

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

1 Branch-and-bound Example

Solve the following IP using branch-and-bound. Solve each sub problem graphically.

$$\begin{aligned}
 \text{(P1)} \quad & z_{IP}^* = \max 4x_1 - x_2 \\
 \text{s.t.} \quad & 7x_1 - 2x_2 \leq 14 \\
 & 2x_1 - 2x_2 \leq 3 \\
 & x_2 \leq 3 \\
 & x_1, x_2 \in \mathbb{Z}^{\geq 0}
 \end{aligned}$$

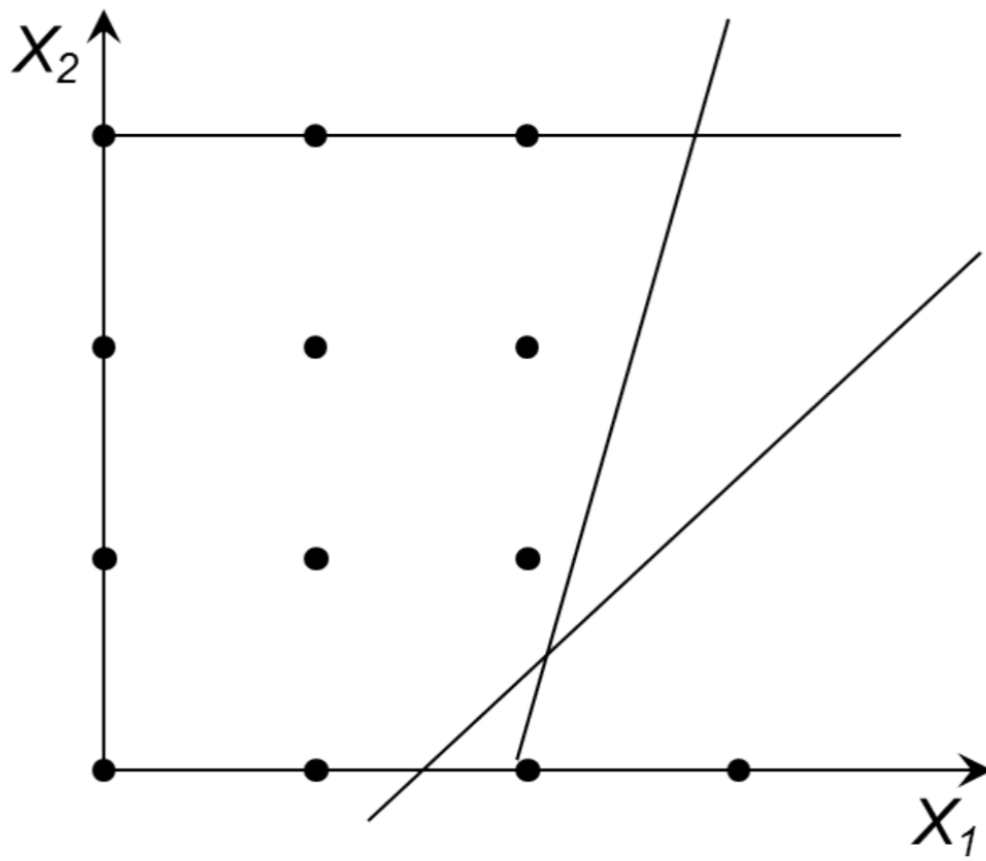
- Solve each sub-problem graphically
- Branching Rules
 - Always select the active node with the largest upperbound for branching.
 - Branch on x_1 if it is fractional. Otherwise branch on x_2 .
- Book-keeping
 - Keep track of the:
 - ◊ incumbent solution \underline{x} ,
 - ◊ global lower bound \underline{z} , 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

Feasible Region



B & B Tree

