The Open University of Sri Lanka

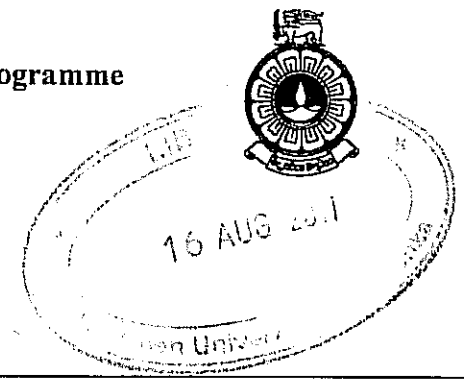
B.Sc Degree Programme/ Continuing Education Programme

Open Book Test (OBT)- 2010/2011

Level 04- Applied Mathematics

AMU 2181/AME 4181 – Mathematical Modeling I

Duration :- One and half hours



Date:- 02.09.2010 **Time:- 4.00p.m.-5.30p.m.**

Answer All Questions.

1. Consider the following linear programming problem

$$\begin{aligned} \text{Maximize} \quad & Z = 40x_1 + 50x_2, \\ \text{subject to} \quad & x_1 - 2x_2 \le 2, \\ & 2x_1 + x_2 \le 6, \\ & -x_1 + x_2 \le 2, \\ & x_1 + x_2 \ge 1, \\ & x_1, x_2 \ge 0. \end{aligned}$$

(a) Plot the feasible region and verify the optimal solution.

(b) Repeat part (a) when a constraint $x_1 + 2x_2 \le 5$ is added to the problem.

2. In a chemical industry two products X and Y are made involving two operations. The production of Y results also in a by-product W. The product X can be sold at Rs.100 profit per unit and Y at Rs.245 profit per unit. The by-product W sells at Rs.150 profit per unit. The company gets three units of W for each unit of Y produced. Forecasts show that they can sell all the units of X and Y produced. The manufacturing times are two hours and three hours per unit for X on operations one and two respectively and four hours and five hours per unit for Y on operations one and two respectively. Because the product W results from producing Y no time is used in producing W. The available times are 18 and 21 hours of operation one and two respectively.

Formulate a linear programming model to find how much X and Y should be produced keeping W in mind to make the highest profit.

3. Consider the following linear programming problem

$$\text{Maximize} \quad Z = 2x_1 + 3x_2,$$

$$\text{subject to} \quad \begin{aligned} x_1 + 3x_2 &\leq 6, \\ 3x_1 + 2x_2 &\leq 6, \\ x_1, x_2 &\geq 0. \end{aligned}$$

(a) Find all the basic feasible solutions and corresponding reduced costs of the non-basic variables.

(b) Find the optimal objective value.