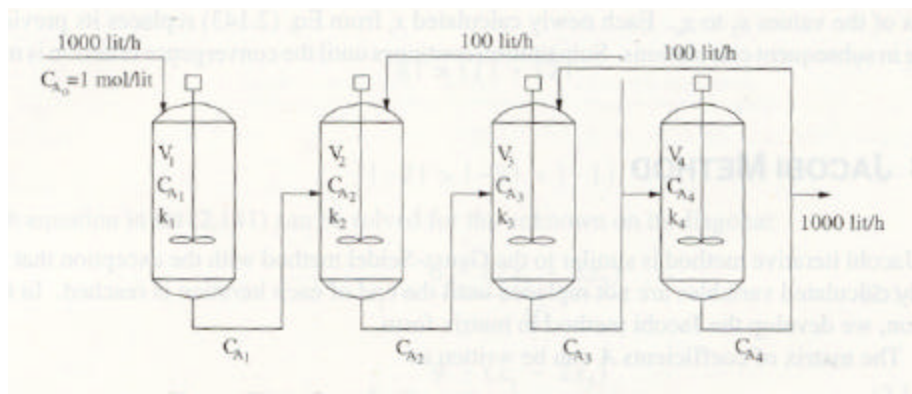


ChE 400 Applied Chemical Engineering Calculations
Fall 2008
Homework #4
Due 10/13/08

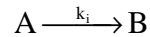
Reminder: Q-3 will take place the same day this homework is due.

1. Series of continuous stirred tank reactors:

A chemical reaction takes place in a series of four continuous stirred tank reactors arranged as shown in the figure.



The chemical reaction is a first-order irreversible reaction of the type:

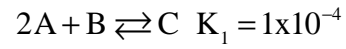


The conditions of temperature in each reactor are such that the value of the rate constant k_i is different in each reactor. Also, the volume of each reactor V_i is different. The values of k_i and V_i are given below.

1. Solve for the concentration of A in each of the reactors:
 - a. State your assumptions
 - b. Develop set of equations
 - c. Identify mathematical form
 - d. Develop a solution strategy. You are required to write a program in Matlab to solve for the concentration of "A" simultaneously in all the reactors using fsolve. Provide a disk with your solution.

Reactor	V_i (L)	k_i (h^{-1})	Reactor	V_i (L)	k_i (h^{-1})
1	1000	0.1	3	100	0.4
2	1500	0.2	4	500	0.3

2. Chemical Equilibrium. Determine the equilibrium conversion of the following reactions



the initial concentrations are: $C_{A,0} = 40$ $C_{B,0} = 15$ $C_{C,0} = 0$ $C_{D,0} = 10$

All concentrations are in kmol/m^3 . Linearize your equations using the Newton Raphson method and solve using Cramer's rule. Solve your problem using an Excel spread sheet as shown in class and in Tutorial III. You don't need to provide this solution on a disk, just print your Excel spread sheet solution.