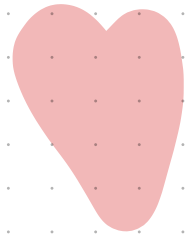
10 Sep 2025

More on Matching & Linear Programming

Announcements

1. Kevin sent emails to (instructor-formed) homework groups



2. In-class midterms

Fri Sept 26 (make-up Mon 9/29 5pm)

~~Fri Nov 7~~ (~~-~~ 11/10 ~~"~~)

Format: closed book, closed notes.

Mostly very short answer (e.g. "define perfect matching")

One medium length answer question (e.g. 1-2 paragraphs)

$$\text{Minimize} \sum_{(u,v)\in E} c(u,v)\cdot x_{uv}$$

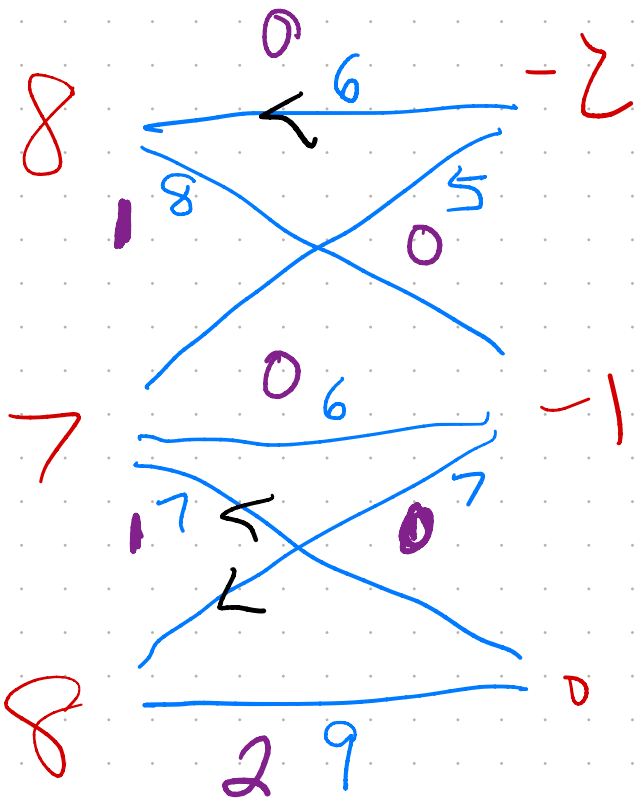
$$\text{subj to} \quad x_{uv} \geq 0 \qquad x_{uv} \in \mathbb{N}$$

$$\sum_{v\in R} x_{uv} = 1 \qquad \forall u \in L$$

$$\sum_{u\in L} x_{uv} = 1 \qquad \forall v \in R$$

integer ↑ linear programming (LP)

(formulation) relaxation of bipartite Min cost perf matching

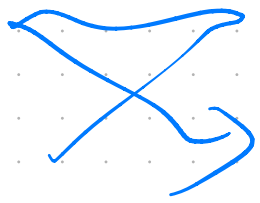


P_1 $c^y(P) = 5$

$c^y(u,v) = c(u,v) - y_u - y_v$

P_2 $c^y(P) = 2$

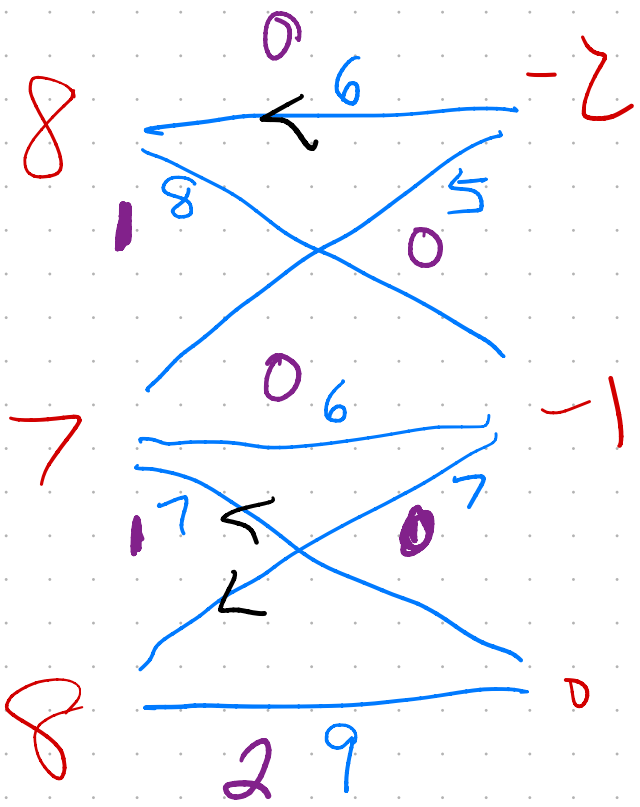
P_3 $c^y(P) = 1$



$$\begin{bmatrix} x_{11} & x_{12} & 0 \\ x_{21} & x_{22} & x_{23} \\ 0 & x_{32} & x_{33} \end{bmatrix}$$

$$\min \quad 6x_{11} + 8x_{12} + 5x_{21} + 6x_{22} + 7x_{23} + 7x_{32} + 9x_{33}$$

$$\text{s.t.} \quad x_{11} + x_{12} = 1$$



$$8x_{11} + 8x_{12} = 8$$

$$7x_{21} + 7x_{22} + 7x_{23} = 7$$

$$8x_{32} + 8x_{33} = 8$$

$$-2x_{11} - 2x_{21} = -2$$

$$-x_{12} - x_{22} - x_{32} = -1$$

$$6x_{11} + 7x_{12} + 5x_{21} + 6x_{22} + 7x_{23} + 7x_{32} + 8x_{33} = 20$$