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1. Wild West produces two types of cowboy hats. A type 1 hat requires three times as much labor time as a type 2. If the all 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 two types are 100 and 300 hats per day for Type 1 and Type 2, respectively. The profit is \$8 per Type 1 and \$5 per Type 2. Determine the number of hats of each type that would maximize profit

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

Answer:

- i)  $x_1$ : number of hats produced Type 1  
 $x_2$ : number of hats produced Type 2

$T$  = labor time

$$3T \cdot x_1 + T \cdot x_2 \leq 450 \cdot T$$

$$\max z = 8 \cdot x_1 + 5 \cdot x_2$$

s.t.

$$3x_1 + x_2 \leq 450$$

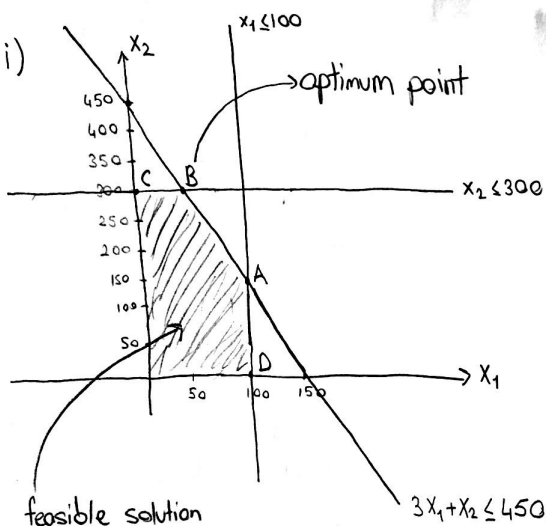
$$x_1 \leq 100$$

$$x_2 \leq 300$$

$$x_1, x_2 \geq 0$$

$$3x_1 + x_2 \leq 450$$

ii)



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$$z = 8x_1 + 5x_2$$

A :  $x_1 = 100$   
 $x_2 = 150$

D :  $x_1 = 100$   
 $x_2 = 0$

B :  $x_1 = 50$   
 $x_2 = 300$

C :  $x_1 = 0$   
 $x_2 = 300$

$$\begin{aligned} z &= 8 \cdot 100 + 5 \cdot 150 \\ &= 800 + 750 \\ &= 1550 \end{aligned}$$

$$\begin{aligned} z &= 8 \cdot 100 + 5 \cdot 0 \\ &= 800 + 0 \\ &= 800 \end{aligned}$$

$$\begin{aligned} z &= 8 \cdot 50 + 5 \cdot 300 \\ &= 400 + 1500 \\ &= 1900 \end{aligned}$$

$$\begin{aligned} z &= 8 \cdot 0 + 5 \cdot 300 \\ &= 0 + 1500 \\ &= 1500 \end{aligned}$$

optimum solution

B point

$$\begin{aligned} x_1 &= 50 \quad x_2 = 300 \\ z &= 1900 \$ \end{aligned}$$