A manufacturer produces nuts and bolts. It takes 1 hour of work on machine A and 3 hours on machine B to produce a package of nuts. It takes 3 hours on machine A and 1 hour on machine B to produce a package of bolts. He earns a profit of Rs17.50 per package on nuts and Rs 7.00 per package on bolts. How many packages of each should be produced each day so as to maximise his profit, if he operates his machines for at the most 12 hours a day?

	A	B	Profit
Nut	1	3	17.5
Bolt	3	1	7
Hours	12	12	

There are two types of fertilisers F_1 and F_2. F_1 consists of 10% nitrogen and 6% phosphoric acid and F_2 consists of 5% nitrogen and 10% phosphoric acid. After testing the soil conditions, a farmer finds that she needs atleast 14 kg of nitrogen and 14 kg of phosphoric acid for her crop. If F_1 costs Rs 6/kg and F_2 costs Rs 5/kg, determine how much of each type of fertiliser should be used so that nutrient requirements are met at a minimum cost. What is the minimum cost?

	F_1	F_2
N_2	10%	5%
P.A.	6%	10%

$F_1 \to x$ kg

$F_2 \to y$ kg

at least :-

$\to N_2 \geq 14$

$P.A. \geq 14$

min

$Z = 6x + 5y$

	$F_1(x)$	$F_2(y)$
N_2	10%	5%
P.A.	6%	10%
Cost	6 Rs/kg	5 Rs/kg

Let:- Quantity of $F_1 = x$ kg.

— " — $F_2 = y$ kg.

For mini cost:- $Z = 6x + 5y$

$\because$ N_2 in both F_1 & F_2 is atleast 14 kg.

$\therefore$ 10% of x + 5% of $y \geq 14$

$\rightarrow \frac{10}{100}x + \frac{5}{100}y \geq 14 \Rightarrow [10x + 5y \geq 1400]$

$\rightarrow [2x + y \geq 280]$ — (1) $[x, y \geq 0]$

Similarly: $x \times 6\% + y \times 10\% \geq 14$

$\rightarrow \frac{6}{100}x + \frac{10}{100}y \geq 14 \Rightarrow 6x + 10y \geq 1400$ (2)

From (1):-

x	70	140
y	140 (A)	0 (B)

From (2):

x	$350/3$	0
y	70 (C)	140 (D)

at (0,0); $0 \geq 700$ → False

So: area away from (→0)

$\therefore$ Here the region is unbounded

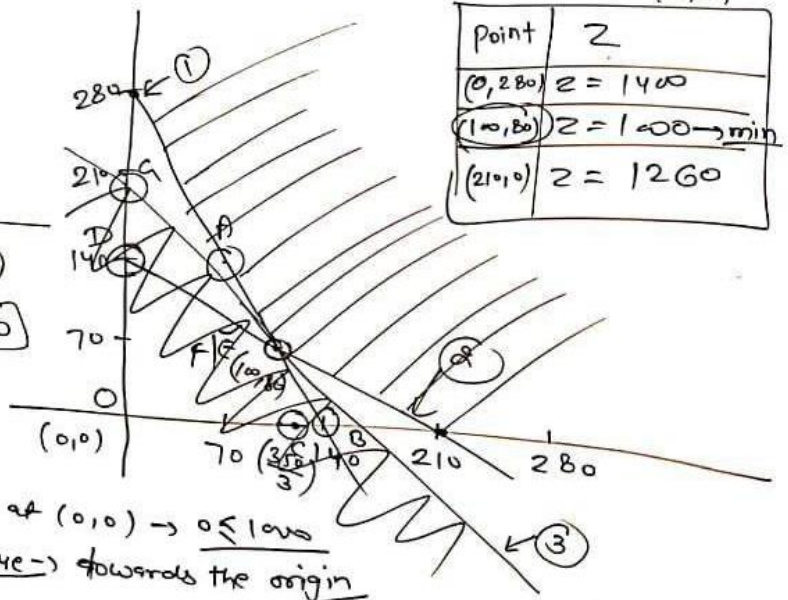
(3) $6x + 5y \leq 1000$

	E	G
x	100	0
y	80	200

at (0,0) → $0 \leq 1000$ True → towards the origin

$3x + 5y \geq 700$ (4)

→ put (0,0) in (1):- $0 \geq 280$ → False → away from (0,0)



Point	Z
(0, 280)	Z = 1400
(100, 80)	Z = 1400 → min
(210, 0)	Z = 1260

So Here there is no common area b/w. eq (1) + (2) & (3)

So Min. Cost = 1000 at (100, 80)

it means → 100 kg F_1 & 80 kg F_2 is produced