

Lecture 13

CSE 331

Sep 28, 2022

If you need it, ask for help



Project groups due **FRIDAY!**

Deadline: Friday, Sep 30, 11:59pm

CSE 331

Syllabus

Piazza

Schedule

Homeworks -

Autolab

Project -

Support Pages -

channel

Sample Exams -

Forming groups

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

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.

Also, if you form a group of size three, please make **only one submission per group**.

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.

</> Potential risk

Note that if you pick the option of being assigned a random group, you take on the risk that a assigned group might not "pull their weight." We unfortunately cannot help with such aspects of group dynamics. (Of course if a group member is being abusive, please do let Atri know.) Please note that a group member who does not do much work will get penalized on the [individual component](#) of the project grade.

• 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, September 30**.

• </> Deadline is strict!

If you do not fill in 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 up by tomorrow on preparing for mid-terms

Sample mid-terms

note @182 stop following 2 views Actions

Sample mid-term exams

You can access the two sample mid-terms (and their solutions) from the navbar on the CSE 331 webpage:

<http://www-student.cse.buffalo.edu/~atri/cse331/fall22/index.html>

I would highly recommend that you do **not** peek into the solutions till you have tried to solve the sample mid-terms.

Here are the direct links:

- [Sample mid-term 1 \(and its solutions\)](#)
- [Sample mid-term 2 \(and its solutions\)](#)

Over the next couple of days, I will put up a post on the mid-terms in general (what topics will be on it, some thoughts on how to prepare and so on). But for now, here is one important clarification: **The sample mid-terms are ONLY meant for y'all to get familiar with the format of the exams.** You should not deduce *ANYTHING* about the coverage of topics or hardness of the exams from the sample mid-terms above. (The mid-term post will talk more about the topics and the actual mid-terms will be harder than the sample exams above).

mid-term

Edit good note | 0

Updated 4 minutes ago by Atri Rudra

Bit more on Quiz 1

note @183 stop following 1 view Actions

Quiz 1 on Friday, Oct 7

The first quiz will be from 11:00-11:10am in class on Friday, October 7. We will have a 5 mins break after the quiz and the lecture will start at 10:35am.

We will hand out the quiz paper at 10:55am but you will **NOT** be allowed to open the quiz to see the actual questions till 11:00am. However, you can use those 5 minutes to go over the instructions and get yourself in the zone.

There will be two T/F with justification questions (like those in the sample mid term 1: @182.) Also quiz 1 will cover all topics we cover in class till Friday, Sep 30.

Also like the mid-term y'all can bring in one letter sized cheat-sheet (you can use both sides). But other than cheatsheet and writing implements nothing else is allowed.

quiz1

Edit good note 0

Updated 3 minutes ago by Abri Rudra

HW 3 out

Homework 3

Due by **11:30pm, Tuesday, October 4, 2022**.

Make sure you follow all the [homework policies](#).

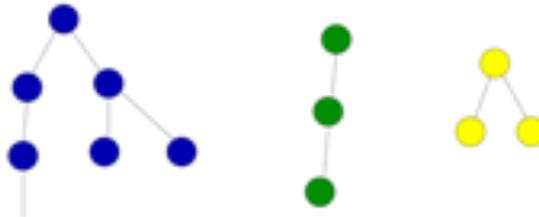
All submissions should be done via [Autolab](#).

Sample Problem

The Problem

This problem is just to get you thinking about graphs and get more practice with proofs.

A **forest** with c components is a graph that is the union of c disjoint trees. The figure below shows for an example with $c = 3$ and $n = 13$ with the three connected components colored blue, red and yellow).



! For those of you who are feeling a little ambitious

For the top 3 submissions in the scoreboard in Python, the top 2 submissions in the scoreboard in Java and the top submission in the scoreboard in C++, we are offering 2.5 bonus points. But be warned! You should not be spending too much time on this. We rather you work on Questions 1 and 2 above.

HW 2 solutions posted

note @191    - stop following **2 views** Actions ▾

Solutions to HW 2 (+HW 3 out)

Here is a link to solutions for HW 1: <https://buffalo.box.com/s/xu4kvaajo114ddj0t14826f7b5fgag>

Please note that downloading is disabled and please do not share the link with anyone else.

Also this will be a good time to do a post-mortem on HW 2: @93

On a related note, HW2 is up: <http://www-student.cse.buffalo.edu/~atri/cse331/fall22/hws/hw3/index.html>

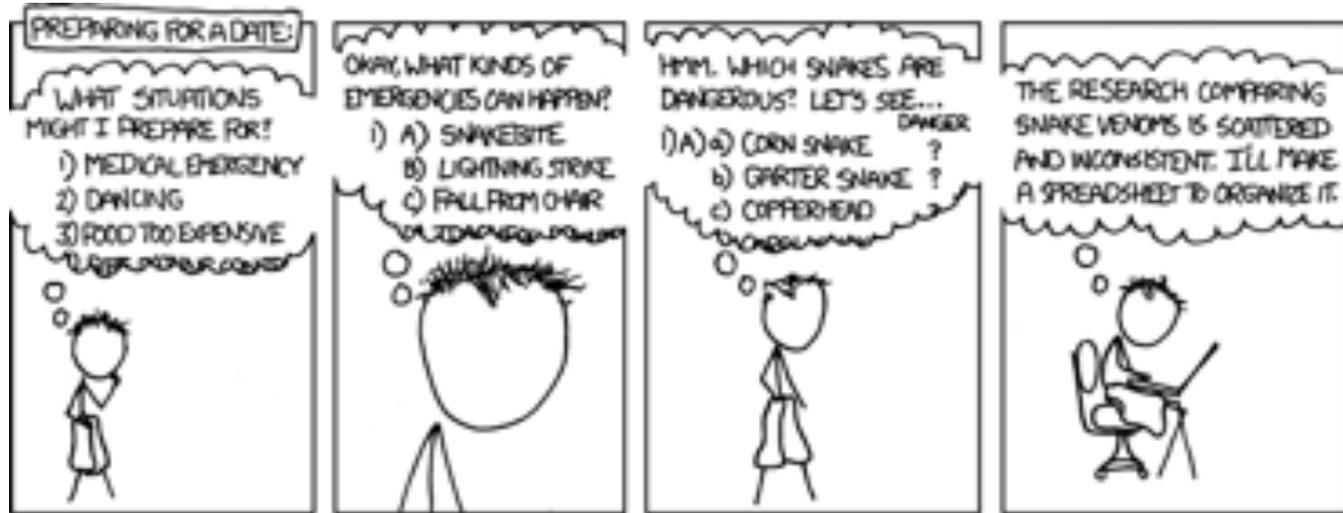
[homework2](#) [homework3](#)

Edit good note | 0 Updated 34 seconds ago by Atri Rudra

Questions?



Depth First Search (DFS)



I REALLY NEED TO STOP USING DEPTH-FIRST SEARCHES.

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

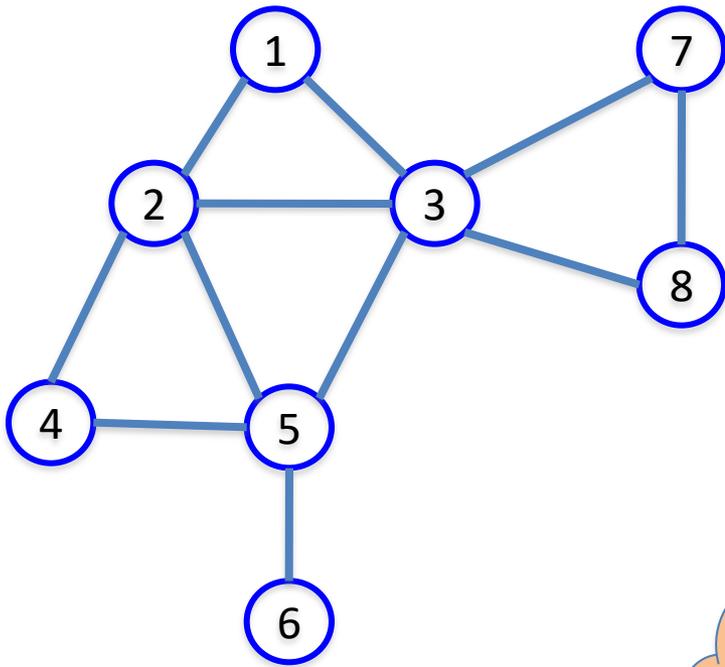
DFS(**u**)

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

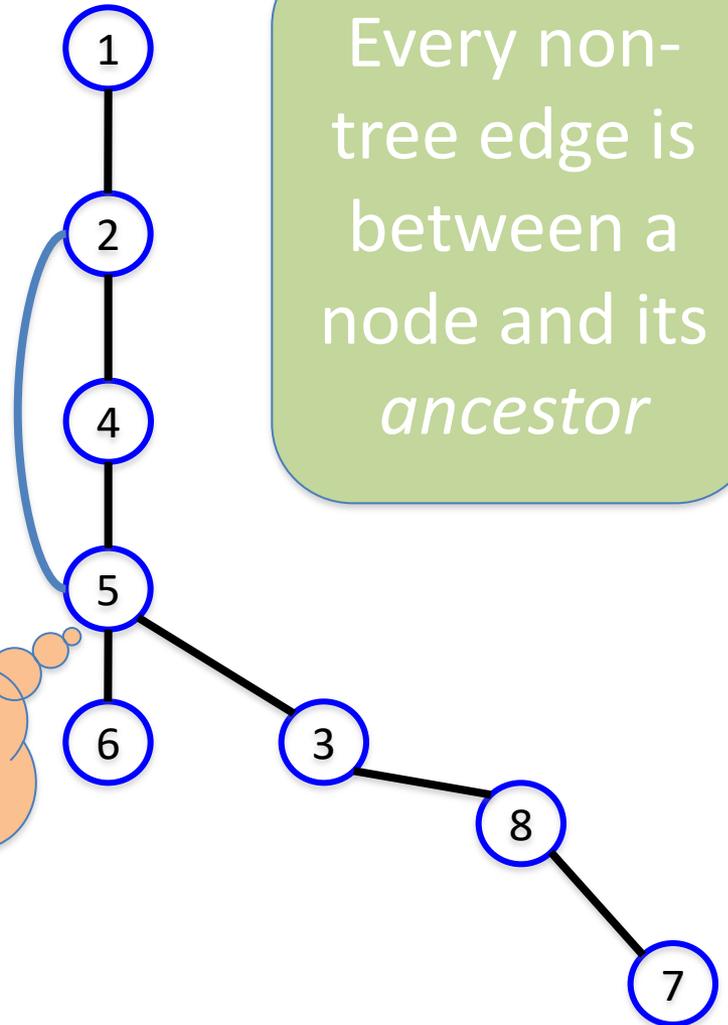
For each edge (**u**,**v**)

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

A DFS run



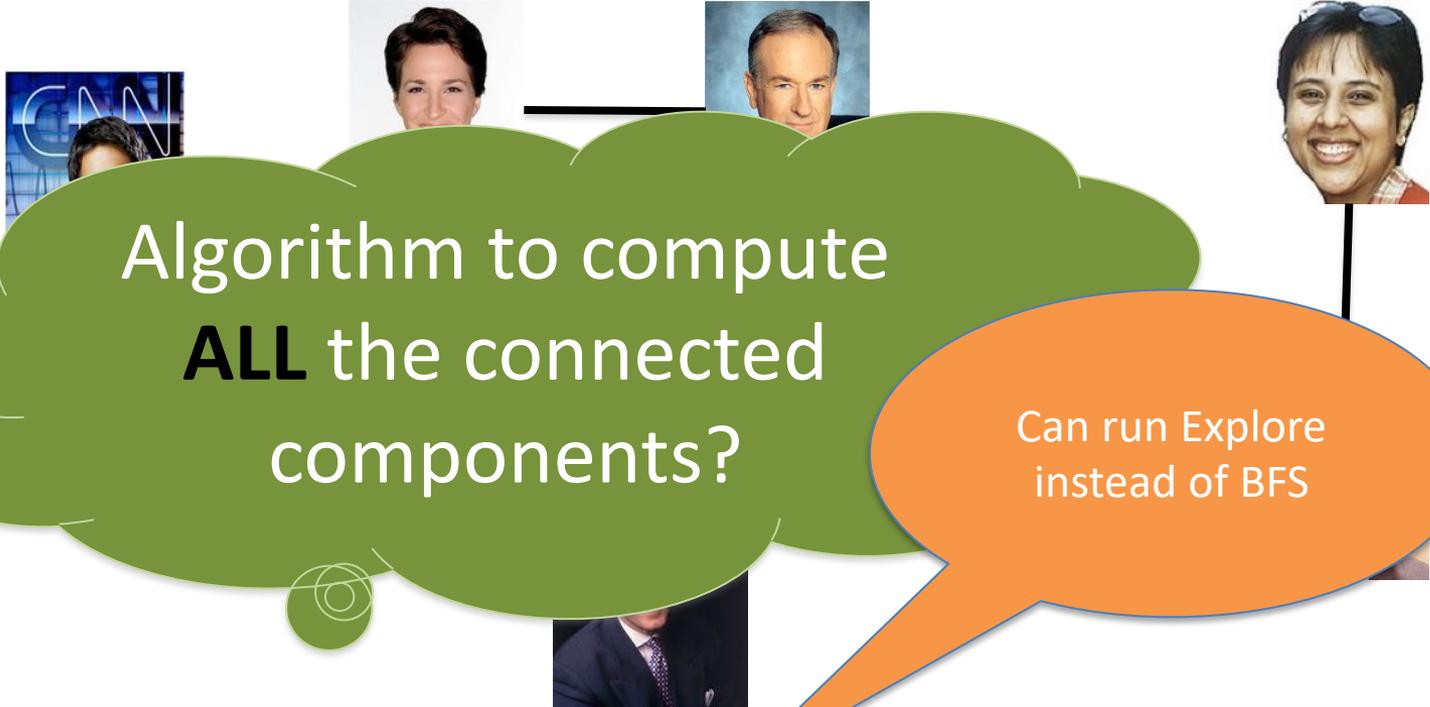
DFS tree



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

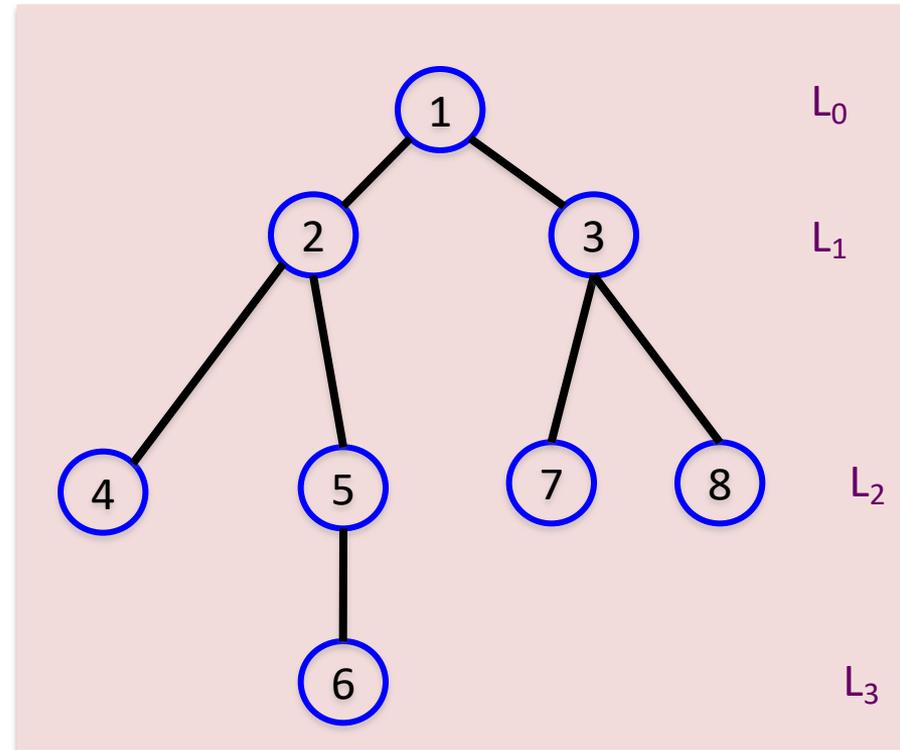
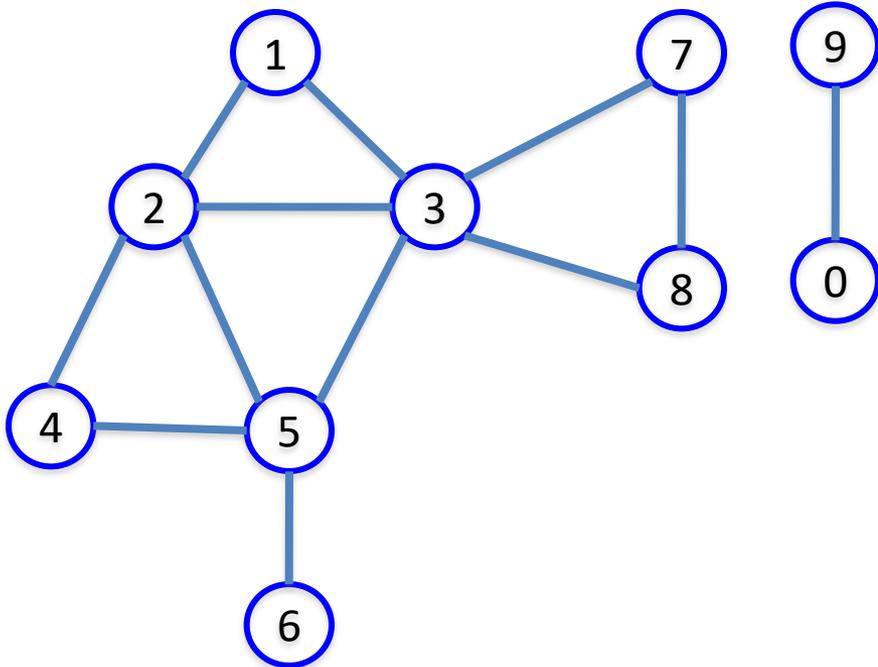
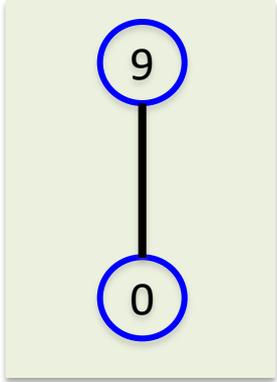


Algorithm to compute
ALL the connected
components?

Can run Explore
instead of BFS

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

Computing all CCs



Today's agenda

Run-time analysis of BFS (DFS)



Stacks and Queues



Last in First out

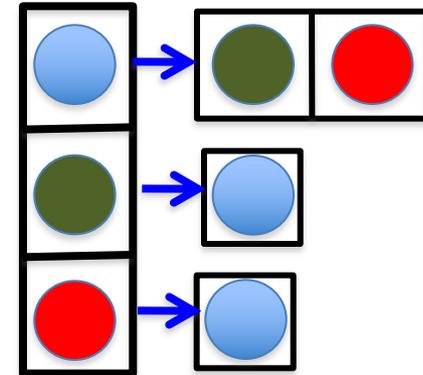
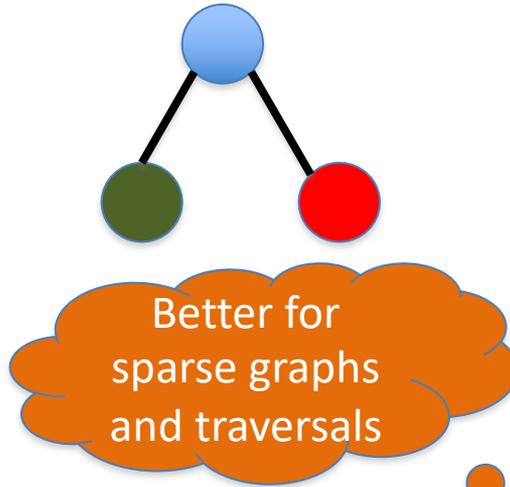
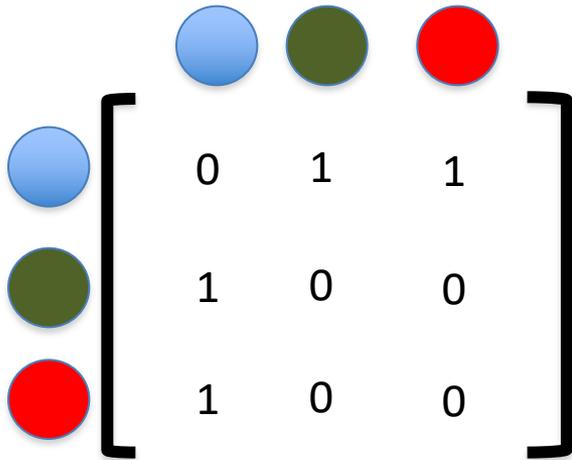


First in First out

But first...

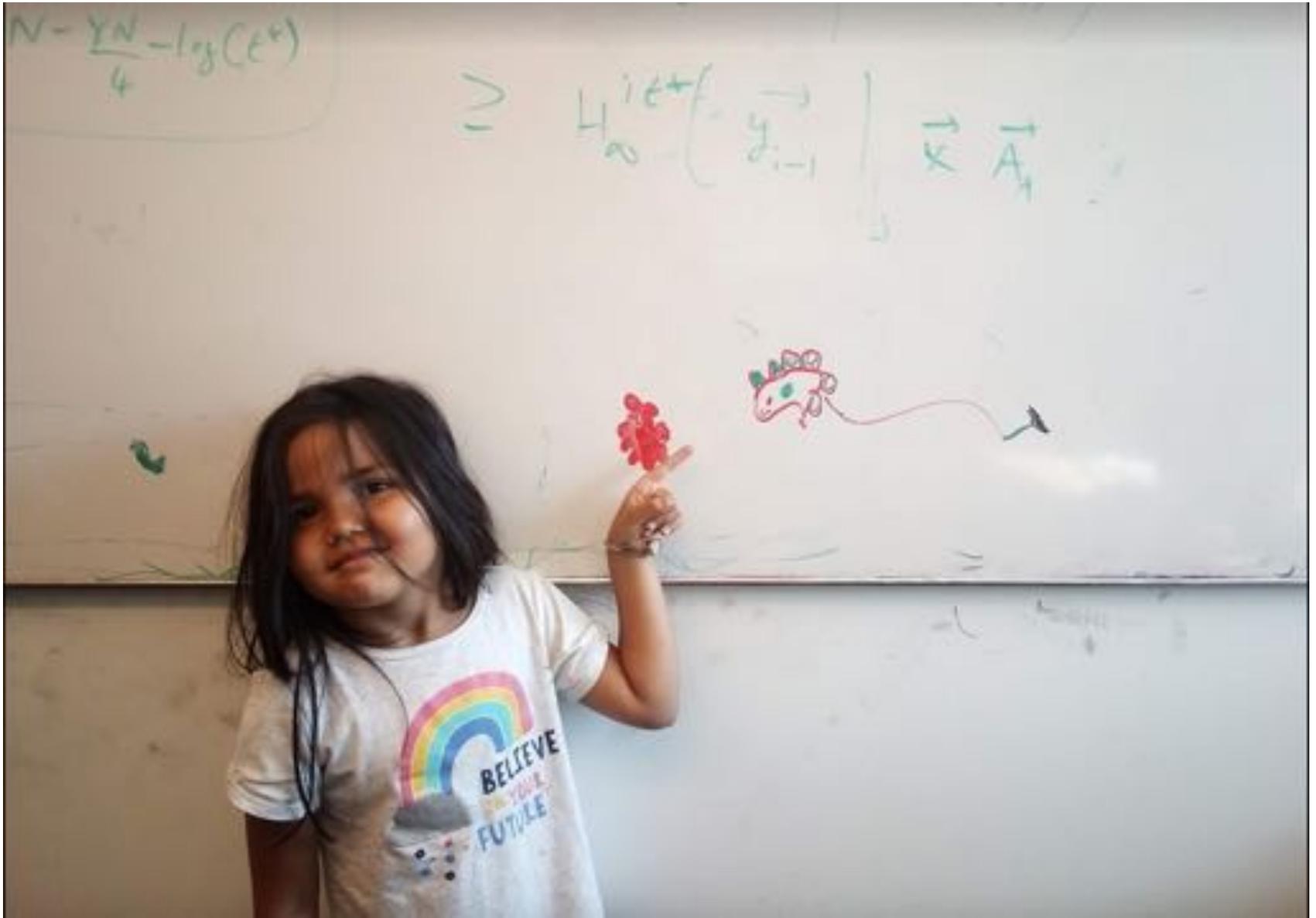
How do we represent graphs?

Graph representations



Adjacency matrix		Adjacency List
$O(1)$	$(u,v) \in E?$	$O(n) [O(n_v)]$
$O(n)$	All neighbors of u ?	$O(n_u)$
$O(n^2)$	Space?	$O(m+n)$

Questions/Comments?

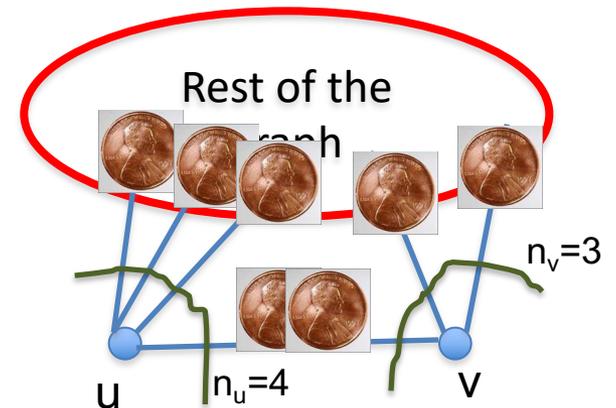


2 · # edges = sum of # neighbors

$$2m = \sum_{u \in V} n_u$$

Give 2 pennies to each edge

Total # of pennies = $2m$



Each edges gives one penny to its end points

of pennies u receives = n_u

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

Use linked lists

Use $CC[v]$ array

Rest of Today's agenda

Space complexity of Adjacency list representation

Quick run time analysis for BFS

Quick run time analysis for DFS (and Queue version of BFS)