Lecture 18

CSE 331

Oct 14, 2022

HW 4 is out

Homework 4

Due by **11:30pm, Tuesday, October 18, 2022**

Make sure you follow all the homework policies.

All submissions should be done via Autolab.

The care package on minimizing the maximum lateness problem would be useful for Q3 and *might* be useful for Q2(b) as well.

Question 1 (High Speed Internet) [50 points]

The Problem

We come back to the issue of many USA regions not having high speed internet. In this question, you will consider an algorithm problem that you would need to solve to help out a (fictional) place get high speed Internet.

You are the algorithms whiz in the effort to bring high speed Internet to `SomePlaceInUSA`. After lots of rounds of discussions and public feedback, it was decided that the most cost-effective way to bring high speed Internet to `SomePlaceInUSA` was to install high speed cell towers to connect all houses in `SomePlaceInUSA` to high speed Internet. There are two things in your favor:

1. It just so happens that all of the n houses in `SomePlaceInUSA` are on the side of a straight road that runs through the town.
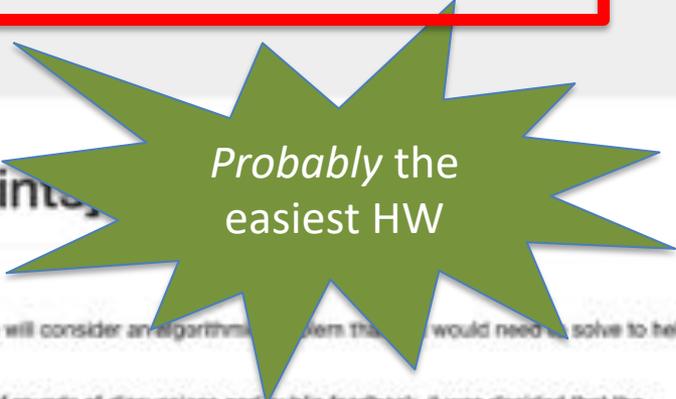
Probably the easiest HW

Please pay attention to instructions

Actions ▾

Pay attention to submission requirements (for Q1+Q2)

When we say you will get a zero if you do not follow an instruction, it is NOT a gentle suggestion. So please make sure you pay attention to the warnings. E.g.:

! Submit part (a) and (b) separately

You need to submit **two (2) PDF** files to Autolab: one for part **(a)** and one for part **(b)**. While you can assume part **(a)** as a given for part **(b)**, to get credit for part **(a)** you have to submit you solution for part **(a)** separately from part **(b)**.

Make sure you submit the correct PDF to the correct submission link on Autolab. If you do not (e.g. if you submit Q1(a) PDF to Q2(a) or even Q1(b)), then you will lose ALL points.

We recommend that you typeset your solution but we will accept scans of handwritten solution -- you have to make sure that the scan is legible.

and this:

! PDF only please

If Autolab cannot display your file, (irrespective of the reason) then you will get a zero (0) on the entire question.

Autolab might not be able to display files in formats other than PDF (e.g. Word cannot be displayed). **Note that Autolab will "accept" your submission even if you submit non-PDF file, so it is YOUR responsibility to make sure you submit in the correct format.** However, after submission, Autolab will try and display your non-PDF submission and it should give an error message then. Also the file size has to be **at most 3MB**.

Make broadband more available

Cattaraugus County

Population: 79518
Median Income: $41,368.88
Access to any cable technology: 67.5%
Access to two or more wireline providers: 61.2%

BOTH
technical and
societal issues
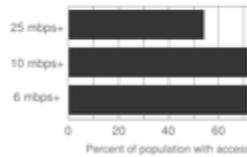
Say you are tasked to come up with the infrastructure

Erie County

Population: 913295
Median Income: $49,817.67
Access to any cable technology: 98.9%
Access to two or more wireline providers: 96.8%
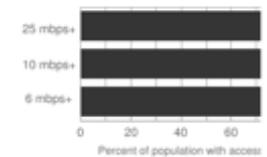
HW 4 Q1: How to lay down towers

Here is a quick visual argument for the above leads to continuous cell coverage:
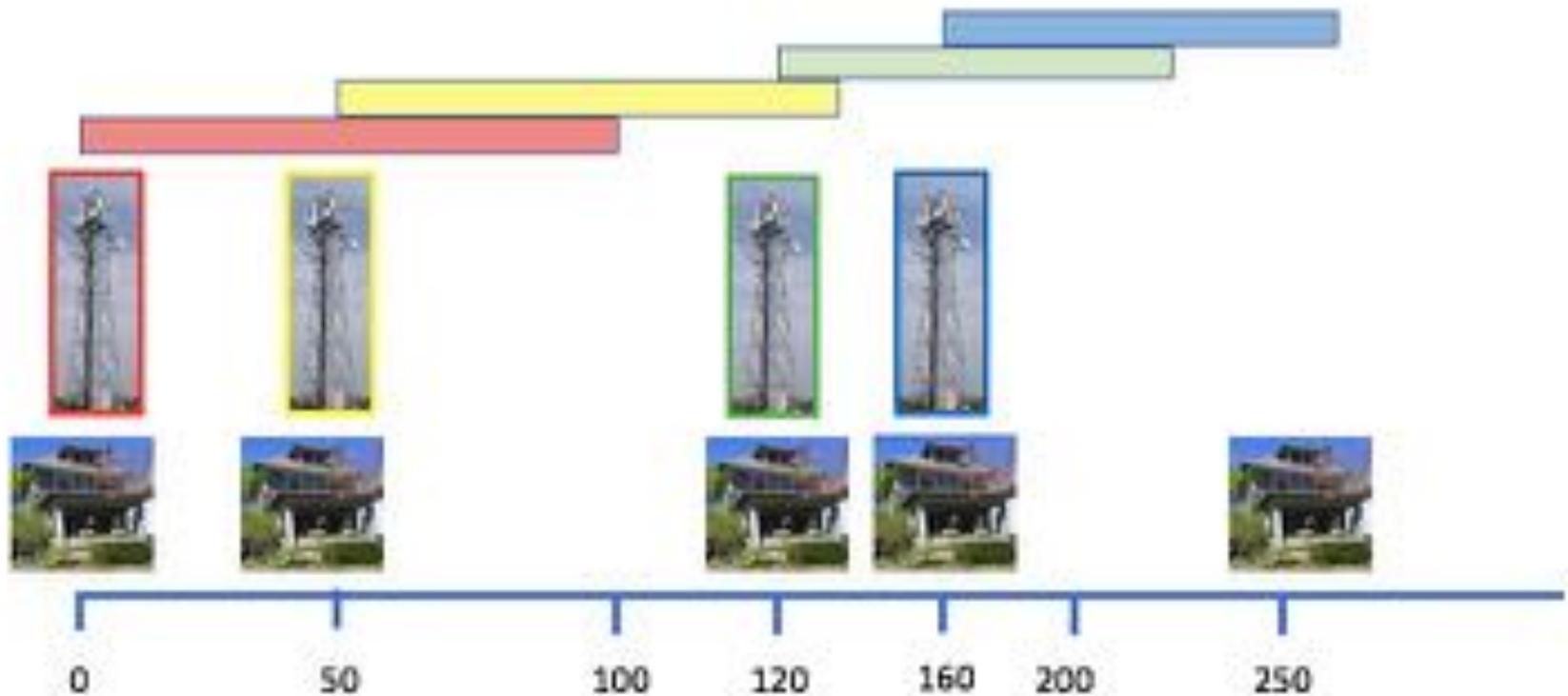
Project deadlines coming up

Fri, Oct 28	Counting Inversions ▶^{F21} ▶^{F19} ▶^{F18} ▶^{F17} x^2	[KT, Sec 5.3] (**Project (Problem 1 Coding) in)**
Mon, Oct 31	Multiplying large integers ▶^{F21} ▶^{F19} ▶^{F18} ▶^{F17} x^2	[KT, Sec 5.5] (**Project (Problem 1 Reflection) in)** *Reading Assignment:* Unraveling the mystery behind the identity
Wed, Nov 2	Closest Pair of Points ▶^{F21} ▶^{F19} ▶^{F18} ▶^{F17} x^2	[KT, Sec 5.4]
Fri, Nov 4	Kickass Property Lemma ▶^{F21} ▶^{F19} ▶^{F18} ▶^{F17} x^2	[KT, Sec 5.4] (**Project (Problem 2 Coding) in)**
Mon, Nov 7	Weighted Interval Scheduling ▶^{F21} ▶^{F19} ▶^{F17} x^2	[KT, Sec 6.1] (**Project (Problem 2 Reflection) in)**

Some other stuff coming up

Ignore HUB mid-semester grade

Questions?

Shortest Path Problem

http://xkcd.com/85/
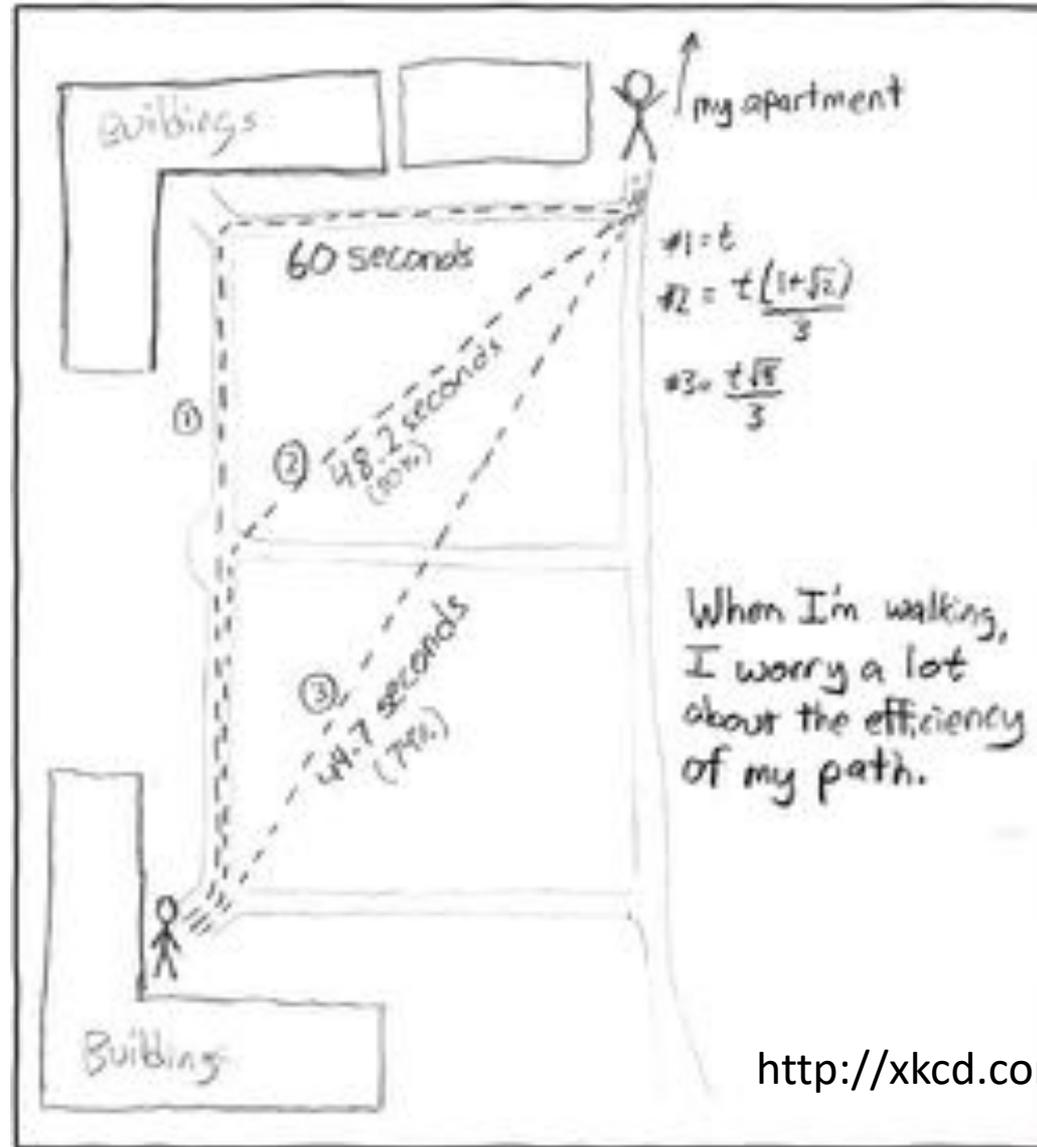
Another more important application

Is BGP a known acronym for you?

Routing uses shortest path algorithm

Shortest Path problem

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

Edge lengths, l_e for e in E

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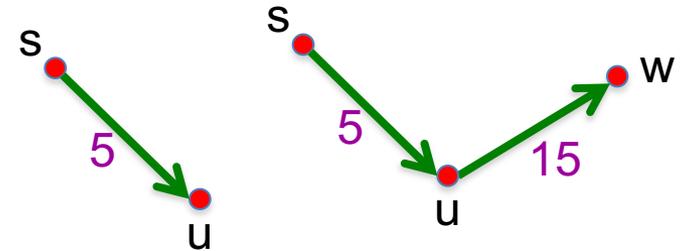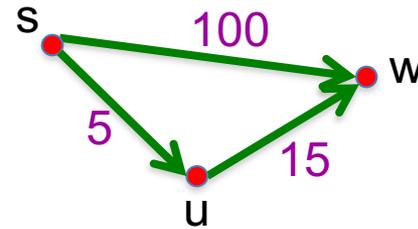
Output: Length of shortest paths from s to all nodes in V

Dijkstra's shortest path algorithm

E. W. Dijkstra (1930-2002)
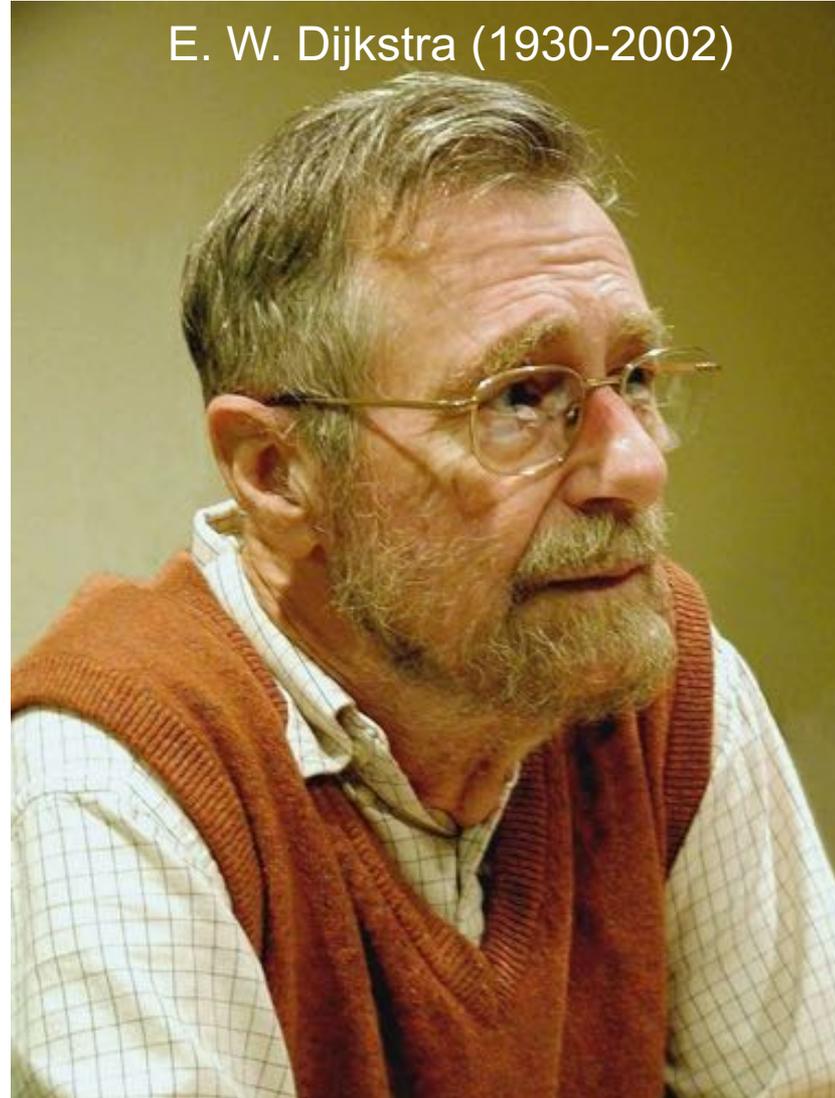
Questions/Comments?
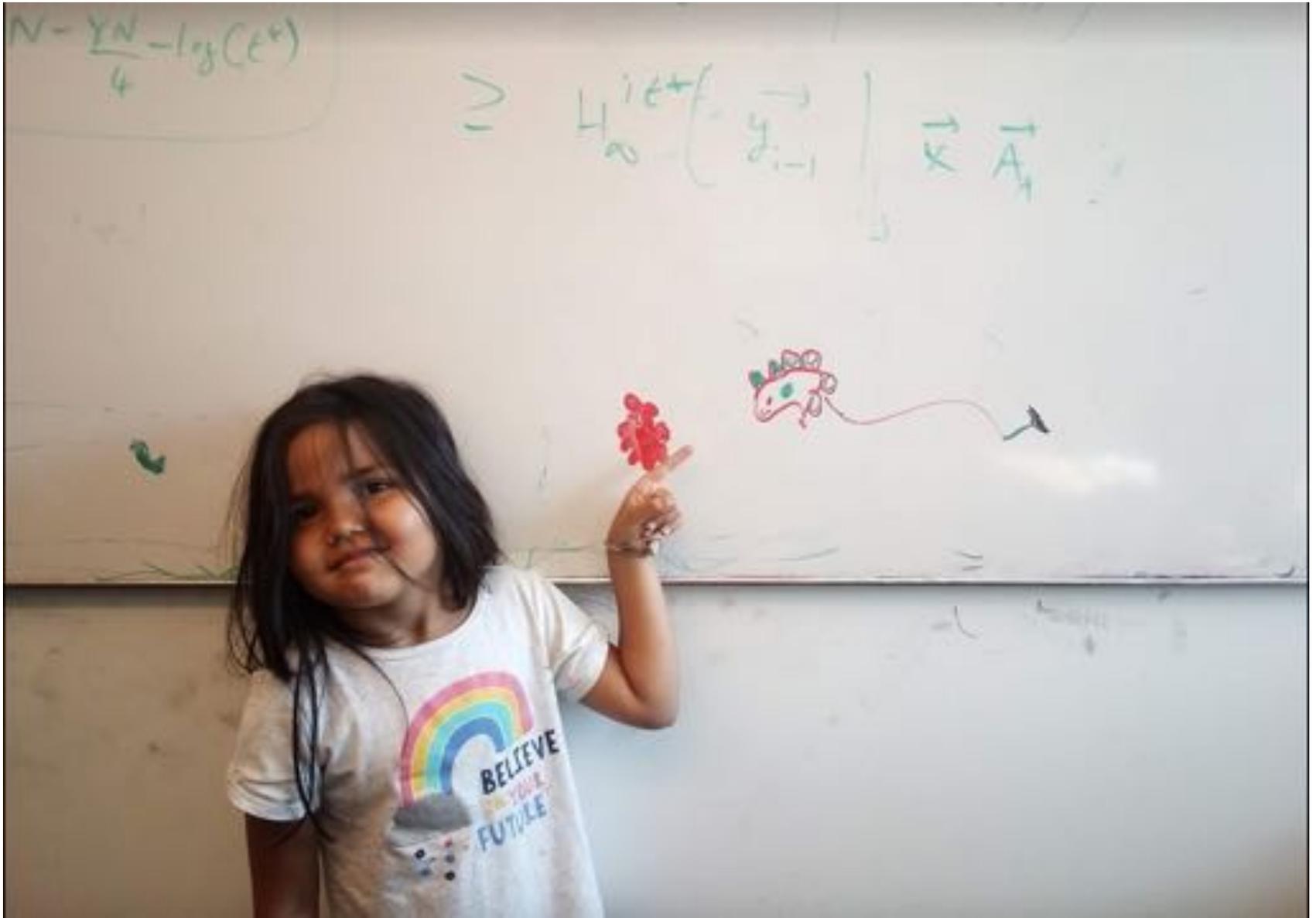
On to the board…

Towards Dijkstra's algo: part ek

Determine $d(t)$ one by one

$$d(s) = 0$$
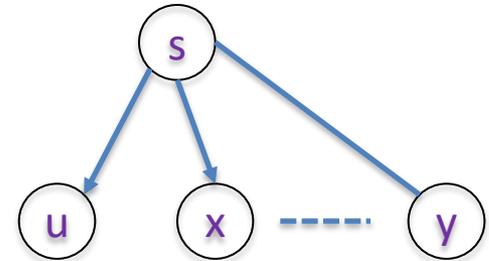
Towards Dijkstra's algo: part do

Determine $d(t)$ one by one

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

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

Not making any claim on other vertices
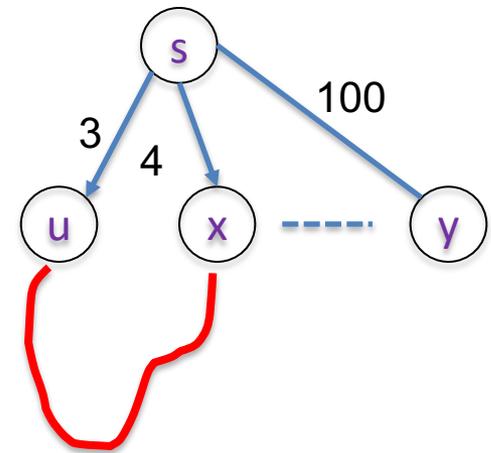
Length of ⟁ is ≥ 0

Towards Dijkstra's algo: part teen

Determine $d(t)$ one by one

R

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

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

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

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

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

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