

T-61.5110 Modeling of Biological Networks

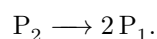
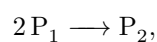
Exercise Session 7

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1. Deterministic to Stochastic model conversion

The dynamics of two species are given as:



The Figure 1 shows a plot that models the deterministic interaction. We may see that the dynamics converge after Time > 8.

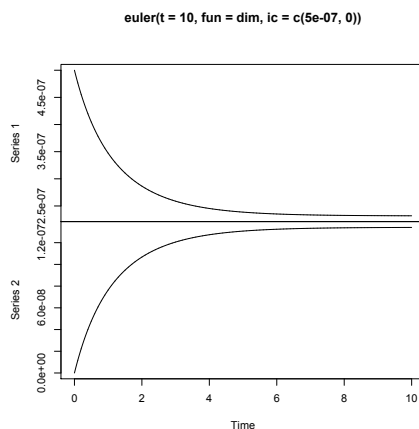


Figure 1: The plot shows the deterministic dynamics of two species.

b. The dynamics of the two species are now simulated using discrete stochastic kinetics. The repeated simulations are in Figure 2. As we may see, there are some

differences, and the dynamics won't converge because this is a probabilistic stochastic model.

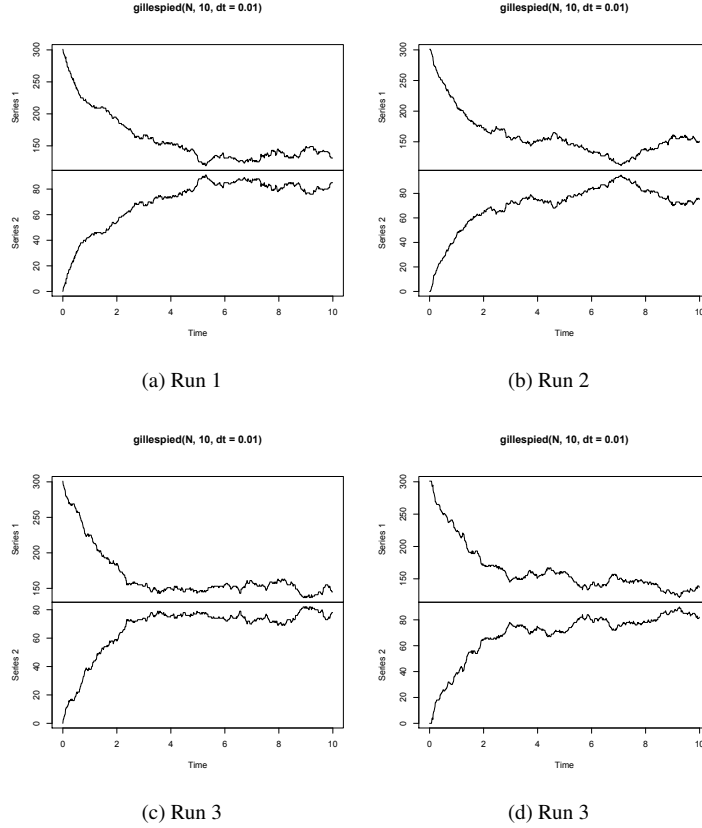
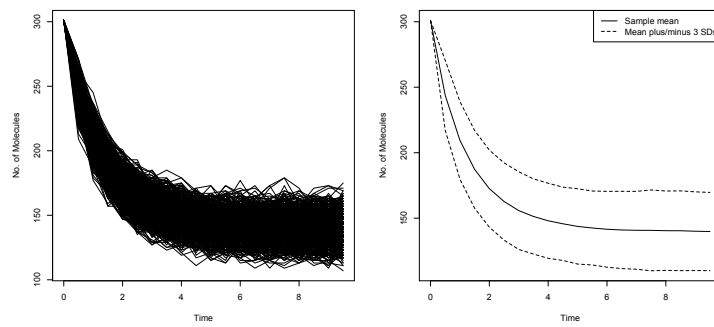


Figure 2: The plots show several runs of the stochastic dynamics of two species.

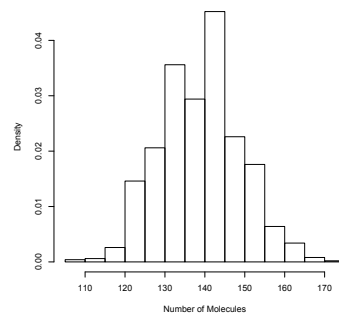
c. We now run the stochastic simulator 1000 times, and compare the number of molecules. The simulation plots are drawn on Figure 3(a), and the sample mean with confidence intervals are on Figure 3(b). A histogram of the amount of molecules on time $T=20$ is shown on Figure 3(c).

2. Stochastic models: Uncertainty and Sensitivity analysis

The stochastic simulator is run again, but now we have uncertainty about about value k_2 . The new results are shown on Figure 4. We can see that the distribution mean is moved further, to about 150 molecules at time $T=20$, when in the case k_2 the mean was under the 150.

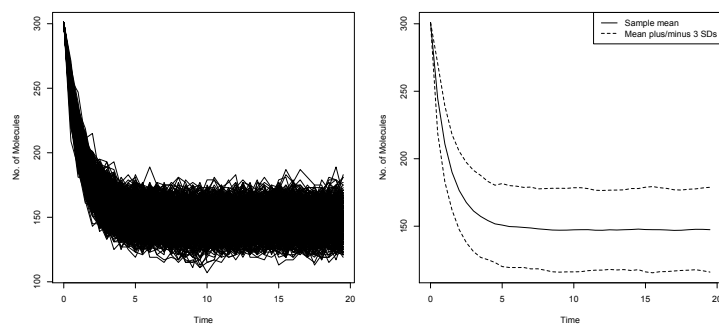


(a) Number of molecules with 1000 simulations. (b) The mean of number of molecules with 1000 simulations.

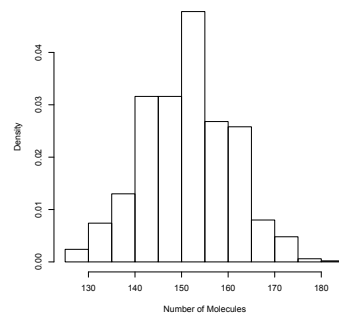


(c) Number of molecules at time T=20.

Figure 3: The plots for the Assignment 1(c).



(a) Number of molecules with 1000 simulations. (b) The mean of number of molecules with 1000 simulations.



(c) Number of molecules at time T=20.

Figure 4: The plots for the Assignment 2.