RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. General Degree in Applied Sciences
Second Year – Semester I Examination – October/ Nov. 2015

MAA 2204 – Linear Programming

Answer **Four** Questions **only**. Time allowed: **Two Hours**

Calculators will be provided

01

(a) Briefly explain the Two Phase Method in Linear Programming.

(b) While finding the solution by Two Phase Method, when does the problem has infeasible and unbounded solutions?

(c) The following tableau show the optimal solution for phase I of the linear programming problem:

Minimize $Z = 2x_1 - x_2 + x_3$

Subject to

$$x_1 + x_2 - 3x_3 \le 8$$
$$4x_1 - x_2 + x_3 \ge 2$$
$$2x_1 + 3x_2 - x_3 \ge 4$$
$$x_1, x_2, x_3 \ge 0$$

B.V.	x_1	x_2	x_3	s_1	s_2	s_3	y_1	y_2	$-w$	Constants
s_1	0	0	$-19/7$	1	$1/14$	$5/14$	$-1/14$	$-5/14$	0	$45/7$
x_1	1	0	$1/7$	0	$-3/14$	$-1/14$	$3/14$	$1/14$	0	$5/7$
x_2	0	1	$-3/7$	0	$1/7$	$-2/7$	$-1/7$	$2/7$	0	$6/7$
$-w$	0	0	0	0	0	0	1	1	1	0

Where y_1, y_2 are artificial variables and s_1, s_2, s_3 are slack and surplus variables and w is the objective function for phase I.

Continue the solution procedure with the phase – II (if required), and show that the problem has unbounded solution.

[P.T.O.]

02 Suppose a company manufactures different electronic components for computers. Component A requires 2 hours of fabrication and 1 hour of assembly, component B requires 3 hours of fabrication and 1 hour of assembly and component C requires 2 hours of fabrication and 2 hour of assembly. The company has up 1000 labour hours for fabrication and 800 labour hours of assembly time for each week. The profit on each component A, B and C is \$7, \$8 and \$10 respectively.

(a) Formulate the above problem as a Linear Programming model to maximize the total profit under the given conditions.

(b) Using Simplex method, calculate how many components of each type should the company manufacture per week in order to maximize its profit? What is the maximum profit?

03

(a) Define surplus and artificial variables, and explain their importance in linear programming.

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

Maximize $Z = 2x_1 + x_2 - 3x_3$

Subject to

$$x_1 + x_2 + x_3 \geq 6$$
$$2x_1 + x_2 = 14$$
$$x_1, x_2, x_3 \geq 0$$

04

(a) Briefly distinguish the Standard Simplex method and Revised Simplex method.

(b) A restaurant makes pizza in two flavors; regular and white pizza. Each pizza uses one portion of dough. Each regular pizza has one portion of sauce and one portion of cheese. Each white pizza has no sauce but uses two portions of cheese. A regular pizza contributes \$2 to profit while a white pizza contributes \$3 to profit. The restaurant starts out with 4 portions of dough, 3 portions of sauce and 6 portions of cheese available.

i. Formulate a linear programming model so as to maximize the total profit.

ii. Use the Revised Simplex method to determine how many pizzas of each type should make to get maximum profit.

05

(a) Obtain the matrix form of a Linear Programming problem with n decision variables and m constraints.

(b) Briefly explain the relationship between Primal and Dual linear programming problems.

(c) Consider the following primal problem;

Maximize $Z = 3x_1 + 4x_2$

Subject to

$$x_1 + 2x_2 \leq 2$$
$$2x_1 - x_2 \leq 3$$
$$x_1 \geq 0, x_2 \geq 0$$

i. Formulate the corresponding dual linear programming problem.

ii. Solve the dual problem graphically.

iii. Obtain the optimal solution of the primal problem using the optimal solution of the dual problem.