RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES, MIHINTALE

B.Sc. (General) Degree in Applied Sciences
Second Year - Semester I – September / October 2019
End Semester Examination

MAA 2204 –LINEAR PROGRAMMING

Time: Two (02) hours

Answer all questions.
Calculators will be provided.

1. a) "Two phase method is more efficient than Big-M method."
Do you agree with this statements? Discuss your answer. **(10 marks)**

b) Consider the following problem:

$$Max\ z = 3x_1 + 2x_2 + x_3$$

$$s.t$$

$$2x_1 + x_2 + x_3 = 12,$$
$$3x_1 + 4x_2 = 11,$$
$$x_1\ is\ unrestricted,$$
$$x_2, x_3 \geq 0.$$

i. Determine a suitable algorithm to solve the problem and explain reasons for your determination. **(10 marks)**

ii. Briefly explain the steps of the algorithm determined in part i. **(30 marks)**

iii. Solve the above problem using the algorithm determined in part i. **(50 marks)**

2. a) Briefly explain about the following terms.

i. Primal feasibility
ii. Dual feasibility **(20 marks)**

b) Convert this primal problem into its dual problem.

$$Max\ z = 3x_1 + x_2 + 2x_3 - x_4$$

$$s.t$$

$$2x_1 - x_2 + 3x_3 + x_4 \leq 1$$
$$x_1 + x_2 - x_3 + x_4 \leq 1$$
$$x_1, x_2, x_3, x_4 \geq 0$$

(30 marks)

c) Solve the dual problem using dual simplex algorithm.

(50 marks)

3. a) Obtain the general Linear Programming problem in matrix form. **(05 marks)**

b) Outline steps of Revised simplex method in linear programming. **(20 marks)**

c) A company produces two types of products by using 3 machines, namely A, B and C. Each unit of product 1 requires one hour on machine A, two hours on machine B and zero hours on machine C. Each unit of product 2 requires one hour of time on each machine. The time available on these machines is limited to 400 hours per month on machine A, 600 hours per month on machine B and 300 hours per month on machine C. Each unit of product 1 can be sold to yield a profit of Rs. 50 and each unit of product 2 can be sold to yield a profit of Rs. 80.

i. Formulate the above problem to maximize the total profit under the given conditions. **(25 marks)**

ii. Solve the formulated problem using revised simplex method. **(50 marks)**

4. a) Define the following terms:

i. Convex set,
ii. Extreme points,
iii. Concave function of single variable. **(15 marks)**

b) Check whether the following functions are convex or concave. Justify your answers.

i. $f(x,y) = (x-y)^2$
ii. $f(x,y) = x_1^4 + 3x_1^2 - 5x_1 + 2x_1x_2 + x_2^2$ **(30 marks)**

c) Consider the following problem:

$$Max\ z = x_1 + x_2 + 3x_3$$

$$s.t$$

$$3x_1 + 2x_2 + x_3 \leq 3,$$
$$2x_1 + x_2 + 2x_3 \leq 2,$$
$$x_1, x_2, x_3 \geq 0.$$

i. Determine a suitable algorithm to solve the problem. **(05 marks)**

ii. Briefly explain the steps of algorithm determined in part i. **(25 marks)**

iii. Solve the above problem using algorithm determined in part i. **(25 marks)**

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