Lecture 11

CSE 331

Sep 24, 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

Register project groups 1 week!

Deadline: Friday, Oct 1, 11:59pm

CSE 331 Syllabus Piazza Schedule Homeworks ▾ Autolab **Project ▾** Support Pages ▾ channel Sample Exams ▾

Project Overview

Group signup form

Forming groups

You form groups of size **exactly three (3)** for the project. Below are the various logistics.

- You have two choices in forming your group:
  1. You can form your group on your own: i.e. you can submit the list of EXACTLY three (3) groups members in your group.

     </> Note

     Note that if you pick this option, your group needs to have **exactly THREE (3)** members. In particular, if your group has only two members you cannot submit as a group of size two. If you do not know many people in class, feel free to use piazza to look for the third group member.

  2. You can submit *just your name*, and you will be assigned a random group *among all students who take this second option*. However, **note that if you pick this option you could end up in a group of size** 2. There will be at most two groups of size 2.

- Submitting your group composition

  Use this Google form to submit your group composition (the form will allow you to pick one of the two options above).

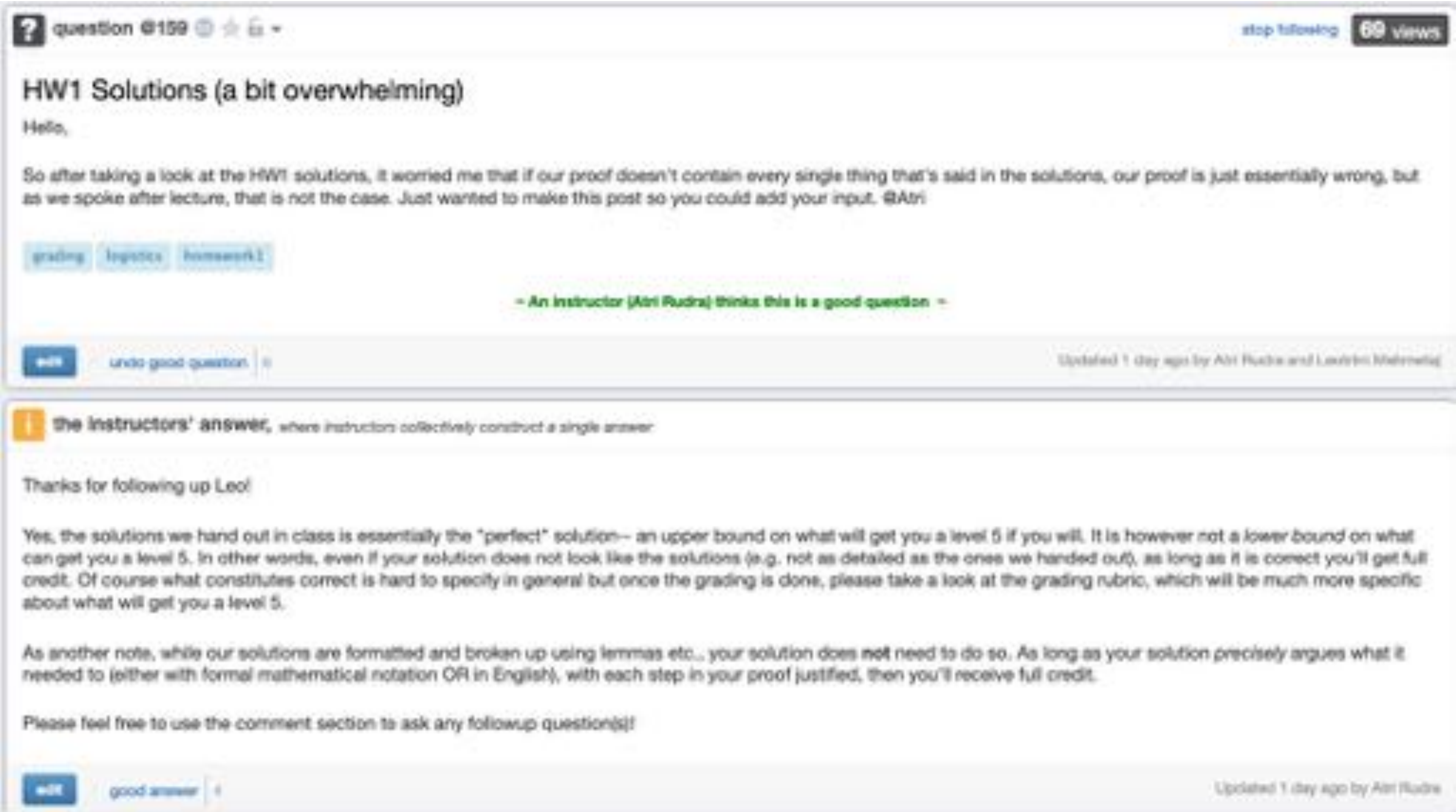
- You need to fill in the form for group composition by **11:59pm on Friday, October 1.**

- </> Deadline is strict!

  If you do not submit the form for group composition by the deadline, then you get a **zero for the entire project.**

If you need it, ask for help

A clarification on our solutions


question @159

stop following

69 views

HW1 Solutions (a bit overwhelming)

Hello,

So after taking a look at the HW1 solutions, it worried me that if our proof doesn't contain every single thing that's said in the solutions, our proof is just essentially wrong, but as we spoke after lecture, that is not the case. Just wanted to make this post so you could add your input. @Atri

grading logistics homework1

~ An instructor (Atri Rudra) thinks this is a good question ~

edit undo good question

the instructors' answer, *where instructors collectively construct a single answer*

Thanks for following up Leo!

Yes, the solutions we hand out in class is essentially the "perfect" solution-- an upper bound on what will get you a level 5 if you will. It is however not a *lower bound* on what can get you a level 5. In other words, even if your solution does not look like the solutions (e.g. not as detailed as the ones we handed out), as long as it is correct you'll get full credit. Of course what constitutes correct is hard to specify in general but once the grading is done, please take a look at the grading rubric, which will be much more specific about what will get you a level 5.

As another note, while our solutions are formatted and broken up using lemmas etc., your solution does **not** need to do so. As long as your solution *precisely* argues what it needed to (either with formal mathematical notation OR in English), with each step in your proof justified, then you'll receive full credit.

Please feel free to use the comment section to ask any followup question(s)!

edit good answer

Updated 1 day ago by Atri Rudra

Full definition of a cycle

note @160

stop following 44 views

Complete definition of a cycle

In class today I was running out of time so I did not *fully* specific the definition of a cycle. Here is the full definition (also on the graph notation page):

A path $u_1, \ldots, u_k$ is a cycle if (1) $u_1 = u_k$, (2) $u_1, \ldots, u_{k-1}$ are distinct, (3) For directed graphs $k \geq 3$ and for undirected graphs $k \geq 4$.

The part that was missing ini the lecture are the lower bounds on k. If e.g. we allowed $k = 3$ for undirected graphs then for the graph that just has the edge (A, B), then the following path would be a "cycle": A, B, A (which clearly is not right).

(Note that the textbook does have condition (3) above-- this was pointed out to me by a 331 student (Isaac Elbaz) about 10 years ago.)

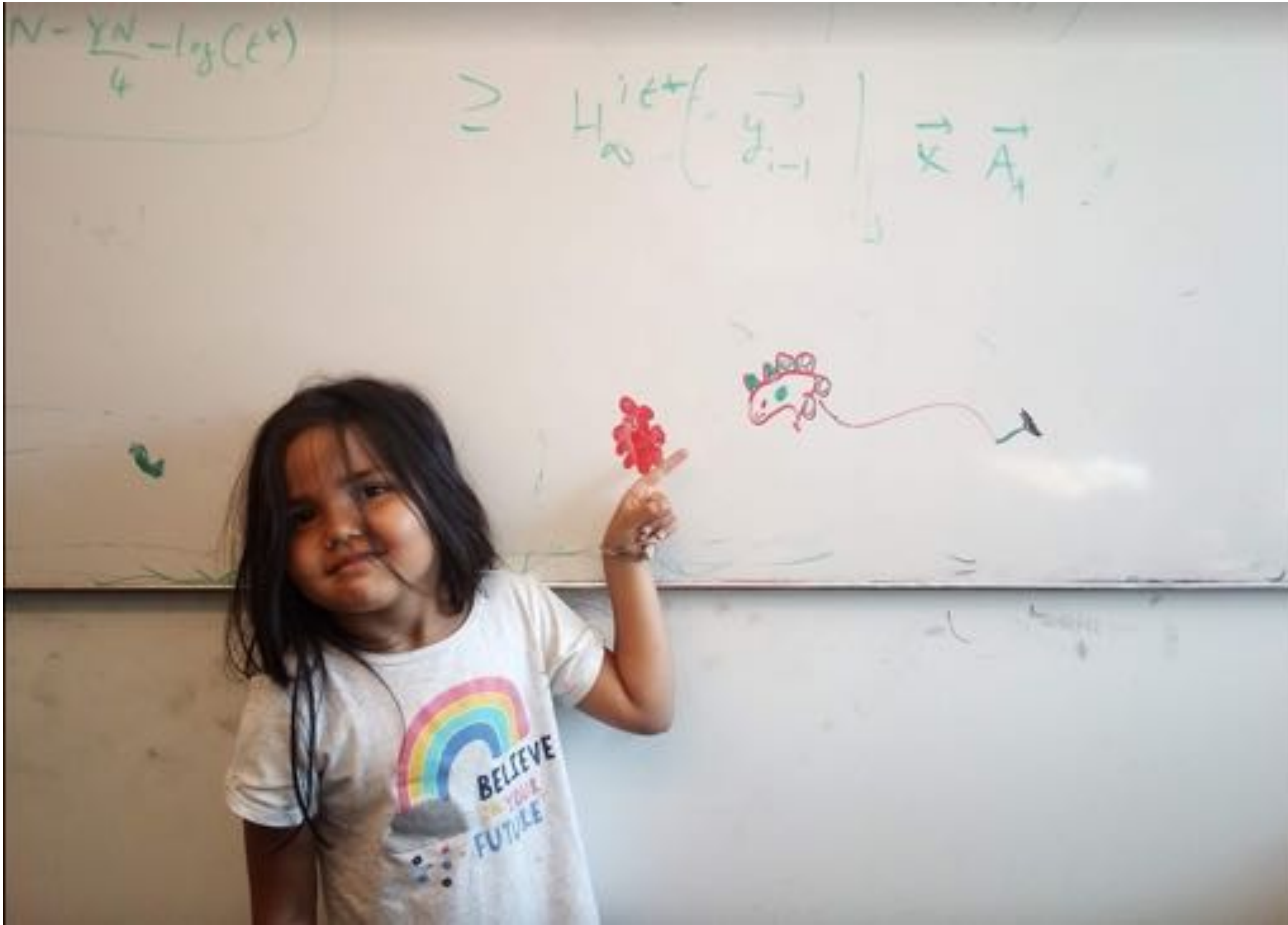
Please use the comments section to ask any questions y'all might have!

lectures

edit good note | 0

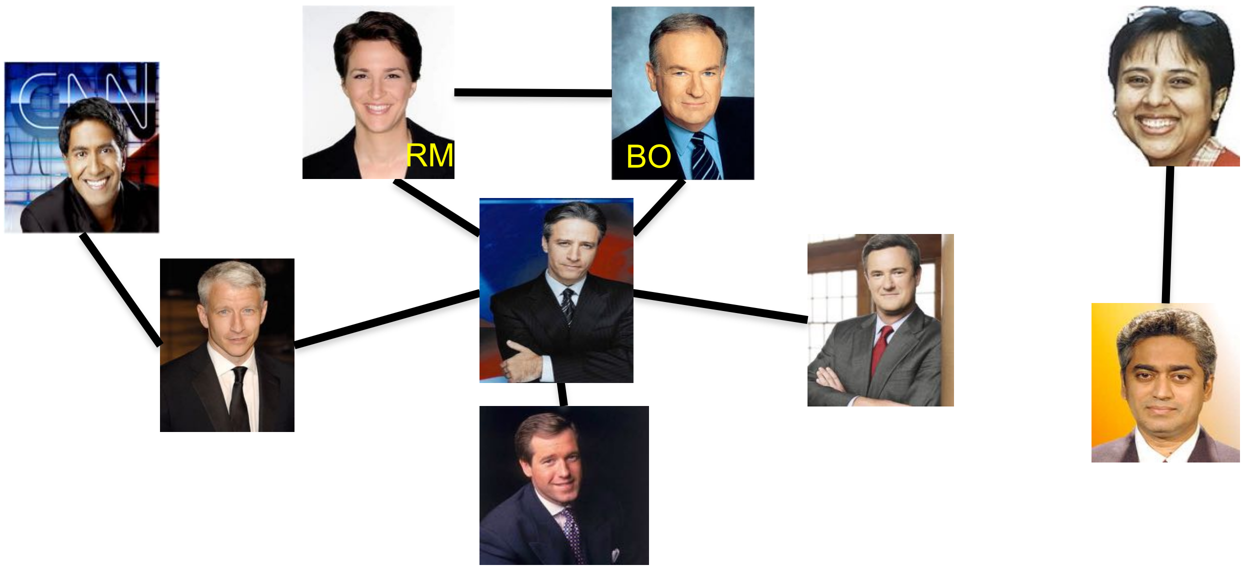
Updated 1 day ago by Atri Rudra

Questions/Comments?



Distance between u and v

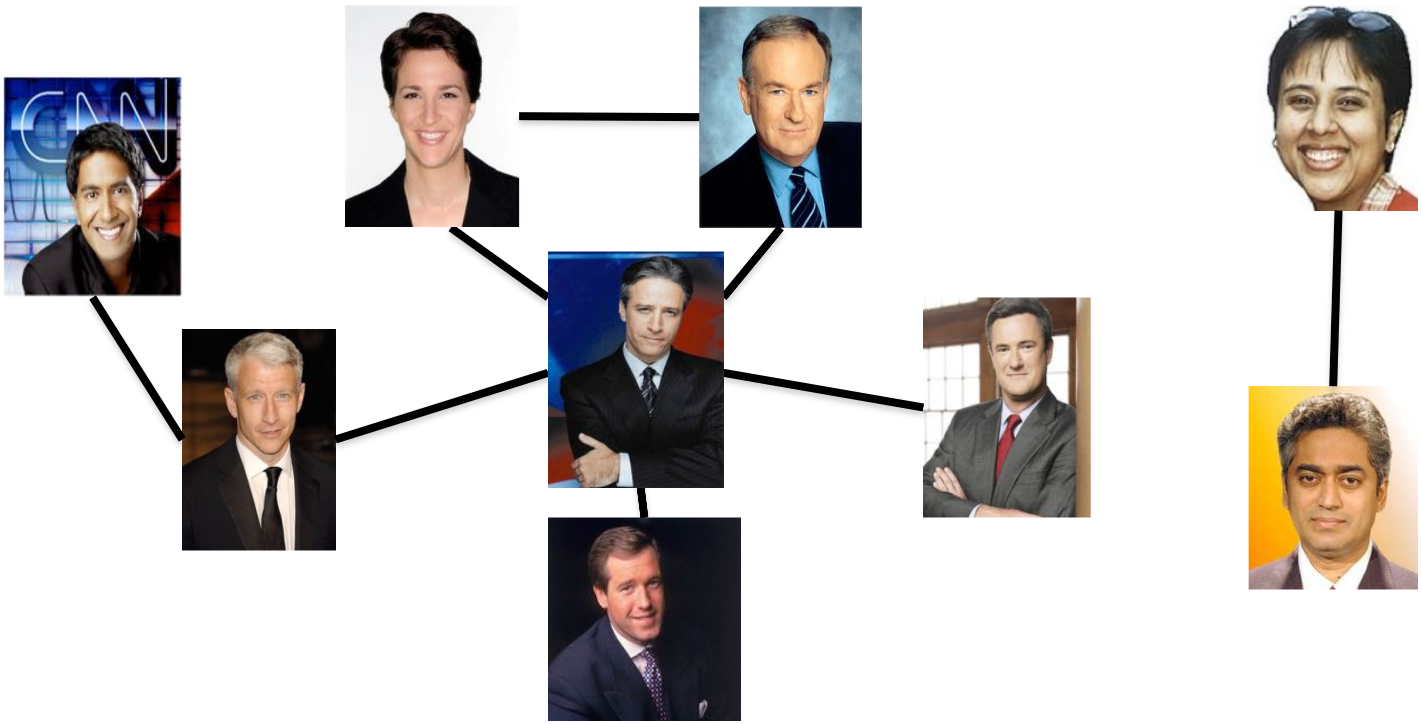
Length of the shortest length path between u and v



Distance between RM and BO? 1

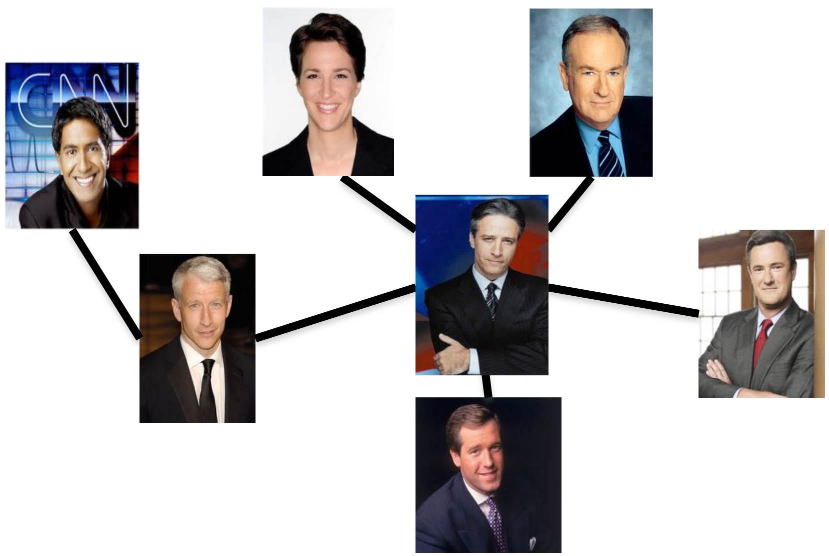
Tree

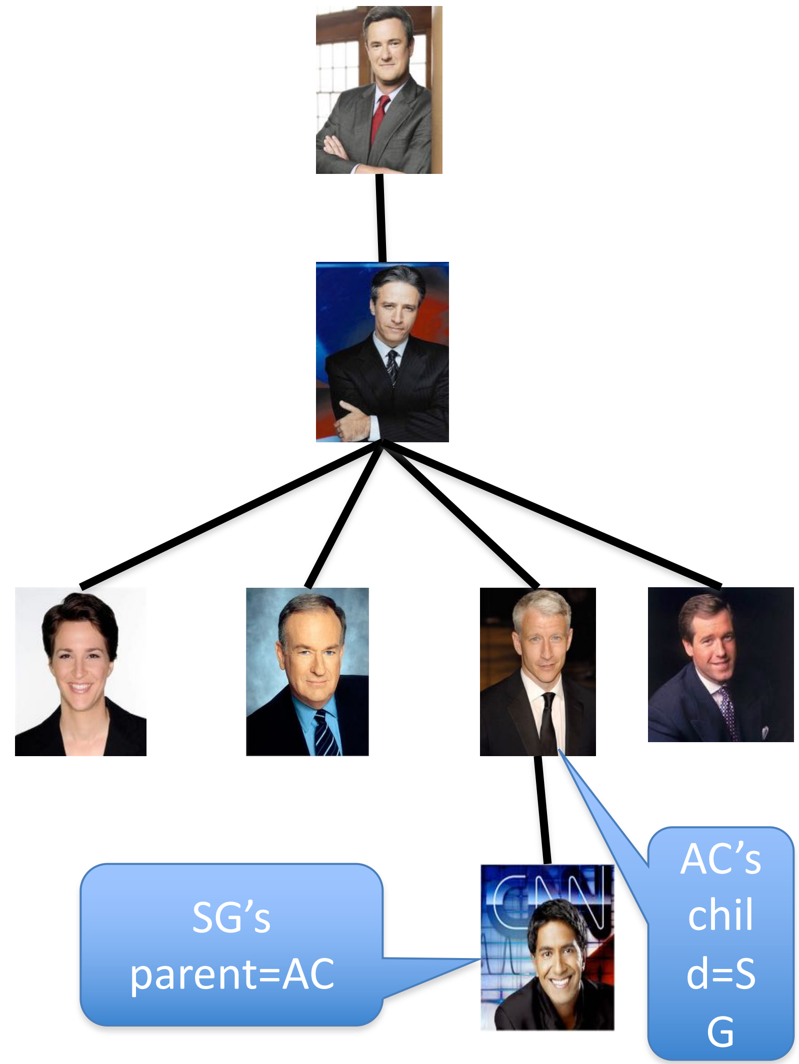
Connected undirected graph with no cycles



Rooted Tree

A rooted tree





Pick any vertex as root

Let the rest of the tree hang under “gravity”

Every n vertex tree has n-1 edges

Trees

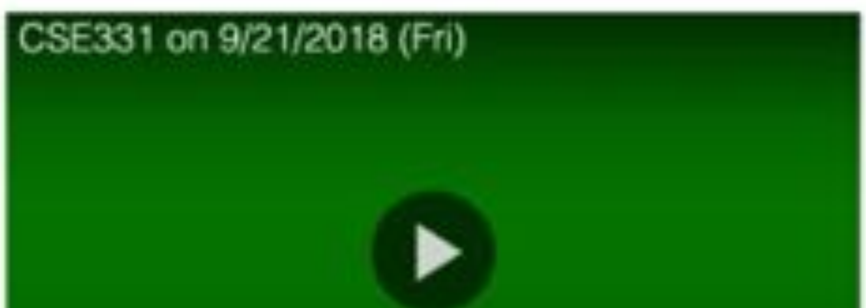
This page collects material from previous incarnations of CSE 331 on trees, especially the proof that trees with n nodes have exactly $n - 1$ edges.

Where does the textbook talk about this?

`Section 3.1` in the textbook has the lowdown on trees.

Fall 2018 material

Here is the lecture video:



Every n vertex tree has n-1 edges

Let G be an undirected graph on n nodes

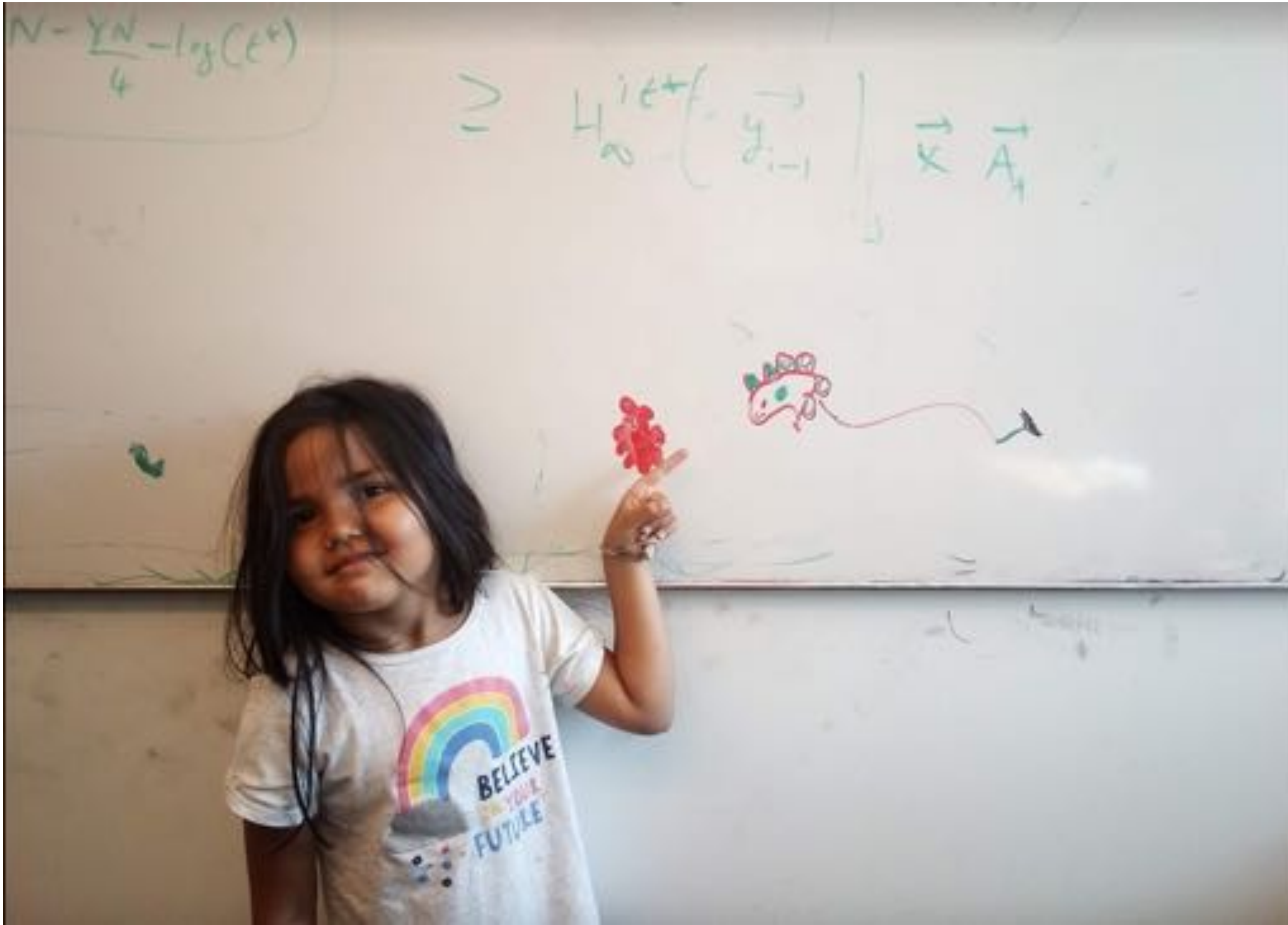
Then ANY two of the following implies the third:

T is connected

T has no cycles

T has n-1 edges

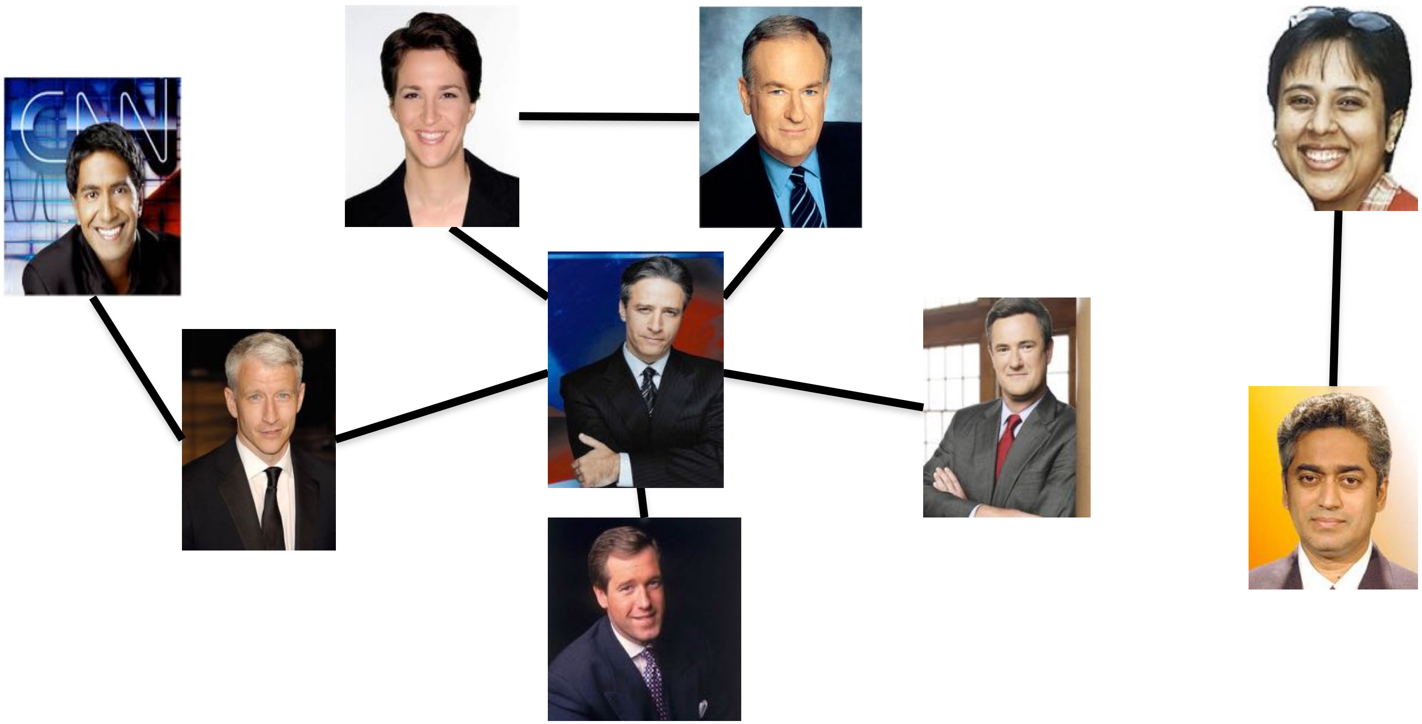
Questions/Comments?



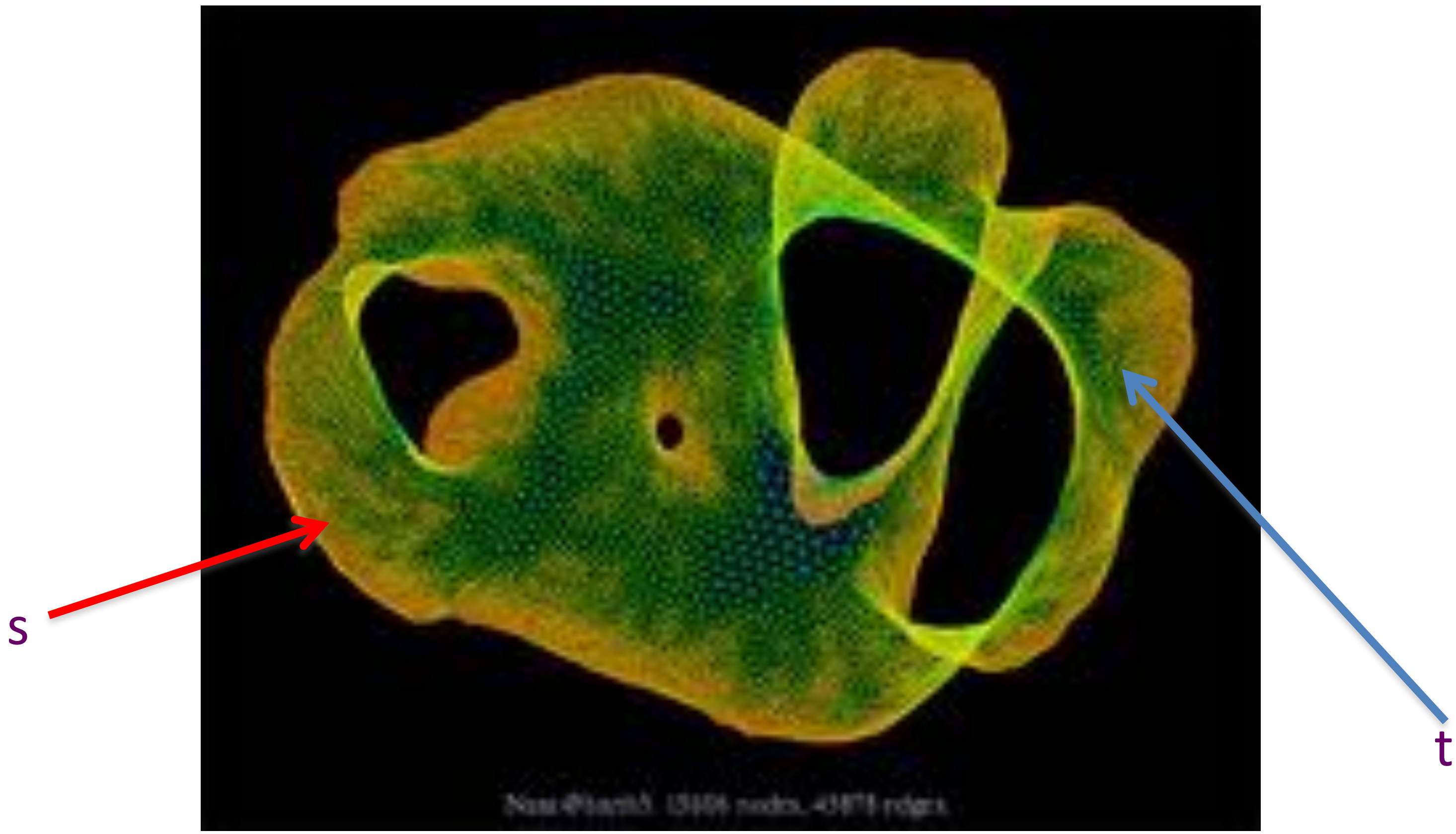
Rest of Today’s agenda

Algorithms for checking connectivity

Checking by inspection



What about large graphs?



Are s and t connected?

Brute-force algorithm?

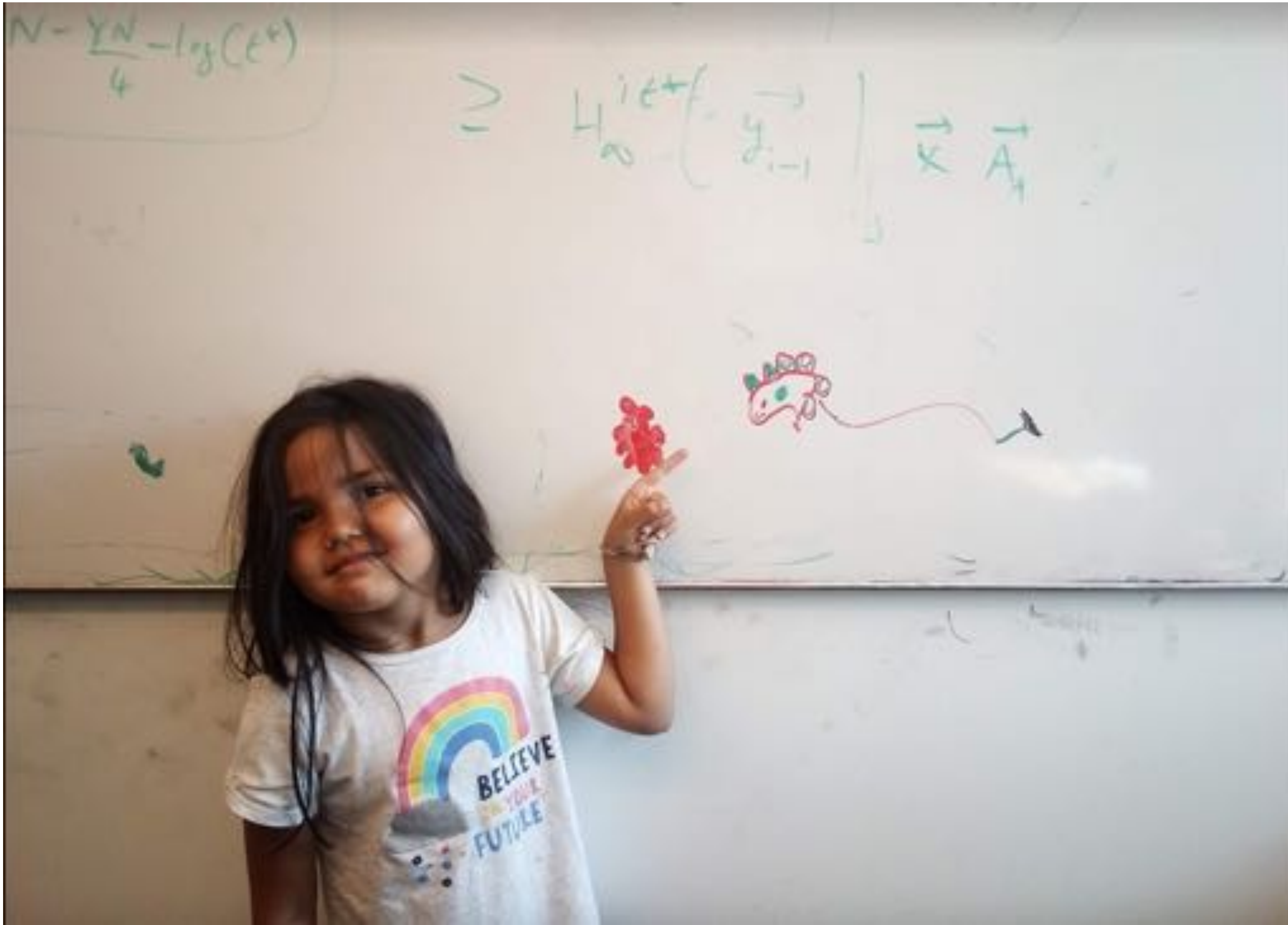
List all possible vertex sequences between s and t

n^n such sequences

Check if any is a path between s and t

Algorithm motivation

Questions/Comments?



Breadth First Search (BFS)

BFS via examples

In which we derive the breadth first search (BFS) algorithm via a sequence of examples.

Expected background

These notes assume that you are familiar with the following:

- Graphs and their representation. In particular,
  - Notion of connectivity of nodes and connected components of graphs
  - Adjacency list representation of graphs
  - Notation:
    - $G = (V, E)$
    - $n = |V|$ and $m = |E|$
    - $CC(s)$ denotes the connected component of s
- Trees and their basic properties

The problem

In these notes we will solve the following problem:

Connectivity Problem

Input: Graph G = (V,E) and s in V

Output: All t connected to s in G

Connected component of s

Breadth First Search (BFS)

Build layers of vertices connected to s

$L_0 = \{s\}$

Assume $L_0,..,L_j$ have been constructed

L_{j+1} set of vertices not chosen yet but are connected by an edge to L_j

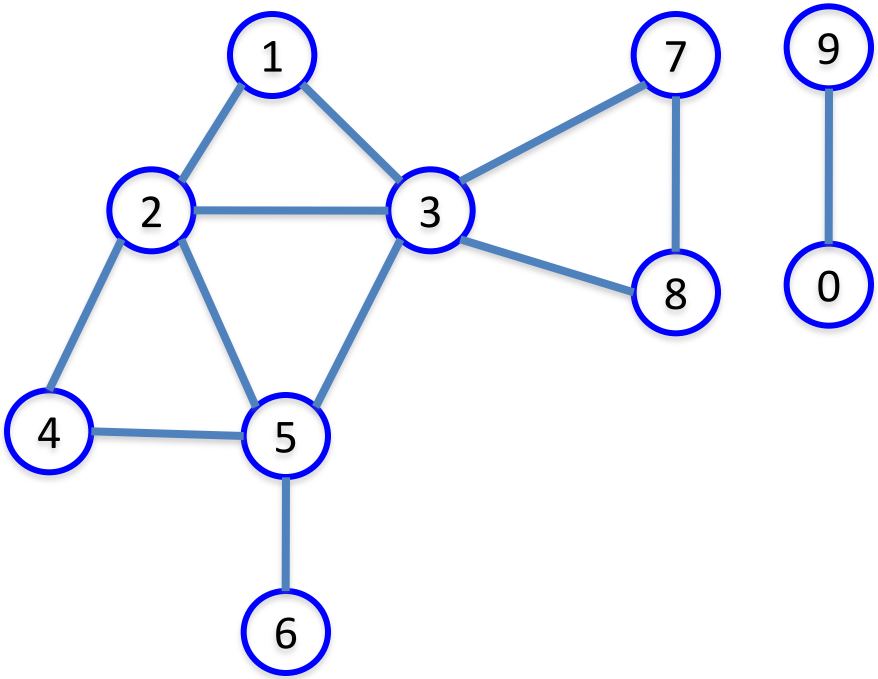
Stop when new layer is empty

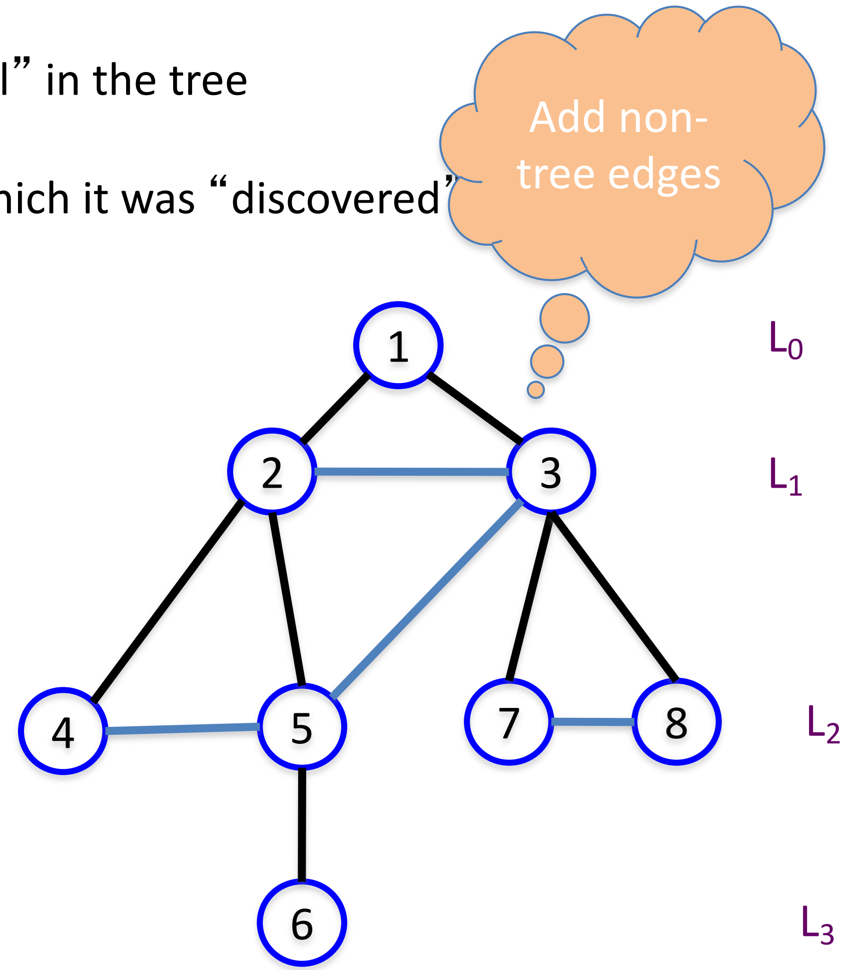
BFS Tree

BFS naturally defines a tree rooted at s

L_j forms the jth "level" in the tree

u in L_{j+1} is child of v in L_j from which it was "discovered"



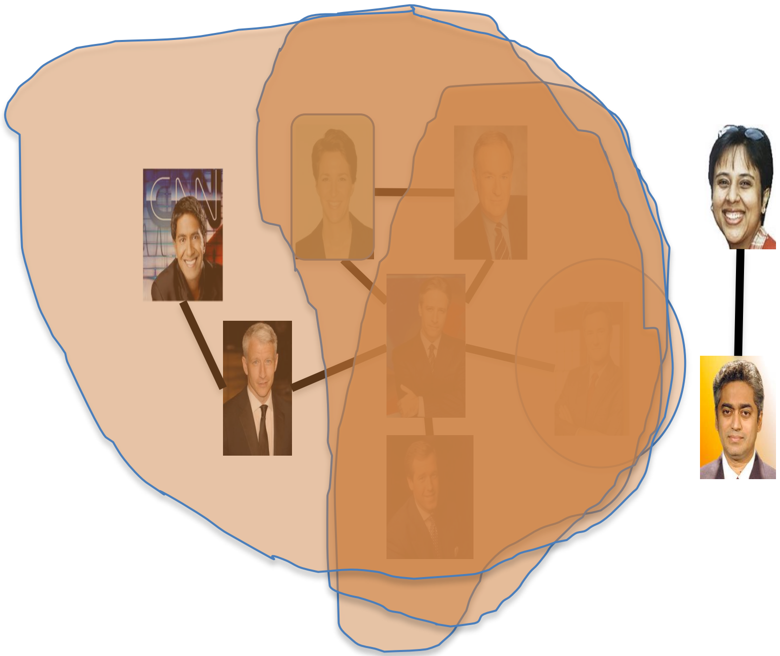


Argue on the board…

Rest of today's agenda

Computing Connected component

Computing Connected Component



Explore(s)

Start with R = {s}

While exists (u,w) edge w not in R and u in R

Add w to R

Output R^* = R

Questions?