THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. /B.Ed. Degree Programme

APPLIED MATHEMATICS-LEVEL 05

APU3141/APE5141- Linear Programming

Final Examination 2013/2014

Duration: Two Hours

Date: 23.06.2014	**Time: 9.30 a.m- 11.30 a.m**

Answer four questions only

(1) The *ABC* Company wishes to plan its advertising strategy. There are two magazines under consideration: Magazine I and Magazine II. Magazine I has a reach of 2000 potential customers and Magazine II has a reach of 2500 potential customers. The cost per page of advertising is Rs 400 and Rs 600 in Magazine I and Magazine II respectively. The firm has a monthly budget of Rs 6000. There is an important requirement that the total reach for income group under Rs.20,000 per annum should not exceed 4000 potential customers. The reach in Magazine I and Magazine II for this income group is 400 and 200 potential customers respectively. How many pages should be bought in the two magazines to maximize the total reach?

i) Formulate the problem as a linear programming problem to maximize the total reach.

ii) Solve the formulated problem in part (i) using the graphical method.

(2) a) Briefly explain the following terms in linear programming:

i) Feasible Solution
ii) Objective function
iii) Unbounded solution
iv) Optimal solution

b) A cement manufacturer produces two types of cement, namely X and Y. The profits per ton for each type are Rs.40 and Rs.50 respectively. Labour and raw material requirements per ton of each type and the total availability for a week are shown in the following table:

	X	*Y*	**Total availability**
Labour hours	4	4	50
Raw material (kg)	200	300	3000

i) Formulate the above problem as a linear programming model to find the number of cement tons to be produced from each type of cement for a week in order to get the maximum profit.

ii) Solve the problem using the Simplex method.

(3) Use Big-M method to solve the following linear programming problem:

Maximize $z = 3x_1 - x_2,$

Subject to $2x_1 + x_2 \leq 2,$

$x_1 + 3x_2 \geq 3,$

$x_2 \leq 4,$

$x_1, x2 \geq 0.$

(4) A dairy firm has three plants, say *A*, *B*, *C*, located throughout a province. Daily milk production at each plant is 6, 1 and 10 million litres respectively. Each day the firm must fulfill the needs of its four distribution centres, say *W*, *X*, *Y*, *Z*. Milk requirement at each centre is 7, 5, 3, 2 million litres respectively. Cost of shipping one million litres of milk from each plant to each distribution centre is given in the following table in hundreds of rupees:

Distribution Centre / Plant	***W***	***X***	***Y***	***Z***
A	2	3	11	7
B	1	0	6	1
C	5	8	15	9

The dairy firm wishes to determine as to how much should be the shipment from which milk plant to which distribution centre so that the total cost of shipment is minimized.

i) Formulate a linear programming model to determine the minimum shipment.

ii) Determine the optimal transportation policy by solving model formulated in part (i).

(5) Use the revised simplex method to solve the following linear programming problem:

Maximize $z = 2x_1+x_2$,

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

$6x_1+x_2 \leq 3$,

$x_1, x_2 \geq 0$.

Verify the solution graphically.

(6) Consider the following linear programming problem:

Maximize $z = 3y_1 + 6y_2 +3y_3$,

Subject to $3y_1 +4y_2 +y_3 \leq 2$,

$y_1 + 3y_2 +2y_3 \leq 1$,

$y_1 , y_2 , y_3 \geq 0$.

(i) Write the dual linear programme for the above problem.

(ii) Solve the dual linear programme given in (i) by using the dual simplex method. Hence, write the optimal solution to the primal problem.

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