Prince of Songkla University

Faculty of Engineering

Final Examination: Semester II   Year 2005

Date: March, 3, 2006   Time 13.30-16.30

Subject: 230 – 501 Comp. Methods in Chem. Eng.   Room: A401

ทุจริตในการสอบ โทษขั้นต่ำ คือ ปรับตกในรายวิชาที่ทุจริต และพักการเรียน 1 ภาคการศึกษา

There are 6 pages of the examination paper including the cover page. Please check the paper and write your name or code on all pages before doing the examination.

1. A calculator and a hand written note (1 A4) are allowed for the exam.

2. Please write the answers clearly and notify the problem number if writing on the back of each page.

3. Taking the exam outside the room **is not allowed**.

Problems	Full Score	
1	40	
2	50	
3	60	

Dr. Kulchanat Prasertsit

1. (40 points) Solve the nondimensional transient heat conduction equation in two dimensions which represents the transient temperature distribution in an insulated plate.

The governing equation is $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = \dfrac{\partial u}{\partial t}$ where u = temperature, x and y are spatial coordinates, and t = time. The boundary and initial condition are

Boundary conditions u(x,0,t) = 0   u(x,1,t) =1
u(0,y,t) = 0   u(1,y,t) = 1
Initial condition   u(x,y,0) =0   0≤x<1   0≤y<1

Write the algorithm of this problem by using the method of line.

2 (50 points) A Chemical plant requires 10^6 L/day of a solution. Three sources are available at different process and supply rates. Each source also has a different concentration of an impurity that must be kept below a minimum level to prevent interference with the chemical. The data for the three sources are summarized in the following table.

      a. Determine the objective function and all constraints for this problem.

      b. Convert the problem to a standard form. What are the basic and non basic variables.

      c. Show how to check whether or not the answer is optimal.

      d. If the answer is not optimal, show how to select the entering variable and the leaving variable.

	Source 1	Source 2	Source 3	Required
Cost($/L)	0.5	1.0	1.2	
Supply (10^5 L/day)	20	10	5	≥ 10
Concentration (mg/L)	135	100	75	≤ 100

3.   (60 points) The saturation concentration of dissolve oxygen (C_{O2}) in water as a function of temperature and chloride concentration is listed in the following table

       a.   Show the algorithm of using the random search method to find the constants a_0, a_1, and a_2 for multiple linear regression: $C_{O2} = a_0 + a_1 T + a_2 C_{Cl}$

       b.   Use least square regression for multiple linear regression and derive a predictive equation for dissolved oxygen concentration as a function of temperature and chloride based on the data from the table.

T, °C	Dissolve Oxygen (C_{O2}, mg/L) for Temperature (°C) and Concentration of Chloride (g/L)		
	C_{Cl}= 0 g/L	C_{Cl} = 10 g/L	C_{Cl} = 20 g/L
0	14.6	12.9	11.4
5	12.8	11.3	10.3
10	11.3	10.1	8.96
15	10.1	9.03	8.08
20	9.09	8.17	7.35
25	8.26	7.46	6.73
30	7.56	6.85	6.20