10.1

Multicommodity flow problem

Katta G. Murty, IOE 612 Lecture slides 10

p commodities, all measured in common units, trickloads, say, which is also the unit for arc capacities. For $r = 1$ to p, s^r, t^r are source, sink for rth commodity. $G = (\mathcal{N}, \mathcal{A}, 0, k, c^1, \ldots, c^p; s^r, t^r, \bar{v}^r, r = 1 \text{ to } p)$ directed. E is node-arc incidence matrix.

Flow conservation must hold at each node for each commodity.

$f^r = (f^r_{ij})$ = node-arc flow vector of rth commodity.

q^r = node-arc incidence vector of hypothetical arc (s^r, t^r).

	f^1	f^2	$\ldots$	f^p	
	I	I	$\ldots$	I	$\leq k$
$\ldots\ldots\ldots\ldots\ldots\ldots$					$\ldots\ldots$
	E	0	$\ldots$	0	$= q^1\overline{v}_1$
	0	E	$\ldots$	0	$= q^2\overline{v}_2$
	$\vdots$	$\vdots$	$\ddots$	$\vdots$	$\vdots$
	0	0	$\ldots$	E	$= q^p\overline{v}_p$
min	c^1	c^2	$\ldots$	c^p	

$f^r \geq 0$ for all r

Becomes a large scale LP. F & F developed an algo. for this problem using an arc-chain formulation. Dantzig, Wolfe later generalized this algo. to the decomposition principle for large scale LP. But this algo. slow.

Recently, IP methods for LP have been specialized to solve these multicommodity flow problems.