



EASTERN UNIVERSITY, SRI LANKA

DEPARTMENT OF MATHEMATICS

THIRD EXAMINATION IN SCIENCE - 2013/2014

FIRST SEMESTER (May/June, 2016)

AM 305 - OPERATIONAL RESEARCH

(PROPER & REPEAT)

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Answer all Questions

Time: Three hours

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1. Define what is meant by the following terms:

\* *linear program*;

\* *feasible region* of a linear programming problem.

The standard weight of a special purpose brick is 5 kg and it contains two basic ingredients  $B_1$  and  $B_2$ .  $B_1$  costs Rs. 5 per kg and  $B_2$  costs Rs. 8 per kg. Strength considerations dictate that the brick contains not more than 4 kg of  $B_1$  and a minimum of 2 kg of  $B_2$ . Since the demand for the product is likely to be related to the price of the brick, find the minimum cost of the brick satisfying the above conditions by using the graphical method.

2. Use the Simplex method to solve the following linear programming problem:

Maximize  $Z = 2x_1 + 3x_2 + 4x_3$ , subject to the constraints:

$$3x_1 + x_2 + 4x_3 \leq 600,$$

$$2x_1 + 4x_2 + 2x_3 \geq 480,$$

$$2x_1 + 3x_2 + 3x_3 = 540, \quad x_1, x_2, x_3 \geq 0.$$

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

Maximize  $Z = 2x_1 + x_2$ , subject to the constraints:

$$3x_1 + 4x_2 \leq 6,$$

$$6x_1 + x_2 \leq 3, \quad x_1, x_2 \geq 0.$$

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

A company has four warehouses and six stores. The warehouses altogether supply of 22 units of a given commodity. Individual supplies at warehouses 1, 2, 3 and 4 are 5, 6, 2 and 9 units respectively. The six stores altogether need 22 units of the commodity. Individual requirements at stores 1, 2, 3, 4, 5 and 6 are 4, 4, 4, 4, 2 and 2 units respectively. Cost of shipping of one unit of commodity from warehouse  $i$  to store  $j$  in rupees is given in the table below.

	Stores					
Warehouses	1	2	3	4	5	6
1	9	12	9	6	9	10
2	7	3	7	7	5	5
3	6	5	9	11	3	11
4	6	8	11	2	2	10

Find, how the commodities should be shipped from the warehouses to the stores in order to minimize the transportation cost by using Vogel's approximation method.

5. Briefly explain the *Hungarian method* for solving assignment problems.

Five wagons are available at stations 1, 2, 3, 4 and 5. These are required to be assigned to stations I, II, III, IV and V. The mileages between various stations are given in the table below.

Stations	I	II	III	IV	V
1	10	5	9	18	11
2	13	9	6	12	14
3	3	2	4	4	5
4	18	9	12	17	15
5	11	6	14	19	10

Find, how the wagons should be assigned to a station so that the total mileage covered is minimized.

6. Find the maximum flow, for the following network by

(a) intuitive technique;

(b) labeling technique.

