EASTERN UNIVERSITY, SRI LANKA

EXTERNAL DEGREE EXAMINATION IN SCIENCE - 2005/2006

THIRD YEAR FIRST SEMESTER (Mar./May, 2010)

EXTMT 305 - OPERATIONAL RESEARCH

Answer all questions Time : Three hours

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

   (b) Explain how do you find the optimal solution in the graphical method.

   (c) A sick patient has been advised by his doctor that his diet must contain at least 4000 units of vitamins, 50 units of minerals and 1400 units of calories. Two foods F_1 and F_2 are available at a cost of Rs.4 and Rs.3 per unit respectively. One unit of food F_1 contains 200 units of vitamins, 1 unit of mineral and 40 units of calories. One unit of food F_2 contains 100 units of vitamins, 2 units of minerals and 40 units of calories. Formulate the above problem as a linear programming problem and solve using graphical method.

2. Use Simplex Method to solve the following Linear Programming Problem:

   Minimize $Z = 8x_1 + 4x_2$, subject to the constraints:

$$
\begin{aligned}
3x_1 + x_2 &\geqslant 27, \\
x_1 + x_2 &= 21, \\
x_1 + 2x_2 &\leqslant 40, \quad x_1, x_2 \geqslant 0.
\end{aligned}
$$

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

Maximize $Z = 60x_1 + 30x_2 + 20x_3$, subject to the constraints:

$$\begin{aligned} 8\,x_1 + 6\,x_2 + x_3 &\leqslant 48, \\ 4\,x_1 + 2\,x_2 + \frac{3}{2}\,x_3 &\leqslant 20, \\ 2\,x_1 + \frac{3}{2}\,x_2 + \frac{1}{2}\,x_3 &\leqslant 8, \quad x_1, x_2, x_3 \leqslant 0. \end{aligned}$$

4. Briefly explain the Vogel's approximation method.

A particular product is manufactured in four factories A, B, C and D; and is centers 1, 2 and 3. The cost in Rs. of product per unit and capacity in kg per un of each plant is given below:

Factory	Cost (Rs.) per unit	Capacity (kg) per unit
A	12	100
B	15	20
C	11	60
D	13	80

Sales center	Sale price (Rs.) per unit	Demand (kg) per unit
1	15	120
2	14	140
3	16	60

Find the optimal sales distribution.

5. Enumerate the steps involved in solving minimization assignment problem.

Five swimmers are eligible to compete in a relay team which is consist of fou mers swimming four different swimming styles; back stroke, breast stroke, free st butterfly. The time taken for the five swimmers Anand, Bhaskar, Chandru, Do Eswar to cover a distance of 100 meters in various swimming styles are given b minutes : seconds. Anand swims the back stroke in 1:09, the breast stroke in 1:

has never competed in the free style or butterfly. Bhaskar is a free style specialist averaging 1:01 for the 100 meters but can also swim the breast stroke in 1:16 and butterfly in 1:20. Chandru swims all styles: the back stroke in 1:10, the butterfly in 1:12, the free style in 1:05 and the breast stroke in 1:20. Dorai swims only the butterfly in 1:11 while Easwar swims the back stroke in 1:20, the breast stroke in 1:16, the free style in 1:06 and the butterfly in 1:10. Which swimmer should be assigned to which swimming style? Who will not be in the relay?

. Find the maximum flow for the following network using:

(a) intuitive technique,

(b) labeling technique.