Quadratic Programming

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In this module, I will use existing optimization packages to solve quadratic programming (QP) problems. Recall the classical form of QP:

$$\min_{x} \frac{1}{2} x^T P x + q^T x$$

subject to $\quad Gx \preceq h$

$$Ax = b$$

Consider the following example:

$$\begin{aligned}
&\min_{x,y \in \mathbb{R}} \tfrac{1}{2} x^2 + 3x + 4y \\
&\text{ subject to} \quad x + 4y \geq 18 \\
&2x + 5y \leq 90 \\
&3x + 4y \leq 80 \\
&x, y \geq 0
\end{aligned}$$

We can then write this example equivalently as the classical form using vectors/matrices:

$$\min_{x,y \in \mathbb{R}} \frac{1}{2} \begin{pmatrix} x \\ y \end{pmatrix}^T \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} 3 \\ 4 \end{pmatrix}^T \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\text{subject to} \begin{pmatrix} -1 & -4 \\ 2 & 5 \\ 3 & 4 \\ -1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \leq \begin{pmatrix} -18 \\ 90 \\ 80 \\ 0 \\ 0 \end{pmatrix}$$

We next use the Python package cvxopt to solve the QP example above. Note that RMarkdown also allows you to run Python code by first installing **reticulate** package.

install.packages('reticulate')