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6 January 2020

Production Planning & Inventory Control:

(1) Making a single product e.g. windows, doors

(2) Estimated demand for next months

1000 – Ist Month
800 – IInd "
1200 – IIIrd "
900 – IVth "

} Make Minimum no. of products

(3) Regular time production = ₹20 per unit
" = ₹25 " "
↳ Overtime (extra time)

(4) Storage Costs
↳ Inventory cost = 3 per unit per month

(5) Regular time Qty (Total) = 300, Extra Time (200)

Formulate LPP for this problem.

Sol

R_j ($j = 1, 2, 3, 4$)

Variables: R_1, R_2, R_3, R_4 = # of quantities produced using Regular Time in month j.

E_1, E_2, E_3, E_4 (E_j $j = 1, 2, 3, 4$) → # of quantities produced using Extra time in month j

I_1, I_2, I_3 → No inventory in starting, has to flush out inventory in 4th time

∴ 3 variables

Goal → Minimize Cost fn (Z)

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$$Z = \text{(Objective fn)} \quad 20\sum_{j=1}^{4} R_j + 25\sum_{j=1}^{4} E_j + 3\sum_{j=1}^{3} I_j$$

Constraints

$R_1 + E_1 \geq 1000$
$R_2 + E_2 + I_1 \geq 800$
$R_3 + E_3 + I_2 \geq 1200$
$R_4 + E_4 + I_3 = 900$

∵ in last Month we ~~have to~~ don't have to store in inventory

If quantity produced is > 1000, then we store it in inventory

$\therefore R_1 + E_1 = 1000 + I_1$

$I_1 + R_2 + E_2 = 800 + I_2$
$I_2 + R_3 + E_3 = 1200 + I_3$
$I_3 + R_4 + E_4 = 900$
$R_1 + R_2 + R_3 + R_4 \leq 800 \; ; \; E_1 + E_2 + E_3 + E_4 \leq 200$
$I_j, R_j, E_j \geq 0$

Methods:

① Graphical Methods

Diet problem with 2 food: apple & Banana

Min $Z = 8A + 10B$
subject to
$0.4A + 1.2B \geq 70$ — ①
$6A + 10B \geq 50$ — ② $A, B \geq 0$ — ④
$0.4A + 0.6B \geq 12$ — ③

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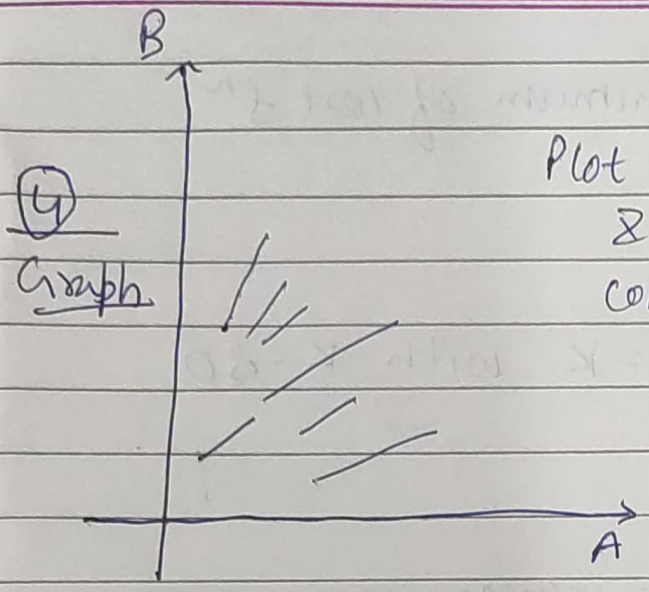
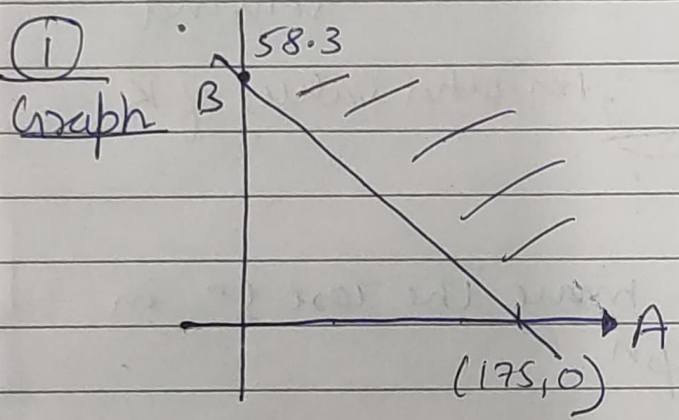
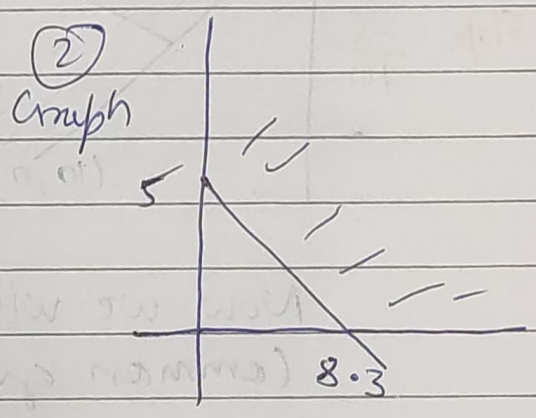


④ Graph

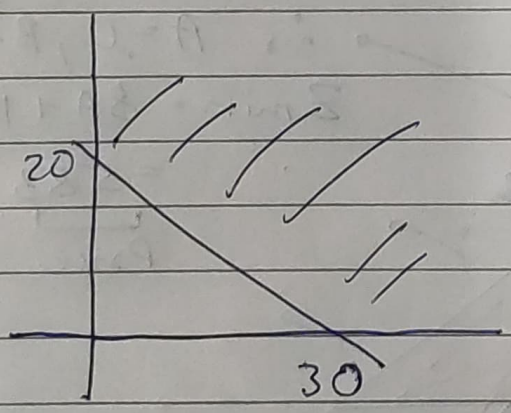
Plot the conditions & find the common region



① Graph

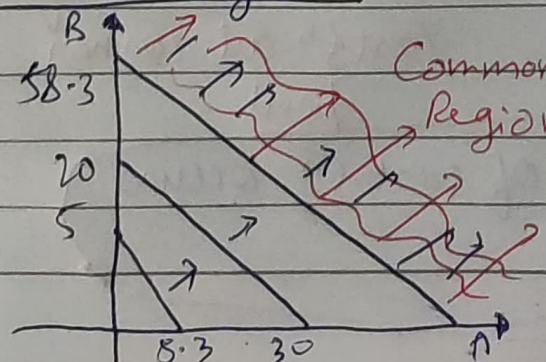


② Graph



③ Graph

Common Region



Common Region or Feasible Region → satisfying Constraints

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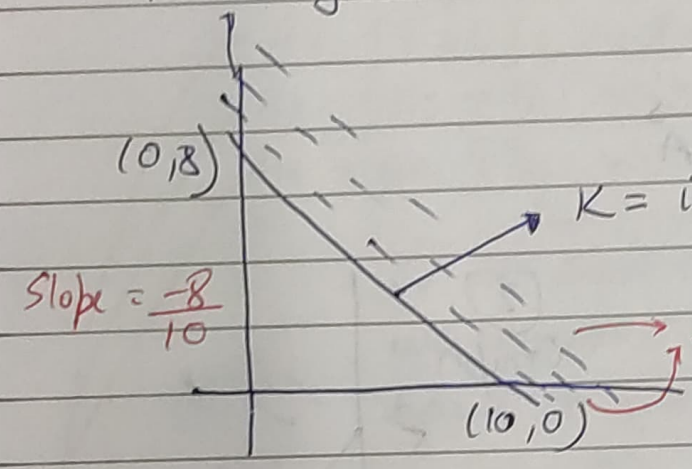
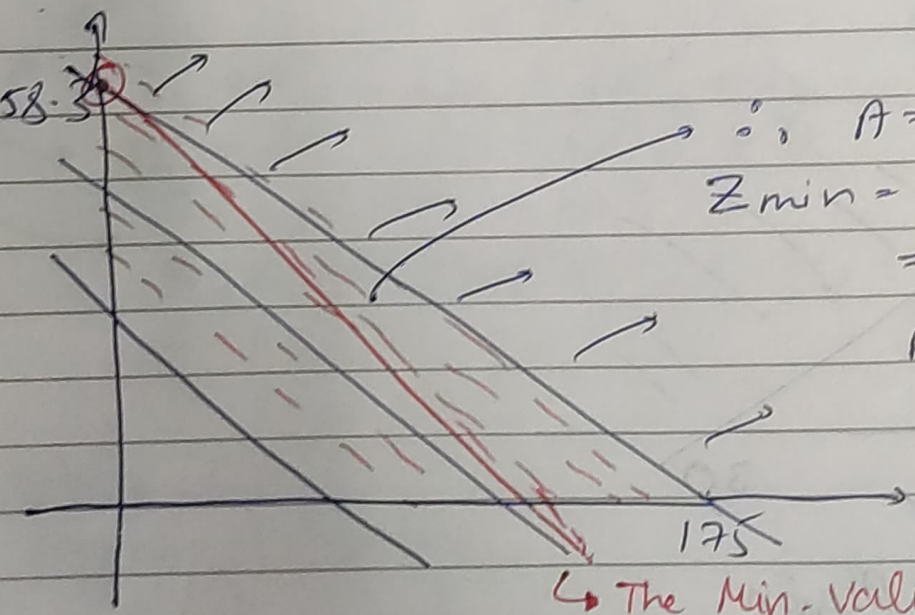
Now find, the minimum of cost f^n

$8A + 10B = K$

Plotting $8A + 10B = K$ with $K = 80$



Now we will move the cost f^n in common graph



# of boundary

$\therefore A = 0, B = 58.3$

$Z_{min} = 8A + 10B$

$= 583$

Price

↳ The Min. Value of Cost f^n at corner point

In general, the min. of cost f^n occurs at corner points