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Question 1: Wild west produces two types cowboy hats. A type 1 hat requires three times as much labor time as a type 2. If the available labor time is dedicated to Type 2 alone, the company can produce a total of 450 type 2 hats a day. The market limits for the types are 100 and 300 hats per day for Type 1 and Type 2, respectively. The profit is \$8 per Type 1 hat and \$5 per Type 2 hat. Determine the number of hats of each type that would maximize profit

- Build the mathematical model of the problem.
- Solve the problem graphically.

Solution i:

$x_1 = \text{Type 1}$

$x_2 = \text{Type 2}$

$$x_1 \leq 100$$

$$x_2 \leq 300$$

$$3x_1 + x_2 \leq 450$$

$$x_1, x_2 \geq 0$$

$$\rightarrow 3 \cdot 100 + x_2 \leq 450$$

$$\quad \quad \quad \hookrightarrow 150$$

$$\rightarrow 3 \cdot x_1 + 300 \leq 450$$

$$x_1 = 50$$

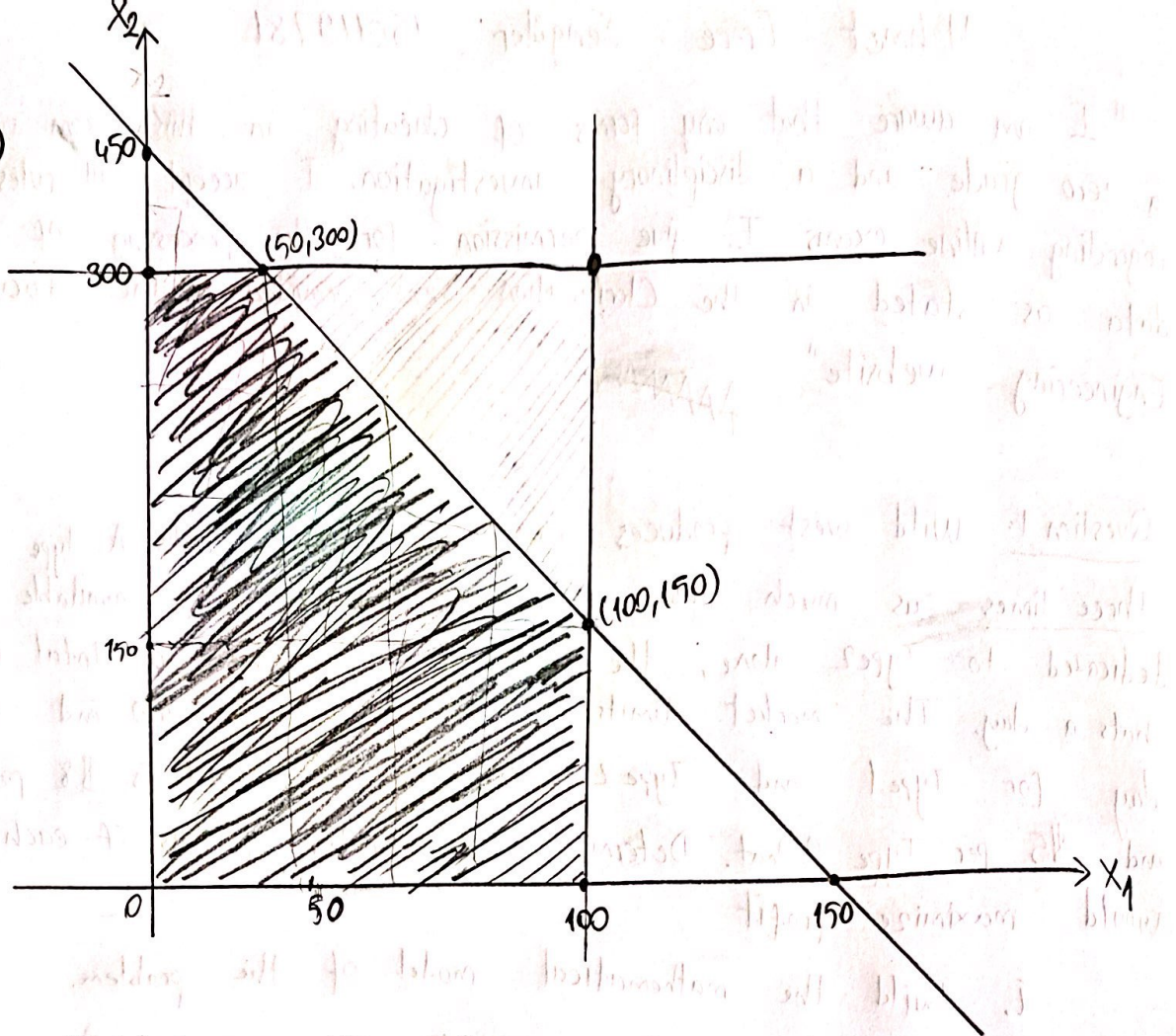
$$8x_1 + 5x_2 = \text{Maximize profit.}$$

$$* \frac{8 \cdot 100}{800} + \frac{5 \cdot 150}{750} = 1550 \text{ (feasible)}$$

$$* \frac{8 \cdot 50}{400} + \frac{5 \cdot 300}{1500} = 1900 \text{ (optimal) } \checkmark$$

(max. profit value)

Solution ii)



$$x_1 \leq 100 \rightarrow x_1 = 100, x_2 = 0$$

$$x_2 \leq 300 \rightarrow x_2 = 300, x_1 = 0$$

$$3x_1 + x_2 \leq 450 \rightarrow \text{for } x_1 = 0, x_2 = 450$$

$$x_1, x_2 \geq 0 \rightarrow \text{for } x_2 = 0, x_1 = 150$$

$$[001 \geq 150]$$

$$[001 \geq 300]$$

$$[001 \geq 450]$$

$$[001 \geq 150]$$

$$[001 \geq 300]$$

$$[001 \geq 450]$$

$$[001 \geq 150]$$

$$[001 \geq 300]$$