EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATION IN SCIENCE 2001/2002

(April'2002)

FIRST SEMESTER

MT 305 - OPERATIONAL RESEARCH

Answer all questions

Time : Three hours

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1. (a) Define the "feasible region for a linear programming problem".

   (b) Once the point on the graph indicating the solution has been obtained, explain how to find the optimal solution from the graph.

A small firm produces two qualities of a product, standard and deluxe. The profit per unit is Rs.100 for the standard quality and Rs.300 for the deluxe quality. Each model requires 1 hour per unit in the machine shop and 40 machine hours are available per week. The standard model can be assembled and finished in 2.5 hours per unit but the deluxe takes 10 hours per unit. There are 200 hours per week available for assembling and finishing. Market research suggests that the maximum

weekly sales of the deluxe model will be 18 units. The products use a special component, of which only 1200 are currently available per week. Each standard unit uses 25 components and each deluxe unit needs 50.

(a) Write down the objective function and constraints.

(b) Use graphical method to find how much standard and deluxe quality units of products, should the company produce weekly to maximize the profit?

2. Briefly explain the "method of selection of a pivot element in 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 kilograms 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) Write down the dual simplex algorithm.

Use the dual simplex method to solve the following problem:

Maximize $Z = -3x_1 - 2x_2$

subject to

$$\begin{aligned} x_1 + x_2 &\geq 1 \\ x_1 + x_2 &\leq 7 \\ x_1 + 2x_2 &\geq 10 \\ x_2 &\leq 3 \end{aligned}$$

and $x_1,\ x_2 \geq 0$.

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

The Machine Oil supplies Limited have four factories F_1, F_2, F_3 and F_4 containing special machine oil. The company supply the oil to four distribution centers A, B, C, D with daily demand $10, 12, 14, 16$ gallons respectively. Transportation costs in rupees per gallon, from factory to the distribution centers, are given below:

Factories	A	B	C	D
F_1	7	3	12	9
F_2	8	11	3	21
F_3	6	15	10	20
F_4	10	3	8	3

The four factories could supply daily production capacities for the products are 8 gallons at F_1, 12 gallons at F_2, 15 gallons at F_3 and 10 gallons at F_4.

(a) Use Vogel's approximation method to find the initial basic feasible solution.

(b) Determine the optimum allocation procedure which will minimize costs and obtain the daily cost for this procedure.

5. Give a brief explanation for Mack's method to find the solution of an Assignment method.

A team of 5 horses and 5 riders has entered a jumping show contest. The number of finality points expected when each rider rides any 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 horses be allotted to the riders so as to minimize the expected loss of the team.