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IE 3035 Quiz 1

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Question: 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 hat. Determine the number of hats each type that would maximize the profit.

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

Answer:

part i)

	Limits	Profit
Type 1	100	$8
Type 2	300	$5

Let say Type 2 T hours needed
Type 1 3T hours needed
available labor time dedicated to Type 2 T → 450 T per day

Assume; x_1 = Number of hats of Type 1
x_2 = Number of hats of Type 2

$Z = 8x_1 + 5x_2$ → need to maximize.

Mathematical model;

$$3x_1T + x_2T \leq 450T$$

$$3x_1 + x_2 \leq 450$$

$$x_1 \leq 100$$

$$x_2 \leq 300$$

$$x_1, x_2 \geq 0$$

and

$$Z = 8x_1 + 5x_2$$

ii) Remember mathematical model;

$Z = 8x_1 + 5x_2$

$3x_1 + x_2 \leq 450$

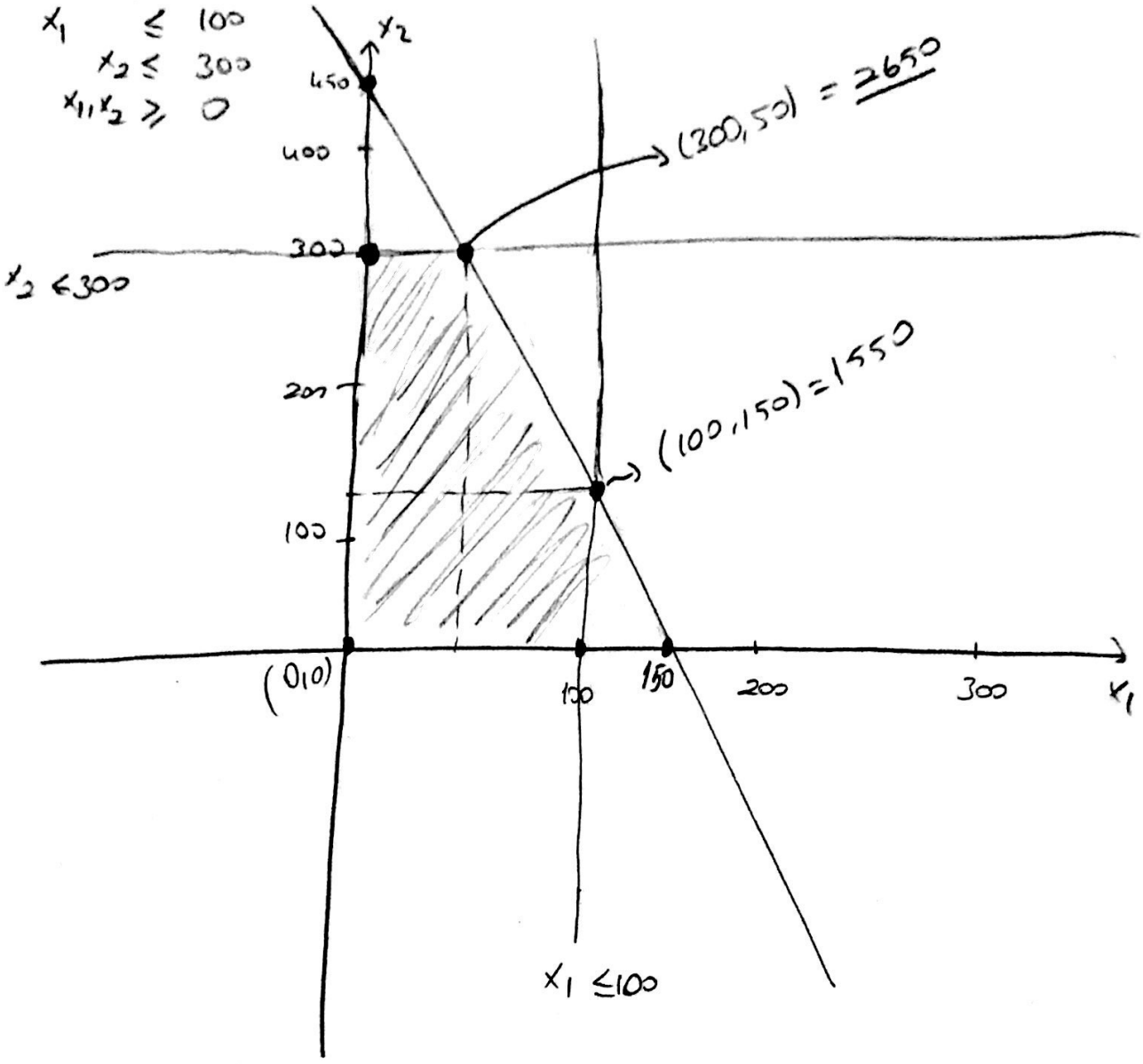
$x_1 \leq 100$

$x_2 \leq 300$

$x_1, x_2 \geq 0$

$3x_1 + x_2 = 450 \Rightarrow x_1 = 0,\ x_2 = 450$

$x_2 = 0,\ x_1 = 150$



We need to maximize: $Z = 8x_1 + 5x_2$

See that when $x_2 = 300$ and $x_1 = 50$ $\quad Z = 8 \times 300 + 5 \times 50 = \boxed{2650}$

$x_1 = 100$ and $x_2 = 150$ $\quad Z = 8 \times 100 + 5 \times 150 = 1550$

$x_1 = 0$ and $x_2 = 0$ $\quad Z = 8 \times 0 + 5 \times 0 = 0$

We can easily see that the optimal solution is 2650 $ when $x_1 = 50$ and $x_2 = 300$ //

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