EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATION IN SCIENCE 2002/2003

(Apr./May.' 2004)

(Repeat)

MT 305 - OPERATIONAL RESEARCH

Answer five questions only

Time : Three hours

1. Explain the following terms in optimization theory:

   (a) Objective function,

   (b) Feasible region.

   A farm is engaged in breeding pigs. The pigs are fed on various products grown on the farm. Because of the need to ensure certain nutrient constituents, it is necessary to buy additionally one or two products, which we shall call A and B. The nutrient constituents (Vitamins and Proteins) in each unit of the products are given below. Product A costs Rs.20 per unit and product B costs Rs.40 per unit.

Nutrient	Nutrient contents in the products		Minimum amount of nutrients
	A	B	
1	36	6	108
2	3	12	36
3	20	10	10

How much of products A and B be purchased at the lowest pos
cost so as to provide the pigs, subject to the nutrients not less
that given in the table?

2. Explain the following terms:

   (a) pivot column;

   (b) pivot row;

   (c) pivot element.

A manufacturing firm has discontinued production of a certain profitable product line. This created considerable excess produc capacity. Management is considering to devote this excess capacit one or more of three products; 1, 2, and 3. The available capacity the machines which might limit output is summarized in the follow table.

Machine Type	Available Time (In machine hours per week)
Milling machine	200
Lathe	150
Grinder	50

The number of machine hours required for each unit of the respect products is given below:

Machine Type	Productivity (In machine hours per unit)		
	Product 1	Product 2	Product 3
Milling machine	8	2	3
Lathe	4	3	–
Grinder	2	–	1

The unit profit would be Rs.20, Rs.6 and Rs.8 respectively for products 1, 2 and 3.

(a) Formulate the problem as a linear programming problem.

(b) Use the simplex method to find how much of each product the firm should produce in order to maximize the profit.

3. Use the Revised simplex method to

minimize $Z = -4x_1 + x_2 + 2x_3$

subject to

$$\begin{aligned} 2x_1 - 3x_2 + 2x_3 &\leq 12\,, \\ -5x_1 + 2x_2 + 3x_3 &\geq 4\,, \\ -3x_1 + 2x_3 &= 1\,, \\ x_1,\ x_2,\ x_3 &\geq 0. \end{aligned}$$

4. Explain the North-West corner rule.

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 given below.

	Production cost per unit (Rs)	Max.capacity (No.of units)
Factory F_1	18	140
Factory F_2	20	190
Factory F_3	16	115

		Agency				
		1	2	3	4	5
Factory	F_1	2	2	6	10	5
	F_2	10	8	9	4	7
	F_3	5	6	4	3	8
Demand		74	94	69	39	119
Sales price(Rs)		35	37	36	39	34

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

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

(c) Determine the optimum production schedule.

5. Briefly explain the " Vogel's approximation method".

A company has three warehouses A, B and C and four stores W, X and Z. The warehouses have altogether a surplus of 150 units of a g commodity as follows:

A – 50

B – 60

C – 40

The four stores need the following amounts:

W – 20

X – 70

Y – 50

Z – 10

Costs (in rupees) of shipping one unit of commodity from wareho to stores are given as follows:

		Stores			
		W	X	Y	Z
Warehouses	A	50	150	70	60
	B	80	70	90	10
	C	15	87	79	81

(a) Workout the transportation schedule by using Vogel's approximation method.

(b) Find the optimal transportation cost.

6. Briefly explain the "Hungarian method" for solving assignment problems.

A company is faced with the problem of assigning six different machines to five different jobs. The costs estimated in hundreds of rupees are given in the table below:

Machines	Jobs				
	1	2	3	4	5
1	2.5	5	1	6	2
2	2	5	1.5	7	3
3	3	6.5	2	8	3
4	3.5	7	2	9	4.5
5	4	7	3	9	6
6	6	9	5	10	6

Solve the problem by minimizing the total cost.

7. Describe the "Mack's method" for solving liner programming proble

A Team of 5 horses and 5 riders has entered a jumping show c test. The number of finality points expected when each rider rides a horse is shown bellow:

	Rider				
	9	20	60	15	21
	38	71	69	49	60
Horse	28	13	80	28	34
	58	34	13	37	25
	30	3	53	20	21

How should the horse be allotted to the riders so as to minimize t expected loss of the team?

8. (a) Define the following terms.

i. Graph,

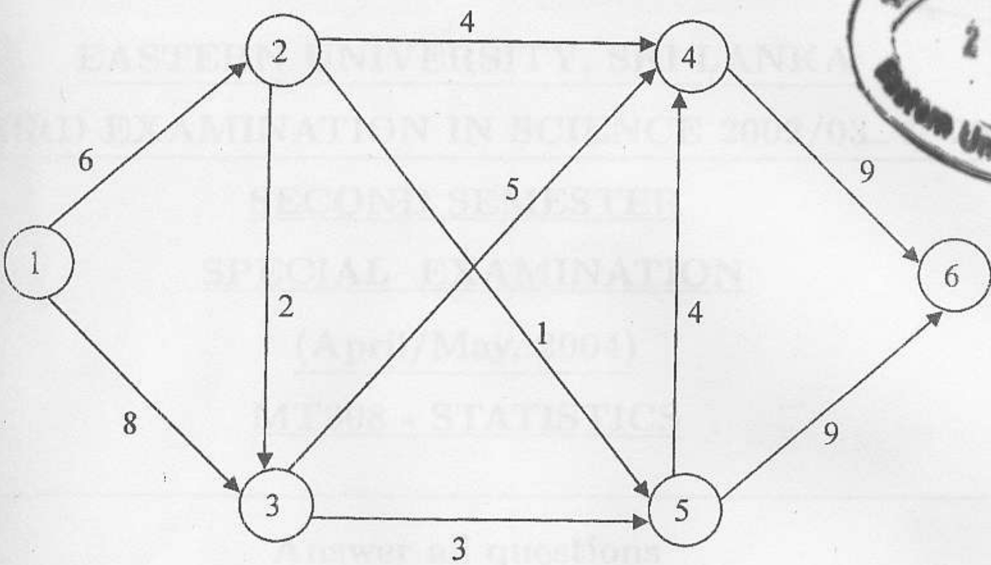
ii. Path,

iii. Loop,

iv. Tree,

v. Source.

(b) Find the maximal flow for the following network using the labeling technique.



(c) Find the shortest distance and path from the node 1 to 10 in the network given below.