EASTERN UNIVERSITY, SRI LANKA
DEPARTMENT OF MATHEMATICS
THIRD EXAMINATION IN SCIENCE - 2015/2016
FIRST SEMESTER (May/June, 2018)
AM 305 - OPERATIONAL RESEARCH

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.

   Sky Ltd. has two products Cloud and Wind. To produce one unit of Cloud, 2 units
   of material X and 4 units of material Y are required. To produce one unit of Wind,
   3 units of material X and 2 units of material Y are required. As the raw material
   X is in short supply so not more than 16 units of material X can be used. Atleast
   16 units of material Y must be used in order to meet the committed sales of Cloud
   and Wind. Cost per unit of material X and material Y are Rs. 2.50 and Rs. 0.25
   respectively. The selling price per unit of cloud and wind are Rs. 12 and Rs. 16
   respectively.

   You are required:

   (i) to formulate mathematical model,

   (ii) to solve it for maximum contribution to the profit graphically.

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

$$\text{Minimize } Z = 8x_1 + 4x_2,$$

$$\text{subject to} \quad 3x_1 + x_2 \geq 27,$$

$$x_1 + x_2 = 21,$$

$$x_1 + 2x_2 \leq 40,$$

$$x_1, x_2 \geq 0.$$

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

$$\text{Maximize } Z = 2x_1 + x_2,$$

$$\text{subject to} \quad 3x_1 + 4x_2 \leq 6,$$

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

$$x_1, x_2 \geq 0.$$

4. Briefly explain the *Vogel's Approximation Method.*

A company has four terminals U, V, W and X. At the start on a particular day, 10, 4, 6 and 5 trailers, respectively are available at these terminals. During the previous night 13, 10, 6 and 6 trailers, respectively were loaded at plants A, B, C and D. The company dispatcher has come up with the costs between the terminals and plants as follows:

Terminals	Plants			
	A	B	C	D
U	20	36	10	28
V	40	20	45	20
W	75	35	45	50
X	30	35	40	25

Find the optimal allocation of loaded trailers from plants to terminals in order to minimize transportation cost by using Vogel's approximation method.

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

A transport corporation has three vehicles at three cities A, B and C. Each vehicle can be assigned to any cities W, X, Y and Z. The distances between the cities are given in the following table :

	Cities			
Vehicles	W	X	Y	Z
A	33	40	43	32
B	45	28	31	23
C	42	29	36	29

Find the assignment of the vehicles among the cities so that the total distance travelled is minimized.

6. Find the maximum flow for the following network by

   (a) intuitive technique;

   (b) labeling technique.