Think about c^d as edge cost.

Compute $\bar{d}^k(v)$ with dists. c^d.

$$\bar{d}^k(v) = d^k(v) + d(v_1) - d(v)$$

$$\bar{d}^n(v) - \bar{d}^k(v) = d^n(v) + d(v_1) - d(v) - \left(d^k(v) + d(v_1) - d(v)\right) = d^n(v) - d^k(v)$$

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Suffice to show

$$0 = \min_v \max_k \left(\frac{\bar{d}^n(v) - \bar{d}^k(v)}{n-k} \right)$$

$\forall v \quad \max_k \bar{d}^n(v) - \bar{d}^k(v) \geq 0$

for some k = length of s.p.

$\bar{d}^k(v) \leq \bar{d}^n(v)$

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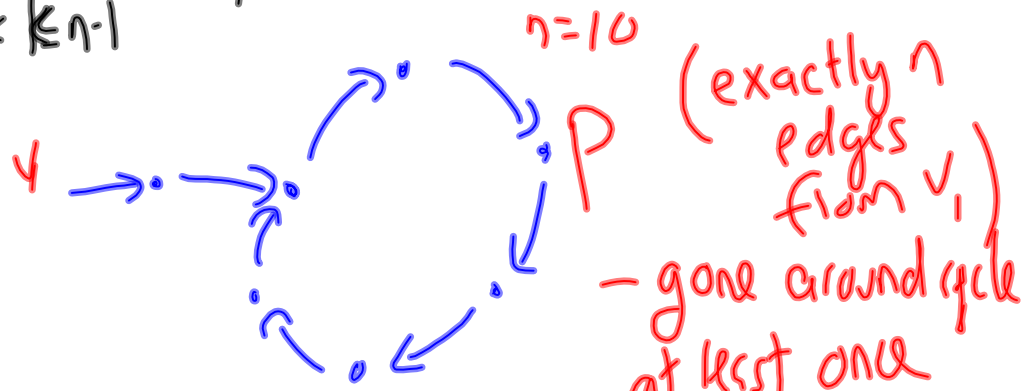
2(i) Show that for some vertex p

$$\max_{0 \le k \le n-1} \bar{d}^n(p) - \bar{d}^k(p) = 0$$



$\bar{d}^n(p) = 0$, also $\bar{d}^k(p) = 0$ for some $k < n$

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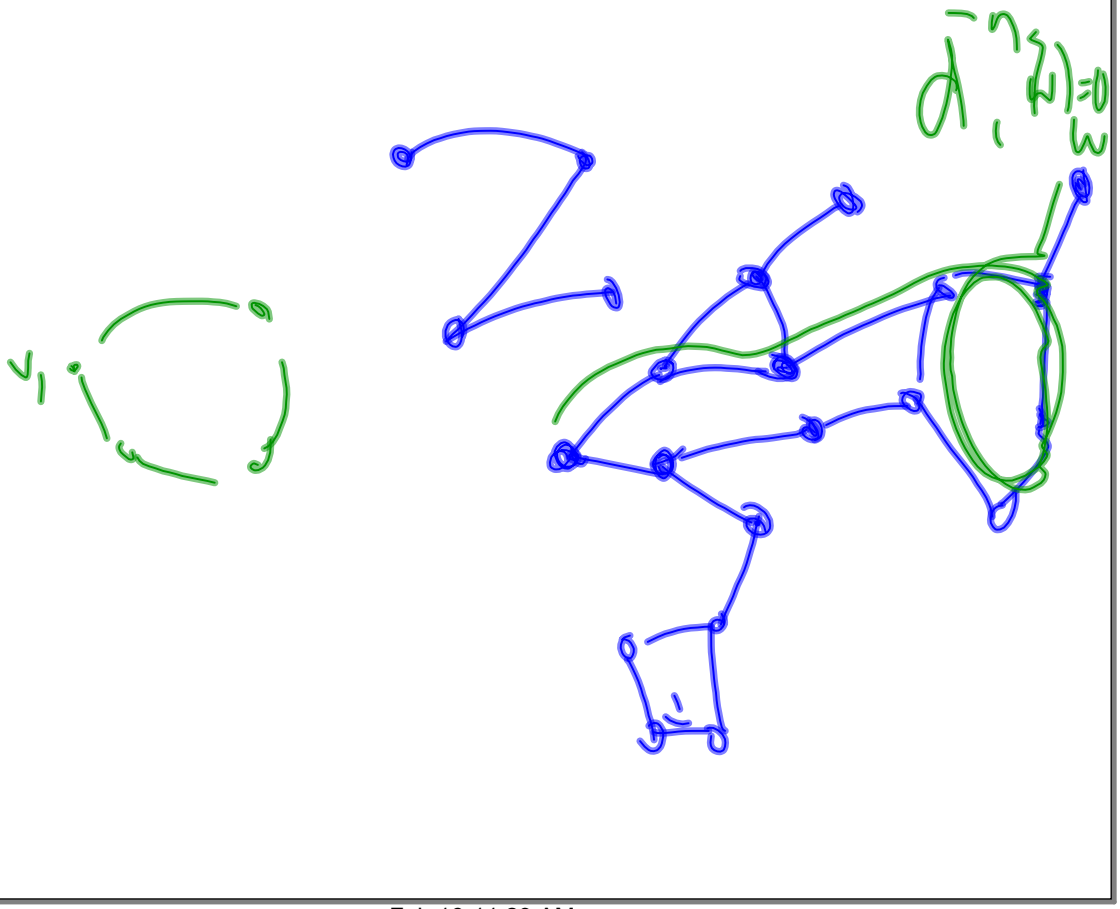

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2) $\mu^* \neq 0$ Suppose we add Δ to every edge

$c'(v,w) = c(v,w) + \Delta$

$\mu'(w) = \frac{\sum c(v,w)}{|w|}$ $\frac{\sum c'(v,w)}{|w|}$

$= \frac{\sum c(v,w) + |w|\Delta}{|w|}$

$= \mu(w) + \Delta$

. Use $c'(v,w) = c(v,w) - \mu^*$, use case 1.

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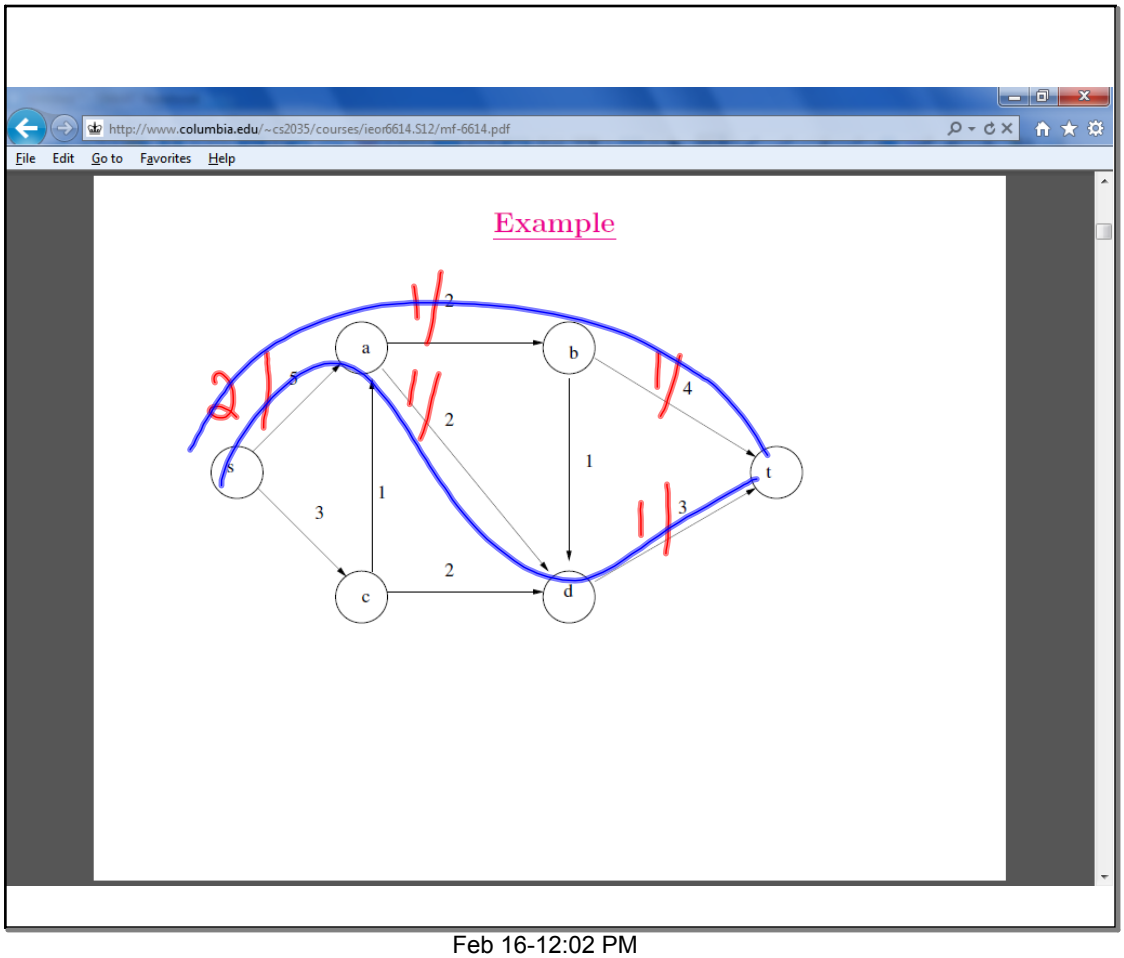

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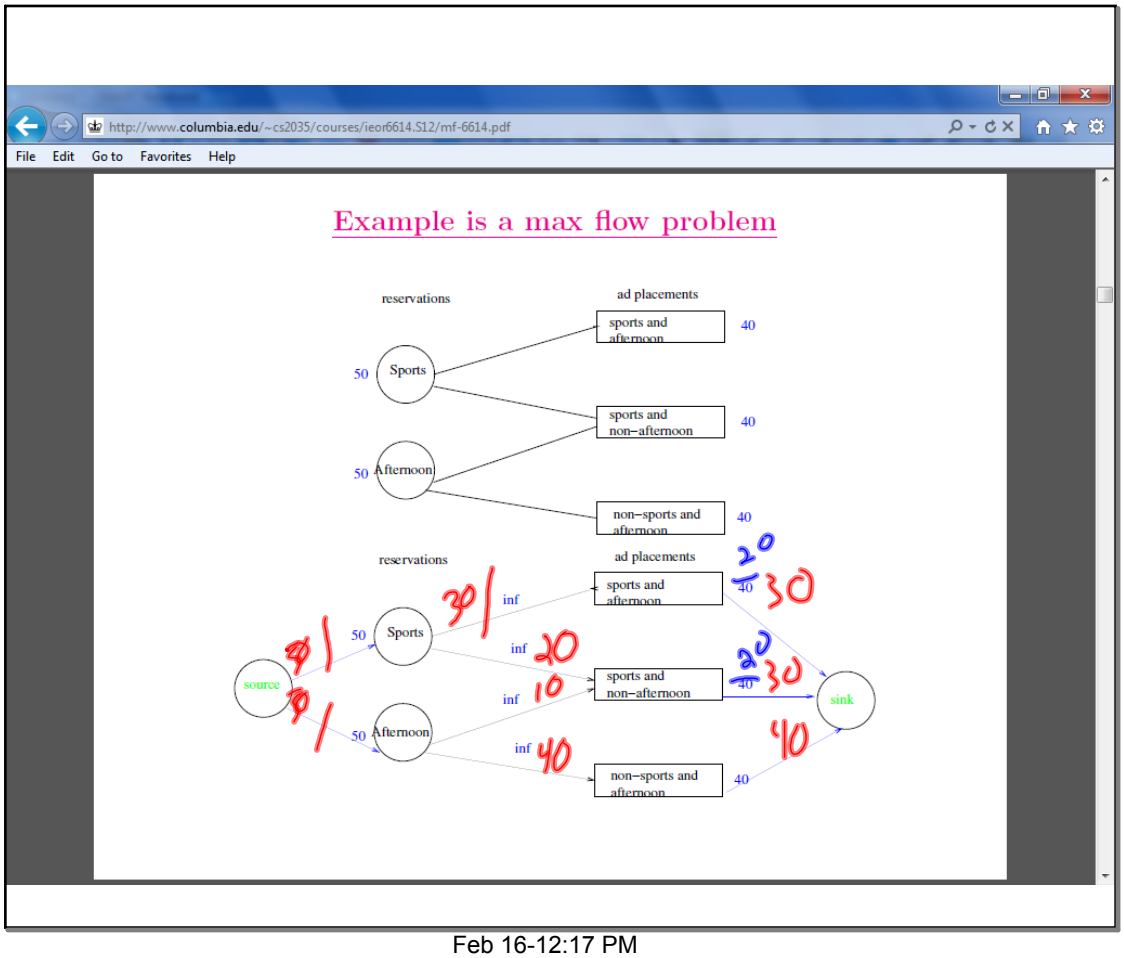

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