EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATION IN SCIENCE 2003/2004

(Nov./Dec.'2004)

FIRST SEMESTER

MT 305 - OPERATIONAL RESEARCH

Answer all questions

Time : Three hours

1. (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:

	Hours required		
Department	Product A	Product B	Available hours during the month
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 farmer has 2000 acres of land on which he can grow corn, wheat and soyabeans. Each acre of corn costs Rs.2000 for preparation, requires 7 man-days of work and yields a profit of Rs.600. An acre of wheat costs Rs.2400 for preparation, requires 10 man-days of work and yields a profit of Rs.800. An acre of soyabeans costs Rs.1400 for preparation, requires 8 man-days of work and yields a profit of Rs.400. If the farmer has Rs.200, 000 for preparation and can count on 16, 000 man-days of work, how many acres should be allocated to each crop to maximize profit?

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 availablities 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 manufacturing company wishes to develop a monthly production schedule for the coming months. Depending upon the sales commitments, the company can either keep the production constant, allowing fluctuations in inventory or inventories can be maintained at a constant level, with fluctuating production. Fluctuating production necessitates in working overtime, the cost of which is estimated to be double the normal production cost of Rs.12 per unit. Fluctuating inventories result in inventory carrying cost of Rs.2 per unit. If the company fails to fulfill its sales commitment, it incurs a shortage cost of Rs.4 per unit per month. The production capacities for the next three months are shown below.

	Production Capacity		
Month	Regular	Overtime	Sales
1	50	30	60
2	50	0	120
3	60	50	40

(a) Obtain the transportation table for the above problem.

(b) Use the North-West corner method to find the initial basic feasible solution.

(c) Determine the optimum production schedule.

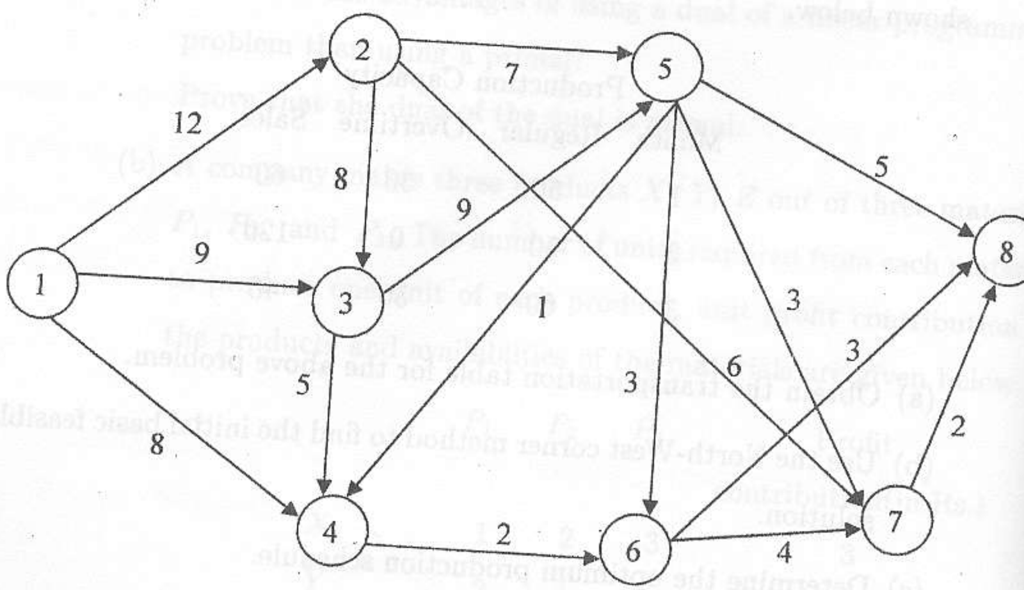
5. Describe the "Mack's method" for solving linear programming problem.

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?

6.



(a) Find the maximum flow for the above network by intuitive technique.

(b) Find the maximum flow for the above network by labelling technique.