CCNet
Center for Complex Networks

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Advanced Computational Physics

Problem Set 5

(Due Date : 1404/09/16)

Problems

1. **Ising model**

   (a) Write a Demon algorithm to compute $\langle E \rangle$, $\langle |M| \rangle$, χ, and C_v as a function of temperature for a 1d Ising system with the Hamiltonian:

   $$\mathcal{H} = -J \sum_i s_i s_{i+1} \tag{1}$$

   Suppose that you have 32 spins and $k_B = J = 1$ and $T = [0, 2]$ with $\Delta T = 0.1$.
   (Hint: For each T, create an initial spin configuration. Then evolve the system using the Demon algorithm.)

2. **Implicit and explicit methods for solving differential equations**

   (a) For function $\frac{df(x)}{dx} = f^2(x)$, step size $\Delta x = 0.5$, and initial condition $f(1) = 1$ use implicit and explicit methods to compute $f(x)$.

   (b) For function $\frac{df(x)}{dx} = -f(x)$, step size $\Delta x = 0.5$, and initial condition $f(1) = 1$ use implicit and explicit methods to compute $f(x)$.

   (c) Compare your results and explain the use case of each method.