EASTERN UNIVERSITY, SRI LANKA

DEPARTMENT OF MATHEMATICS

THIRD EXAMINATION IN SCIENCE - 2009/2010

FIRST SEMESTER (June/July, 2011)

MT305 - OPERATIONAL RESEARCH

swer all questions — 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 additional one or two products, which we shall call A and B. The nutrient constituent (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 constituents in the product A	B	Minimum amount of nutrients
1	36	6	108
2	3	12	36
3	20	10	100

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

2. Use simplex method to solve the following Linear Programming Problem:

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

$$\begin{aligned} -x_1 - x_2 &\geqslant -8, \\ -6x_1 - 4x_2 &\leqslant -12, \\ 5x_1 + 8x_2 &= 20, \quad x_1, x_2 \geqslant 0. \end{aligned}$$

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

Minimize $Z = x_1 - 3x_2 + 2x_3$, subject to the constraints:

$$\begin{aligned} 3x_1 - x_2 + 2x_3 &\geqslant 7, \\ -2x_1 + 4x_2 &\leqslant 12, \\ -4x_1 + 3x_2 + 8x_3 &\leqslant 10, \quad x_1, x_2, x_3 \geqslant 0. \end{aligned}$$

4. Ozianic enterprizes is having three plants manufacturing T-shirt, located at different t locations. Production cost differs from plant to plant. There are five sales spots of company located in different regions of the country. The sales prices can differ from reg to region. The shipping cost from each plant to each sales spots and other data are gi by the following table:

Production Data Table

Production cost per unit	Max. capacity in No.of units	Plant No.
20	150	1
22	200	2
18	125	3

Shipping Costs Table

	Sales spot 1	Sales spot 2	Sales spot 3	Sales spot 4	Sales spot 5
Plant 1	1	1	5	9	4
Plant 2	9	7	3	3	6
Plant 3	4	5	8	2	7

Demand and Sales Price

	Sales spot 1	Sales spot 2	Sales spot 3	Sales spot 4	Sales spot 5
Demand	80	100	75	45	125
Sales Price	30	32	31	34	29

Find the production and distribution schedule most profitable to the company.

Enumerate the steps involved in solving minimization assignment problems.

An air-line that operates 7 days a week has the time table shown below. Crews must have a minimum layover 5 hours between flights. Obtain the pairing of the flights that minimizes layover time away from home assuming that crews flying from Singapore to Sri Lanka can be based either at Singapore or Sri Lanka for any given pairing, the crew will be based at the city that results in smaller layover.

Flight No.	Singapore Depart	Sri Lanka Arrival	Flight No.	Sri Lanka Depart	Singapore Arrival
101	9.00	10.00	201	10.00	11.15
102	10.00	11.00	202	10.30	11.45
103	15.30	16.30	203	14.00	15.15
104	20.30	21.30	204	19.30	20.45

(a) Draw the network for the following project.

(b) Find the maximum flow for the network using

i. Intuitive technique,

ii. Labeling technique.

The following information are given regarding the project:

Activity	Required preceding activity	Duration (Days)
A	None	6
B	None	8
C	A	4
D	A	1
E	A	2
F	B, E	5
G	B, E	3
H	D, G	4
I	C, F, H	8
J	D, G	9