Chapter 7 Integer Linear Programming

7.1 Z = 210

7.2 Z = 28

7.3 Z = 116

7.4 Z = 115.33

7.5 Let X_1 = number of QM110 students
X_2 = number of QM210 students

$$\begin{aligned}
\text{MAX Z:} \quad & 6X_1 + 9X_2 && \text{(Profit, \$)} \\
\text{Subject to:} \quad & X_1 + 2X_2 \leq 10 && \text{(Max. hours per week)} \\
& X_1 \leq 3 && \text{(Max. QM110 students)} \\
& X_2 \leq 5 && \text{(Max. QM210 students)} \\
& X_1, X_2 = \text{integer} && \text{(Integer Restriction)} \\
& X_1, X_2 \geq 0 && \text{(Nonnegativity)}
\end{aligned}$$

7.6 Let X_1 = Pinecrest site
X_2 = Woodlands site
X_3 = Arbor Oaks site
X_4 = Regency site
X_5 = Hillsboro site
X_6 = Hillwood site

$$\begin{aligned}
\text{MAX Z:} \quad & 10000X_1 + 12000X_2 + 20000X_3 \\
& + 24000X_4 + 16000X_5 + 6000X_6 && \text{(Profit, \$)} \\
\text{Subject to:} \quad & 120000X_1 + 100000X_2 + 164000X_3 + 206000X_4 \\
& + 100000X_5 + 82000X_6 \leq 600000 && \text{(Total Invest.)} \\
& X_1, X_2, X_3, X_4, X_5, X_6 \leq 1 && \text{(Binary Restriction)} \\
& X_1, X_2, X_3, X_4, X_5, X_6 \geq 0 && \text{(Nonnegativity)}
\end{aligned}$$

7.7 Let X_1 = investment in Stock A
X_2 = investment in Stock B
X_3 = investment in Stock C
X_4 = investment in Income Bond A
X_5 = investment in Income Bond B
X_6 = investment in Income Bond C

MAX Z: $100X_1 + 200X_2 + 60X_3 + 120X_4 + 200X_5 + 80X_6$ (Return, $)

S.T: $1000X_1 + 2000X_2 + 700X_3 + 1400X_4 + 1600X_5 + 800X_6 \leq 5000$ (Total Investment)

$X_1 + X_2 + X_3 \leq 2$ (Max. # of stocks)

$X_4 + X_5 + X_6 \geq 2$ (Min. # of bonds)

$X_1 + X_2 + X_3 + X_4 + X_5 + X_6 \geq 4$ (Min. # of invest.)

$X_1, X_2, X_3, X_4, X_5, X_6 \leq 1$ (Binary Restriction)

$X_1, X_2, X_3, X_4, X_5, X_6 \geq 0$ (Nonnegativity)

7.8 Let X_1 = number of salesmen allocated to East Region
X_2 = number of salesmen allocated to South Region
X_3 = number of salesmen allocated to Southwest Region

MAX Z: $14000X_1 + 15000X_2 + 15500X_3$

S.T.: $2750X_1 + 3000X_2 + 2500X_3 \leq 150000$ (Max. Sales Expense)

$X_1 \leq 40$ (Max. Salesmen, E)

$X_2 \leq 40$ (Max. Salesmen, S)

$X_3 \leq 40$ (Max. Salesmen, SW)

$X_1 \geq 15$ (Min. Salesmen, E)

$X_2 \geq 15$ (Min. Salesmen, S)

$X_3 \geq 15$ (Min. Salesmen, SW)

$X_1 + X_2 + X_3 \leq 100$ (Total Salesmen)

X_1, X_2, X_3 = integer (Integer Restriction)

$X_1, X_2, X_3 \geq 0$ (Nonnegativity)

7.9 Let X_1 = number of sets of men's clubs
X_2 = number of sets of women's clubs
X_3 = number of sets of junior clubs

MAX Z: $170X_1 + 165X_2 + 145X_3$ (Profit, $)

S.T.: $1.25X_1 + 1.30X_2 + 0.75X_3 \leq 100$ (Total Hours per Month)

$X_1 \geq 5$ (Men’s backlog)

$X_2 \geq 3$ (Women’s backlog)

$X_3 \geq 5$ (Junior’s backlog)

X_1, X_2, X_3 = integer (Integer Restriction)

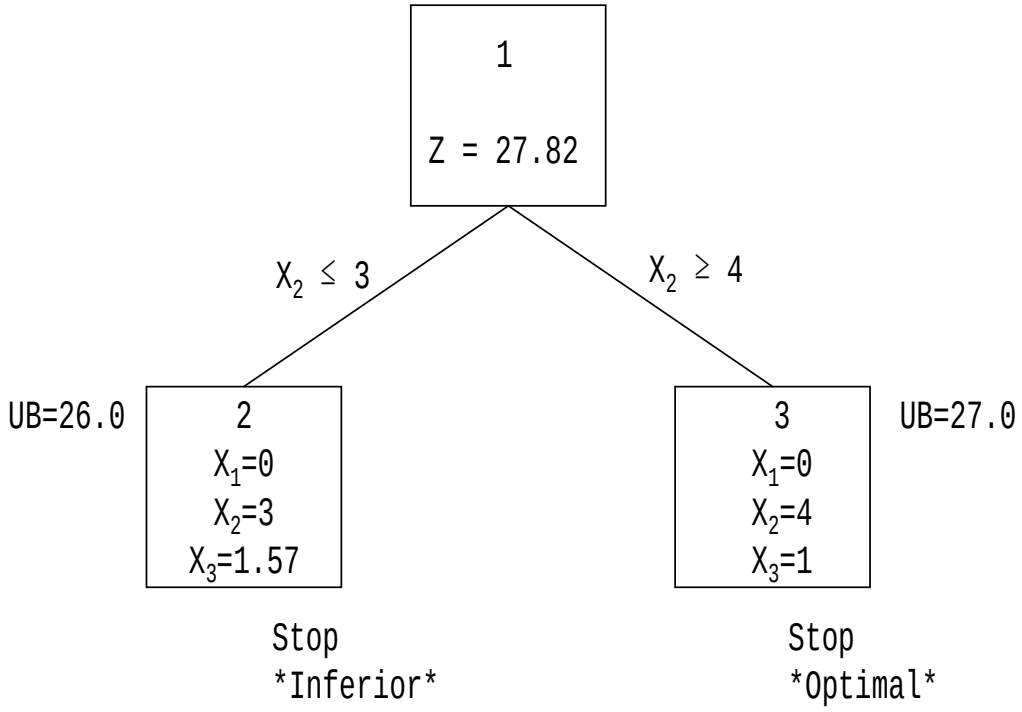
$X_1, X_2, X_3 \geq 0$ (Nonnegativity)

7.10 Let X_1 = number of lighters
X_2 = number of mirrors
X_3 = number of knives

MAX Z:	$10X_1 + 8X_2 + 7X_3$	(Profit, $)
S.T.:	$2X_1 + 8X_2 + 10X_3 \leq 32$	(Total weight, ozs.)
	$X_1 \geq 1$	(Min. # of lighters)
	$X_2 \geq 1$	(Min. # of mirrors)
	$X_3 \geq 1$	(Min. # of knives)
	X_1, X_2, X_3 = integer	(Integer restriction)
	$X_1, X_2, X_3 \geq 0$	(Nonnegativity)

7.11 $X_1 = 4$, $X_2 = 4$, $Z_{MAX} = 32$

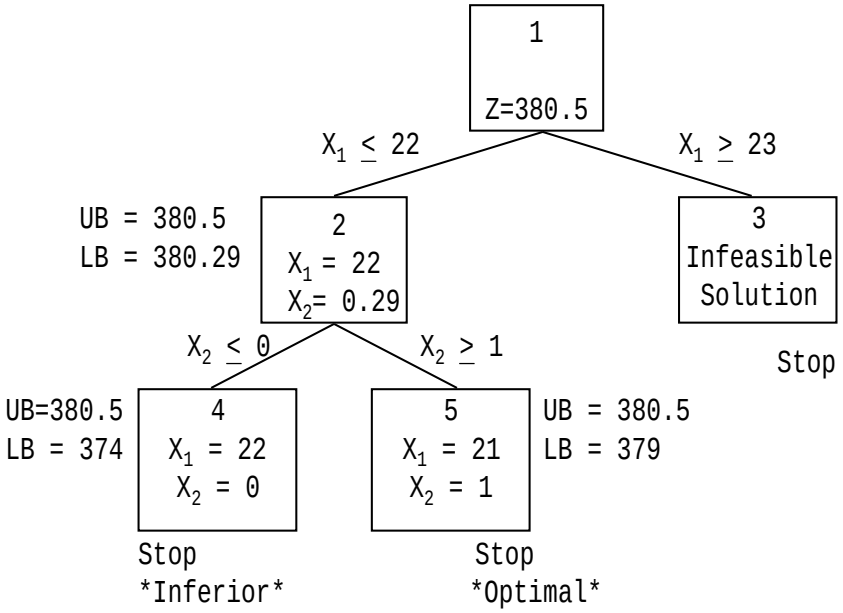
7.12 UB = 27.818 ($X_1 = 0$, $X_2 = 3.909$, $X_3 = 1.182$)
LB = 22 ($X_1 = 0$, $X_2 = 3$, $X_3 = 1$)



7.13 $X_1 = 8$; $X_2 = 1$; $Z_{MIN} = 60$

7.14 $X_1 = 8$; $X_2 = 13$; $Z_{MIN} = 139$

7.15 UB = 380.5 (X_1 = 22.167, X_2 = 0.167)
LB = 374 (X_1 = 22, X_2 = 0)



7.16 $X_1 = 2$; $X_2 = 3$; $X_3 = 2$; $Z_{MAX} = 1260$.

7.17 $X_1 = 2$; $X_2 = 4$; $Z_{MAX} = 48$

7.18 $X_1 = 0$; $X_2 = 1$; $X_3 = 1$; $X_4 = 1$; $X_5 = 1$; $X_6 = 0$; $Z_{MAX} = 72000$.

7.19 $X_1 = 1$; $X_2 = 0$; $X_3 = 0$; $X_4 = 1$; $X_5 = 1$; $X_6 = 1$: $Z_{MAX} = 500$.

7.20 $X_1 = 15$; $X_2 = 15$; $X_3 = 25$: $Z_{MAX} = 822500$.

7.21 $X_1 = 6$; $X_2 = 3$; $X_3 = 118$; $Z_{MAX} = 18625$.

7.22 $X_1 = 7$; $X_2 = 1$; $X_3 = 1$; $Z_{MAX} = 85$.

7.23 $X_1 = 6$; $X_2 = 0.667$; $Z_{MAX} = 32$.

7.24 $X_1 = 6$; $X_2 = 1.6$; $Z_{MIN} = 55.2$.

7.25 Z = 360000.

7.26 Z = 314.

7.27 Z = 318.