



**EASTERN UNIVERSITY, SRI LANKA**

**THIRD EXAMINATION IN SCIENCE - 2005/2006**

**FIRST SEMESTER (Aug./Sep.,2007)**

**MT 305 - OPERATIONAL RESEARCH**

**(Proper & Repeat)**

Answer all questions

Time : Two hours

- Q1. (a) Define the “feasible region for a linear programming problem”.  
(b) Explain how do you find the optimal solution in the graphical method.

A mine company own two different mines A and B that produce an ore which, after being crushed, is graded into three classes: high, medium and low-grade. The company has contracted to provide a smelting plant with 12 tons of high-grade, 8 tons of medium-grade and 24 tons of low-grade ore per week. The two mines have different operating characteristics as detailed below :

Mine	Cost per day (in thousand Rs.)	Production (tons per day)		
		High	Medium	Low
A	180	6	3	4
B	160	1	1	6

Assuming 5 working days per week, how many days per week should each mine be operated to minimize the total operating cost, fulfilling the smelting plant contract?

Q2. Explain the method of selection of a pivot element in the simplex method.

Use Simplex Method to solve the following linear programming problem :

Minimize  $Z = 3x_1 + 8x_2$ , subject to the constraints :

$$x_1 + x_2 = 200,$$

$$x_1 \leq 80,$$

$$x_2 \geq 60, \quad x_1, x_2 \geq 0.$$

Q3. Use Revised Simplex Method to solve the following linear programming problem

Minimize  $Z = -4x_1 + x_2 + 2x_3$ , subject to the constraints:

$$2x_1 - 3x_2 + 2x_3 \leq 12,$$

$$-5x_1 + 2x_2 + 3x_3 \geq 4,$$

$$3x_1 - 2x_3 = -1, \quad x_j \geq 0, \quad j = 1, 2, 3.$$

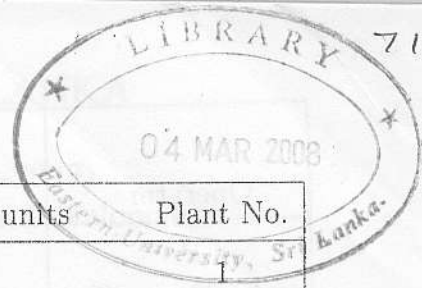
The following identities may help you in your computation.

$$\begin{pmatrix} 1 & 0 & 2 \\ 0 & 1 & 3 \\ 0 & 0 & 2 \end{pmatrix}^{-1} = \begin{pmatrix} 1 & 0 & -1 \\ 0 & 1 & -3/2 \\ 0 & 0 & 1/2 \end{pmatrix}, \quad \begin{pmatrix} 1 & -3 & 2 \\ 0 & 2 & 3 \\ 0 & 0 & 2 \end{pmatrix}^{-1} = \begin{pmatrix} 1 & 3/2 & -13/4 \\ 0 & 1/2 & -3/4 \\ 0 & 0 & 1/2 \end{pmatrix}$$

$$\begin{pmatrix} 2 & -3 & 2 \\ -5 & 2 & 3 \\ -3 & 0 & 2 \end{pmatrix}^{-1} = \begin{pmatrix} 4/17 & 6/17 & -13/17 \\ 1/17 & 10/17 & -16/17 \\ 6/17 & 9/17 & -11/17 \end{pmatrix}.$$

Q4. ABC Enterprises is having three plants manufacturing dry-cells, located at different locations. Production cost differs from plant to plant. There are five sales offices of the company located in different regions of the country. The sales prices can differ from region to region. The shipping cost from each plant to each sales office and other data are given by following tables:

Production Data Table



Production cost per unit	Max. capacity in No. of units	Plant No.
20	150	1
22	200	2
18	125	3

Shipping Costs Table

	Sales office 1	Sales office 2	Sales office 3	Sales office 4	Sales office 5
Plant 1	1	1	5	9	4
Plant 2	9	7	8	3	6
Plant 3	4	5	3	2	7

Demand & Sales Prices

	Sales office 1	Sales office 2	Sales office 3	Sales office 4	Sales office 5
Demand	80	100	75	45	125
Sales Price	30	32	31	34	29

Find the production and distribution schedule most profitable to the company.

Q5. Enumerate the steps involved in solving maximization assignment problems.

An organization producing 4 different products A, B, C and D having 4 operators P, Q, R and S, who are capable of producing any of the four products, works effectively 7 hours a day. The time (in minutes) required for each operator for producing each of the product are given in the cells of the following matrix along with profit (Rs. per unit):

Operator	Product			
	A	B	C	D
P	6	10	14	12
Q	7	5	3	4
R	6	7	10	10
S	20	10	15	15
Profit (Rs./unit)	3	2	4	1

Find out the assignment of operators to products which will maximize the profit.

Q6. Find the maximum flow for the following network by

(a) Intuitive technique,

(b) Labeling technique.

