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Mathematical Optimization — Assignment 4 - Hints

https://moodle-app2.let.ethz.ch/course/view.php?id=3610

- **Exercise 1:** The easiest way is to reformulate the programs such that they are in canonical form or standard form. There's also a way to directly formulate a Dual program, which we will cover in the exercise class on Friday.
- **Exercise 2:** The problem given in Exercise 2 is of the form $\max\{c^{\mathrm{T}}x\colon Ax \leq b,\ x \geq 0\}$ and the corresponding Dual is therefore $\min\{y^{\mathrm{T}}b\colon y^{\mathrm{T}}A \geq c^{\mathrm{T}},\ y \geq 0\}$ (we will derive this in the next exercise class). In this case, the (strong) complementary slackness conditions are formed by two sets of equalities, namely $x \in P$ and $y \in D$ are optimal if and only if

$$x_i(y^{\mathrm{T}}A_{\cdot,i} - c_i) = 0,\ \forall i \in \{1, \dots, n\},$$
$$y_j(A_{j,\cdot}x - b_j) = 0,\ \forall j \in \{1, \dots, m\}.$$

  If you apply these conditions, you don't need to reformulate the problem as a problem in canonical form :-)
- **Exercise 3:** For **b)**, one trick is to choose a symmetric constraint matrix A, i.e. $A^{\mathrm{T}} = A$.
- **Exercise 4:** Start by choosing a point $x \in C$ such that $c^{\mathrm{T}}x > 0$. Try to rewrite x as a sum.