EASTERN UNIVERSITY, SRI LANKA

DEPARTMENT OF MATHEMATICS

THIRD EXAMINATION IN SCIENCE - 2016/2017

FIRST SEMESTER (March/April, 2019)

AM 305 - OPERATIONAL RESEARCH

Answer all Questions   Time: Three hours

1. Define what is meant by the following terms:

   * *Linear Programming*;

   * *objective function* of a Linear Programming Problem.

   A firm manufactures two products A and B on which the profits earned per unit are Rs.3 and Rs.4 respectively. Each product is processed on two machines M_1 and M_2. Product A requires one minute of processing time on M_1 and two minutes on M_2, while B requires one minute on M_1 and one minute on M_2. Machine M_1 is available for not more than 7 hours and 30 minutes, while machine M_2 is available for 10 hours during any working day. Find the number of units of products A and B to be manufactured to get maximum profit.

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

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

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

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

   $$2x_1 + 3x_2 + 3x_3 = 540,$$

   where $x_1,\ x_2,\ x_3 \geq 0$.

3. Use *Revised Simplex Method* to solve the following Linear Programming Prob[
   Minimize $Z = -4x_1 + x_2 + 2x_3$ subject to the constraints:

$$2x_1 - 3x_2 + 2x_3 \leq 12,$$

$$-5x_1 + 2x_2 + 3x_3 \geq 4,$$

$$3x_1 - 2x_3 = -1,$$

where $x_1, x_2, x_3 \geq 0$.

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

   Find the optimum solution by using Vogel's Approximation Method to the follo[
   transportation problem in which the cells contain the transportation cost in ru[
   between different cities. The supplies in the cities U, V, W and X are 40, 3[
   and 10 respectively and the demands in the cities A, B, C, D and E are 30[
   15, 20 and 5 respectively.

	Cities				
Cities	A	B	C	D	E
U	7	6	4	5	9
V	8	5	6	7	8
W	6	8	9	6	5
X	5	7	7	8	6

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

   A small garment making unit has five tailors stitching five different types of [
   ments. All the five tailors are capable of stitching all the five types of garme[
   The output per day per tailor for each type of garment is given below:

	Garments				
Tailors	1	2	3	4	5
A	7	9	4	8	6
B	4	9	5	7	8
C	8	5	2	9	8
B	6	5	8	10	10
C	7	8	10	9	9

The profits (Rs.) for each type of garment are 2, 3, 2, 3 and 4 respectively.

(i) Which type of garment should be assigned to which tailor in order to maximize the profit?

(ii) If tailor D is absent for a specified period and no other substitute tailor is available, what should be the optimal assignment?

6. Find the maximum flow for the following network by

(a) intuitive technique;

(b) labeling technique.