Lecture 19

CSE 331

Mar 9, 2020

Mid-terms this week

note @297

The midterm post

First, midterm-I is on **Wednesday, Mar 11** and midterm-II is on **Friday, Mar 13** during the usual class timings (i.e. 2:00-2:50pm in Knox 109). Below

Logistics:

- The exam will be closed book and closed notes. However, you can bring in **one** 8.5" X 11" (letter-sized) review sheet. (If you prefer you can br as long as it is one sheet (you can use both sides). It can be hand-written or typed up doesn't matter-- however, you are not allowed to bring i but can concentrate on the main ideas in the material we have covered. The exam (as you can probably understand from the sample midterm)

Midterm material:

- The questions will be from **all** the material in Section 1.1, Chapters 2 and 3 and Sections 4.1, 4.2 (which will be a reading assignment) and 4.4 week. *This also includes the support page material, reading assignments and recitation notes.* Also, see the next couple of points.
- Most of the questions (over both the midterm exams) will be from Chapters 1, 3 and 4. (You could have guessed this from the time we spend 2 in some sense is very basic: you can be asked to analyze the run time of an algorithm related to stuff from Chapter 1, 3 or 4.)
- Most of the questions will be from the sections we covered in class. This, however, does not mean that there can't be any question from the s pages. (Also see next point.)
- We did not cover certain sections in the book, e.g., we did not cover Sec 3.4 and 3.5 at all in class. However, Sec 3.4 and 3.5 are very nice ap on BFS/DFS algorithms.
- You guys will not have a HW problem on Sec 3.6 or Section 4 before the midterm exams. So in the worst-case, I'll only ask T/F question(s) fr be trifled with.)

For preparation:

- Work through the sample midterm exams (@233). Do **not** use the sample midterm to deduce **anything** about the relative coverage of different *exams will be harder than the sample midterm exams*. The actual midterms will follow the exact same format for the sample midterms: i.e. the
- I encourage you to not look at the solutions to the sample midterms before you have spent some quality time by yourself on the midterm ques

Instructor OHs: 4-6 today, no on wed

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Instructor's office hours in the midterm week

For the next week, I'm going to move my Wed OH to Mon 5:00-5:50, to answer all your questions before both midterms. I also need to deal with scanning the midterm papers on Wed. In other words;

- My OH on Monday (Mar 9) will be between 4:00-5:50.
- I will NOT have OH on Wed (Mar 11) at 3:00-3:50.

It's also reflected in the Google Calendar.

office hours

Quiz 1: T/F dilemma!

(a) (**Part 1**) Argue why the following statement is **TRUE**.

If $f(n) = c \cdot g(n)$, then $2^{f(n)} = \left(2^{g(n)}\right)^c$ for every real number c.

(**Part 2**) Is the following statement true or false? Also remember to briefly JUSTIFY your answer.

If $f(n)$ is $\Theta(g(n))$, then $2^{f(n)}$ is $\Theta(2^{g(n)})$.

True **False** (Please **CIRCLE** your answer)

Those are not okay; you'll get zero!

(a) (**Part 1**) Argue why the following statement is **TRUE**.

If $f(n) = c \cdot g(n)$, then $2^{f(n)} = \left(2^{g(n)}\right)^c$ for every real number c.

It is false.

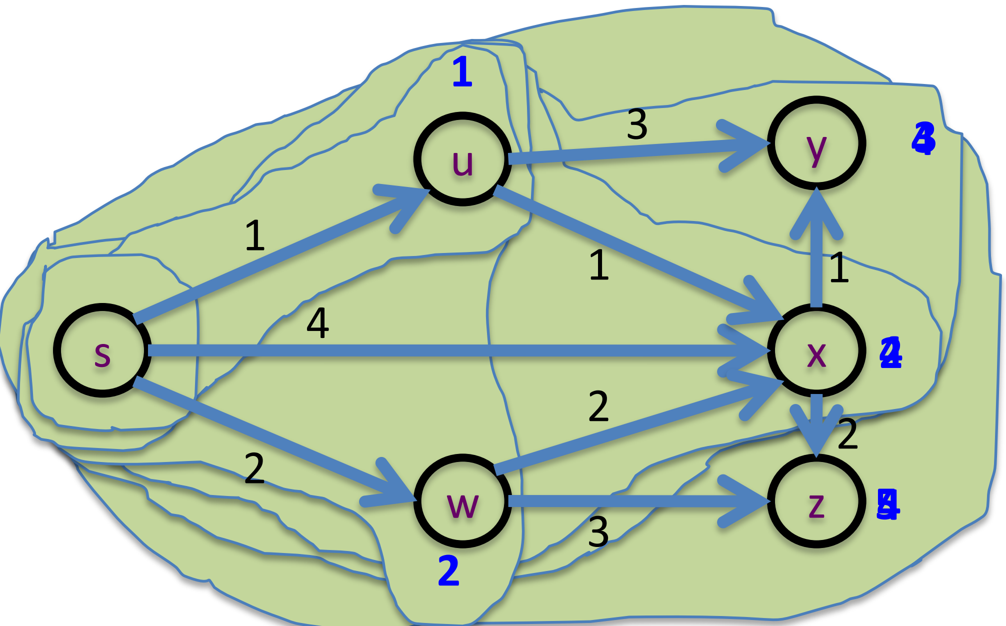
True **False** (Please **CIRCLE** your answer)

False, it runs on

True **False** (Please **CIRCLE** your answer)

Also; it makes no sense to leave it unanswered;
just choose one: you have nothing to lose

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

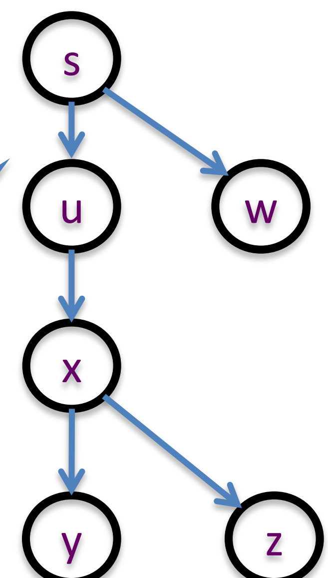
While there is a x not in R with (u,x) in E, u in R

Pick w among all x with smallest d'(w) value

Add w to R

d(w) = d'(w)

Shortest paths



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

Runtime analysis of Dijkstra's Algorithm

Dijkstra's shortest path algorithm

P_u shortest s-u path in "Dijkstra tree"

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

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 among all x with smallest d'(w) value

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

Dijkstra's shortest path algorithm

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

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 among all x with smallest $d'(w)$ value

  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]

Mid-term topics done!

Anything till now is fair game for the mid-terms