Supply Chain Analysis HW #2

Maximize $Z = 10x_1 + 20x_2$,

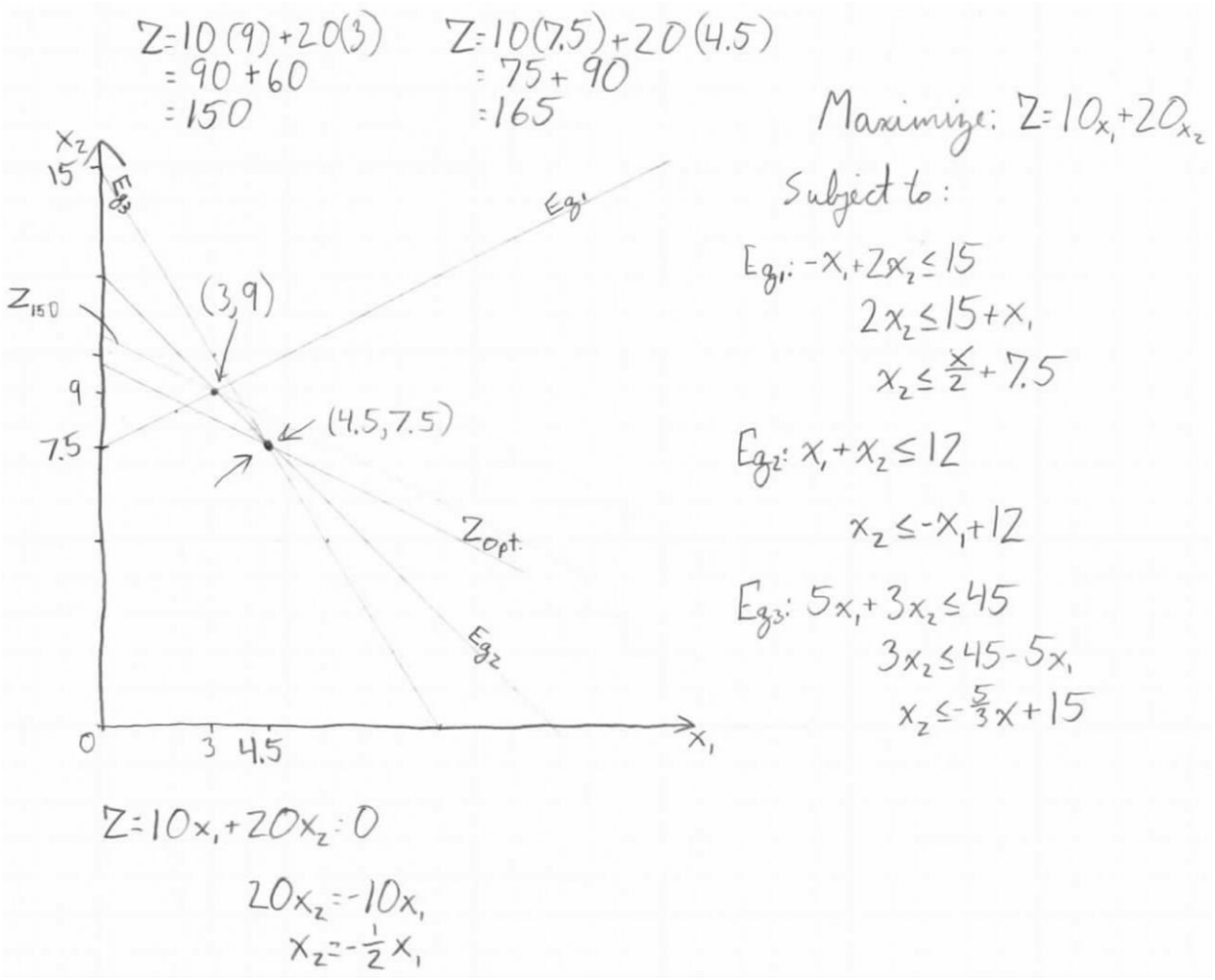
subject to

$$-x_1 + 2x_2 \leq 15$$
$$x_1 + x_2 \leq 12$$
$$5x_1 + 3x_2 \leq 45$$

and

$$x_1 \geq 0,\ x_2 \geq 0.$$

1. Use the graphical method to solve the problem



$Z_{Optimum}$ is at point (7.5, 4.5), where Z = 165

2. Whitt Window Company, a company with only three employees, makes two different kinds of hand-crafted windows: a wood-framed and an aluminum-framed window. The company earns $300 profit for each wood-framed window and $150 profit for each aluminum-framed window. Doug makes the wood frames and can make 6 per day. Linda makes the aluminum frames and can make 4 per day. Bob forms and cuts the glass and can make 48 square feet of glass per day. Each wood-framed window uses 6 square feet of glass and each aluminum-framed window uses 8 square feet of glass. The company wishes to determine how many windows of each type to produce per day to maximize total profit.

   a. Describe the analogy between this problem and the Wyndor Glass Co. problem discussed in Sec. 3.1.

      This problem is very similar to the Wyndor Glass Co. problem, in that it is a classic product mix problem. There are two main products with their own resource constraints which may or may not be binding, as well as a shared resource which will surely have a resource constraint.

   b. Then construct and fill in a table like Table 3.1 for this problem, identifying both the activities and the resources.

Worker	Items produced: Product 1: Wood-framed window	Items produced: Product 2: Aluminum-framed window	Production Available per Day
Doug	1	0	6
Linda	0	1	4
Bob	6	8	48
Profit per window	$300	$150	

   c. Formulate a linear programming model for this problem.

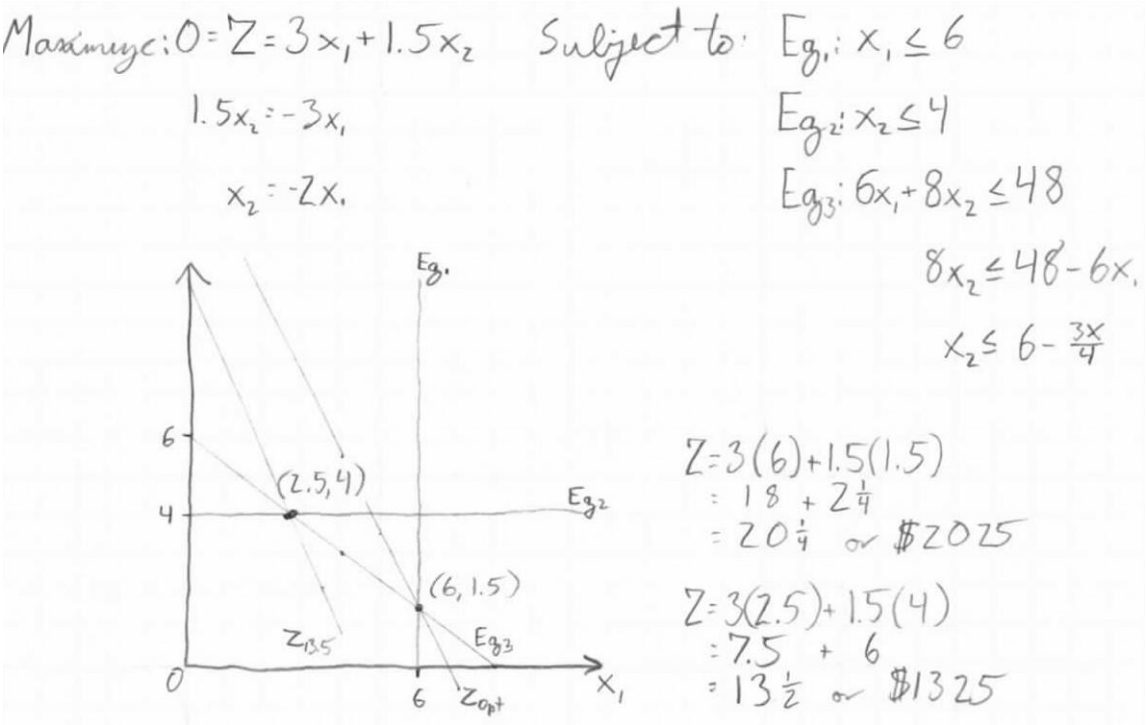
Maximize: $Z = 3x_1 + 1.5x_2$

Subject to: $x_1 \le 6$ and $x_1 \ge 0$,

$x_2 \le 4$ $x_2 \ge 0$

$6x_1 + 8x_2 \le 48$

d. Use the graphical method to solve this model.



$Z_{Optimum}$ is at point (6, 1.5), where Z = $2025

3. The Omega Manufacturing Company has discontinued the production of a certain unprofitable product line. This act created considerable excess production capacity. Management is considering devoting this excess capacity to one or more of three products; call them products 1, 2, and 3.
    a. The available capacity on the machines that might limit output is summarized in the following table:

Machine Type	**Available Time (Machine Hours per Week)**
Milling Machine	500
Lathe	350
Grinder	150

    b. The number of machine hours required for each unit of the respective products is

Productivity Coefficient (in machine hours per unit)			
Machine Type	**Product 1**	**Product 2**	**Product 3**
Milling Machine	9	3	5
Lathe	5	4	0
Grinder	3	0	2

c. The sales department indicates that the sales potential for products 1 and 2 exceeds the maximum production rate and that the sales potential for product 3 is 20 units per week. The unit profit would be \$50, \$20, and \$25, respectively, on products 1, 2, and 3. The objective is to determine how much of each product Omega should produce to maximize profit.

i. Formulate a linear programming model for this problem.

	Production Time per Batch, Machine Hours			**Production Available per Day**
	Product			
	1	**2**	**3**	
Milling Machine	9	3	5	500
Lathe	5	4	0	350
Grinder	3	0	2	150
Profit per product	\$50	\$20	\$25	

Maximize: $Z = 50x_1 + 20x_2 + 25x_3$

Subject to: $9x_1 + 3x_2 + 5x_3 \leq 500$; and $x_1 \geq 0$,

$5x_1 + 4x_2 + 0x_3 \leq 350$; $x_2 \geq 0$,

$3x_1 + 0x_2 + 2x_3 \leq 150$; $x_3 \geq 0$

ii. Use a computer to solve this model by the simplex method.

Please see Excel spreadsheet.