

Department of Chemical Engineering, Indian Institute of Technology Delhi
CHL 774: Process Optimization
Semester I, 2006-2007

Major Examination

Date: 02/12/06

Time: 2 hr

Marks: 50

Note:

1. Do not answer a question in more than one place. If the answer to a question is given at different places, only the first continuous attempt will be evaluated.
2. Show all the intermediate steps of the methods employed for the solution of the problems.
3. Supplementary answer-sheets will not be provided.

1. [16 Marks] Find optimal solution to transportation problem with four supply points and three demand station given in the following table

	Costs			Supply
	12	20	32	
	15	22	18	
	10	14	12	
	15	12	31	
Demand	4	4	6	

2. [8 Marks] Five workers are available to perform four jobs. Using the Hungarian method, assign jobs to minimize total time. Also report the minimum total time.

	1	2	3	4	← Jobs
Worker 1	6	20	14	10	
Worker 2	12	18	6	20	
Worker 3	18	14	15	12	
Worker 4	12	8	9	18	
Worker 5	10	12	20	14	

3. [12 Marks] A duct system having four sections is designed for a total pressure drop of 600 Pa. Ducts costs for various pressure drops in the sections are given in the following Table. Determine minimum cost and corresponding pressure drops. Duct flow requirements states that there should be a pressure drop in each section.

Section	Cost (in Rupees)		
	$\Delta P = 100 \text{ Pa}$	$\Delta P = 200 \text{ Pa}$	$\Delta P = 300 \text{ Pa}$
1	2350	2150	2010
2	1900	1720	1610
3	1410	1320	1180
4	990	910	840

4. [7 Marks] Determine the first Gomory cut for the following integer programming problem

$$\begin{array}{ll}\text{Maximize} & x_1 + x_2 \\ \text{Subject to} & 2x_1 - x_2 \leq 5 \\ & x_1 + 2x_2 \leq 3 \\ & x_1, x_2 \geq 0 \text{ and integer}\end{array}$$

5. [7 Marks] Solve the following problem using quadratic exterior penalty function

$$\begin{array}{ll}\text{Minimize :} & (x_1 - 2)^2 + (x_1 - 1)^2 \\ \text{subject to :} & \frac{x_1^2}{4} + x_2 \leq 1 \\ & -x_1 + 2x_2 \geq 1\end{array}$$