QMM Assignment 1

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Question 1
a.
Decision variables
The choice variables in this problem are two distinct bag models. They are Mini and Collegiate. We'll refer to them as follows.

$$Collegiatebag = X_a$$

$$Minibag = X_b$$

b.
objective function
A profit of 32dollar is made from each Collegiate bag, and a profit of 24dollar from each Mini backpack.

$$Maximize(Profit)Z = 32X_a + 24X_b$$

c.
Constraints
In this problem, we have two different kinds of constraints. They're
Labor constraints:

$$45X_a + 40X_b \leq (35)(40)(60)$$

It takes 45 minutes to labor each Collegiate and 40 minutes to labor each Mini.

Material constraint:

$$3X_a + 2X_b \leq 5000$$

Three square feet are used by each Collegiate and two square feet by each Mini.

Non negativity :

$$X_a, X_b \geq 0$$

$$X_a \leq 1000$$

$$X_b \leq 1200$$

d.
Full mathematical formulation

$$Max \;\; Z = 32X_a + 24X_b$$

$$45X_a + 40X_b \leq (35)(40)(60)$$

$$3X_a + 2X_b \leq 5000$$

$$X_a, X_b \geq 0$$

$$X_a \leq 1000$$

$$X_b \leq 1200$$

Question 2:
a. Decision variables

$$L_n = number \;\; of \;\; large \;\; shirts \;\; produced \;\; in \;\; nth \;\; plant$$

$$M_n = number \;\; of \;\; medium \;\; shirts \;\; produced \;\; in \;\; nth \;\; plant$$

$$S_n = number \;\; of \;\; small \;\; shirts \;\; produced \;\; in \;\; nth \;\; plant$$

where n=1,2,3.

b. LP Model
objective function :

$$Maximize \;\; Z = 420(L_1 + L_2 + L_3) + 360(M_1 + M_2 + M_3) + 300(S_1 + S_2 + S_3)$$

Constraints
capacity constraint:

$$L_1 + M_1 + S_1 \leq 750$$

$$l_2 + M_2 + S_2 \leq 900$$

$$L_3 + M_3 + S_3 \leq 450$$

storage constraints:

$$20L_1 + 15M_1 + 12S_1 \leq 13000$$

$$20L_2 + 15M_2 + 12S_2 \leq 12000$$

$$20L_3 + 15M_3 + 12S_3 \leq 5000$$

sales constraint:

$$L_1 + L_2 + L_3 \leq 900$$

$$M_1 + M_2 + M_3 \leq 1200$$

$$S_1 + S_2 + S_3 \leq 750$$

constraints to avoid lay off's

$$(L_1 + M_1 + S_1) * (100/750) = (L_2 + M_2 + S_2) * (100/900) = (L_3 + M_3 + S_3) * (100/450)$$

Non negativity :

$$L_1, L_2, L_3 \geq 0$$

$$M_1, M_2, M_2 \geq 0$$

$$S_1, S_2, S_3 \geq 0$$