

This assignment is **due on Apr 22/23** in your tutorial session. You are allowed (even encouraged) to discuss these problems with your fellow classmates. All submitted work, however, must be *written individually* without consulting someone else's solutions or any other source like the web.

Problem 1: Show how to convert the polyhedron $\{x \in \mathcal{R}^n \mid Ax \geq b\}$ into an equivalent polyhedron where the variables cannot take negative values. *Hint: You'll have to use two variables per old variable.*

Problem 2: Show how to convert the polyhedron $\{x \in \mathcal{R}^n \mid Ax \geq b, x \geq 0\}$ following into an equivalent polyhedron in standard form. *Hint: You'll have to introduce one new variable per constraint.*

Problem 3: Consider the following linear program

$$\begin{aligned} & \text{minimize} && 7x_1 + 3x_2 \\ & \text{subject to} && 4x_1 + x_2 \geq 10 \\ & && 4x_1 + 2x_2 \geq 16 \\ & && x_1 + 2x_2 \geq 8 \end{aligned}$$

Plot the feasible region and find the optimal solution.

Problem 4: Propose three alternative objective functions for the above LP such that

- i) The optimal solution is unique
- ii) There are multiple optimal solutions
- iii) There is no optimal solution (the objective function is unbounded).