HOMEWORK #6: Differential Equations

The second question is due in class on Thursday, October 13, 2005. The rest is due electronically by midnight on Thursday, October 13, 2005.

1. Read chapter 4.

2. Simulate by hand using Euler’s method the following set of differential equations for 1 second with a time step of 0.2 seconds starting with initial concentrations of $[S_1] = 10.0$, $[S_2] = 10.0$, $[S_3] = 10.0$, and $[S_4] = 10.0$. Redo your simulation using the Fourth-Order Runge-Kutta.

\[
\frac{d[S_1]}{dt} = 0.2[S_3] - 0.1[S_1][S_2] \\
\frac{d[S_2]}{dt} = 0.3[S_4] - 0.1[S_1][S_2] \\
\frac{d[S_3]}{dt} = 0.1[S_1][S_2] - 0.2[S_3] \\
\frac{d[S_4]}{dt} = 0.2[S_3] - 0.3[S_4]
\]

3. Use Dizzy to perform differential equation simulation of your network. Compare the plots that you get with stochastic simulation using an ensemble size of 1, 10, and 100. Do your stochastic simulation and differential equation simulation agree as you increase ensemble size? If so, would differential equation simulation be appropriate for your network? If not, why is stochastic simulation required for your network? Explain your answers.

4. TURNIN: send a plain text writeup of your analysis supported with png plots to myers@ece.utah.edu as attachment(s).