THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. /B.Ed. Degree Programme

APPLIED MATHEMATICS-LEVEL 05

APU3141/APE5141- Linear Programming

Final Examination 2012/2013

Duration: Two Hours.

Date: 12.06.2013	**Time: 9.30 a.m- 11.30 a.m**

Answer four questions only.

(1) a) The evening shift resident doctors in a government hospital work for five consecutive days and have two consecutive days off. Their five days of work can start on any day of the week and the schedule keeps rotating. The hospital requires the following minimum number of doctors for each day.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
35	55	60	50	60	50	45

No more than 40 doctors can start their five working days on the same day.

Formulate the problem as a linear programming problem to minimize the number of doctors employed by the hospital.

b) The final simplex tableau for a profit maximization linear programming problem is given below. Here, X_1, X_2 are products, s_1, s_2 are the slack in labor hours and raw material and Z is the total profit:

Basis	X_1	X_2	s_1	s_2	Solution
X_1	1	0	0.75	-0.01	7.5
X_2	0	1	-0.50	0.01	5
Z	0	0	5	0.10	550

(i) Is the solution feasible? Justify.

(ii) Is the solution optimal? Justify.

(iii) How many of X1 and X_2 products are needed to produce according to this solution? What is the total profit?

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

Maximize $z = -x_1 + 3x_2$,

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

$3x_1 + x_2 \leq 3$,

$x_1 \leq 4$,

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

(3) A taxi hire company has one taxi at each of five depots a, b, c, d and e. A customer requires a taxi in each town, namely A, B, C, D and E. Distance (in kms) between depots (origins) and towns (destinations) are given in the following distance matrix:

Origin \ Destination	a	b	c	d	e
A	140	110	155	170	180
B	115	100	110	140	155
C	120	90	135	150	165
D	30	30	60	60	90
E	35	15	50	60	85

How should taxis be assigned to customers so as to minimize the distance travelled?

(4) An organization has four destinations at D_1, D_2, D_3 and D_4 and three sources at S_1, S_2 and S_3 for supply of a good. The transportation cost per unit is given below.

	D_1	**D_2**	**D_3**	**D_4**	**Availability (Supply)**
S_1	13	16	19	17	250
S_2	17	19	16	15	200
S_3	15	17	17	16	250
Requirement (Demand)	100	150	250	100	

a) Formulate a linear programming model for the given transportation problem.

b) Find an initial basic feasible solution to this problem by Northwest corner rule.

c) Find the optimal solution.

(5) a) What is meant by dual problem of a linear programming model?

b) Consider the following linear programming problem:

Minimize $z = y_1 + 2y_2$,

Subject to $y_1 + 2y_2 \leq -3$,

$y_1 + 3y_2 \leq -1$,

$y_1, y_2 \geq 0$.

(i) Give 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 solution of the primal problem.

(6) Solve the following linear programming problem using two phase simplex method:

Minimize $z = 4x_1 + 6x_2 + 5x_3$,

Subject to $2x_1+4x_2+3x_3 \geq 32$,

$x_1 +2x_2+4x_3 \geq 28$,

$x_1, x_2, x_3 \geq 0$.

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