



- 1 Consider the following linear programming problem:

$$\min c^\top x \quad \text{subject to } Ax \geq b, \quad x \geq 0.$$

Rewrite this program in the standard form. State the dual of the latter, and try to simplify it so that its constraints are stated utilizing matrix A^\top .

- 2 Find the dual of the linear optimisation problem

$$5x_1 + 3x_2 + 4x_3 \rightarrow \min \quad \text{subject to } \begin{cases} x_1 + x_2 + x_3 = 1, \\ x_i \geq 0, \quad i = 1, 2, 3, \end{cases}$$

and compute its (i.e., the *dual's*) solution.

Using the dual solution, find the primal.

- 3 Consider the polyhedral set given by the following set of inequalities:

$$\begin{aligned} x_1 &\geq 0, \\ x_2 &\geq 0, \\ x_1 + 2x_2 &\geq 1. \end{aligned}$$

By following the proof of Representation theorem for polyhedral sets (see this note) find the explicit representation of this polyhedral set as a sum of a compact polyhedron (given as a convex combination of its extreme points) and a closed convex cone. A drawing may be a useful tool for further understanding the representation.