Branch-and-bound Example (L17)

1 Today...

- This example is part of Lesson 17, Branch-and-bound.

2 Branch-and-bound Example

Solve the following IP using branch-and-bound.

$$\begin{aligned} \text{(P1)} \quad z^*_{IP} = \max\ & 8x + 7y \\ \text{s.t.} \quad & -18x + 38y \leq 133 \\ & 13x + 11y \leq 125 \\ & 10x - 8y \leq 55 \\ & x, y \in \mathbb{Z}^{\geq 0} \end{aligned}$$

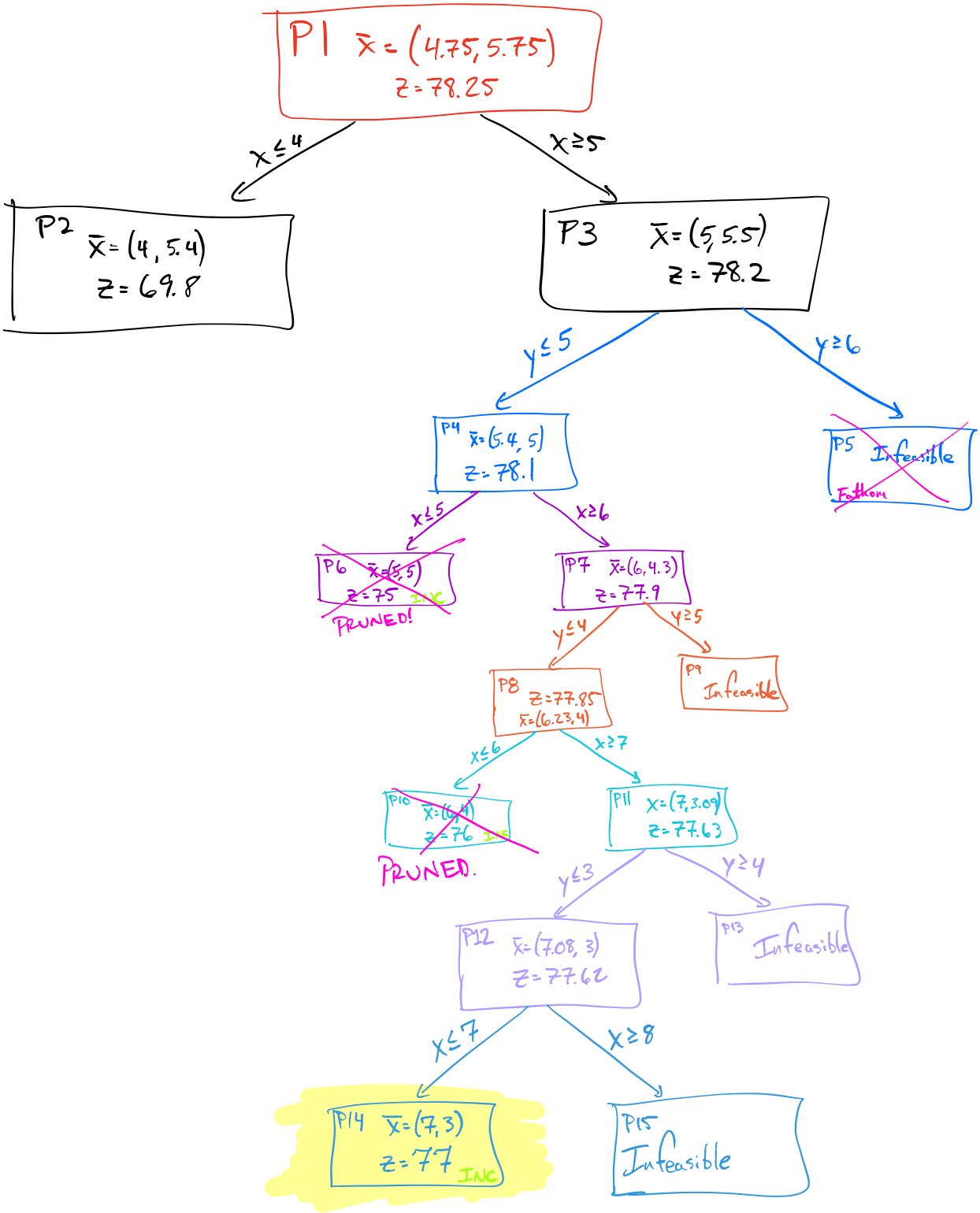
- Use Python to solve LP relaxations of subproblems
- Branching Rules
  - Always select the active node with the largest upperbound for branching.
  - Branch on x if it is fractional. Otherwise branch on y.
- Book-keeping
  - Keep track of the:
    - incumbent solution $\underline{x}$, global lower bound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

This is our branching rule.

Variable Selection Rule

incumbent solution ($\underline{x}$) **global lower bound** ($\underline{z}$) **global upper bound** **MIP gap**

B & B Tree



OPTIMAL SOLUTION

$z^* = 77 \quad x^* = (7, 3)$