These problems are coupled by complementarity conditions

$$(\lambda_i^1)_k f_k = 0 \qquad k = 1 \cdots \# E$$

$$(\lambda_i^2)_k \cancel{f_4} (c_k - f_k) = 0 \qquad k = 1 \cdots \# E$$

(i.e. either the inequality is <u>active</u> or its Lagrange multiplier is 0)

Flow's Now

$(\lambda_i^1)_k = 0$ implies that flow is > 0

$(\lambda_i^2)_k = 0$ " " $< c$

- The non-zero λ_i's identify edges that could disconnect (i.e. any path ~~not~~ containing one is not augmenting)
- If the non-zero λ_is meet the <u>equality</u>, we have a <u>cut</u>

There is a <u>general point</u> here

- consider $\big(\underbrace{f}_{\text{primal vars}}, \underbrace{\lambda_i^1, \lambda_i^2, \lambda_e}_{\text{dual vars.}}\big) = (p, d)$

1) ~~at a solution~~ if p is soln to Primal, d is soln to dual

p, d are <u>complementary</u>

(follows from KKT).

2) if (p, d) are <u>complementary</u> <u>and</u>

p is primal feasible and

d is dual feasible ~~then~~

$\Updownarrow$

p solves primal d solves dual.