

§6.5: INTRO TO THE DUAL PROBLEM

- 1.] DAKOTA FURNITURE COMPANY: A furniture company manufactures desks, tables, and chairs. The manufacture of each type of furniture requires lumber and two types of skilled labor: finishing and carpentry. The amount of each resource needed to create each product, the selling price of each product, and the available amounts of each resource are provided in the table below:

Resource	Product			Available Resources
	Desk	Table	Chair	
Lumber (board ft)	8	6	1	48
Finishing (hours)	4	2	1.5	20
Carpentry (hours)	2	1.5	0.5	8
Selling Price (\$)	60	30	20	

- a.) Your objective is to maximize revenue for the Dakota Furniture company. Formulate the *maximization* LP.

Define $x_i = \#$ of product i sold.

$$\text{Max } z = 60x_1 + 30x_2 + 20x_3$$

$$\text{Subject to } 8x_1 + 6x_2 + x_3 \leq 48$$

$$4x_1 + 2x_2 + 1.5x_3 \leq 20$$

$$2x_1 + 1.5x_2 + 0.5x_3 \leq 8$$

$$x_1, x_2, x_3 \geq 0$$

← This is the Primal LP.

- b.) You're an entrepreneur willing to purchase all of Dakota Furniture company's resources. Formulate a *minimization* LP for the minimum purchasing price w that you'll offer to Dakota after considering the value of each unit of resource. Define y_i as the price paid for one unit of resource i .

Define $y_i =$ price paid for 1 unit of resource i (board feet, finishing hours, carpentry hours)

$$\text{Min } w = 48y_1 + 20y_2 + 8y_3$$

$$\text{Subject to } 8y_1 + 4y_2 + 2y_3 \geq 60$$

$$6y_1 + 2y_2 + 1.5y_3 \geq 30$$

$$y_1 + 1.5y_2 + 0.5y_3 \geq 20$$

$$y_1, y_2, y_3 \geq 0$$

← This is the Dual LP.