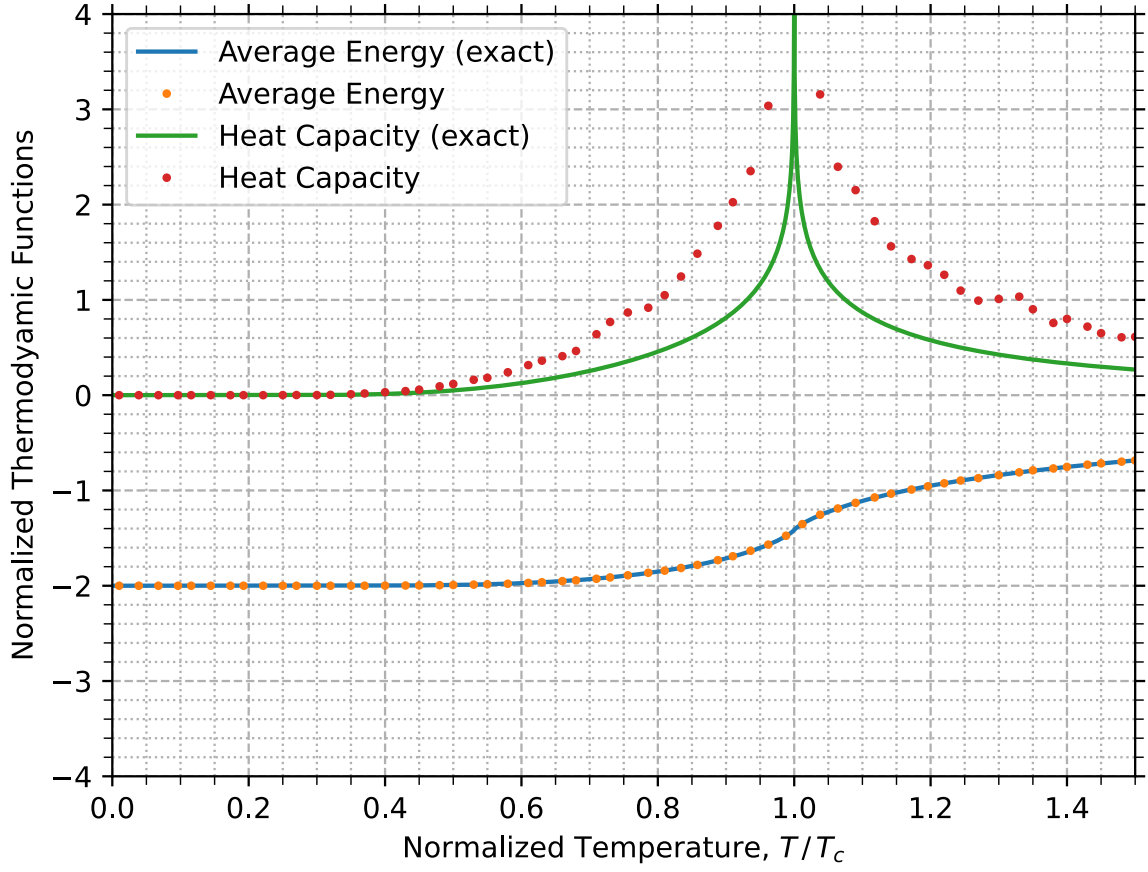(d) $T/T_c = 1.00$ $\langle s \rangle = 0.50$

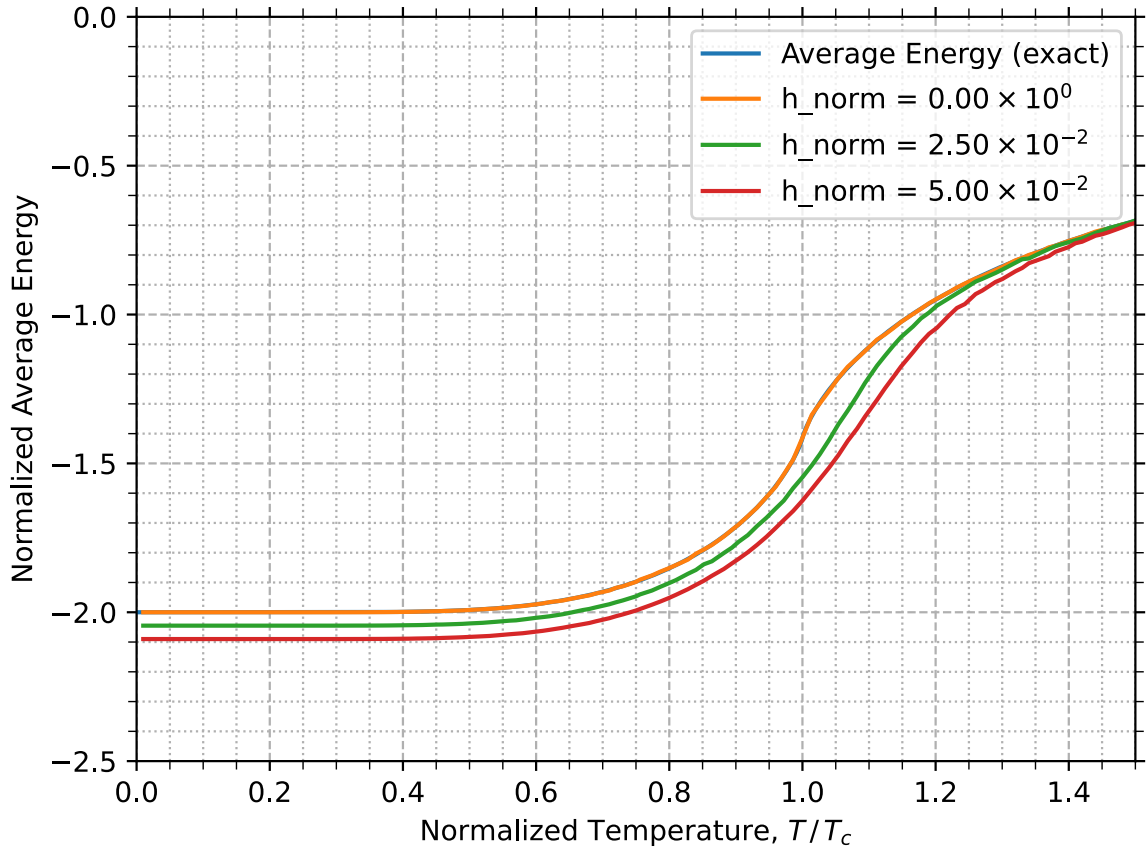(e) $T/T_c = 1.05$ $\langle s \rangle = -0.01$

(f) $T/T_c = 1.50$ $\langle s \rangle = 0.00$

Figure 3: Magnetic Domains at Different Temperatures (black refers to up spin and white refers to down spin).

(a) Average Energy and Heat Capacity in Absence of External Magnetic Field.

(b) Average Energy for Different Values of External Magnetic Field (exact solution is for $h = 0$ and is almost completely overlapped by the simulated data).
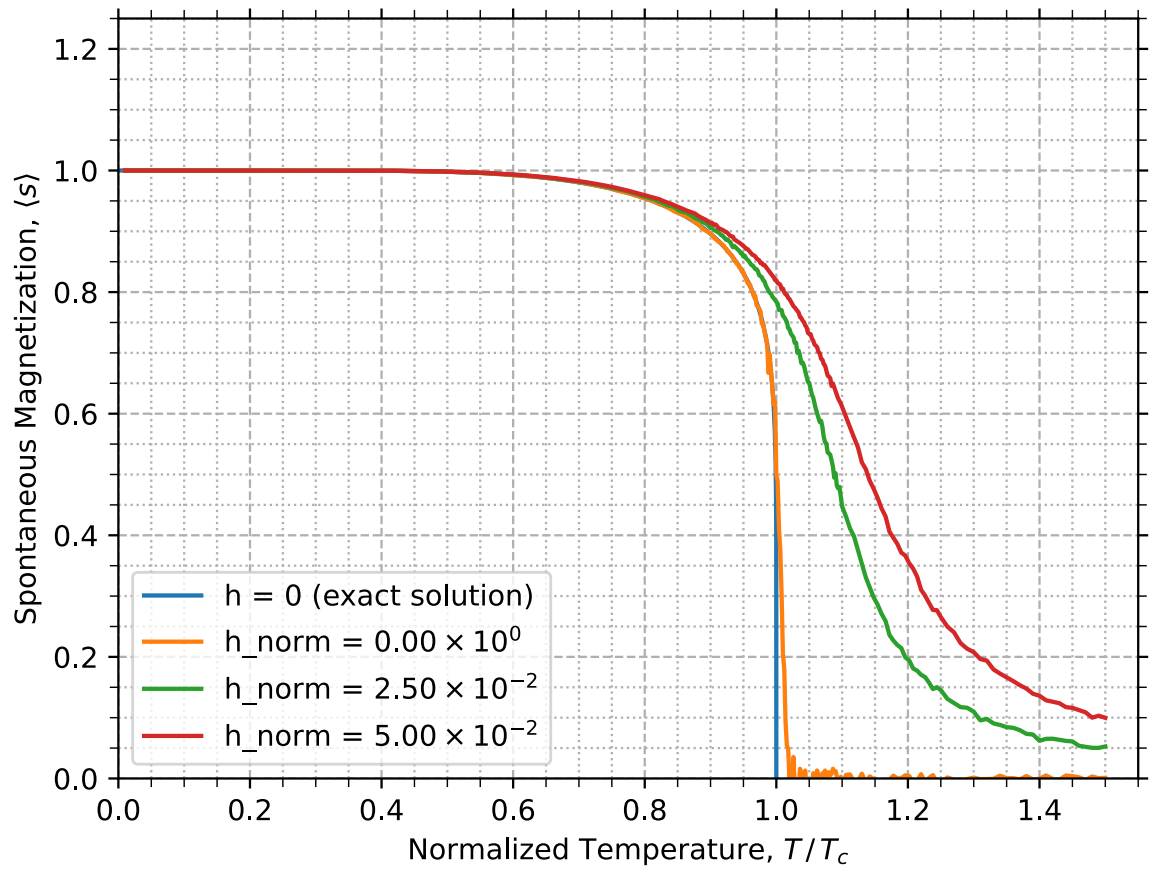
Figure 4: Thermodynamic Functions.

Figure 5: Magnetization for Different Magnetic Fields (It is almost unaffected for $T < T_c$).