

Branch-and-bound Python Example (Accompanying Lesson 14)

1 Today...

- This example is part of Lesson 14, Branch-and-bound.

2 Branch-and-bound Example

Solve the following IP using branch-and-bound.

$$\begin{array}{ll}
 \text{(P1)} & z_{IP}^* = \max 8x + 7y \\
 \text{s.t.} & -18x + 38y \leq 133 \\
 & 13x + 11y \leq 125 \\
 & 10x - 8y \leq 55 \\
 & x, y \in \mathbb{Z}^{\geq 0}
 \end{array}
 \left. \vphantom{\begin{array}{l} \text{(P1)} \\ \text{s.t.} \end{array}} \right\} \begin{array}{l} \text{example of} \\ \text{BBB notes} \end{array}$$

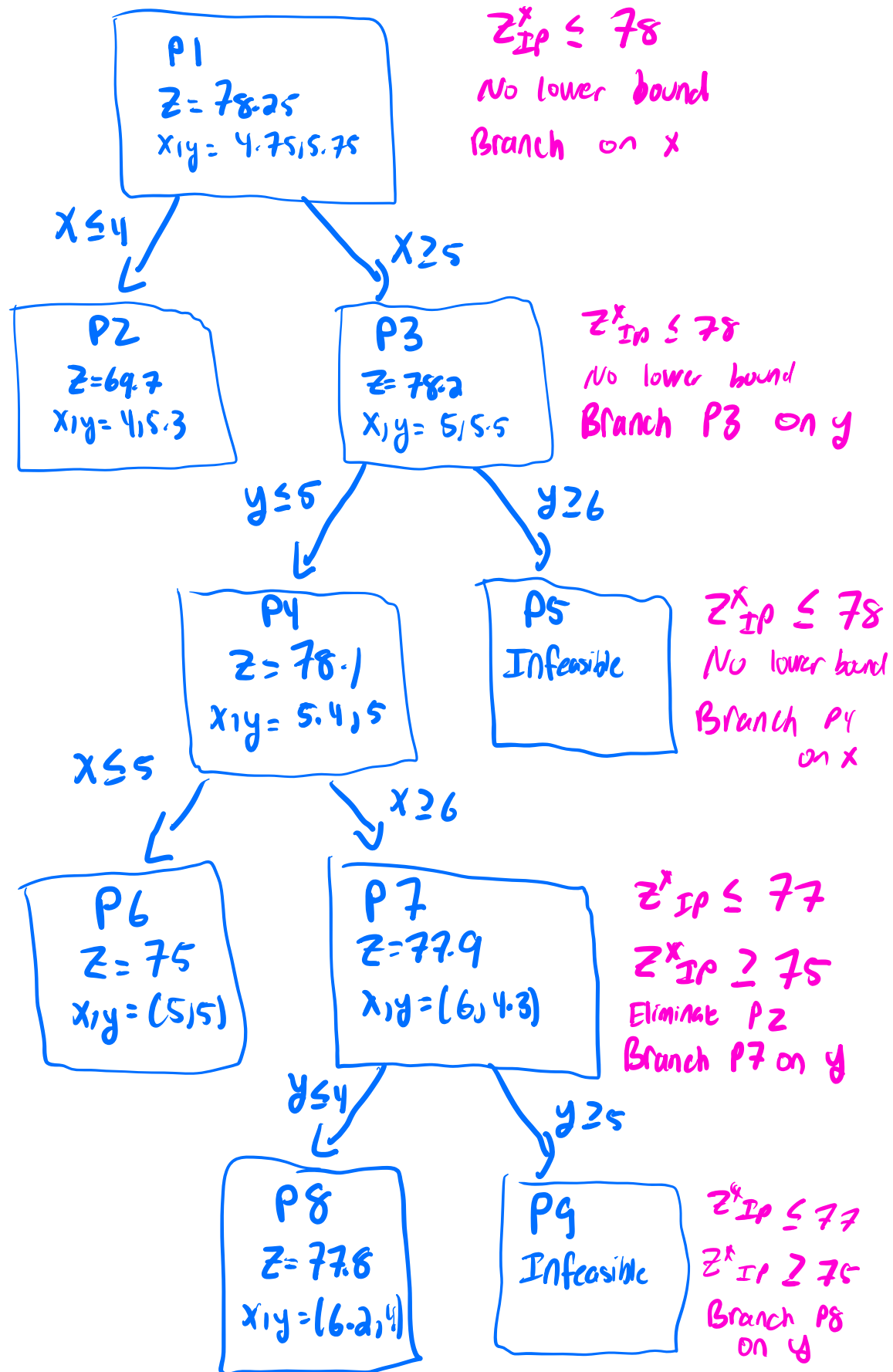
- Use Python to solve LP relaxations of subproblems) uploaded to Blackboard
- Branching Rules
 - Always select the active node with the largest upperbound for branching.
 - Branch on x if it is fractional. Otherwise branch on y .
- Book-keeping
 - Keep track of the:
 - ◊ incumbent solution \underline{x} ,
 - ◊ global lower bound \underline{z} , and
 - ◊ list of active nodes.
 - Draw the branch-and-bound tree:
 - ◊ Record the local upper bound (z) and relaxed optimal solution (x) for each subproblem.
 - ◊ Label each edge with the constraint that is added to form the child subproblem.
 - ◊ X-out fathomed nodes. Circle incumbent solution nodes.
 - Use the provided diagram to illustrate the (relaxed) feasible region of each subproblem.

incumbent solution \underline{x}

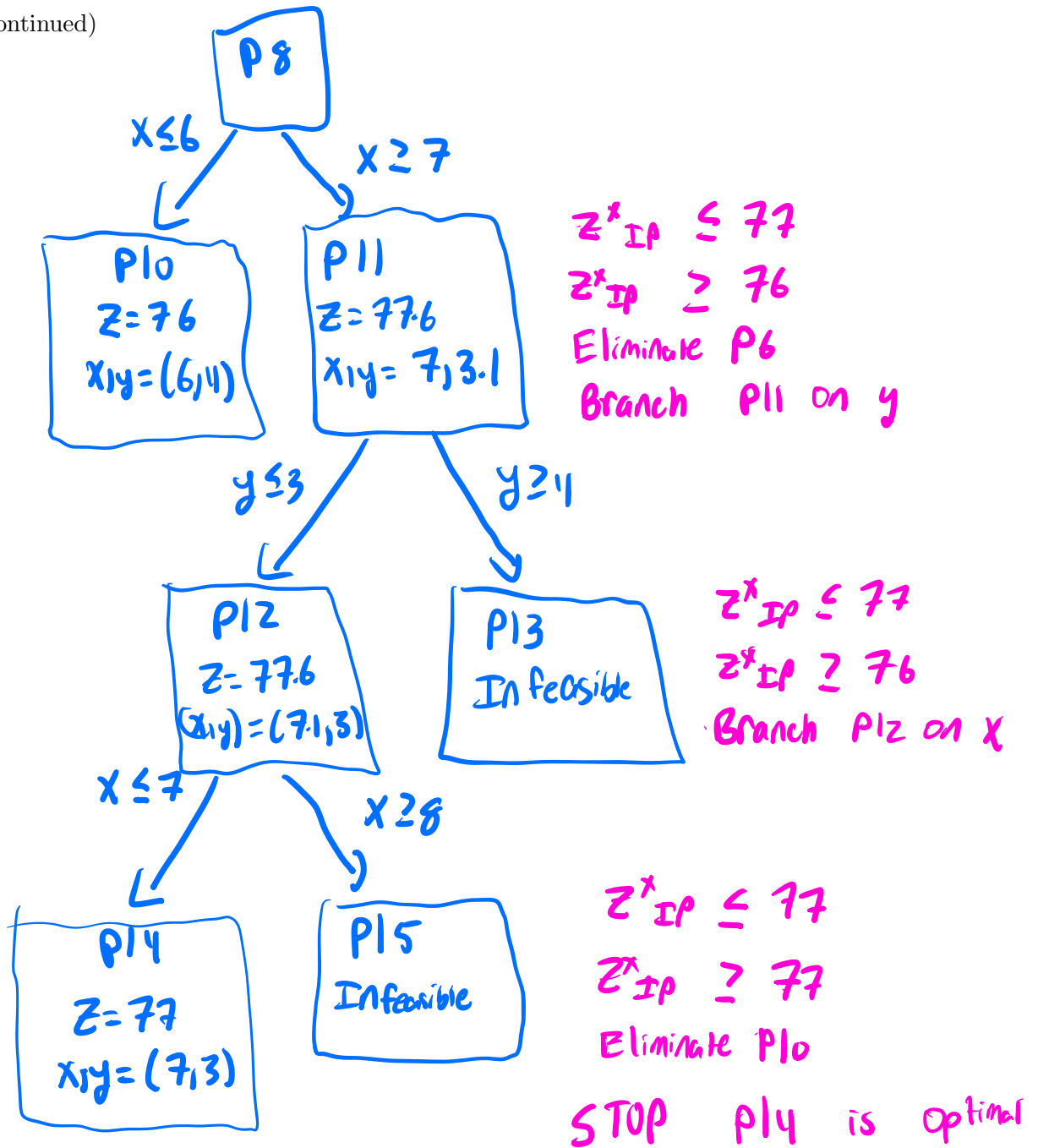
global lower bound \underline{z}

active nodes

B & B Tree

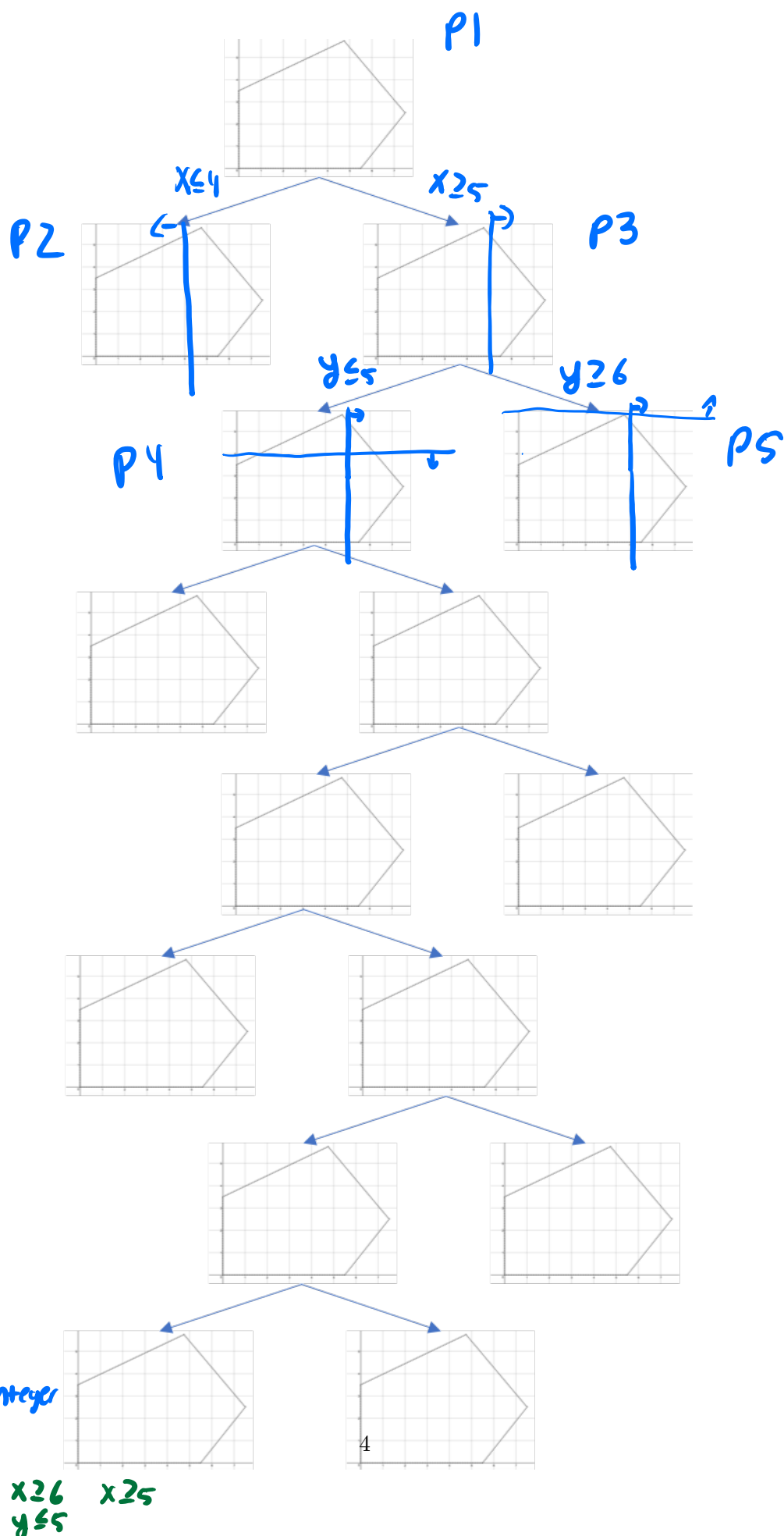


(B&B Tree Continued)



$$x, y = (7, 3)$$

$$z^* = 77$$



P14 IP

Max $8x + 7y$

$$-18x + 38y \leq 133$$

$$13x + 11y \leq 125$$

$$10x - 8y \leq 55$$

$x, y \geq 0$ integer

$$x \leq 7$$

$$y \leq 3$$

$$x \geq 2$$

$$y \leq 4$$

$$x \geq 6$$

$$y \leq 5$$

