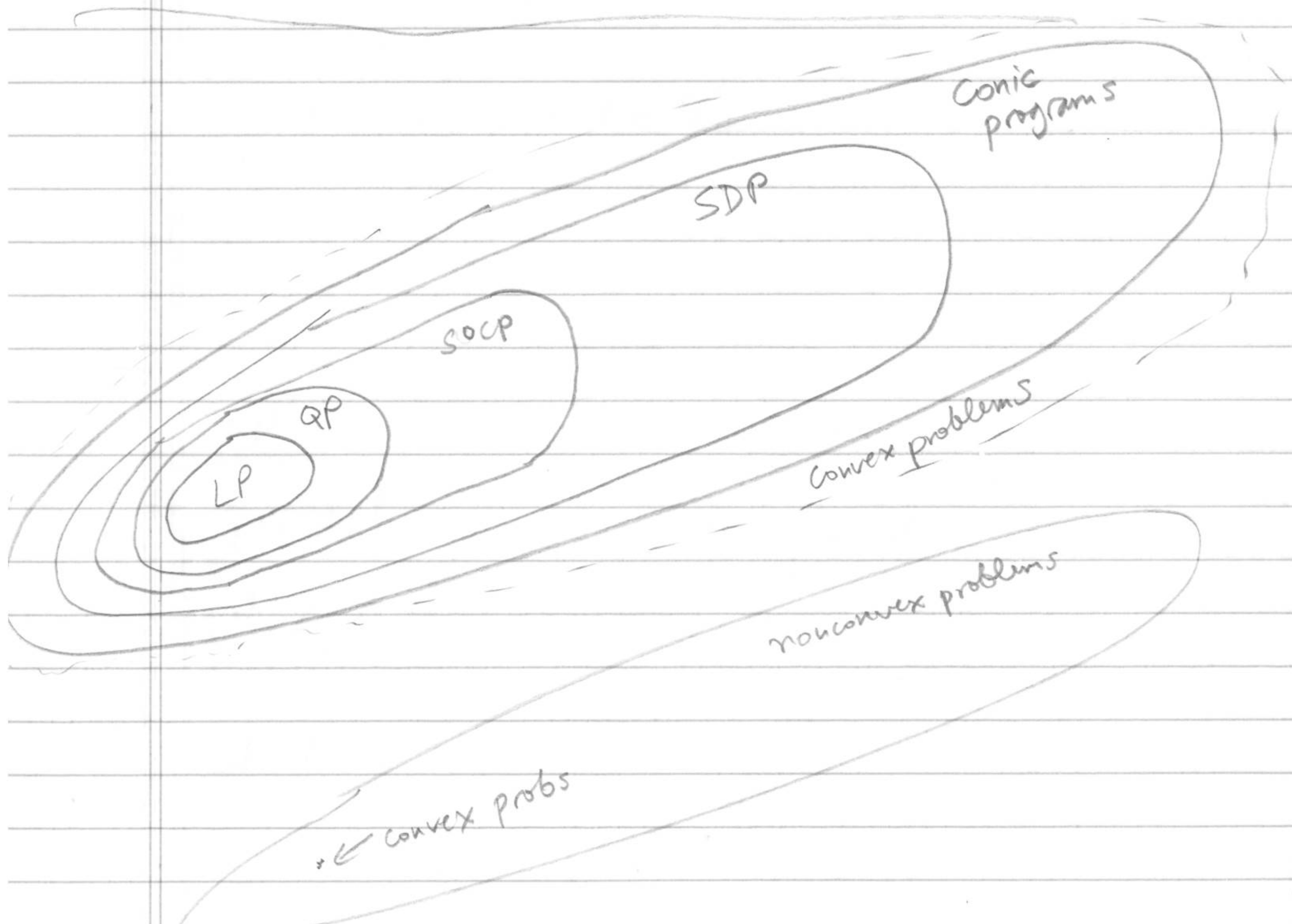
$\mathrm{rank}(R)$ is convex function

$$\mathrm{rank}(\alpha A + (1-\alpha)B) \not\leq \alpha\,\mathrm{rank}(A) + (1-\alpha)\,\mathrm{rank}(B)$$

$$\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix} \qquad \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$$



$$\|\beta\|_0 = \sum_{i=1}^{p} \mathbb{1}\{\beta_i \neq 0\}$$

$$|X_j^T(y - X\beta)| \leq \lambda, \quad j = 1, \dots p$$

$$-\lambda \leq X_j^T(y - X\beta) \leq \lambda, \quad j = 1, \dots p$$

$$X \succeq 0 \iff X \in \mathbb{S}^n_+$$

$$\lambda(X) = (\lambda_1(X), \dots \lambda_n(X))$$

<u>LPs</u>

$$Dx \leq d$$

$$\sum \underset{\substack{\uparrow \\ \text{cols of } D}}{d_j} x_j \leq d$$

<u>SDPs</u>

$$\sum \underset{\substack{\uparrow \\ r \times r}}{F_j} \cdot x_j \preceq F_0$$

$$F_j = \begin{bmatrix} d_{j1} & & \\ & \ddots & \\ & & d_{jr} \end{bmatrix}$$

$$\mathbb{1}\mathbb{1}^T = \begin{pmatrix} | & | & & | \\ | & | & \cdots & | \\ | & | & & | \end{pmatrix}$$

$$\|X\|_{tr} = \sum_{i=1}^{r} \sigma_i(X)$$

$$\|x\| = \max_{\|y\|_* \le 1} y^T x$$

$$\|X\|_{tr} = \max_{\|Y\|_{op} \le 1} Y \bullet X$$

$$\begin{bmatrix} tI & x \\ x^T & t \end{bmatrix} \succeq 0 \iff tI - \frac{xx^T}{t} \succeq 0$$

$$\iff t^2 I - xx^T \succeq 0$$

$$\iff \|x\|_2^2 \le t^2$$