Problem Set (3) Sensitivity Analysis and Duality:

1) A company produces two products, A and B. the unit revenues are 4$ and 5$ respectively. Two raw materials M1 and M2 are used in the manufacture of the two products have respectively daily availabilities of 15 and 24 units. One unit of product A uses 2 units of M1 and 4 units of M2, and one unit of product b uses 3 units of M1 and 3 units of M2.

a- Determine the dual prices of M1 and M2 and their feasibility ranges.

b- Suppose that 3 additional units of M1 can be acquired at the cost of 0.75 $ per unit. Would you recommend the additional purchase?

c- What is the most the company should pay per unit of M2?

d- If M2 availability is increased by 5 units, determine the associated optimum revenue.

e- Determine the optimality condition for c_A / c_B that will keep the optimum solution unchanged.

f- Determine the optimality ranges for c_A and c_B. Assuming that the other coefficient is kept constant at its present value.

2) Obtain the dual problem of the following LPP's:

a- $Max\ Z\ = 20x_1 + 30x_2$

subject to:

$$x_1 + 2x_2 \leq 20,$$
$$x_1 + x_2 \leq 12,$$
$$5x_1 + x_2 \leq 40$$
$$x_1 \geq 0\ , x_2 \geq 0$$

b- $Max\ Z\ = 4x_1 + 7x_2 + x_3$

subject to:

$$x_1 + x_2 + x_3 = 10,$$
$$5x_1 - x_2 + x_3 \geq 12,$$
$$x_1 + 7x_2 - 3x_3 \leq 4,$$
$$x_1 \geq 0\ , x_2 \geq 0, x_3 \geq 0$$