Exercise 8, Discrete Mathematics for Bioinformatics

Sascha Meiers, Martin Seeger

Winter term 2011/2012

8.1 Linear Optimization

$$2x_1 + 3x_2 = \min \Leftrightarrow -2x_1 - 3x_2 = \max. \tag{1}$$

$$3x_1 + 6x_2 \leq 7 \Leftrightarrow 3x_1 + 6x_2 + x_3 = 7,\ x_3 \geq 0. \tag{2}$$

$$x_1 \text{ free} \Leftrightarrow x_1 = x_4 - x_5,\ x_4 \geq 0,\ x_5 \geq 0.$$

Insert the previous equation into (2):

$$6x_2 + x_3 + 3x_4 - 3x_5 = 7,\ x_3 \geq 0,\ x_4 \geq 0,\ x_5 \geq 0.$$

Finally,

$$2x_1 + 2x_2 = 5 \Leftrightarrow 2x_2 + 2x_4 - 2x_5 = 5,$$

$$-2x_1 - 3x_2 = -3x_2 - 2x_4 + 2x_5 = \max.$$

Summarizing,

$$\max \left\{ (-3, 0, -2, 2) \begin{pmatrix} x_2 \\ x_3 \\ x_4 \\ x_5 \end{pmatrix} \middle| \begin{pmatrix} 6 & 1 & 3 & -3 \\ 2 & 0 & 2 & -2 \end{pmatrix} \begin{pmatrix} x_2 \\ x_3 \\ x_4 \\ x_5 \end{pmatrix} = \begin{pmatrix} 7 \\ 5 \end{pmatrix}, \begin{pmatrix} x_2 \\ x_3 \\ x_4 \\ x_5 \end{pmatrix} \geq 0 \right\}.$$

8.2 Linear Optimization

x

8.3 Linear Optimization

x

8.4 Profit Optimization

x