EASTERN UNIVERSITY, SRI LANKA

XTERNAL DEGREE EXAMINATION IN SCIENCE - 2005/2006

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

EXTMT 305 - OPERATIONAL RESEARCH

nswer 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:

   $$3x_1 + x_2 \geqslant 27,$$
   $$x_1 + x_2 = 21,$$
   $$x_1 + 2x_2 \leqslant 40, \quad x_1, x_2 \geqslant 0.$$

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

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

$$8x_1 + 6x_2 + x_3 \leqslant 48,$$

$$4x_1 + 2x_2 + \frac{3}{2}x_3 \leqslant 20,$$

$$2x_1 + \frac{3}{2}x_2 + \frac{1}{2}x_3 \leqslant 8, \quad x_1, x_2, x_3 \leqslant 0.$$

4. Briefly explain the Vogel's approximation method.

A particular product is manufactured in four factories A, B, C and D; and is s
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

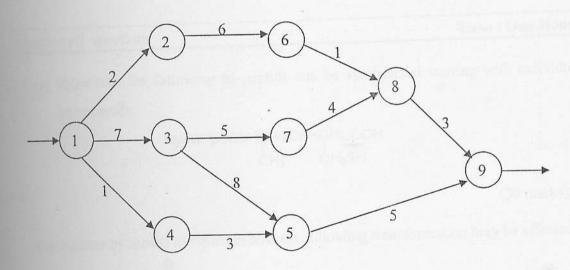| Sales center	Sale price (Rs.) per unit	Demand (kg) per unit
1	15	120
2	14	140
3	16	60

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 four
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 aver-aging 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?

6. Find the maximum flow for the following network using:

   (a) intuitive technique,

   (b) labeling technique.