

## Quadratic Programming :-

↳ QP is particular class in mathematical optimization problem.

AP is used in curve fitting, SVM (support)

$$\Rightarrow \left(-\frac{1}{2}\right) x^T P x + \underset{1}{q^T} x \Rightarrow \text{Objective function.}$$

$\Rightarrow$

$Gx \leq b$   
 $Ax = b$

$\rightarrow$  General constraint

$\frac{1}{\sqrt{2}} \begin{pmatrix} 1 & i \\ 0 & 1 \end{pmatrix}$

Assume 3 edge modes  $\xi$  (1 file):

$$\Rightarrow f \begin{matrix} e_1 & e_2 & e_3 \\ \begin{bmatrix} a_1 & a_2 & a_3 \end{bmatrix} & \begin{bmatrix} q \\ q_2 \\ q_3 \end{bmatrix} & \begin{bmatrix} x_1/p_1 \\ x_2/p_2 \\ x_3/p_3 \end{bmatrix} \end{matrix} + \begin{bmatrix} x_1, x_2, x_3 \end{bmatrix} \begin{bmatrix} 1/2 & 1/3 & 1/3 \\ 1/2 & 1/3 & 1/3 \\ 1/2 & 1/3 & 1/3 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$$\Rightarrow \left( \frac{x_1^2}{p_1} + \frac{x_2^2}{p_2} + \frac{x_3^2}{p_3} \right)$$

Handwritten notes and diagrams:

- Top left:  $f$  and  $x_3$  with a downward arrow.
- Top center: A diagram showing a set of points  $x_1, x_2, x_3$  enclosed in a circle, with a larger circle around it. An arrow points from this diagram to the text "C.P. quad from".
- Top right: A diagram showing a set of points  $x_1, x_2, x_3$  enclosed in a circle, with a larger circle around it. An arrow points from this diagram to the text "C.P. quad from".
- Bottom left: A large bracket  $[$ .
- Bottom center: A large bracket  $[$ .
- Bottom right: A circle containing the text "size of file".

Quadratic Programming:

$$\rightarrow \frac{1}{2} X^T P X$$

$$+ \begin{bmatrix} x_1 & x_2 & x_3 \end{bmatrix} \begin{bmatrix} x_1/c_1 \\ x_2/c_2 \\ x_3/c_3 \end{bmatrix}$$

$$+ \begin{bmatrix} x_1 & x_2 & x_3 \end{bmatrix} \begin{bmatrix} (x_2/c_2 + x_3/c_3) + 2(x_1/t_1) \\ (x_1/c_1 + x_3/c_3) + 2(x_2/t_2) \\ (x_1/c_1 + x_2/c_2) + 2(x_3/t_3) \end{bmatrix}$$

$$\frac{x_1^2}{c_1} + \frac{x_2^2}{c_2} + \frac{x_3^2}{c_3} +$$

Quadratic Programming:  $\rightarrow$  It has a objective which is

Quadratic function of decision variables.

$$\rightarrow (2x_1^2 + 3x_2^2 + 4x_1x_2)$$

$$\rightarrow x_1, x_2, \dots$$

(In Quadratic Programming the constraints are linear).

$$\begin{bmatrix} x_1 & x_2 & x_3 & \dots \end{bmatrix} \begin{bmatrix} 1 \\ x_e \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ \vdots \\ x_4 \end{bmatrix} \quad \text{ex1}$$

$$\begin{bmatrix} x_1 & x_2 & x_3 \end{bmatrix} \begin{bmatrix} \quad \\ \quad \\ \quad \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

$$\begin{bmatrix} x_1 & x_2 & x_3 \end{bmatrix} \begin{bmatrix} x_1/c_1 \\ x_2/c_2 \\ x_3/c_3 \end{bmatrix} + \begin{bmatrix} x_1 & x_2 & x_3 \end{bmatrix} \begin{bmatrix} x_1/c_2 + x_2/c_3 + 2x_1/100 \\ x_1/c_1 + x_2/c_3 + 2x_2/100 \\ x_1/c_1 + x_2/c_2 + 2x_3/100 \end{bmatrix} \quad \text{ex1}$$

$$\Rightarrow x_1^2/c_1 + x_2^2/c_2 + x_3^2/c_3 + \left( \frac{x_1 x_2}{c_2} + \frac{x_1 x_3}{c_3} + \frac{2x_1^2}{100} \right)$$

$$+ \left( \frac{x_1 x_2}{c_1} + \frac{x_2 x_3}{c_3} + \frac{2x_2^2}{100} \right) + \left( \frac{x_1 x_3}{c_1} + \frac{x_2 x_3}{c_2} + \frac{2x_3^2}{100} \right)$$

$$\begin{bmatrix} x_1 & x_2 & x_3 \end{bmatrix}_{1 \times 3} \begin{bmatrix} p_1 & p_2 & p_3 \\ p_4 & p_5 & p_6 \\ p_7 & p_8 & p_9 \end{bmatrix}_{3 \times 3} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}_{3 \times 1} + \begin{bmatrix} q_1 & q_2 & q_3 \end{bmatrix}_{1 \times 3} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}_{3 \times 1}$$

$$\begin{bmatrix} x_1 & x_2 & x_3 \end{bmatrix}_{1 \times 3} \begin{bmatrix} p_1 x_1 + p_2 x_2 + p_3 x_3 \\ p_4 x_1 + p_5 x_2 + p_6 x_3 \\ p_7 x_1 + p_8 x_2 + p_9 x_3 \end{bmatrix}_{3 \times 1} + q_1 x_1 + q_2 x_2 + q_3 x_3$$

$$\Rightarrow \textcircled{p_1 x_1^2} + p_2 \textcircled{x_1 x_2} + \textcircled{p_3 x_1 x_3} + p_4 \textcircled{x_1 x_2} + \textcircled{p_5 x_2^2} + p_6 x_2 x_3 \\ + \textcircled{p_7 x_1 x_3} + p_8 x_2 x_3 + \textcircled{p_9 x_3^2}$$

$$\Rightarrow p_1 x_1^2 + p_5 x_2^2 + p_9 x_3^2 + x_1 x_2 (p_2 + p_4) + x_1 x_3 (p_3 + p_7) \\ + x_2 x_3 (p_6 + p_8)$$

$$x_1^2 \left( \frac{1}{c_1} + \frac{1}{50} \right) + x_2^2 \left( \frac{1}{c_2} + \frac{1}{50} \right) + x_3^2 \left( \frac{1}{c_3} + \frac{1}{50} \right)$$

$$+ x_1 x_2 \left( \frac{1}{c_2} + \frac{1}{c_1} \right) + x_1 x_3 \left( \frac{1}{c_3} + \frac{1}{c_1} \right)$$

$$+ x_2 x_3 \left( \textcircled{\frac{1}{c_2}} + \textcircled{\frac{1}{c_3}} \right)$$