

Column Generation (CG)

- A set of columns, $a \in \mathcal{A} \subset \mathbb{R}^m$, $c_a \in \mathbb{R}$, $b \in \mathbb{R}^m$
- **Large-scale** primal and dual problems:

$$\begin{array}{ll}
 \text{(P)} & \max \sum_{a \in \mathcal{A}} c_a x_a \\
 & \sum_{a \in \mathcal{A}} a x_a \leq b \\
 & x_a \geq 0 \quad a \in \mathcal{A} \\
 \text{(D)} & \min \pi b \\
 & \pi a \geq c_a \quad a \in \mathcal{A} \\
 & \pi \geq 0
 \end{array}$$

• **Column generation** separates the original problem into master and pricing subproblems

• **Master problem** (restricted master problem) is a linear program with a small number of columns

• **Pricing problem**

$$\max_{a \in \mathcal{A}} c_a - \pi a$$

$$\min_{a \in \mathcal{A}} c_a - \pi a$$

• **Column generation** iterates between master and pricing

• **Column generation**

$$\max_{a \in \mathcal{A}} c_a - \pi a$$

• **Column generation**

$$\min_{a \in \mathcal{A}} c_a - \pi a$$

$$\max_{a \in \mathcal{A}} c_a - \pi a$$

Column Generation

S Marginson



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