

# Mathematical Programming: Modelling and Applications

Leo Liberti

LIX, École Polytechnique

`liberti@lix.polytechnique.fr`

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## SDP : exe. 2, solution

$LP$  is a special instance of an  $SDP$ .

To see one way of doing this, suppose that  $(c, a_1, \dots, a_m, b_1, \dots, b_m)$  comprise the data for  $LP$ . Then define:

$$A_i = \begin{pmatrix} a_{i1} & 0 & \dots & 0 \\ 0 & a_{i2} & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & a_{in} \end{pmatrix}, \quad i = 1, \dots, m, \quad \text{and} \quad C = \begin{pmatrix} c_1 & 0 & \dots & 0 \\ 0 & c_2 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & c_n \end{pmatrix}.$$

Then  $LP$  can be written as:

$$SDP : \text{ minimize } C \bullet X$$

$$\begin{aligned} \text{s.t.} \quad & A_i \bullet X = b_i, \quad i = 1, \dots, m, \\ & X_{ij} = 0, \quad i = 1, \dots, n, \quad j = i + 1, \dots, n, \\ & X \succeq 0, \end{aligned}$$

with the association that

$$X = \begin{pmatrix} x_1 & 0 & \dots & 0 \\ 0 & x_2 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & x_n \end{pmatrix}.$$