

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:

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

• **Large-scale** implies that the number of columns is large and the number of rows is small

• **Column generation** is a method for solving large-scale LPs by iteratively adding columns to the problem

• **Primal problem**

$$\max \sum_{a \in \mathcal{A}} c_a x_a$$

$$\sum_{a \in \mathcal{A}} a x_a \leq b$$

$$x_a \geq 0 \quad a \in \mathcal{A}$$

$$x_a \geq 0 \quad a \in \mathcal{A}$$

• **Dual problem**

$$\min \pi b$$

$$\pi a \geq c_a \quad a \in \mathcal{A}$$

$$\pi \geq 0$$

$$\pi \geq 0$$

Column Generation

R Bogdan



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