MSBA Program
Quantitative Management Modeling
Assignment number 2 (Q1-Q2-Q3)

Question number 1: (Computer Center Staffing)

Decision Variables:

Z: This is the objective variable to maximize profit

P1: The Number of Part time consultants who work for the first shift (8am – noon)

P2: The Number of Part time consultants who work for the second shift (noon – 4pm)

P3: The Number of Part time consultants who work for the third shift (4pm – 8pm)

P4: The Number of Part time consultants who work for the fourth shift (8pm – midnight)

F1: The Number of full-time consultants who work for the first shift (8am – 4pm)

F2: The Number of full-time consultants who work for the second shift (noon – 8pm)

F3: The Number of full-time consultants who work for the third shift (4pm – midnight)

Objective Function:

Max profit Z = 48 (P1 + P2 + P3 + P4) **+ 112 (**F1 + F2 + F3)

Constraints

$F1 + P1 \geq 4$

$F1 + F2 + P2 \geq 8$

$F2 + F3 + P3 \geq 10$

$F3 + P4 \geq 6$

$P1 \geq F1$

$P2 \geq F1 + F2$

$P3 \geq F2 + F3$

$P4 \geq F3$

$P_1, P_2, P_3, P_4 \geq 0$

$F_1, F_2, F_3, \geq 0$

b) We need to add more full-time consultants to the three shifts

so, we will add three more fs F4, F5, F6

F4 represents the new staff of the first shift

F5 represents the new staff of the first shift

F6 represents the new staff of the first shift

Objective Function:

Max profit Z = 48 (P1 + P2 + P3 + P4) **+ 112 (**F1 + F2 + F3 +F4 +F5 + F5)

Constraints

$F1 + F4 + P1 \geq 4$

$F1 + F2 + F4 + + F5 + P2 \geq 8$

$F2 + F3 + F5 + F6 + P3 \geq 10$

$F5 + F6 + P4 \geq 6$

$P1 \geq F1$

$P2 \geq F1 + F2$

$P3 \geq F2 + F3$

$P4 \geq F3$

$P_1, P_2, P_3, P_4 \geq 0$

$F_1, F_2, F_3, F4, F5, F6 \geq 0$

Q2: The Decision Variables:

Z: objective variable to maximize profit

X1: represents the number of units produced from model “Collegiate”

X2: represents the number of units produced from model “Mini”

Objective Function: Max. $Z = 32X_1 + 24X_2$

The constraints are:

1. $3X_1 + 2X_2 \leq 5000$
2. $45X_1 + 40X_2 \leq 84{,}000$
3. $X_1 \leq 1000$
4. $X_2 \leq 1200$
5. $X_1, X_2 \geq 0$

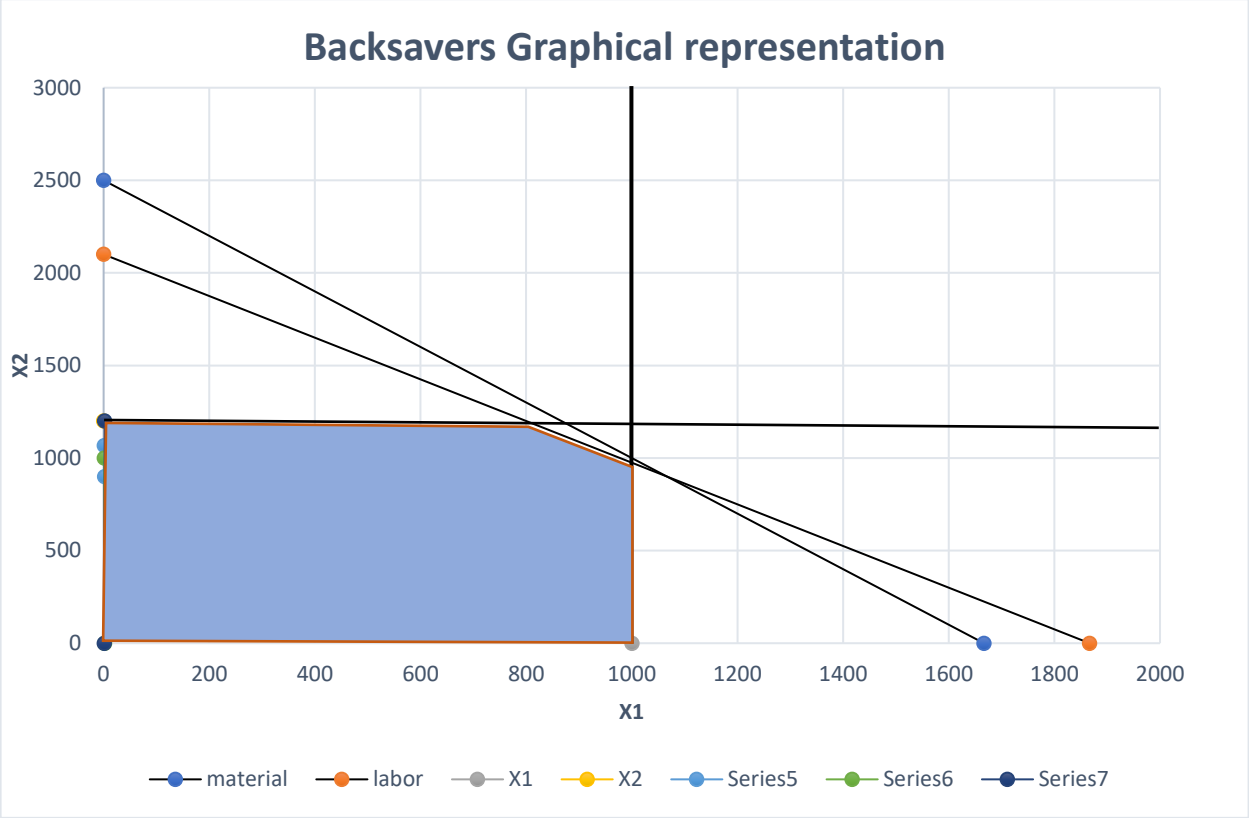
Solution:

1- $3X1 + 2X2 = 5000$
(0, 2500)

(1,666.66, 0)

2- $45X_1 + 40X_2 = 84{,}000$
(0, 2100)
(1866.66, 0)

3- $X1 \leq 1000$
4- $X2 \leq 1200$



X1 = 1000, and X2 = 1000

Q3:

Decision Variables:

Z: objective variable to maximize profit

L_i: represents the total number of units produced from “Large-Size” (Lp1 + Lp2 + Lp3)

M_i: represents the total number of units produced from “Medium-Size” (Mp1 + Mp2 + Mp3)

S_i: represents the total number of units produced from “Small-Size” (Sp1 + Sp2 + Sp3)

Lp_1: Number of Large-Size units produced by Plant (1)

Lp_2: Number of Large-Size units produced by Plant (2)

Lp_3: Number of Large-Size units produced by Plant (3)

Mp_1: Number of Medium-Size units produced by Plant (1)

Mp_2: Number of Medium-Size units produced by Plant (2)

Mp_3: Number of Medium-Size units produced by Plant (3)

Sp_2: Number of Small-Size units produced by Plant (1)

Sp_1: Number of Small-Size units produced by Plant (2)

Sp_3: Number of Small-Size units produced by Plant (3)

Objective Function:

Max. Z = 420 ($Lp_1 + Lp_2 + Lp_3$) + **360 (**$Mp_1 + Mp_2 + Mp_3$) **+ 300 (**$Mp_1 + Mp_2 + Mp_3$)

S.T

Lp1 + Mp1 + Sp1 ≤ 750

Lp2 + Mp2 + Sp2 ≤ 900

Lp3 + Mp3 + Sp3 ≤ 450

20 Lp1 + 15 Mp1 + 12 Sp1 ≤ 13000

20 Lp2 + 15 Mp2 + 12 Sp2 ≤ 12000

20 Lp3 + 15 Mp3 + 12 Sp3 ≤ 5000

Lp1 + Lp2 + Lp3 ≤ 900

Mp1 + Mp2 + Mp3 ≤ 1200

Sp1 + Sp2 + Sp3 ≤ 750

Lp1, Lp2, Lp3, Mp1, Mp2, Mp3, Sp1, Sp2, Sp3 ≥ 0