

Integer programming Chapter 6

(skipping chapter 4 and 5)

- An integer programming problem is LPP in which the variables are required to have integer values.
- To solve an IPP
 - (1) Solve the associated LPP
 - (2) Do other stuff

EX #6.10

Maximize

$$z = x_1 + 2x_2 + 3x_3 + x_4$$

Subject to

$$3x_1 + 2x_2 + x_3 + 4x_4 \leq 10$$

$$5x_1 + 3x_2 + 2x_3 + 5x_4 \leq 5$$

with $x_1, x_2, x_3, x_4 \geq 0$, and integral

$$\begin{cases} 3x_1 + 2x_2 + x_3 + 4x_4 + x_5 = 10 \\ 5x_1 + 3x_2 + 2x_3 + 5x_4 + x_6 = 5 \end{cases}$$

$$A = \begin{bmatrix} 3 & 2 & 1 & 4 & 1 & 0 \\ 5 & 3 & 2 & 5 & 0 & 1 \end{bmatrix}$$

$$x_b = \begin{bmatrix} x_5 \\ x_6 \end{bmatrix} \quad C_b = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$C_r = [1 \ 2 \ 3 \ 1 \ 0 \ 0]^T$$

Init simplex table

$$\begin{array}{c|c|c} & X^T & \\ \hline X_0 & A & b \\ \hline & & C^T B \\ \hline \end{array}$$

$C_0^T A - C^T$

$$\begin{array}{c|c|c} & X^T & \\ \hline X_0 & A & B \\ \hline & C_0^T A - C^T & C_0^T B \\ \hline \end{array}$$

$$\begin{array}{c|cccccc|c} & X_1 & X_2 & X_3 & X_4 & X_5 & X_6 & \\ \hline X_0 & 3 & 2 & 1 & 4 & 1 & 0 & 10 \\ \hline X_1 & 5 & 3 & 2 & 5 & 0 & 1 & 5 \\ \hline & -1 & -2 & -3 & -1 & 0 & 0 & 0 \\ \hline \end{array}$$

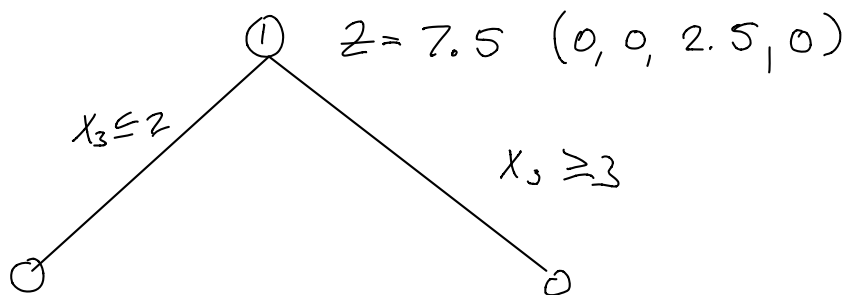
Proceed w usual:

Result

$$\begin{cases} X_1 = 0 \\ X_2 = 0 \\ X_3 = 2.5 \\ X_4 = 0 \end{cases} \quad z = 7.5$$

Now use branch and bound method

2 cuts for X_3 : $X_3 \leq 2$ or $X_3 \geq 3$



Solve two new LPPs with new X_3 constraints

$$X_3 \leq 2$$

$$X_3 \geq 3$$

$$z = X_1 + 2X_2 + 3X_3 + X_4$$

Subject to

$$3X_1 + 2X_2 + X_3 + 4X_4 \leq 10$$

$$z = X_1 + 2X_2 + 3X_3 + X_4$$

Subject to

$$3X_1 + 2X_2 + X_3 + 4X_4 \leq 10$$

$$5x_1 + 3x_2 + 2x_3 + 5x_4 \leq 5$$

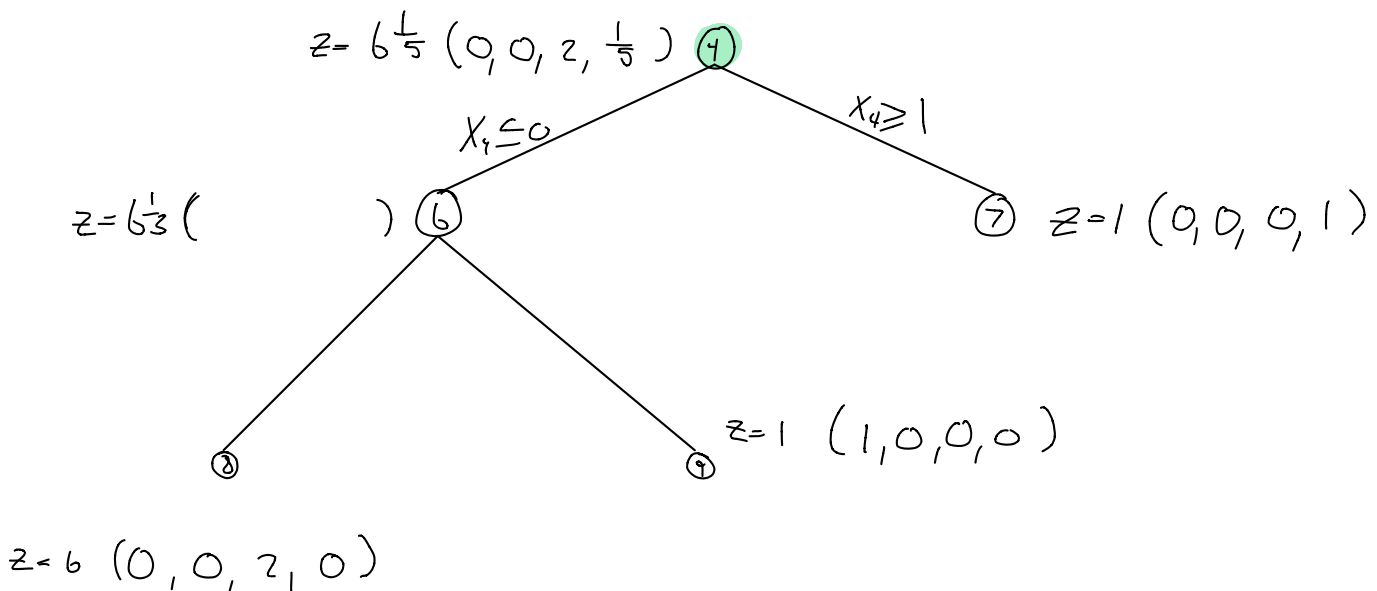
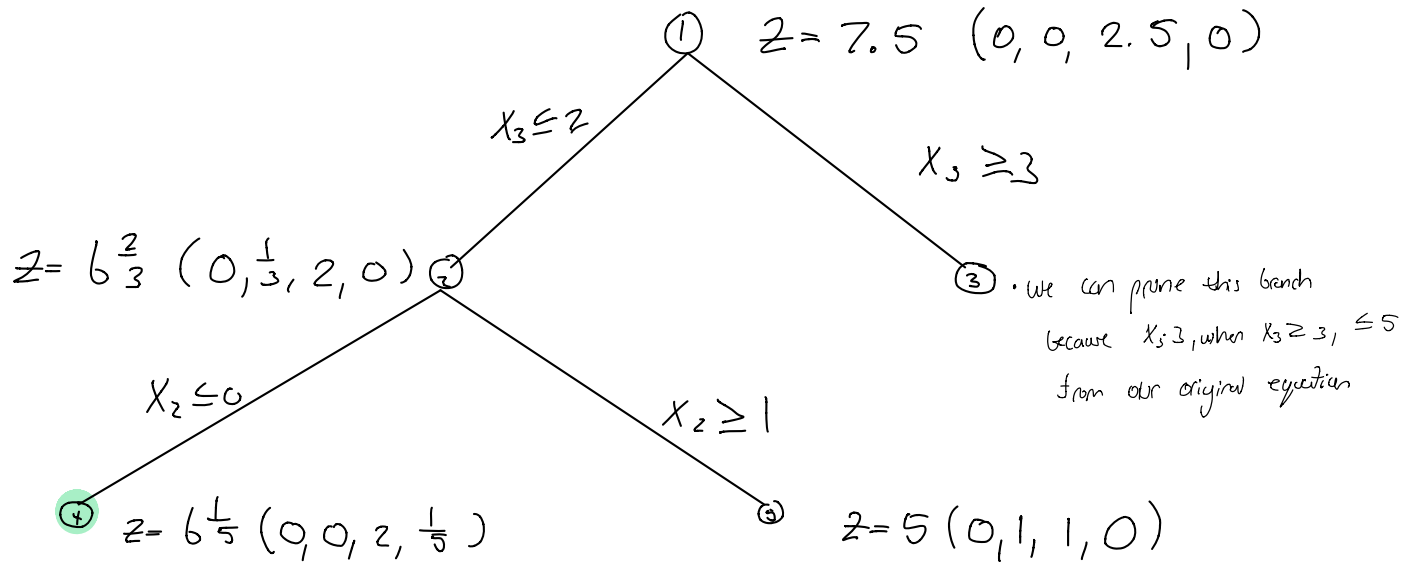
with $x_1, x_2, x_4 \geq 0$, and integral

$$x_3 \leq 2$$

$$5x_1 + 3x_2 + 2x_3 + 5x_4 \leq 5$$

with $x_1, x_2, x_4 \geq 0$, and integral

$$x_3 \geq 3$$



Dan

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Chapter 6, 6.11 will be the take home quiz 3

• I will need to note why/how we adjusted our solution