SIMPLEX: NUMBER OF POSSIBLE DICTIONARIES

Original LP
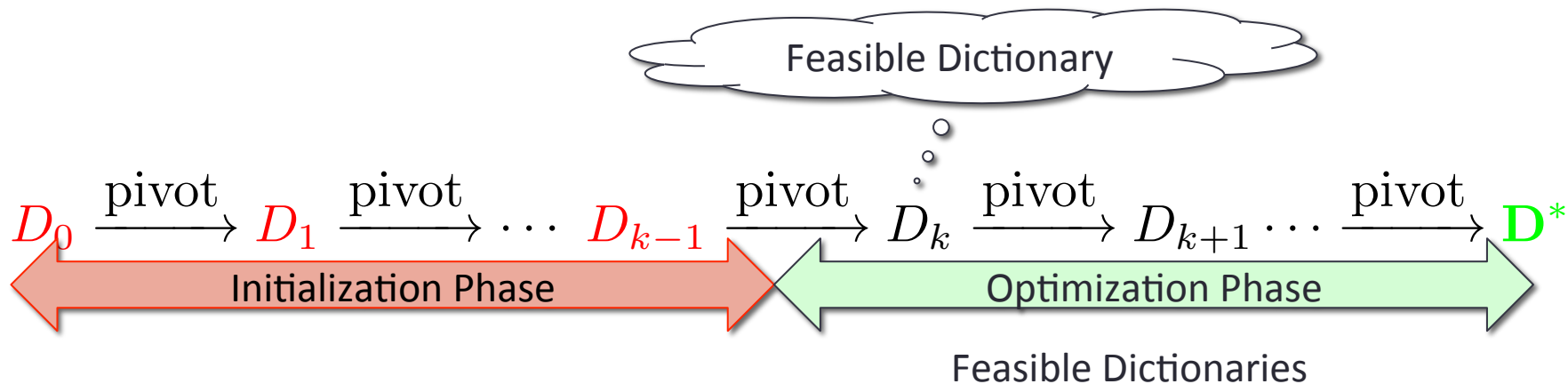
n decision variables
m rows in A.

$$\max \quad \mathbf{c^T x}$$
$$A\mathbf{x} \leq \mathbf{b}$$
$$\mathbf{x} \geq 0$$

$$\max \quad \mathbf{c^T x}$$
$$A\mathbf{x} + \mathbf{x_s} = \mathbf{b}$$
$$\mathbf{x}, \mathbf{x_s} \geq 0$$

Simplex Overview

Dictionary (Opt. Phase)

$$Basis \ \ B = \{x_{b_1}, \ldots, x_{b_m}\}$$

$$\begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \\ x_{n+1} \\ \vdots \\ x_{n+m} \end{pmatrix}$$

$$\mathbf{x_B} = \mathbf{p} + R\,\mathbf{x_I}$$
$$z = e_0 + \mathbf{e^\mathsf{T} x_I}$$

Overview

For any LP instance, the number of possible dictionaries is finite.

1. Every dictionary uniquely reconstructed from basis set.

2. # of basis set is upper bounded by $\binom{n+m}{m}$

DICTIONARY RECONSTRUCTION

Surgery ☺