

EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATION IN SCIENCE 2003/2004

(Nov./Dec.'2004) (Repeat)

FIRST SEMESTER

MT 305 - OPERATIONAL RESEARCH

Answer all questions

Time : Three hours

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

A plant manufactures two products *A* and *B*. The profit contribution of each product has been estimated as Rs.20 for product *A* and Rs.24 for product *B*. Each product passes through three departments of the plant. The time required for each product and total time available in each department are as follows:

Department	Hours required		Available hours during the month
	Product <i>A</i>	Product <i>B</i>	
1	2	3	1500
2	3	2	1500
3	1	1	600

The company has a contract to supply at most 250 units of product *B* per month. Formulate the problem of finding a monthly production schedule that maximizes the total profit as a linear programming model and find the optimal solution by using graphical method.

2. Explain the method of selection of a pivot element in the Simplex method.

A chemical company must produce 10,000 kilograms of a special mixture for a customer. The mixture consists of ingredients A , B and C . A costs Rs.8 per kilogram, B costs Rs.10 per kilogram and C costs Rs.11 per kilogram. No more than 3,000 kilogram of A can be used and at least 1,500 kilograms of B must be used. Also, at least 2,000 kilograms of C are required.

- (a) Formulate the problem as a linear programming problem.
- (b) Use the simplex method to find how much of each ingredients, the firm should use in order to minimize the cost.

3. (a) What are the advantages of using a dual of a linear programming problem than using a primal?

Prove that the dual of the dual is primal.

(b) A company makes three products X , Y , Z out of three materials P_1 , P_2 , and P_3 . The number of units required from each material to produce one unit of each product, unit profit contribution of the products and availabilities of the materials are given below:

	P_1	P_2	P_3	Profit contribution(in Rs.)
X	1	2	3	3
Y	2	1	1	4
Z	3	2	1	5

Amount

available(units) 10 12 15

- i. Formulate the problem as a linear programming problem maximizing the total profit.
- ii. Write the dual problem of (i).
- iii. Find the optimal solution of the problem using its dual.



4. Explain the North-West corner method.

A company has three factories manufacturing the same product and five sales agencies in different parts of the country. Production costs differ from factory to factory and the sales prices from agency to agency. The shipping cost per unit product from each factory to each agency is known. Given the following data, find the production and distribution schedules most profitable to the company.

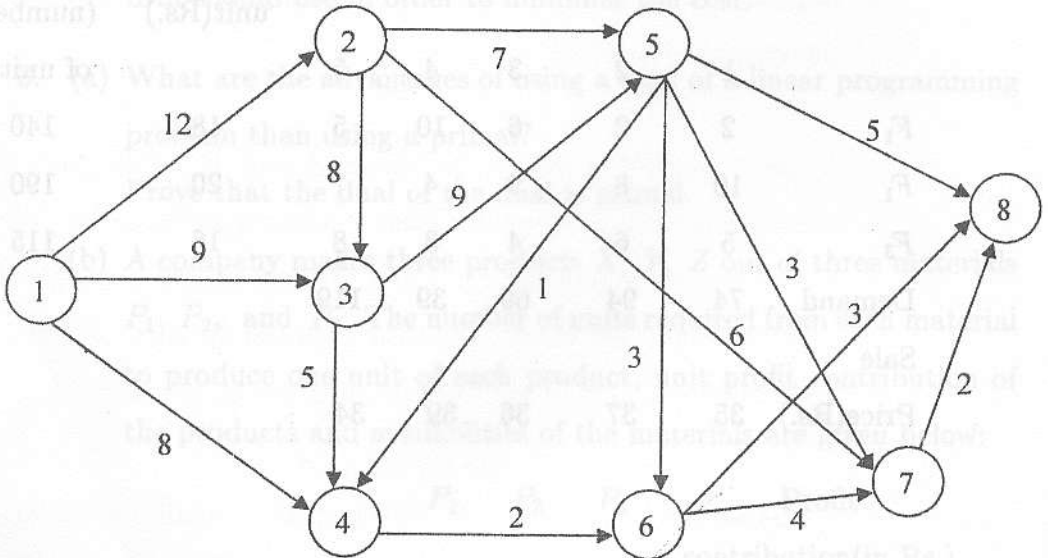
	Agencies					Production cost per unit(Rs.)	Machine capacity (number of units)
	1	2	3	4	5		
F_1	2	2	6	10	5	18	140
F_2	10	8	9	4	7	20	190
F_3	5	6	4	3	8	16	115
Demand	74	94	69	39	119		
Sale Price(Rs.)	35	37	36	39	34		

5. Describe the "Mack's method" for solving linear programming problem.

Five contractors have submitted tenders to take up five projects advertised. It is noted that one contractor can be assigned one job as otherwise time for completion and quality of workmanship will be affected. The estimates of cost in thousand rupees given by each of them are indicated below:

Contractor	Project				
	1	2	3	4	5
A	32	38	40	28	40
B	40	24	28	21	36
C	41	27	33	30	37
D	22	38	41	36	36
E	29	33	40	35	39

Find out the assignment such that the total cost of completing the five projects is minimum. What is the minimum cost?



- Find the maximum flow for the above network by intuitive technique.
- Find the maximum flow for the above network by labelling technique.