

AO Exercise 3

minimize $x_1^2 + 4x_1x_2 + 4x_2^2$

minimize $(x_1 + 2x_2)^2$

linear minimize $|x_1 + 2x_2|$

minimize $x_1 + 2x_2$, $x_1 + 2x_2 \geq 0$, $f = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$

$$9x_1^2 + 16x_2^2 = \left\| \begin{pmatrix} 3x_1 \\ 4x_2 \end{pmatrix} \right\|_2^2 = \left\| \underbrace{\begin{pmatrix} 3 & 0 \\ 0 & 4 \end{pmatrix}}_{A_1} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} \right\|_2^2$$

$$\Rightarrow \left\| \begin{pmatrix} 3 & 0 \\ 0 & 4 \end{pmatrix} \vec{x} \right\|_2 \leq 5$$

~~SO~~ SOCP:

minimize $x_1 + 2x_2$

subject to $\left\| \begin{pmatrix} 3 & 0 \\ 0 & 4 \end{pmatrix} \vec{x} \right\|_2 \leq 5$

$$x_1 + 2x_2 \geq 0$$

$$x_1 - x_2 = 1$$

Linear programming

minimize $\|(2x_1 + 3x_2, -3x_1)\|_\infty$

minimize $\max\{|2x_1 + 3x_2|, |-3x_1|\}$

minimize t

with: $t \geq |2x_1 + 3x_2|$, $t \geq |-3x_1|$

$$\Rightarrow t \geq 2x_1 + 3x_2, t \geq -2x_1 - 3x_2, t \geq -3x_1, t \geq 3x_1$$

subject to: $|x_1 - 2x_2| \leq 3$

$$\Rightarrow x_1 - 2x_2 \leq 3, -x_1 + 2x_2 \leq 3, \text{ ~~} x_1 - 2x_2 \geq 3 \text{ }~~$$

(2) minimize z +

Subject to : $t - 2x_1 - 3x_2 \geq 0$

$$t - 3x_1 \geq 0$$

$$x_1 - 2x_2 - 3 \geq 0$$

$$-x_1 + 2x_2 - 3 \geq 0$$

$$x_1 \geq 0$$

$$x_2 \geq 0$$