Lecture 20

CSE 331

Oct 16, 2023

Exams this week

Mid-term 1: **Wednesday**

Mid-term 2: **Friday**

Project Group formation

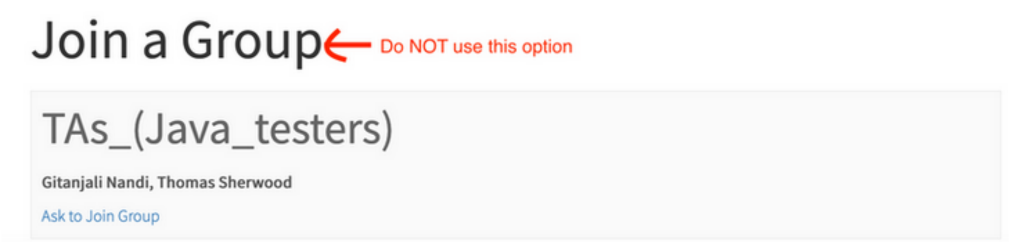
note @331 · stop following · 43 views

Actions

When forming groups on Autolab

I forgot to add this warning earlier but I have updated the Autolab project page to add a warning to **not click on the "Join a Group" function when you are creating your group on Autolab:**

> ### Do NOT click on `Join a Group`
>
> **Do NOT use the "Join a Group" feature. ONLY follow the instructions above EXACTLY.**
>
> This step can be un-done but needs intervention on our part BUT that'll cause delays on your side and we are not responsible if you miss your deadline due to this delay.
>
> Here is what such an option looks like (the actual group name and group members would be different in your case:



project · autolab

Edit · good note | 0

Updated 21 hours ago by Atri Rudra

My response to your feedback

note @336 · stop following · 3 views · Actions

Reponse to feedback

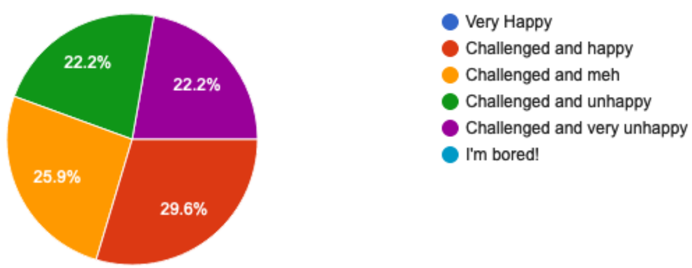
Thanks to everyone who give feedback @281!

Below, I will post some pie-charts that I think give some interesting overall picture of how y'all feel about the course and then some responses to the written comments. I apologize for the delay in doing this and I understand that some of this feedback could have been useful if given earlier-- sorry about that 😦

First some pie-charts:

Overall your feeling about CSE 331

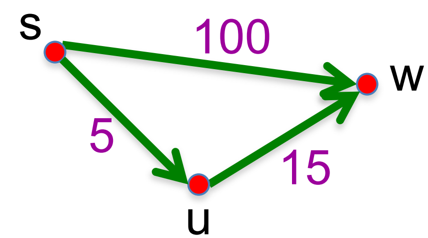
27 responses



While of course having unhappy/very unhappy students is not ideal, at least the fraction of students who are very unhappy are (comfortably larger) than those that are not very unhappy. This was **not** the case in the few couple of offerings so I'm glad to see the "tide turn" time around. Also (bit less than) 50% of the respondents are not unhappy. Again not ideal but better than where this was few course offerings ago.

Questions?

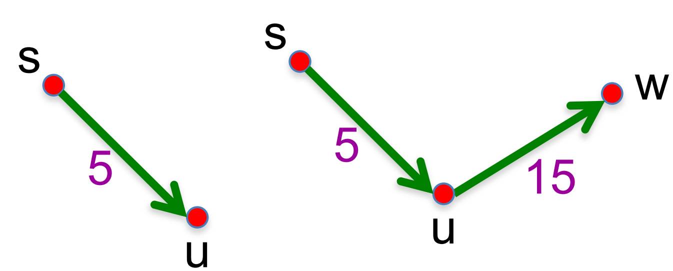
Shortest Path problem



Input: *Directed* graph G=(V,E)

Edge lengths, l_e for e in E

"start" vertex s in V

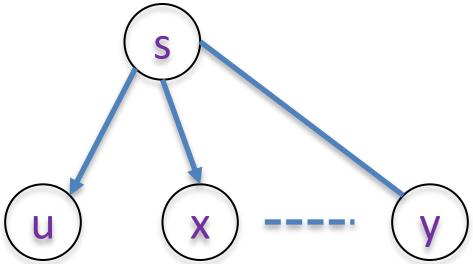


Output: Length of shortest paths from s to all nodes in V

Towards Dijkstra's algo: part ek

Determine d(t) one by one

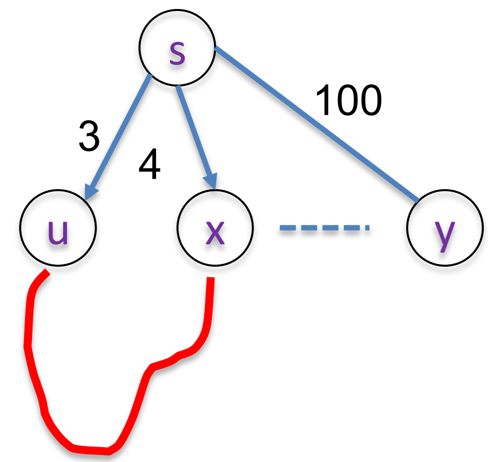
$d(s) = 0$



Towards Dijkstra's algo: part do

Determine d(t) one by one

Let u be a neighbor of s with smallest $\ell_{(s,u)}$



$$d(u) = \ell_{(s,u)}$$

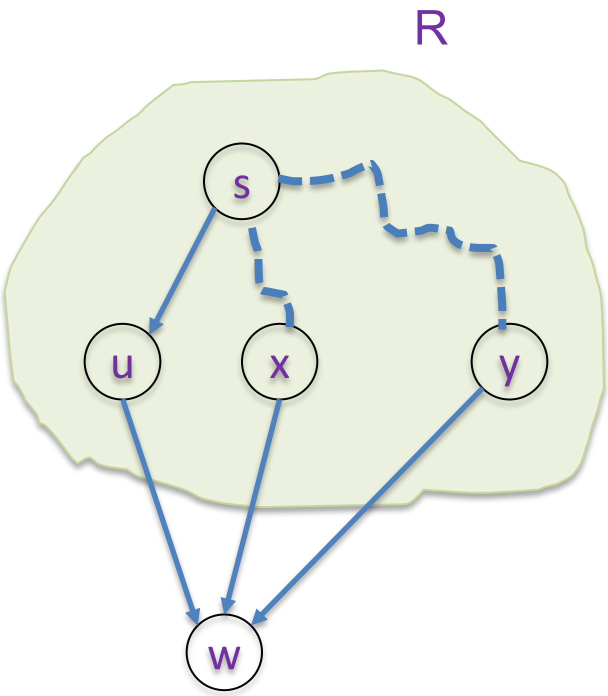
Length of is ≥ 0

Not making any claim
on other vertices

Towards Dijkstra's algo: part teen

Determine d(t) one by one

Assume we know d(v) for every v in R



Compute an upper bound d'(w) for every w not in R

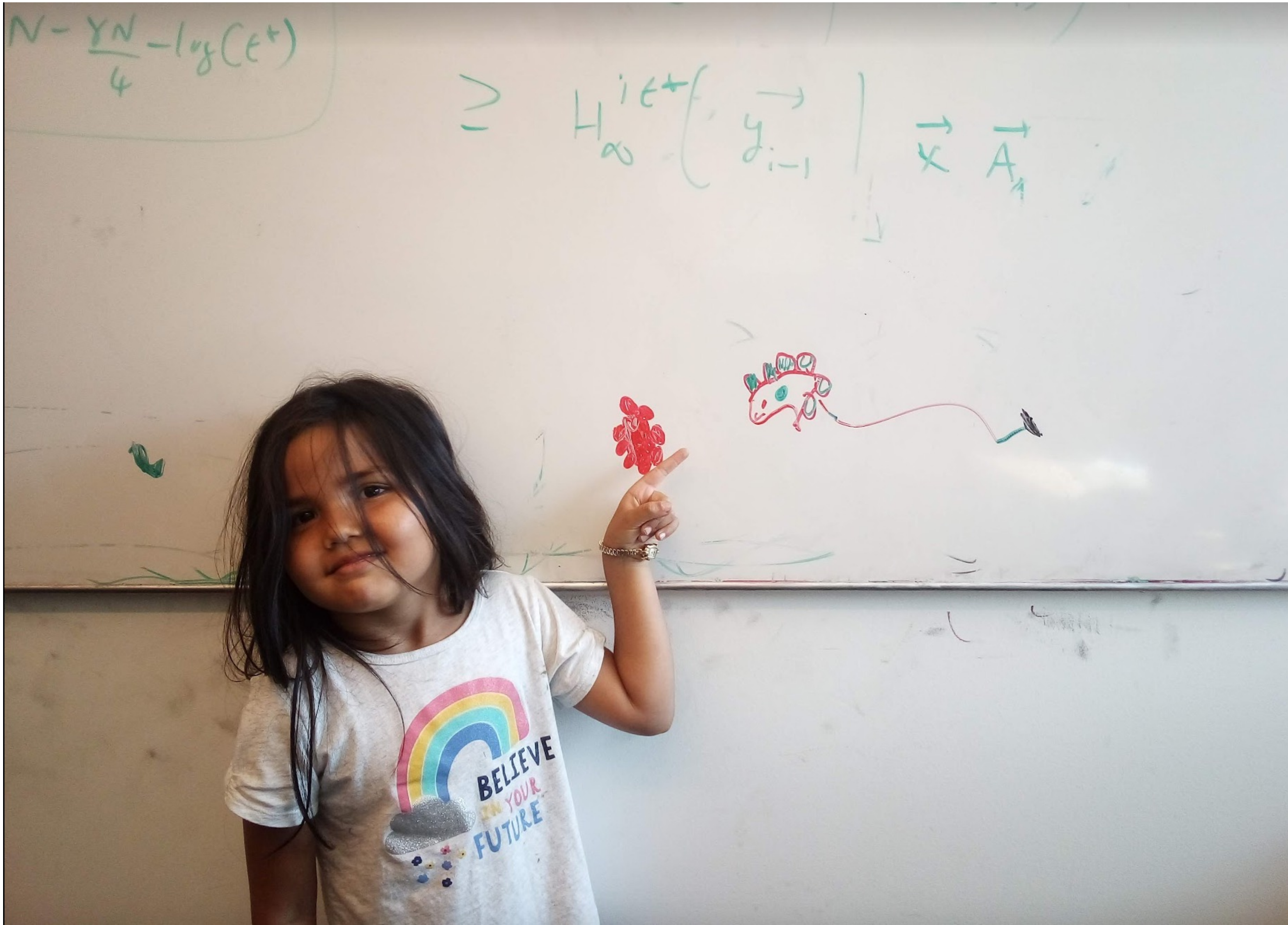
$d(w) \leq d(u) + \ell_{(u,w)}$

$d(w) \leq d(x) + \ell_{(x,w)}$

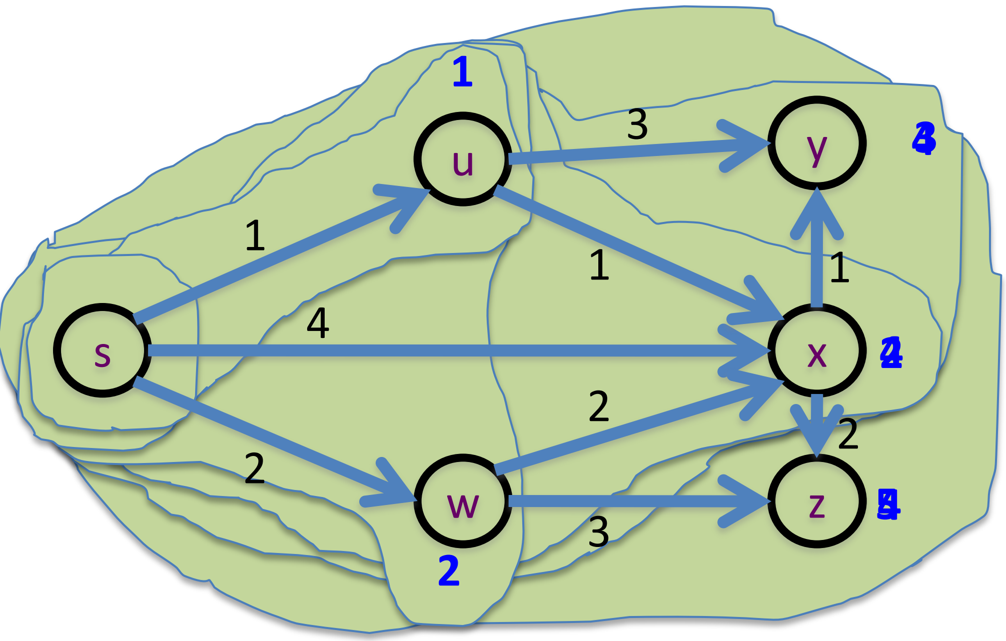
$d(w) \leq d(y) + \ell_{(y,w)}$

$d'(w) = \min_{e=(u,w) \text{ in } E,\ u \text{ in } R} d(u) + \ell_e$

Questions/Comments?



Dijkstra's shortest path algorithm

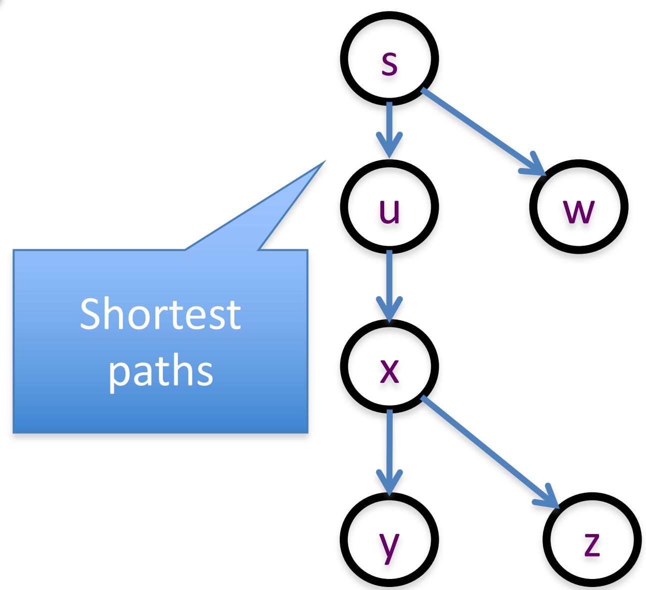


$d'(w) = \min_{e=(u,w) \text{ in } E,\ u \text{ in } R} d(u) + \ell_e$

d(s) = 0 d(u) = 1

d(w) = 2 d(x) = 2

d(y) = 3 d(z) = 4



Input: Directed G=(V,E), $\ell_e \geq 0$, s in V

R = {s}, d(s) =0

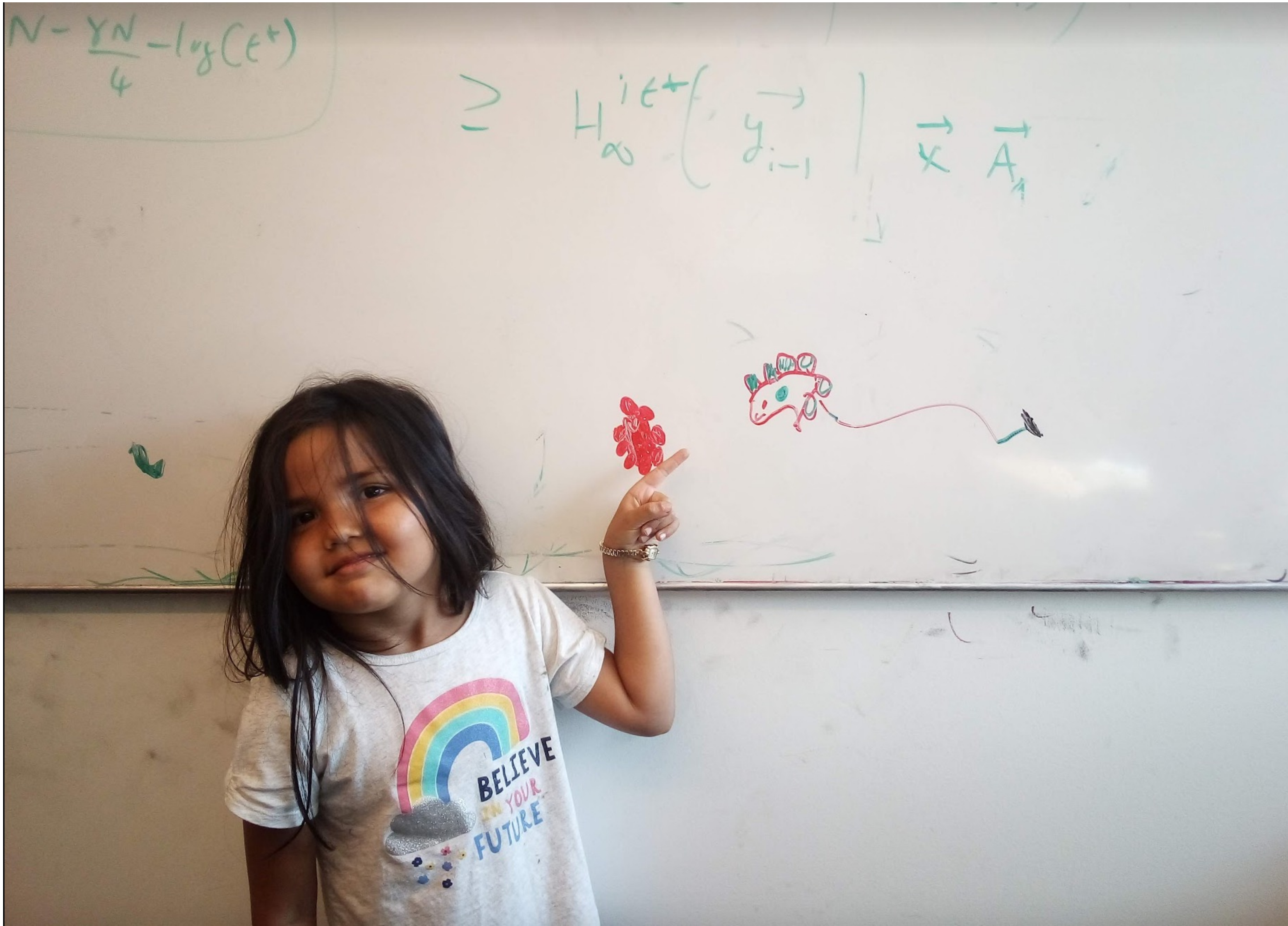
While there is a x not in R with (u,x) in E, u in R

Pick w that minimizes d'(w)

Add w to R

d(w) = d'(w)

Questions/Comments?



Couple of remarks

The Dijkstra's algo does not explicitly compute the shortest paths

Can maintain "shortest path tree" separately

Dijkstra's algorithm does not work with negative weights

Left as an exercise

Rest of Today’s agenda

Prove the correctness of Dijkstra’s Algorithm

Dijkstra's shortest path algorithm

P_u shortest s-u path in "Dijkstra tree"

$d'(w) = \min_{e=(u,w) \text{ in } E,\ u \text{ in } R} d(u)+\ell_e$

Input: Directed $G=(V,E)$, $\ell_e \geq 0$, s in V

R = {s}, d(s) =0

While there is a x not in R with (u,x) in E, u in R

Pick w that minimizes d'(w)

Add w to R

d(w) = d'(w)

Lemma 1: At end of each iteration, if u in R, then P_u is a shortest s-u path

Lemma 2: If u is connected to s, then u in R at the end

Proof idea of Lemma 1

Dijkstra's shortest path algorithm

$d'(w) = \min_{e=(u,w) \text{ in } E,\ u \text{ in } R} d(u)+\ell_e$

Input: Directed $G=(V,E)$, $\ell_e \geq 0$, s in V

$R = \{s\}$, $d(s) = 0$

While there is a x not in R with (u,x) in E, u in R

Pick w that minimizes $d'(w)$

Add w to R

$d(w) = d'(w)$

At most n iterations

$\Sigma_{x \in V} O(In_x+1)$
$=O(m+n)$ time

$O((m+n)n)$ time bound is trivial

$O((m+n) \log n)$ time implementation with priority Q

Reading Assignment

Sec 4.4 of [KT]