Lecture 19

CSE 331

Oct 18, 2021

Please have a face mask on

Masking requirement

UR requires all students, employees and visitors – regardless of their vaccination status – to wear face coverings while inside campus buildings.

https://www.buffalo.edu/coronavirus/health-and-safety/health-safety-guidelines.html

Project deadlines coming up

Fri, Oct 29	Counting Inversions F19 F18 F17 x^2	[KT, Sec 5.3] (**Project (Problem 1** Coding **) in**)
Mon, Nov 1	Multiplying large integers F19 F18 F17 x^2	[KT, Sec 5.5] (**Project (Problem 1** Reflection **) in**) *Reading Assignment:* Unraveling the mystery behind the identity
Wed, Nov 3	Closest Pair of Points F19 F18 F17 x^2	[KT, Sec 5.4]
Fri, Nov 5	Kickass Property Lemma F19 F18 F17 x^2	[KT, Sec 5.4] (**Project (Problem 2** Coding **) in**)
Mon, Nov 8	Weighted Interval Scheduling F19 F17 x^2	[KT, Sec 6.1] (**Project (Problem 2** Reflection **) in**)

Some other stuff coming up

note @322 | stop following | 61 views

What's next?

Now that the mid-terms are done, hope y'all take some time to decompress! Some of you might have questions on how you're doing in the course, how you did in the mid-term exams and perhaps some of you think you'd like to come and chat with me.

I just wanted to give y'all some heads up on this:

- (As a tangent, note that HW 4 is already out: @321)
- Our goal is to be able to finishing grading (both the) mid-terms by early to mid next week.
  - Your TAs also have mid-terms so we appreciate your patience as they grade your mid-terms!
  - Once that is done, as with the HWs, I'll release the stats as well as the grading rubric. The usual re-grade policy will apply (though keep @320 in mind).
- Once the mid-terms are graded I'll assign temporary letter grades to y'all (based on your scores of HWs1-3, Quiz 1 and mid-terms) just so that y'all get a sense of where you stand in the course currently.
  - I'll put up a piazza post with the details once the temp. letter grades have been assigned.
  - Note that this will not be the same as the mid-semester grade that I need to submit to HUB (mainly because the mid terms will not be graded by this Friday, which is when the mid-semester grades are due).
- Those who have a D+ or below in their temporary letter grade, I'll send email asking you to setup a one-on-one meeting (<=10 mins).
  - Even if you have a better grade than D+ but want to chat about your performance, you can also sign up (but those with D+ or below will get preference for a slot)
  - I'll put up a piazza post with details once I finalize the meeting slots.

mid-term | grading

edit | good note | 0

Updated 20 hours ago by Atri Rudra

Mid-semester grade on HUB

note @330

stop following

0 views

IGNORE the mid-semester grade on HUB

On HUB, you will now see a mid-semester grade for CSE 331. **Please ignore the grade.** I will be posting a more appropriate mid-semester letter grade (see @322) sometime next week. The mid-semester grade on HUB (which is only MS/MU) only takes HWs 1-3 and Quiz 1 into account. The more accurate mid-term temp. letter grade will also take your mid-term exam scores into account-- again as mentioned in @322, once I have computed that more accurate temp letter grade, I will post on piazza with more details.

UB requires that I submit a mid-semester grade by tomorrow. In previous semester the deadline was after I assigned the temp. mid-term grade but UB moved up the schedule this years, which is why I uploaded a cruder mid-semester grade for now.

mid-term grading

edit good note 0

Updated Just now by Atri Rudra

Overheard by a TA (in F19)..

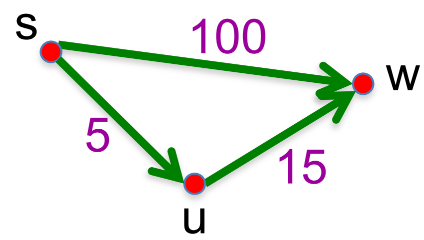
I can't wait to be done with 331……

then I can have a normal life again

Questions?

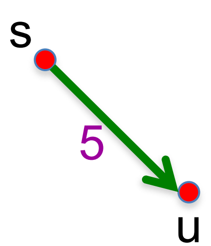
Shortest Path problem

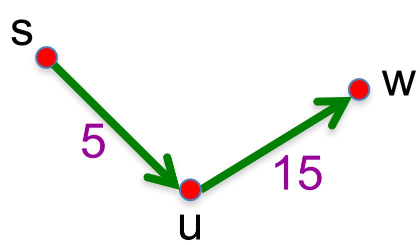
Input: *Directed* graph $G=(V,E)$



Edge lengths, l_e for e in E

"start" vertex s in V



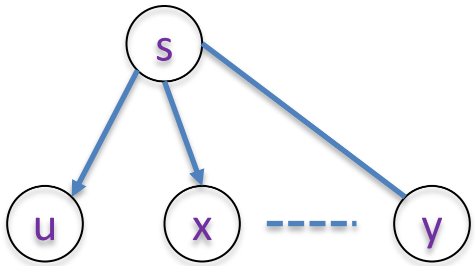


Output: Length of shortest paths from s to all nodes in V

Towards Dijkstra's algo: part ek

Determine d(t) one by one

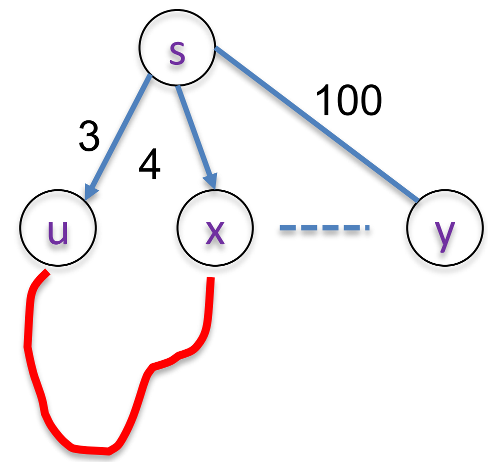
d(s) = 0



Towards Dijkstra's algo: part do

Determine d(t) one by one

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



Length of  is $\geq$ 0

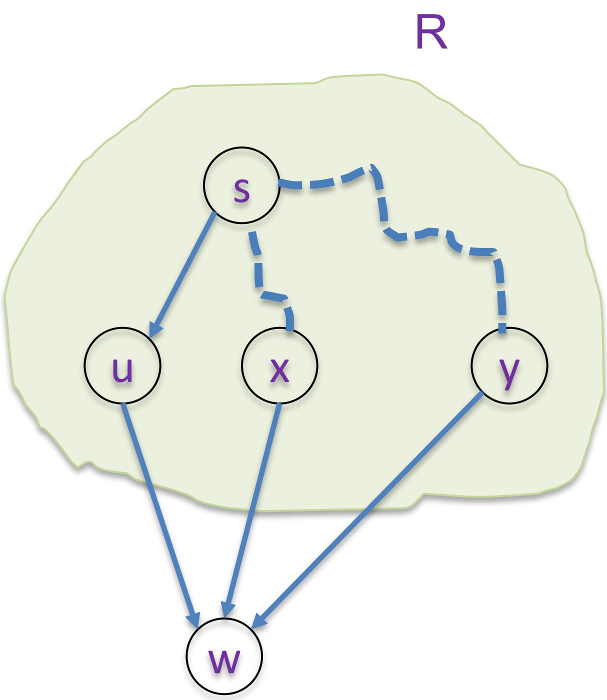
$$d(u) = l_{(s,u)}$$

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

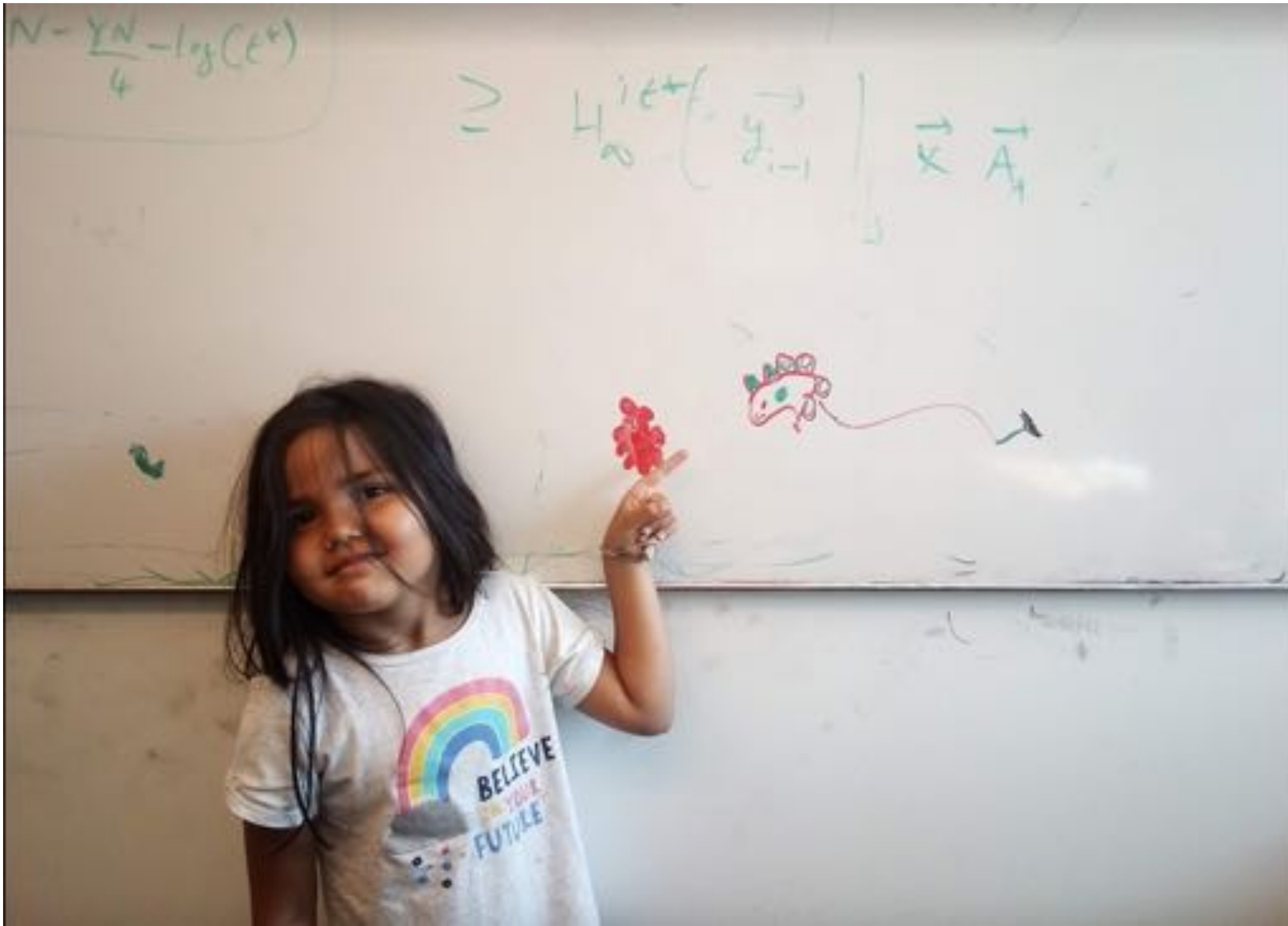
$$d(w) \leq d(u) + l_{(u,w)}$$

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

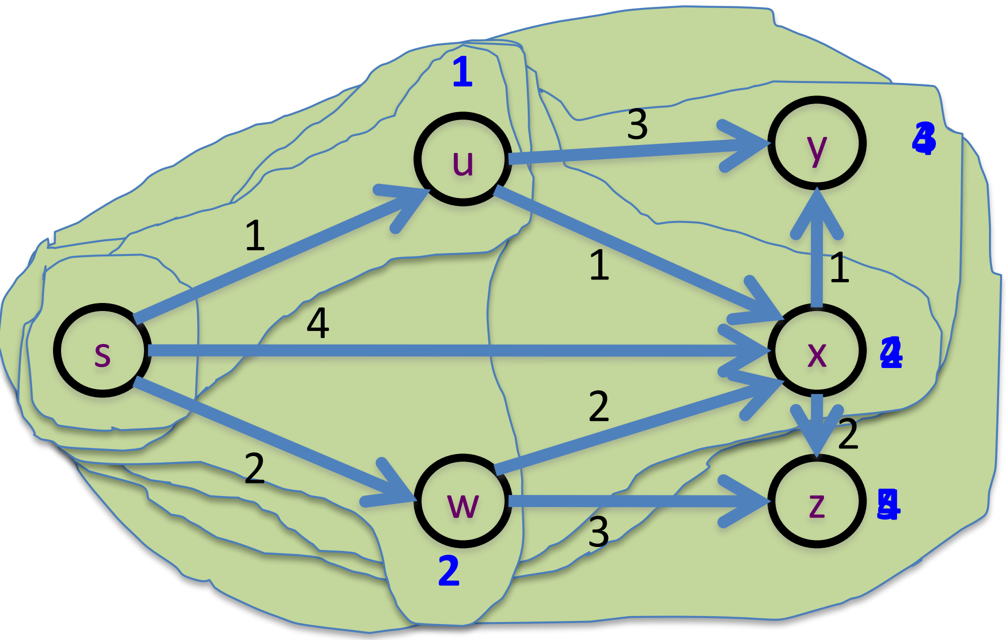
$$d(w) \leq d(y) + l_{(y,w)}$$

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

Questions/Comments?



Dijkstra's shortest path algorithm



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

d(s) = 0

d(u) = 1

d(w) = 2

d(x) = 2

d(y) = 3

d(z) = 4

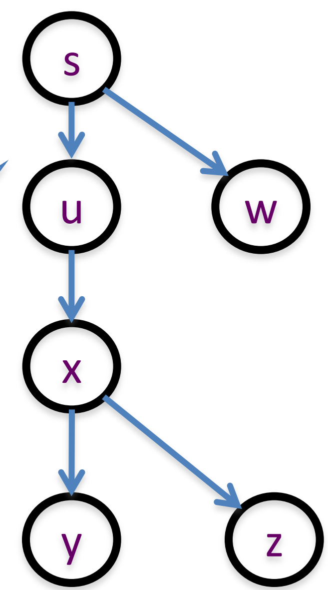
Input: Directed G=(V,E), $l_e \geq 0$, s in V

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

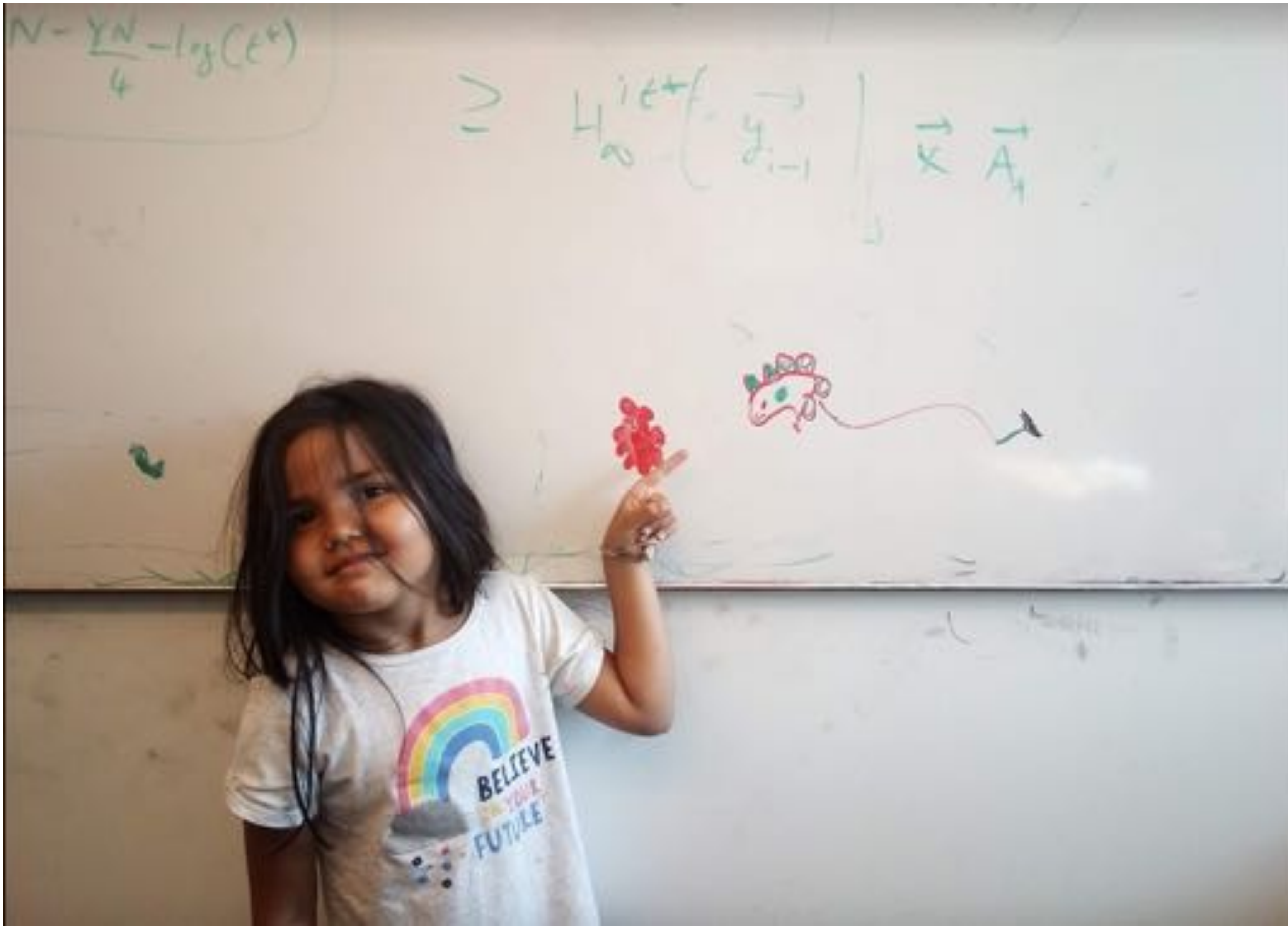
While there is a x not in R with (u,x) in E, u in R

- Pick w that minimizes d'(w)
- Add w to R
- d(w) = d'(w)

Shortest paths



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"

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

Input: Directed $G=(V,E)$, $l_e \geq 0$, 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

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

Input: Directed $G=(V,E)$, $l_e \geq 0$, 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

$\Sigma_{x \in V} O(\text{In}_x+1)$
$=O(m+n)$ 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]