

# Chemistry 4000/5001/7001 Fall 2010 Assignment 9

**Due:** Friday, Nov. 19, 4:00 p.m.

**Marks:** 24

In this assignment, you will carry out a bifurcation analysis of the three-variable cell cycle model presented on page 277 of the textbook consisting of equations 10.9–10.11. This model represents the cell cycle during the early divisions after the fertilization of an egg.

1. Create an `xppaut` input file for this model, and verify that you can reproduce the results of Figure 10.10 of the textbook. Submit your `xppaut` input file. [2 marks]
2. By trial-and-error, find a value of  $[\text{Cdc20}]_T$  at which the system has a stable steady state. [2 marks]
3. Using `auto`, obtain a bifurcation diagram for this system as a function of  $[\text{Cdc20}]_T$ . In addition to the diagram itself, describe briefly the bifurcations that occur and how the behavior changes at each of the bifurcation points. [10 marks]
4. The rate of cyclin synthesis ( $k_1$ ) is also an important parameter. Obtain a bifurcation diagram as a function of  $k_1$ . Along with your diagram, present a brief discussion of your observations and of their biological implications. [10 marks]