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Exercise Series

Exercise 1:

Consider two models of color TV sets; Model A and B, are produced by a company to maximize profit. The profit realized is \$300 from A and \$250 from set B. The limitations are
a. Availability of only 40 hrs of labor each day in the production department,
b. A daily availability of only 45 hrs on machine time, and
c. Ability to sale 12 set of model A.

Constraints	Resources used per unit		Maximum available hours
	Model A (x_1)	Model A (x_2)	
Labor Hours	2	1	40
Machine Hours	1	3	45
Marketing Hours	1	0	12
Profit	300\$	250\$	

How many sets of each model will be produced each day so that the total profit will be as large as possible?

Exercise 2:

Suppose that a machine shop has two different types of machines; Machine 1 and Machine 2, which can be used to make a single product. These machines vary in the amount of product produced per hr., in the amount of labor used and in the cost of operation. Assume that at least a certain amount of product must be produced and that we would like to utilize at least the regular labor force.

Items	Resources used per unit		Minimum Required Hours
	Machine 1 (x_1)	Machine 2 (x_2)	
Product produced/hr	20	15	100
Labor/hr	2	3	15
Profit	25\$	30\$	

How much should we utilize on each machine in order to utilize total costs and still meets the requirement?

Exercise 3:

Solving the following linear program using the simplex method

$$\text{Max}: Z = 1X_1 + X_2 + 4X_3 + 2X_4 + 1X_5$$

$$\text{S/T} \begin{cases} 4X_1 + X_2 + 1.5X_3 + 2.5X_4 + 0X_5 \leq 150 \\ 2X_1 + 3X_2 + 1X_3 + 2X_4 + 7X_5 \leq 180 \\ 0X_1 + 2X_2 + 2X_3 + 0X_4 + 2X_5 \leq 120 \end{cases}$$

$$X_1, X_2, X_3, X_4, X_5 \geq 0$$

Exercise 4: Solving the following linear program using the simplex method

$$\text{Max}: Z = X_1 + 2X_2$$

$$X_1 - X_2 \geq 3$$

$$2X_1 + X_2 \leq 10$$

$$X_1, X_2 \geq 0$$

Exercise 5: write the dual of the following primal:

$$\text{Min}: Z=3X_1-2X_2+4X_3$$
$$3X_1+5X_2+4X_3\geq 7$$
$$6X_1-X_2+3X_3\geq 4$$
$$7X_1+2X_2-3X_3\leq 10$$
$$X_1-2X_2+5X_3\geq 3$$
$$4X_1+7X_2-2X_3\geq 2$$
$$X_1, X_2, X_3 \geq 0$$

Exercise 6: write the dual of the following linear programming problem:

$$\text{Min}: Z=2X_1+3X_2+4X_3$$
$$2X_1+3X_2+5X_3\geq 2$$
$$3X_1+X_2+7X_3=3$$
$$X_1+4X_2+6X_3\leq 5$$
$X_1, X_2 \geq 0$, X_3 is unrestricted.

Exercise 7: write the dual of the following linear programming problem:

$$\text{Min}: Z=3X_1+X_2+X_3-X_4$$
$$X_1-5X_2+3X_3+4X_3\leq 5$$
$$X_1+X_2=-1$$
$$X_3-X_4\geq -5$$
$$X_1, X_2, X_3, X_4 \geq 0$$

Exercise 8: Find the optimal integer solution for the following LPP

$$\text{Max}: Z=X_1+X_2$$
$$3X_1+2X_2\leq 5$$
$$X_2\leq 2$$
$X_1, X_2 \geq 0$, and are integers

Exercise 9

Four factories, A, B, C and D produce sugar and the capacity of each factory is given below: Factory A produces 10 tons of sugar and B produces 8 tons of sugar, C produces 5 tons of sugar and that of D is 6 tons of sugar. The sugar has demand in three markets X, Y and Z. The demand of market X is 7 tons, that of market Y is 12 tons and the demand of market Z is 4 tons. The following matrix gives the transportation cost of 1 ton of sugar from each factory to the destinations. Find the Optimal Solution for least cost transportation cost by using **North-West corner method.**

Factories	**Cost in Da. per ton (× 100) Markets**			**Availability in tons**
	X	**Y**	**Z**	
A	4	3	2	**10**
B	5	6	1	**8**
C	6	4	3	**5**
D	3	5	4	**6**
Requirements in tons	**7**	**12**	**4**	Σ b = 29, Σ d = 23

Exercise 10

A company is spending DA1000 on transportation of its units from three plants to four distribution centres. The availability of unit per plant and requirement of units per distribution centre, with unit cost of transportation are given as follows:

Plants \ D. Centres	D_1	D_2	D_3	D_4	capacity
P_1	19	30	50	12	7
P_2	70	30	40	60	10
P_3	40	10	60	20	18
Requirement	5	8	7	15	

What is the maximum possible saving by optimum distribution? Use the MODI method.