Operations Research

Formative Assessment 1 (Part 1)

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Item 1

1. The Primo Insurance Company is introducing two new product lines: special risk insurance and mortgages. The expected profit is 5 dollar per unit on special risk insurance and 2 dollar per unit on mortgages. Management wishes to establish sales quotas for the new product lines to maximize total expected profit. The work requirements are as follows:

Department	Work-Hours per Unit		Work-Hours Available
	Special Risk	Mortgage	
Underwriting	3	2	2400
Administration	0	1	800
Claims	2	0	1200

Linear Model

Decision Variables

x number of work-hours for special risk

y number of work-hours for mortgage.

Objective Function

Maximize $P = 5x + 2y$

Constraints

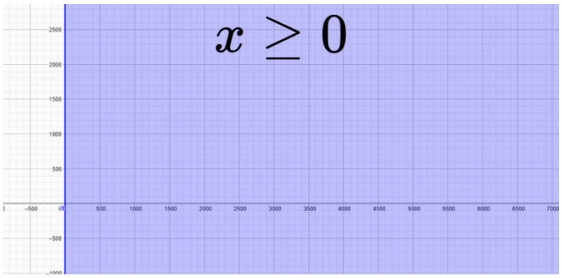
$x, y \geq 0$

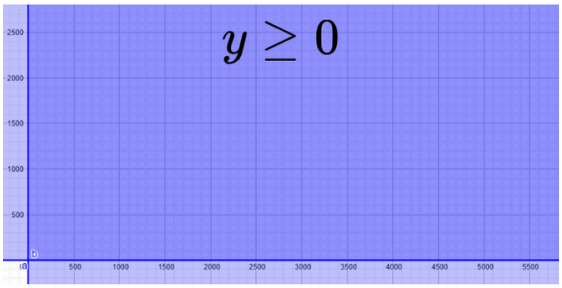
$3x + 2y \leq 2400$

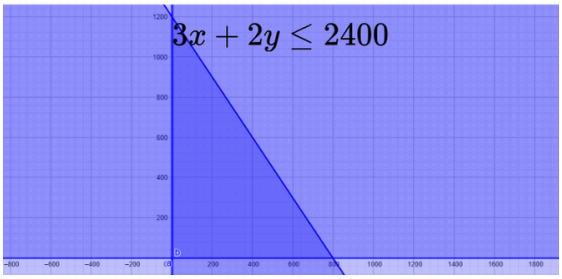
$y \leq 800$

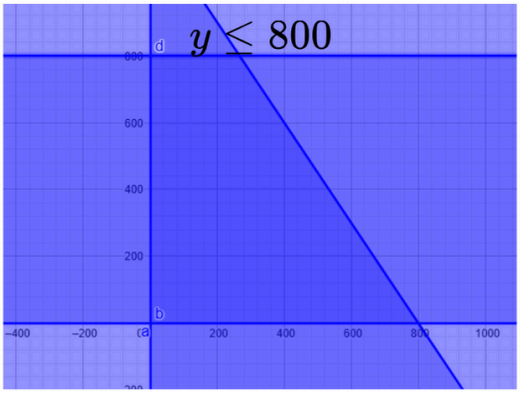
$2x \leq 1200$

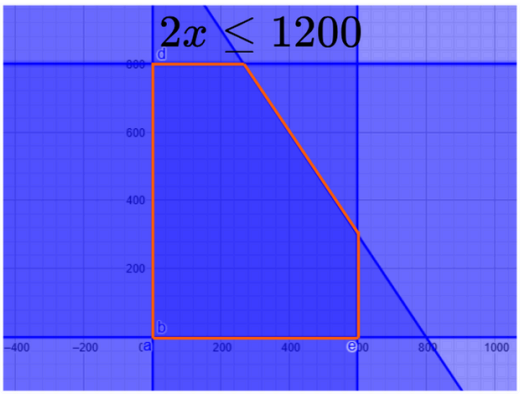
Solution via Graphical Method





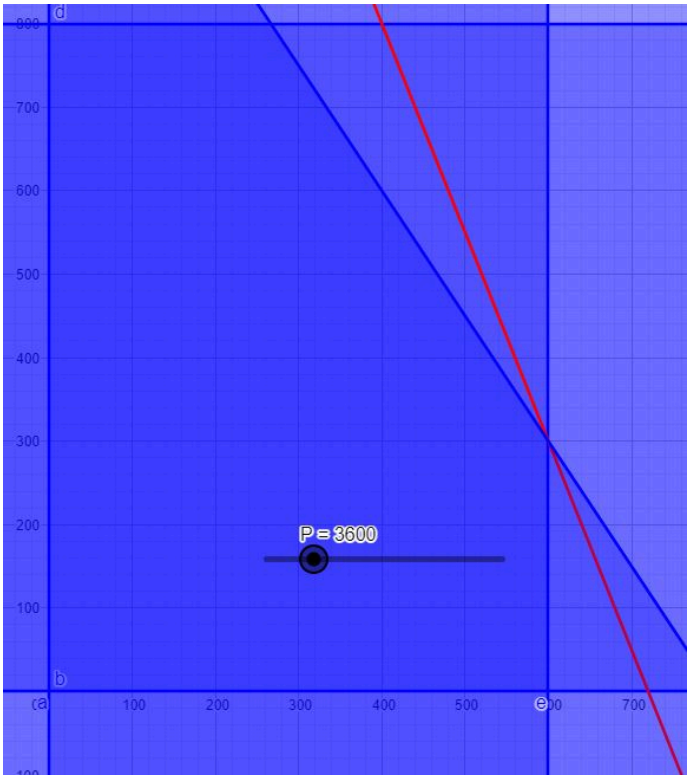






The shade region is the feasible region.

To input the objective function $P = 5x + 2y$



Solution:

$(x, y) = (600, 300)$

Final P

$P = 5x + 2y = 5(600) + 2(300) = \$3900$

Item 2

Model

Minimize $Z = 40x_1 + 50x_2$

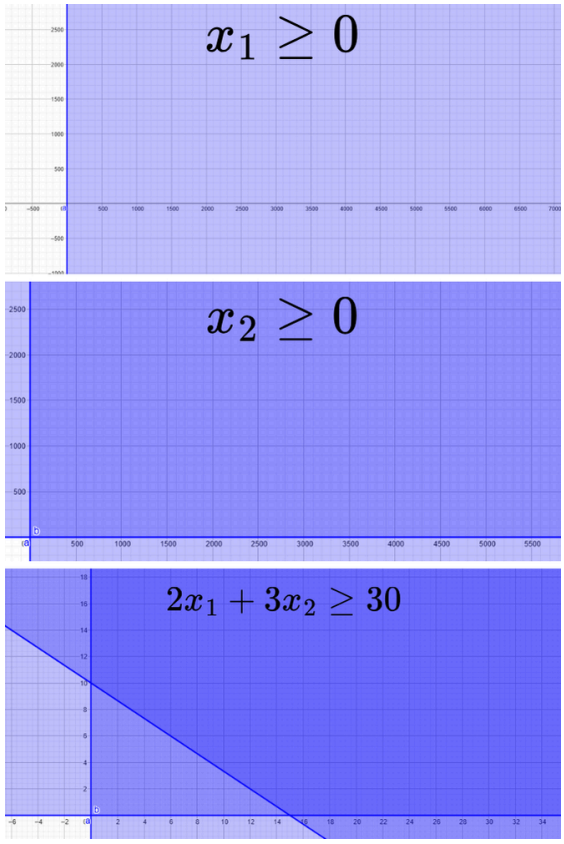
Constraints

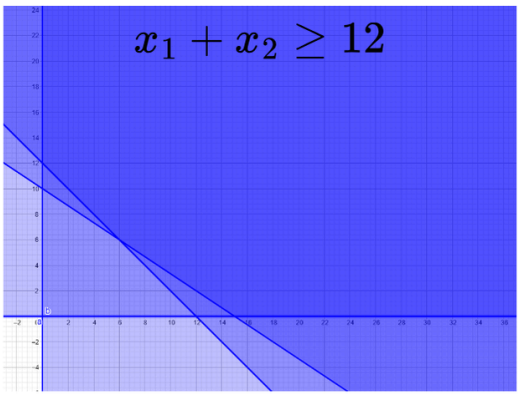
$2x_1 + 3x_2 \geq 30$

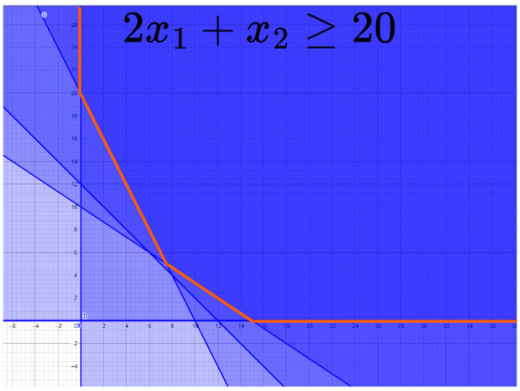
$x_1 + x_2 \geq 12$

$2x_1 + x_2 \geq 20$

Solution view Graphical Method

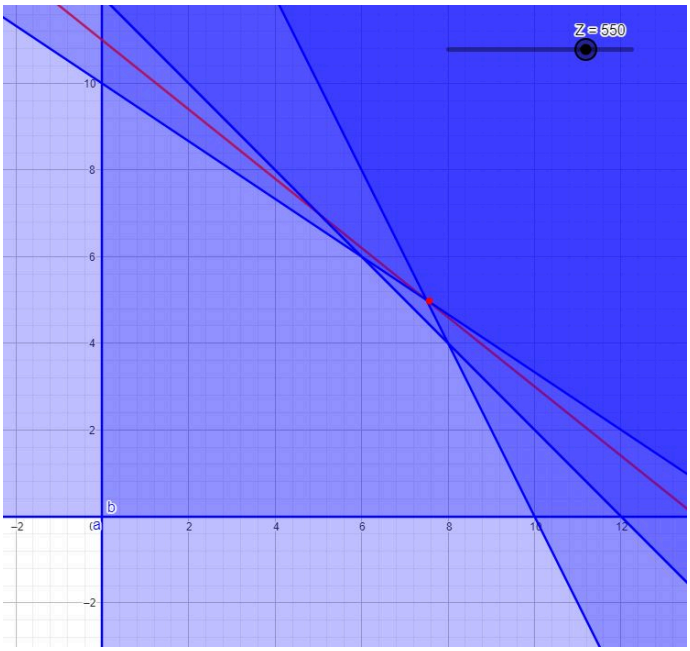






The shaded region is the feasible region.

To input the objective function $Z = 40x_1 + 50x_2$

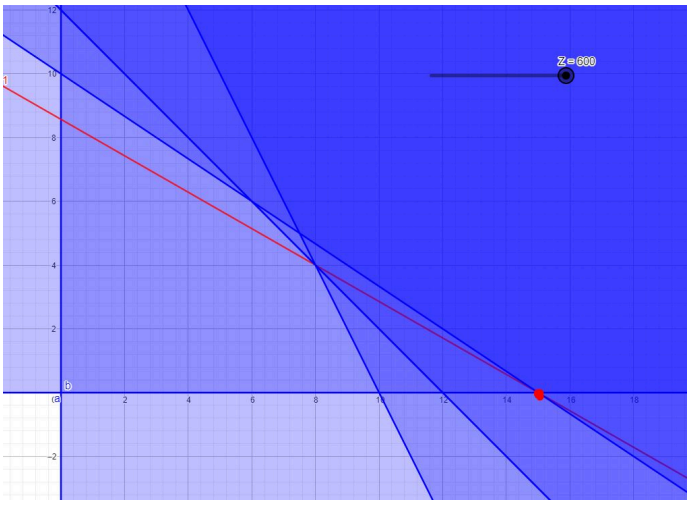


Solution:

$(x_1, x_2) = (7.5, 5)$

$Z = 40x_1 + 50x_2 = 40(7.5) + 50(5) = 550$

If objective function is $Z = 40x_1 + 70x_2$

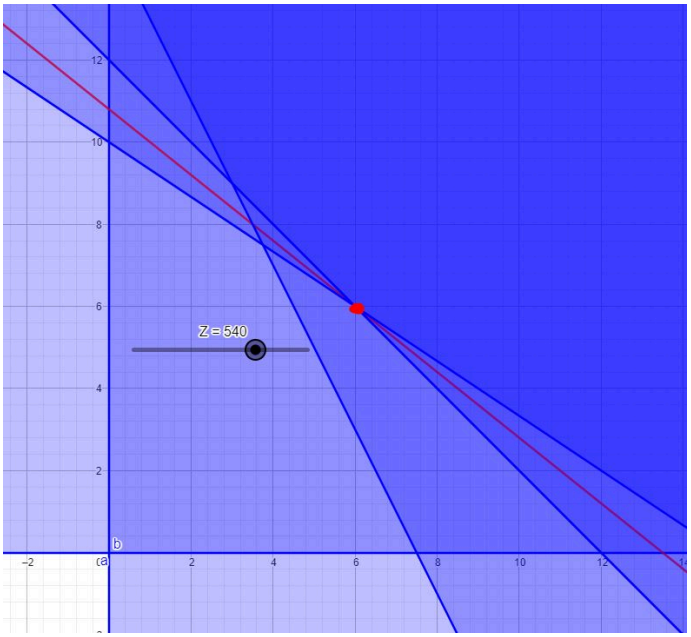


$(x_1, x_2) = (15, 0)$

$Z = 40x_1 + 70x_2 = 40(15) + 50(0) = 600$

Both the solution and the value of Z will change. The Z increases so this isn't ideal considering we are trying to minimize the Z.

If third constraint is $2x_1 + x_2 \geq 15$



$(x_1, x_2) = (6, 6)$

$Z = 40x_1 + 50x_2 = 40(6) + 50(6) = 540$

So the Z will decrease compared to the original constraints, which is in fact ideal considering we are trying to minimize the Z.