

Lecture 12

CSE 331

Sep 27, 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>

If you need it, ask for help



Project groups due **FRIDAY!**

Deadline: Friday, Oct 1, 11:59pm

Forming groups

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

Project Overview

Group signup form

- 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**.

Upcoming quiz/exams

Quiz 1 Friday NEXT week

Mid-term 1 Monday in TWO weeks

Mid-term 2 Wed two days after Mid-term 1

Piazza post (+sample mid-terms) up by Thur. on preparing for mid-terms

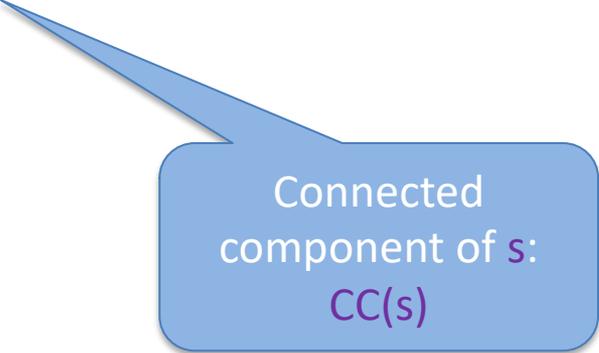
Questions?



Connectivity Problem

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

Output: All t connected to s in G



Connected
component of s :
 $CC(s)$

Breadth First Search (BFS)

Build layers of vertices connected to s

$$L_0 = \{s\}$$

Assume L_0, \dots, L_j have been constructed

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

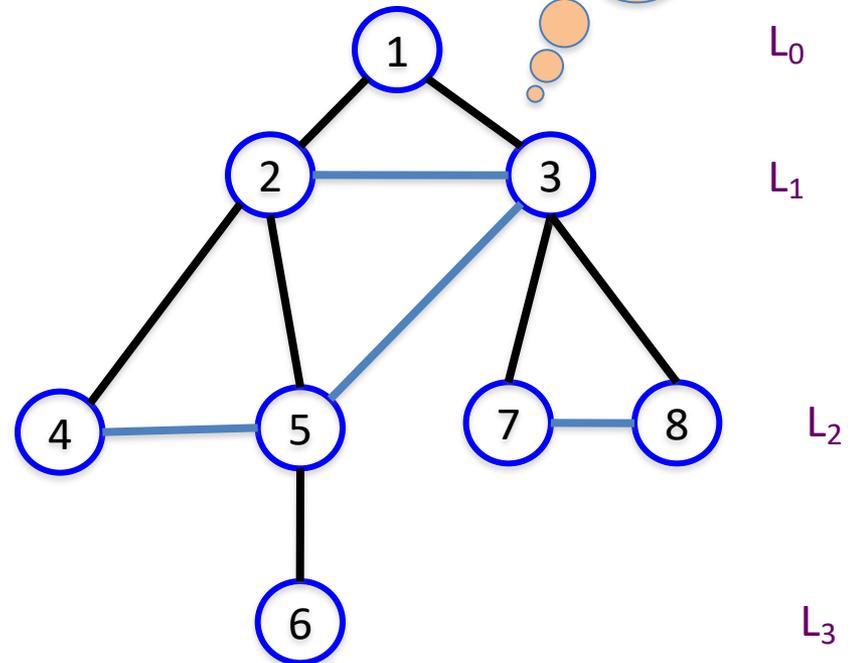
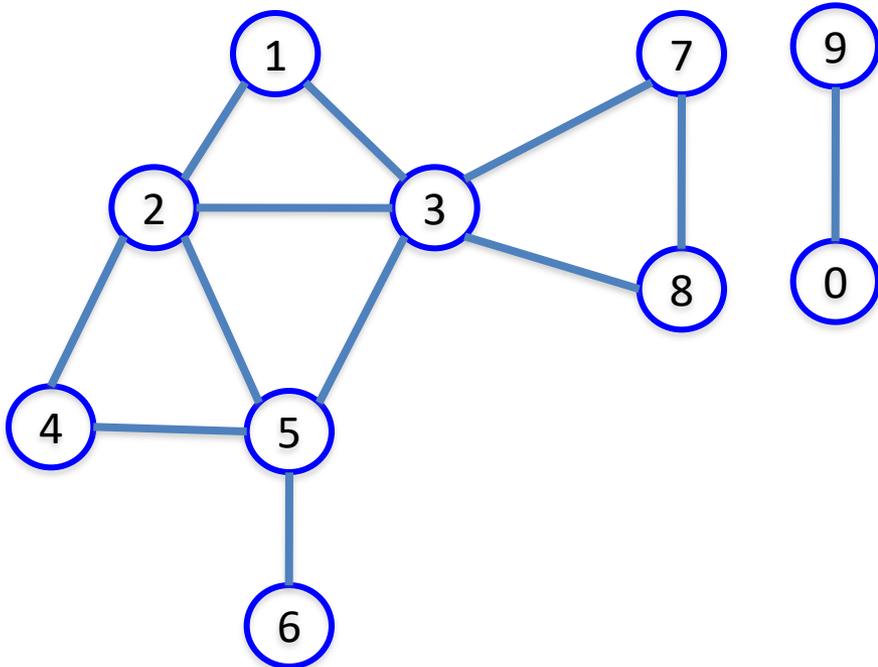
Stop when new layer is empty

BFS Tree

BFS naturally defines a tree rooted at s

L_j forms the j th “level” in the tree

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



Two facts about BFS trees

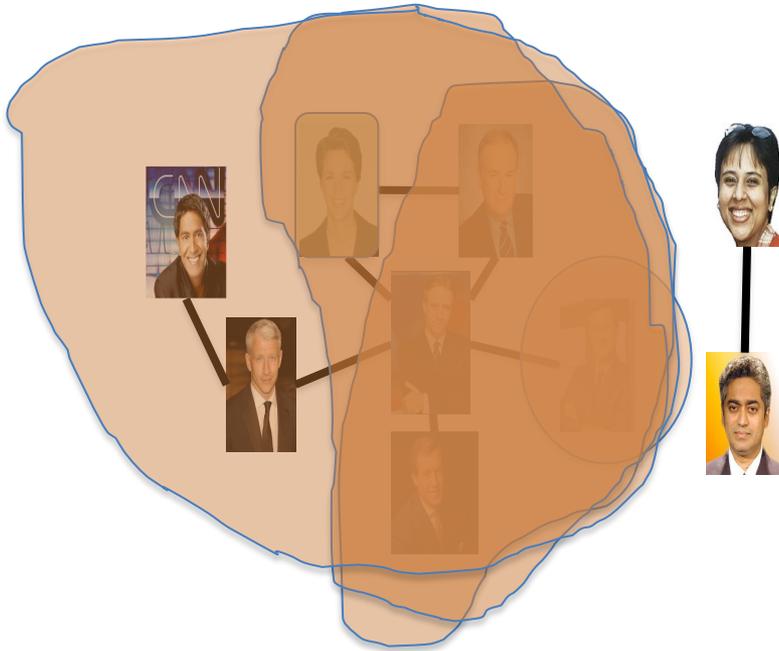
All non-tree edges are in the same or consecutive layer

If u is in L_i then $\text{dist}(s,u) = i$

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 $R^* = R$

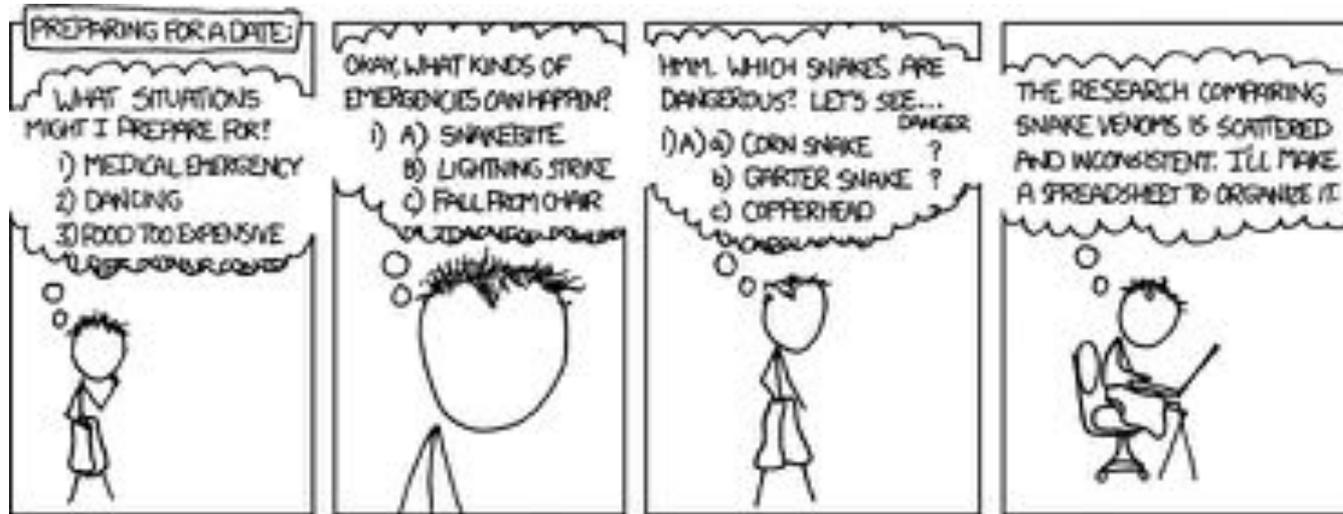
Argue correctness on the board...



BFS



Depth First Search (DFS)



I REALLY NEED TO STOP USING DEPTH-FIRST SEARCHES.

<http://xkcd.com/761/>

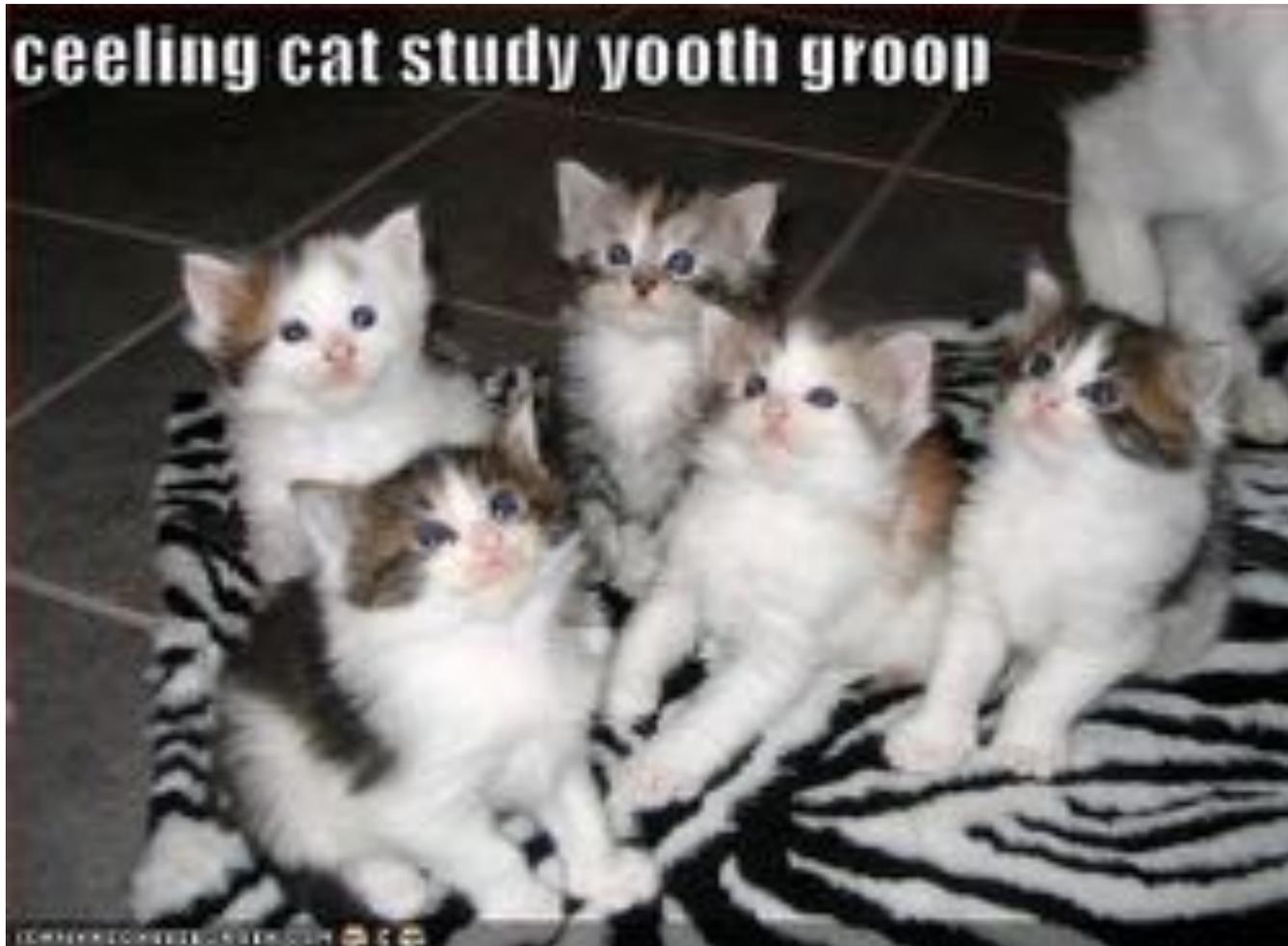
DFS(**u**)

Mark **u** as explored and add **u** to **R**

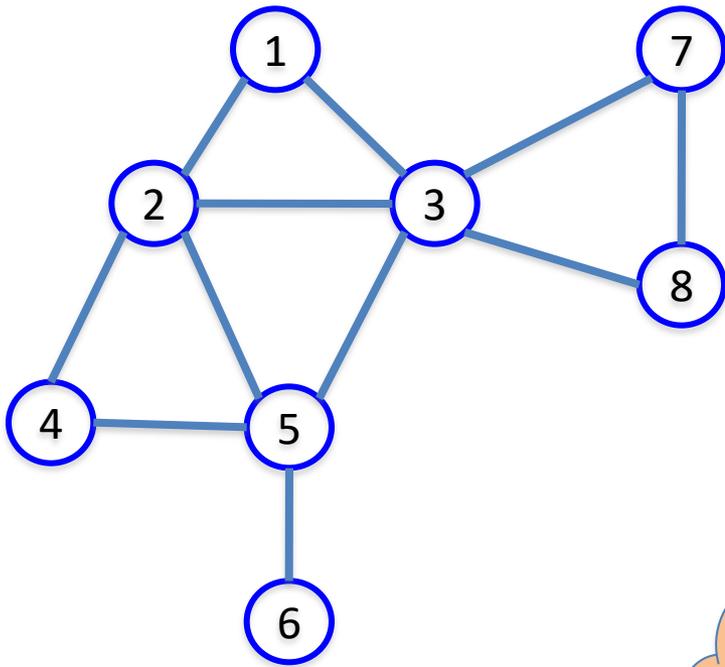
For each edge (**u**,**v**)

 If **v** is not explored then DFS(**v**)

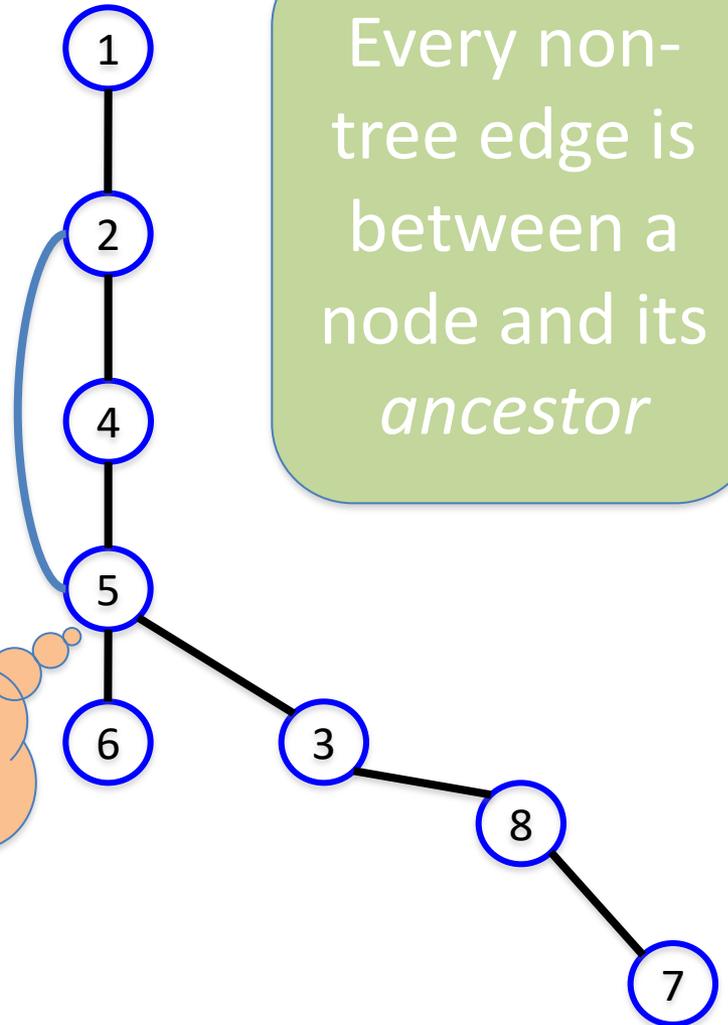
Why is DFS a special case of Explore?



A DFS run



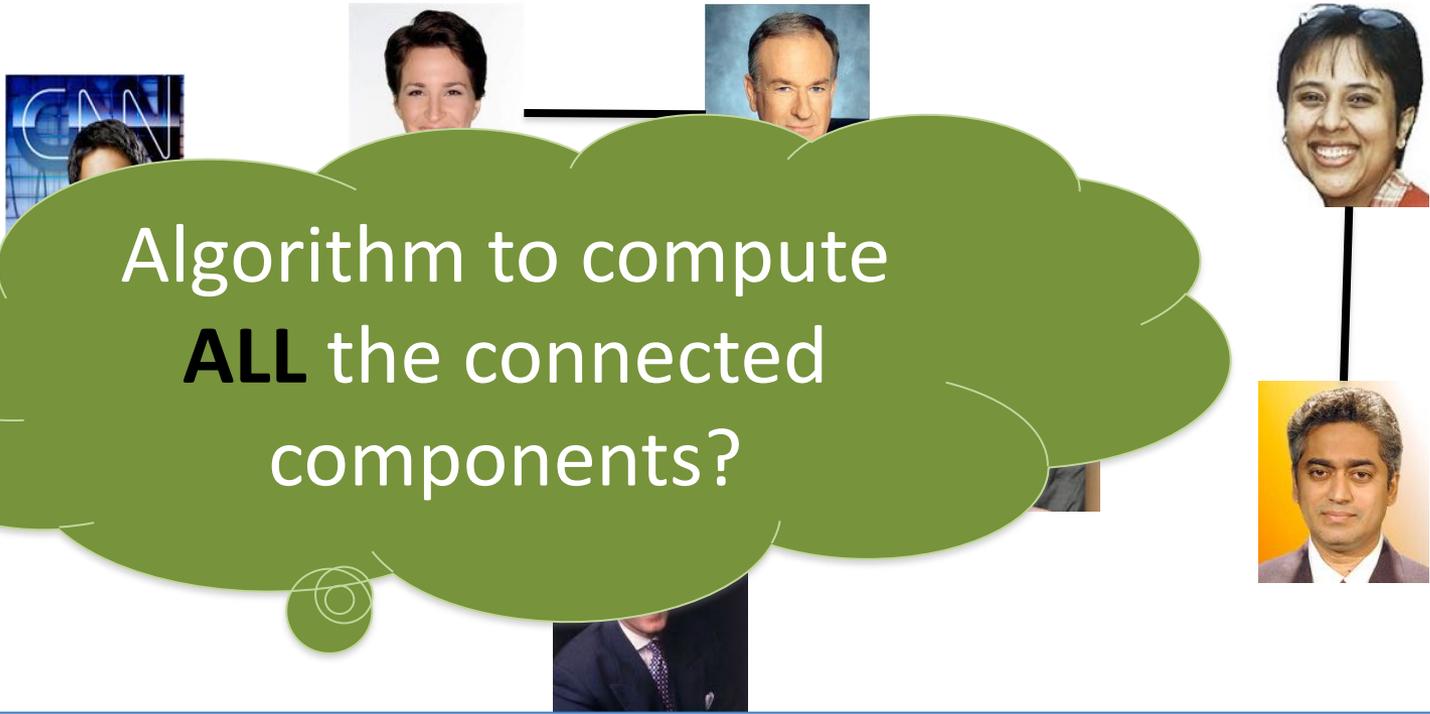
DFS tree



Every non-tree edge is between a node and its *ancestor*

Connected components are disjoint

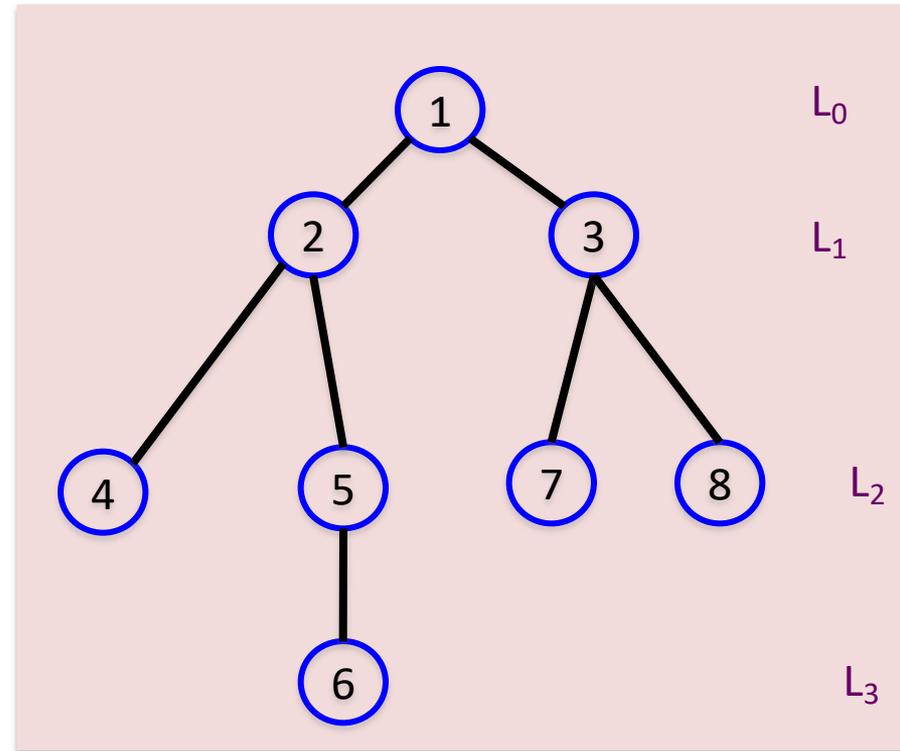
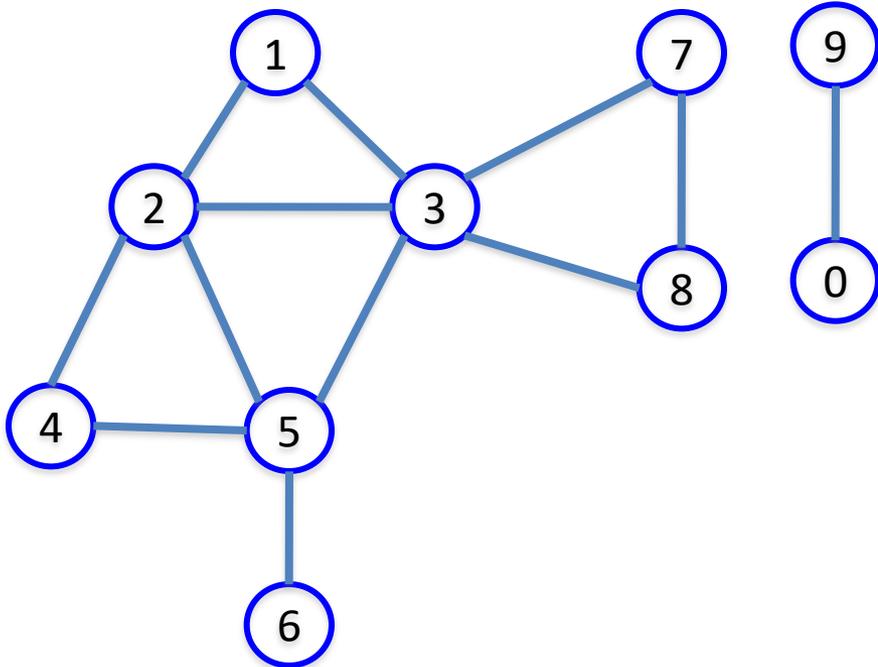
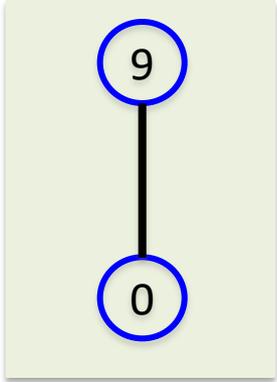
Either Connected components of s and t are the same or are disjoint



Algorithm to compute
ALL the connected
components?

Run BFS on some node s . Then run BFS on t that is not connected to s

Computing all CCs



Questions?

