EASTERN UNIVERSITY, SRI LANKA

DEPARTMENT OF MATHEMATICS

EXTERNAL DEGREE EXAMINATION IN SCIENCE -2009/2010

THIRD YEAR FIRST SEMESTER- (June / Sept., 2012)

EXTMT 305 – OPERATIONAL RESEARCH

Answer **all** questions. Time: **Three** hours.

01. A company makes two products (X and Y) using two machines (A and B). Each unit of X requires 50 minutes processing time on machine A and 30 minutes processing time on machine B. Each unit of Y requires 24 minutes processing time on machine A and 33 minutes processing time on machine B. Available processing time on machine A is 40 hours and on machine B is 35 hours per week. Profits per unit of X and Y are Rs. 50 and Rs. 30, respectively. Formulate the problem of deciding how much of each product to produce in a week as a linear program. Determine the optimal product mix that will maximize profit using graphical method.

02. Use the **Simplex** method to solve the following problem.

Maximize $Z = X_1 + 2X_2 - X_3$

Subject to the constraints;

$$2X_1 + X_2 + X_3 \leq 14,$$
$$4X_1 + 2X_2 + 3X_3 \leq 28,$$
$$2X_1 + 5X_2 + 5X_3 \leq 30,$$
$$X_1,\ X_2,\ X_3 \geq 0.$$

(P. T. O.)

03. Solve the following linear program, using **Dual Simplex** method.

06.

Minimize $Z = 7X_1 + 2X_2 + 5X_3 + 4X_4$

Subject to the constraints;

$$2X_1 + 4X_2 + 7X_3 + X_4 \geq 5,$$
$$8X_1 + 4X_2 + 6X_3 + 4X_4 \geq 8,$$
$$3X_1 + 8X_2 + X_3 + 4X_4 \geq 4,$$
$$X_1 \geq 0,\ X_2 \geq 0,\ X_3 \geq 0,\ X_4 \geq 0.$$

04. Using **Revised Simplex** method, solve the following linear program.

Maximize $Z = 2X_1 + 3X_2 - X_3 + 4X_4$

Subject to the constraints;

$$X_1 - 2X_2 + X_4 + 4X_5 \leq 10,$$
$$X_1 + X_2 + 3X_3 + 2X_4 \leq 16,$$
$$2X_1 + (1/2)\,X_2 - X_3 - X_4 \leq 8,$$
$$X_1, X_2, X_3, X_4 \geq 0.$$

05. A small garment industry has five tailors stitching five different types of garments. All are capable of stitching the five types of garments. The output per day per tailor a profit (Rs.) for each type of garment are given below.

Tailors	Garments				
	1	2	3	4	5
A	7	9	4	8	6
B	4	9	5	7	8
C	8	5	2	9	8
D	6	5	8	10	10
E	7	8	10	9	9
Profit per garment (Rs.)	2	3	2	3	4

(i) Formulate the problems as the linear programming by clearly stating the constrai

(ii) Find the optimal assignment that maximizes the profit using **Hungarian** method.

(iii)What is the profit for the optimal assignment?

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06. A company has three factories (F_1, F_2, F_3) and four warehouses (W_1, W_2, W_3, W_4) in different locations. The company wants to transport items from factories to warehouses at the minimum total transportation cost. Transportation cost per unit from each factory to each warehouse is as follow.

Factory	**Warehouse**				**Factory Capacity**
	W_1	W_2	W_3	W_4	
F_1	19	30	50	10	**7**
F_2	70	30	40	60	**9**
F_3	40	8	70	20	**18**
Warehouse Requirements	**5**	**8**	**7**	**14**	**34**

Build the mathematical model for the above transportation problem. Find the initial feasible solution by **Vogel's Approximation** Method (VAM). Check optimality of the solutions using **Modified** method (MODI) or **UV** method.