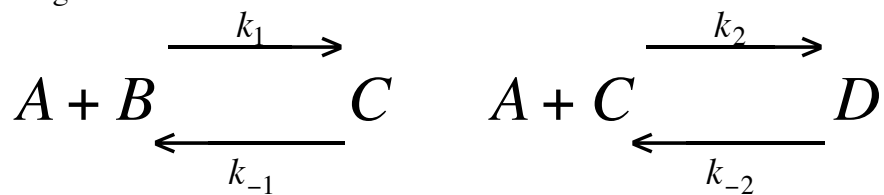


Problem C2
Kinetic Model of a Biochemical Reaction
Due: April 13, 2006

For this assignment you may use any spreadsheet program that you have access to (the assignment has been tested using Excel). However, you must save your files in a format that can be read by Excel and that preserves formulas and graphs.

Total of 40 points

Consider the following two reactions:



1. Construct a spreadsheet model of the kinetics of this system using Euler's method for numerical integration.
 - a) Create cells for each of the rate constants, create names to refer to them, and enter values of 0.4 for all
 - b) Create cells for the values of each reactant, create names to refer to them, and enter initial values of $A_0=20$, $B_0=6$, $C_0=0$, and $D_0=0$
 - c) Create a cell for the time step and enter a value of 0.004
 - d) Enter formulas for $A(t)$, $B(t)$, $C(t)$ and $D(t)$ (using the named cells) so that they are calculated for each of 251 time steps (one column for each reactant)
 - e) Create a plot of $A(t)$, $B(t)$, $C(t)$ and $D(t)$ vs. t

Save your spreadsheet using a name of the form "*LastnameC2part1.xls*"

2. Copy the spreadsheet into multiple sheets within the same workbook.
 - a) Use a different spreadsheet for values of k_1 from 0.2 to 1.8 in increments of 0.2.
 - b) Create an additional sheet with copies of the final values of A,B,C, and D for each k_1 and create a plot of the final values of A, B, C and D as a function of k_1 .

Save your spreadsheet using a name of the form "*LastnameC2part2.xls*"

3. Create a text or Word file containing
 - a) A few sentences describing the conclusions you draw about the behavior of the system from viewing the two plots.
 - b) A few sentences describing how the behavior of the system changes (both kinetically and at steady state) if B_0 is changed to 16. **Do not save the spreadsheets with the modified values of B_0 !**

Save this file using a name of the form "*LastnameC2part3.doc* or *.txt*".

Submit your three files via dropbox. Be sure that your files are named as described or they will not be graded.

Students in 03-510 and 03-710 may choose to write Maple or Matlab scripts instead of spreadsheets; however the same plots must be generated.

Extra credit

4. (10 points) Do **Exercise 4** in **Section 9.6** of Yeagers (page 316).
5. (10 points) Do **Exercise 3** in **Section 4.3** of Yeagers (pages 118-119).