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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 avaliable labor time is dedicated to Type2 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 Type1 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.

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

	Labor	Limit	Profit
Type 1	3t	100	$8
Type 2	t	300	$5

450t max labour

Desicion Variables

x_1 : Number of Type 1 hat
x_2 : Number of Type 2 hat

Objective Function

To maximize profit

$$z = 8x_1 + 5x_2$$

s.t.

Constraints

$3x_1 + x_2 \leq 450$

$x_1 \leq 100$

$x_2 \leq 300$

$x_1, x_2 \in N$

$x_1, x_2 \geq 0$

Graphically

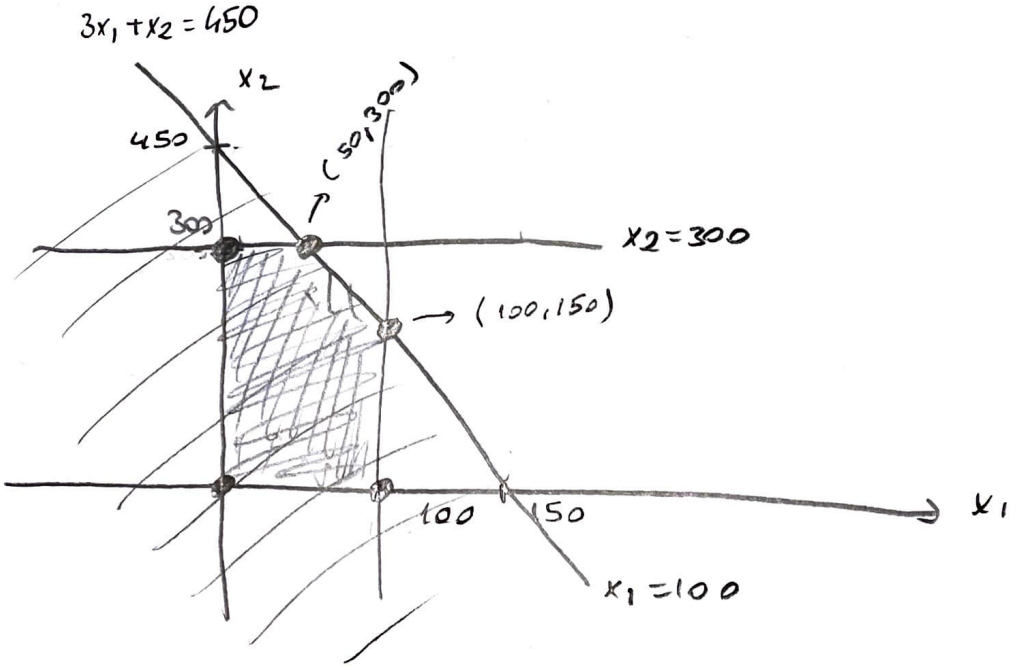
$3x_1 + x_2 = 450$

$x_1 = 0 \Rightarrow x_2 = 450$

$x_2 = 0 \Rightarrow x_1 = 150$

$x_1 = 100$

$x_2 = 300$



Solution 1

$x_1 = 0$, $x_2 = 0$ $\quad z = 0 + 0 = 0\$$ feasible solution

Solution 2

$x_1 = 0$, $x_2 = 300$ $\quad z = 0 + 1500 = 1500\$$ feasible solution

Solution 3

$x_1 = 100$, $x_2 = 0$ $\quad z = 800 + 0 = 800\$$ feasible solution

Solution 4

$x_1 = 100$, $x_2 = 150$ $\quad z = 800 + 750 = 1550\$$ feasible solution

Solution 5

$x_1 = 50$, $x_2 = 300$ $\quad z = 400 + 1500 =$ **1900$ optimal solution**

To maximize profit it should produce 50 type1 , 300 type 2 and so it's profit will be 1900$.