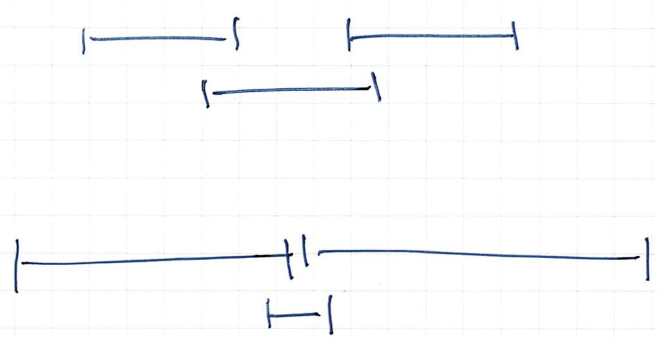
Optimal solution ?

{4, 6, 7} No

{1, 11, 6, 7} Yes

{1, 11, 5, 7} Yes

① Increasing length

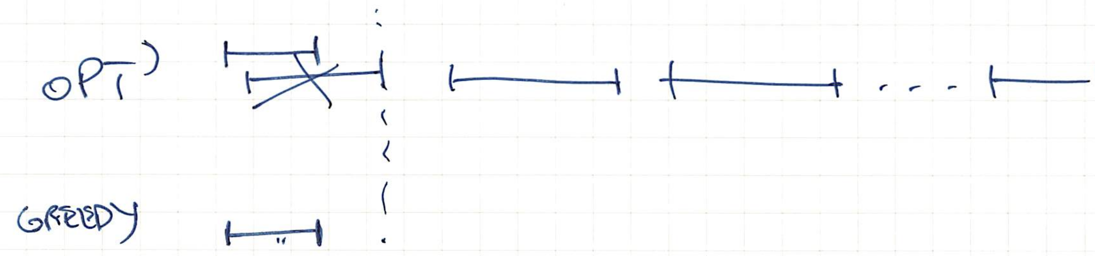


exchange argument →

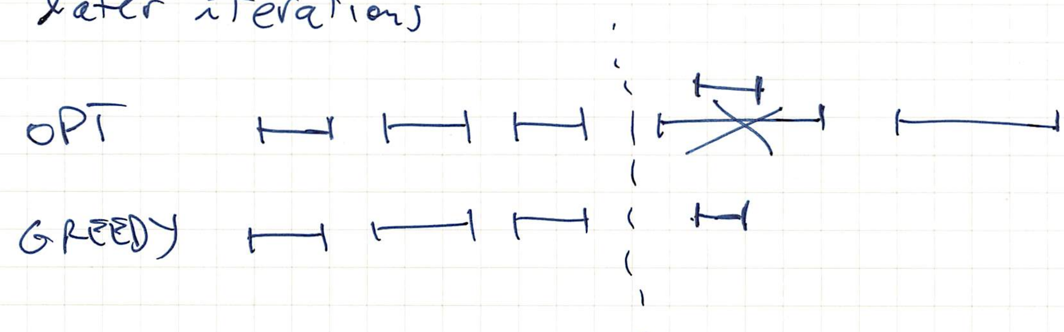
③ Increasing starting time

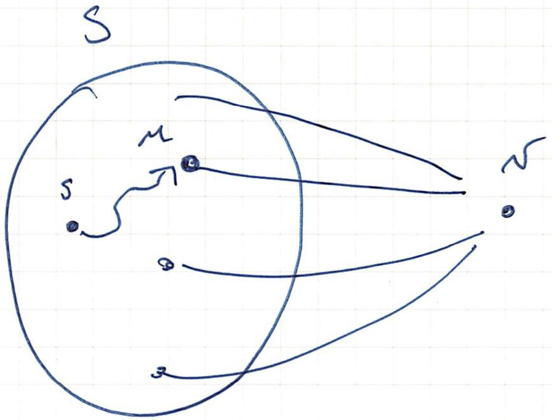
④ Increasing finishing time is OPTIMAL

first iteration



later iterations

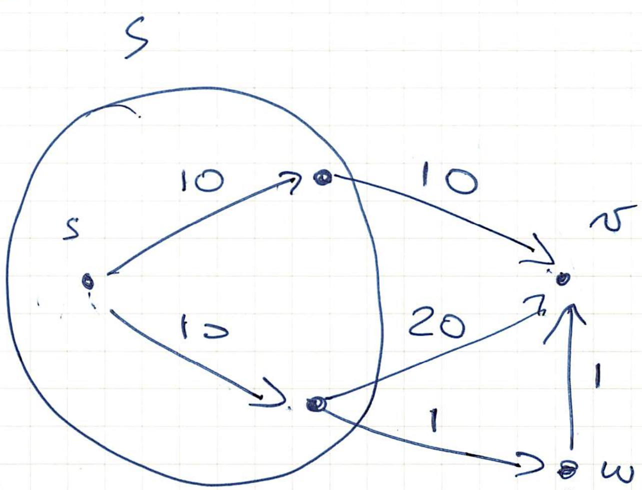




$$\text{estimate}(v) = \min_{\substack{(u,v)\in E \\ u \in S}} \left(\text{dist}(s,u) + \ell(u,v) \right)$$

We know $\text{dist}(s,u)$ $\forall\, u \in S$

<u>Claim</u>: $\text{estimate}(v) \geq \text{dist}(s,v)$ $\forall\, v \notin S$

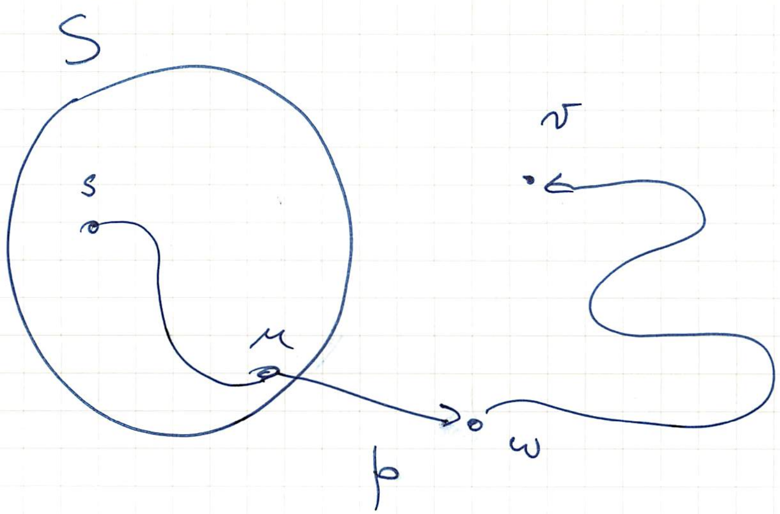


$\text{estimate}(v) = 20$

$\text{estimate}(w) = 11$

Claim: If $v \notin S$ minimizing $\text{estimate}(v)$

then $\text{dist}(s, v) = \text{estimate}(v)$



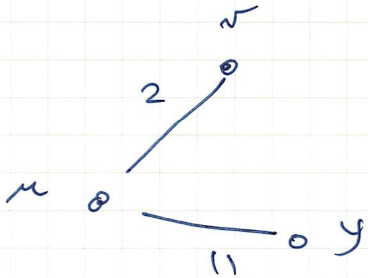
$$\ell(p) \geq \text{estimate}(w)$$

$$\geq \text{estimate}(v)$$

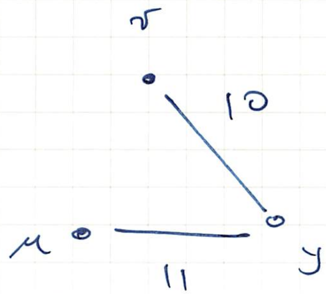
$$\Longrightarrow \text{dist}(s, v) = \text{estimate}(v)$$

(i) $\forall e \in E : \ell(e) \geq 0$

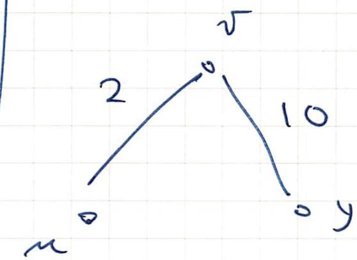
(ii) v minimizes $\text{estimate}(v)$: $v \notin S$



13



21

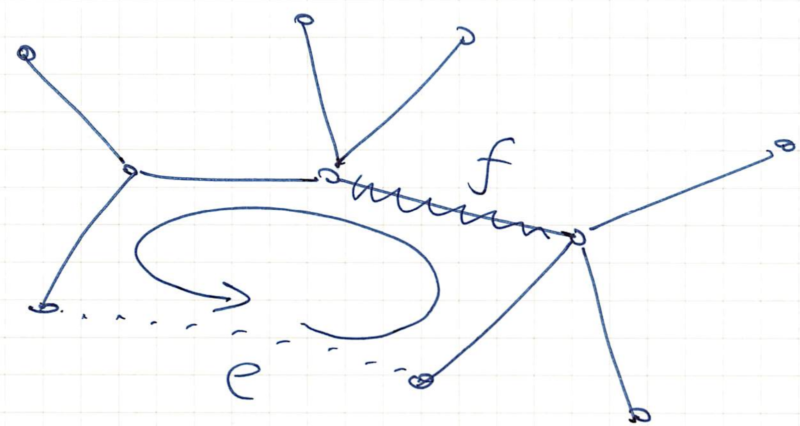


$\boxed{12}$

OPT

e : minimizing $c(e)$

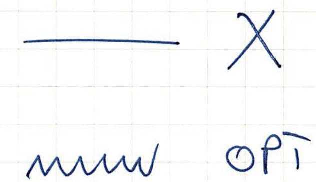
and $e \notin OPT$

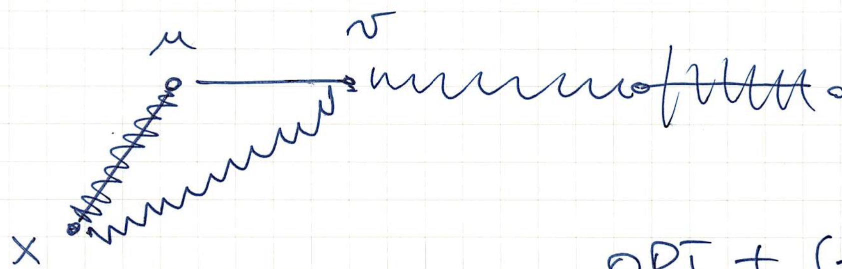


$$c(OPT+e-f) = c(OPT)+c(e)-c(f) < c(OPT) \Longleftarrow OPT+e-f \text{ is still a S.T.}$$

OPT and X

agree up to just before (u, v)





$$OPT + (u,v) - (x,v)$$

$$c(u,v) \leq c(x,v)$$

$$\Rightarrow c\big(OPT + (u,v) - (x,v)\big) \leq c(OPT)$$