Quantitative Management Modeling

Assignment 2

Q1: (Computer Center Staffing)

Decision Variables:

Z: objective variable to maximize profit

P1: Number of Part-Time consultants for (8am – noon)

P2: Number of Part-Time consultants for (noon – 4pm)

P3: Number of Part-Time consultants for (4pm – 8pm)

P4: Number of Part-Time consultants for (8pm – midnight)

F1: Number of Full-Time consultants for (8am – 4pm)

F2: Number of Full-Time consultants who work in shift (noon – 8pm)

F3: Number of Full-Time consultants who work in shift (4pm – midnight)

Objective Function:

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

Constraints

$F1 + P1 \geq 4$

$F1 + F2 + P2 \geq 8$

$F2 + F3 + P3 \geq 10$

$F3 + P4 \geq 6$

$P1 \geq F1$

$P2 \geq F1 + F2$

$P3 \geq F2 + F3$

$P4 \geq F3$

$F_1, F_2, F_3, P_1, P_2, P_3, P_4 \geq 0$

b- we will add more 2 full-time in the second shift and 2 part-time in the third shift

Objective Function:

Max. $Z = 112 (F_1 + F_2 + F_3 + 2) + 48 (P_1 P_2 + P_3 + P_4 + 2)$

constraints

$F_1 + P_1 \geq 4$

$F_1 + (2) F_2 + P_2 \geq 8$

$(2) F_2 + F_3 + (1.4) P_3 \geq 10$

$F_3 + P_4 \geq 6$

$F1, F2, F3, P1, P2, P3, P4 \geq 0$

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. $Z = 32X1 + 24X2$

constraints

$3X1 + 2X2 \leq 5000$

$45X1 + 40X2 \leq 84{,}000$

$X1 \leq 1000$

$X2 \leq 1200$

$X1, X2 \geq 0$

Solution:

1- $3X1 + 2X2 = 5000$

(0, 2500)

(1,666.66, 0)

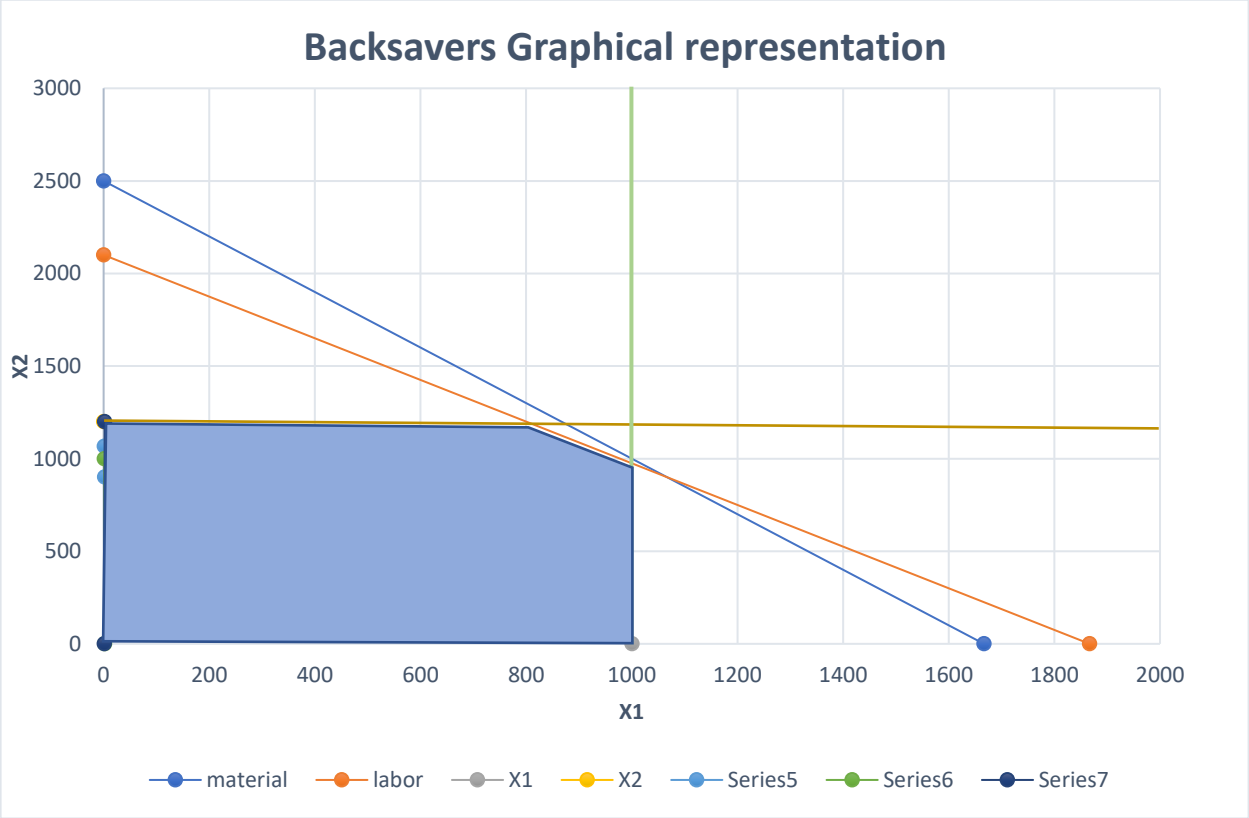
2- $45X1 + 40X2 = 84{,}000$

(0, 2100)

(1866.66, 0)

3- $X1 \leq 1000$

4- $X2 \leq 1200$



1- 3X1 + 2X2 = 5000

X1 = 1000

3 (1000) + 2X2 = 5000

2X2 = 2000 (1000, 1000)

2- 45X1 + 40X2 = 84,000

X2 = 1200

45X1 + 40 (1200) = 84,000

45X1 = 36,000 (800, 1200)

we find that the optimal solution is X1 = 1000, and X2 = 1000

Q3:

Table 1 Weigelt Corporation problem

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

Production Capacity Constraints

$Lp1 + Mp1 + Sp1 \leq 750$ ——(1)——→

$Lp2 + Mp2 + Sp2 \leq 900$ ——(2)——→

$Lp3 + Mp3 + Sp3 \leq 450$ ——(3)——→

Storage Space Constraints

$20\ Lp1 + 15\ Mp1 + 12\ Sp1 \leq 13000$ (4)

$20\ Lp2 + 15\ Mp2 + 12\ Sp2 \leq 12000$ (5)

$20\ Lp3 + 15\ Mp3 + 12\ Sp3 \leq 5000$ (6)

Sales Forecasting Constraints

$Lp1 + Lp2 + Lp3 \leq 900$ (7)

$Mp1 + Mp2 + Mp3 \leq 1200$ (8)

$Sp1 + Sp2 + Sp3 \leq 750$ (9)

$Lp1, Lp2, Lp3, Mp1, Mp2, Mp3, Sp1, Sp2, Sp3 \geq 0$