Quantitative Managment Modeling [Rohith chandra Koyyala.]

Assignment - Module 2

1) Say x denote collegiate backpacks and y is mini backpacks

a) The decision Variables are

	x	y	Total available
unit profit	\$32	\$ 24	
Nylon [sq.ft]	3	2	5400
Labor [hrs]	0.75	0.667	1400
Sales forecast	1000	1200	

b) The goal is to produce backpacks and maximize profits

Total profit $z = \$32x + 24y$ is the object fonction

Say if 10 units are produced

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

c) Constraints are the limited resources available for fabric & labor hours

Total fabric $F = 3x + 2y \leq 5400$ sq. ft

$F = 3(10) + 2(10) = 50$ and

Total hours $L = 0.75x + 0.667y \leq 1400$ hours

$L = 0.75(10) + 0.667(10) = 14.17$

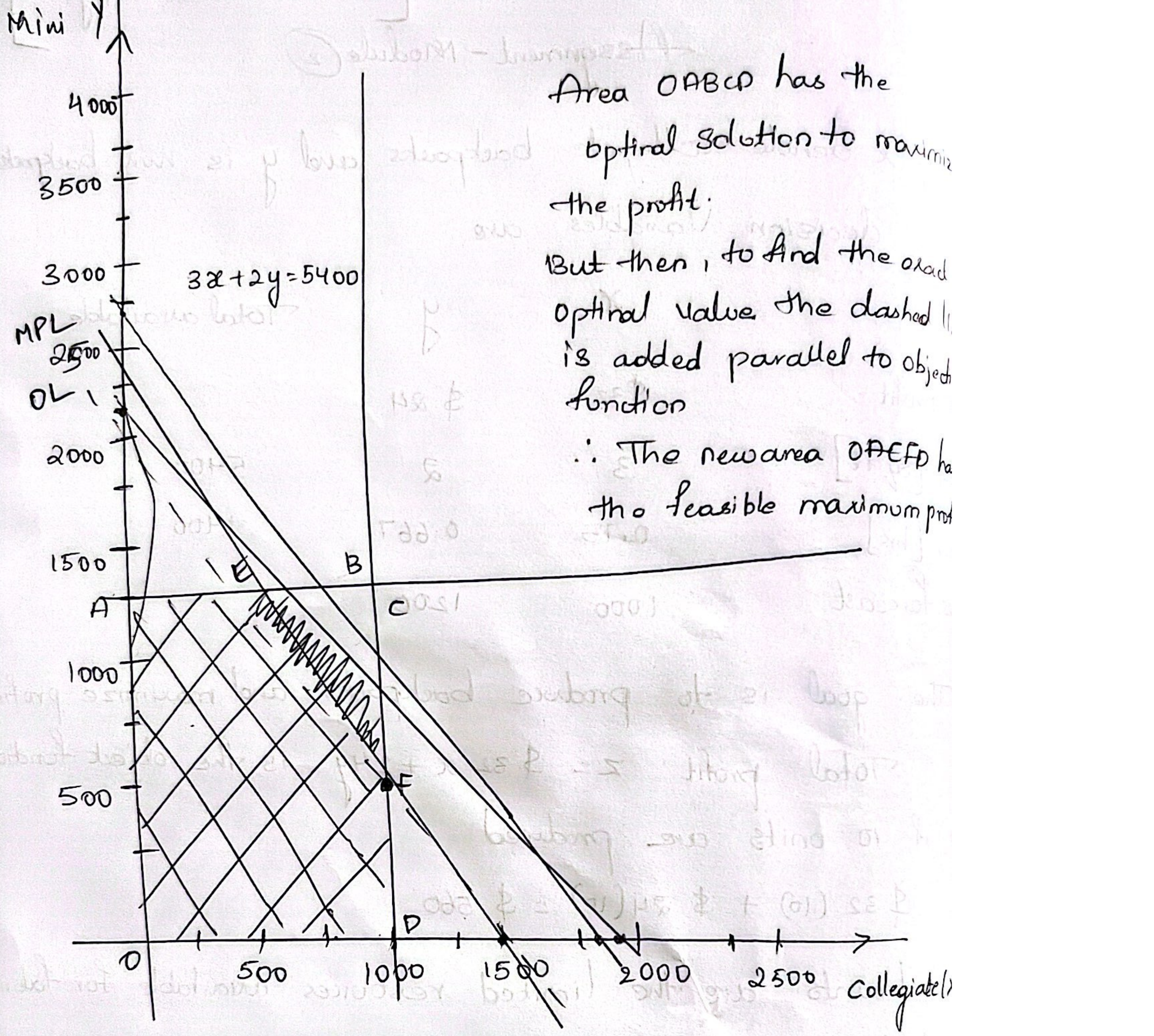
Now, units produced $\leq$ Sales forecast

$x \leq 1000$

$y \leq 1200$

$x \geq 0$ and $y \geq 0$

b) Solving this formulation using a graphical method



Area OABCD has the optimal solution to maximize the profit.

But then, to find the exact optimal value the dashed line is added parallel to objective function

∴ The new area OAEFD has the feasible maximum profit

→ Say, the objective function \$ 48,000 under the objective line (OL) $\$\,32x + 24y = 48000$

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

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

∴ The maximum profit is produced with 1000x bags and 975y bags

$\$\,32x + 24y =$

2) Say there are 3 plants: P_1, P_2, P_3
The Sizes of units are S, M, L

a) The decision Variables are –

	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 the total net profit per day

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

Constraints

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

$$20P_{L_1} + 15P_{M_1} + 12P_{S_1} \leq 13000$$
$$20P_{L_2} + 15P_{M_2} + 12P_{S_2} \leq 12000$$
$$20P_{L_3} + 15P_{M_3} + 12P_{S_3} \leq 5000$$

$$P_{L_1} + P_{L_2} + P_{L_3} \leq 900$$
$$P_{M_1} + P_{M_2} + P_{M_3} \leq 1200$$
$$P_{S_1} + P_{S_2} + P_{S_3} \leq 750$$

$$1/750\,[P_{L_1} + P_{M_1} + P_{S_1}] - 1/900\,[P_{L_2} + P_{M_2} + P_{S_2}] = 0$$
$$1/750\,[P_{L_1} + P_{M_1} + P_{S_1}] - 1/450\,[P_{L_3} + P_{M_3} + P_{S_3}] = 0$$

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 redudant

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

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