Branch-and-bound Python Example (Accompanying Lesson 16)

1 Today...

- This example is part of Lesson 16, Branch-and-bound.

2 Branch-and-bound Example

Solve the following IP using branch-and-bound.

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

- 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 $\underline{z}$, 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)