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Quantitative Management Modeling

Assignment - 1

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1 (a) Decision variables:

Imagine C and M. denotes the collegiate and Mini backpacks produces for students. So the variables are C and M

We can n't make negative backpacks both C and M must be greater than 0, so

$0 \leq C \leq 1000$

$0 \leq M \leq 1200$

(b)

Objective function : Our objective is to maximize the profits, pulling the appropriate information out of statement

$$P(C, M) = 32C + 24M$$

	C	M	Total
Unit profit	\$32	\$24	
Nylon (sqft)	3	2	5400
Labor (hrs)	0.75	0.667	1400
Sales forecast	1000	1200	

Say 10 units produced

$\$32(10) + \$24(10) = \$560$

(c) Constraints : Constraints are the amount of materials we work with each week and labor hours each week

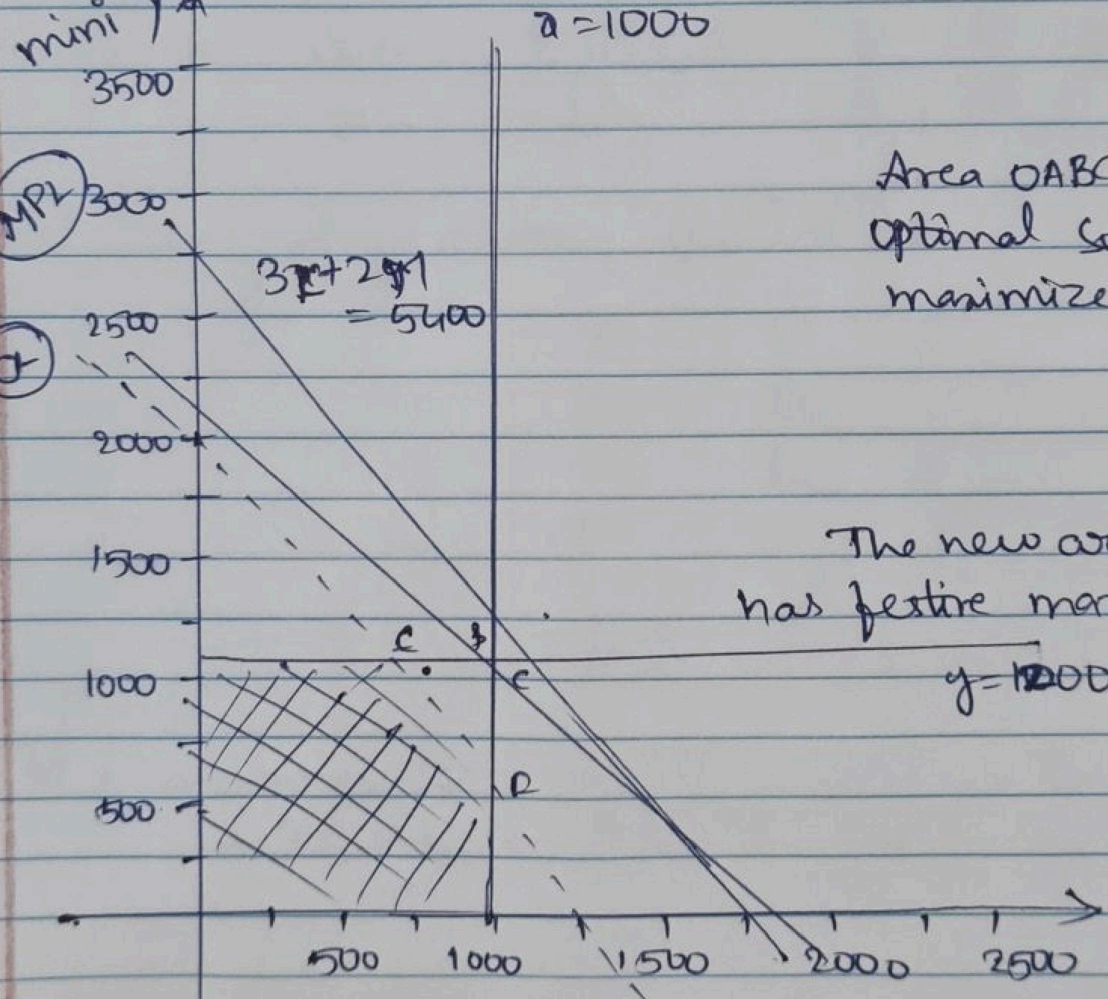
Total fabric $F = 3C + 2M \leq 5400$ sq ft
$F = 3(10) + 2(10) = 50$ and

Total hours $L = 0.75C + 0.667M \leq 1400$ hrs
$L = 0.75(10) + 0.667(10)$
$= 14.17$

Units produced $\leq$ sales forecast

$x \leq 1000$
$y \leq 1200$
$x \geq 0$ & $y \geq 0$

d) Solving this formulation using a geographi-cal method?



Area OABCD has the optimal solution to maximize profit

The new area OAEFD has festive maximum profit

→ say, the objective function \$48000 under objective line (OL).

$$\$32C + \$24M = 48000$$

This makes MPL the maximum profit line giving us the co-objectives

$$(x, y) = (1000, 975)$$

The maximum profit is produced with 1000C bags & 975My bags

$$32C + 24M = 55,400$$

(2) There are 3 plants $P_1 : P_2 : P_3$
sizes S, M, L

(a) The decision variables

	P_1	P_2	P_3
S	P_{S_1}	P_{S_2}	P_{S_3}
M	P_{M_1}	P_{M_2}	P_{M_3}
L	P_{L_1}	P_{L_2}	P_{L_3}

Z is total profit per day

(b) Maximize $Z = 420P_{L_1} + 360P_{M_1} + 300P_{S_1} + 420P_{L_2} + 360P_{M_2} + 300P_{S_2} + 420P_{L_3} + 360P_{M_3} + 300P_{S_3}$

(4)

Constraints

$$P_{L_1} + P_{M_1} + P_{S_1} \leq 750$$
$$P_{L_2} + P_{M_2} + P_{S_2} \leq 900$$
$$P_{L_3} + P_{M_3} + P_{S_3} \leq 450$$

$$20P_{L_1} + 15P_{M_1} + 12P_{S_1} \leq 1300$$
$$20P_{L_2} + 15P_{M_2} + 12P_{S_2} \leq 12000$$
$$20P_{L_3} + 15M_3 + 12P_{S_3} \leq 5000$$

$$P_{L_1} + P_{L_2} + P_{L_3} \leq 900$$

$$P_{M_1} + P_{M_2} + P_{M_3} \leq 1200$$

$$P_{S_1} + P_{S_2} + P_{S_3} \leq 750$$

$$1/750\,(P_{L_1} + P_{L_2} + P_{L_3}) - 1/900\,(P_{L_2} + P_{M_2} + P_{S_2}) = 0$$

$$1/750\,(P_{L_1} + P_{M_1} + P_{S_1}) - 1/450\,(P_{L_3} + P_{M_3} + P_{S_3}) = 0$$

and $P_{L_1} \geq 0 \quad P_{L_2} \geq 0 \quad P_{L_3} \geq 0$
$P_{M_1} \geq 0 \quad P_{M_2} \geq 0 \quad P_{M_3} \geq 0$
$P_{S_1} \geq 0 \quad P_{S_2} \geq 0 \quad P_{S_3} \geq 0$

We can say the best equality constraint is redundant

$$1/900\,(P_{L_2} + P_{M_2} + P_{S_2}) - 1/450\,(P_{L_3} + P_{M_3} + P_{S_3}) = 0$$