Lecture 13

CSE 331

Sep 29, 2021

Please have a face mask on

Masking requirement

Your face mask **must cover** your nose and mouth at all times.

UB 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

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.**

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

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/fall21/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

HW 3 out

Homework 3

Due by **8:00am, Wednesday, September 29, 2021**.

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, read and yellow).
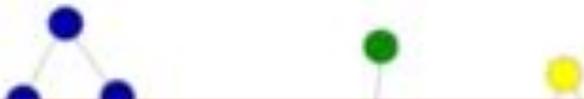
! For those of you who are feeling a little ambitious

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
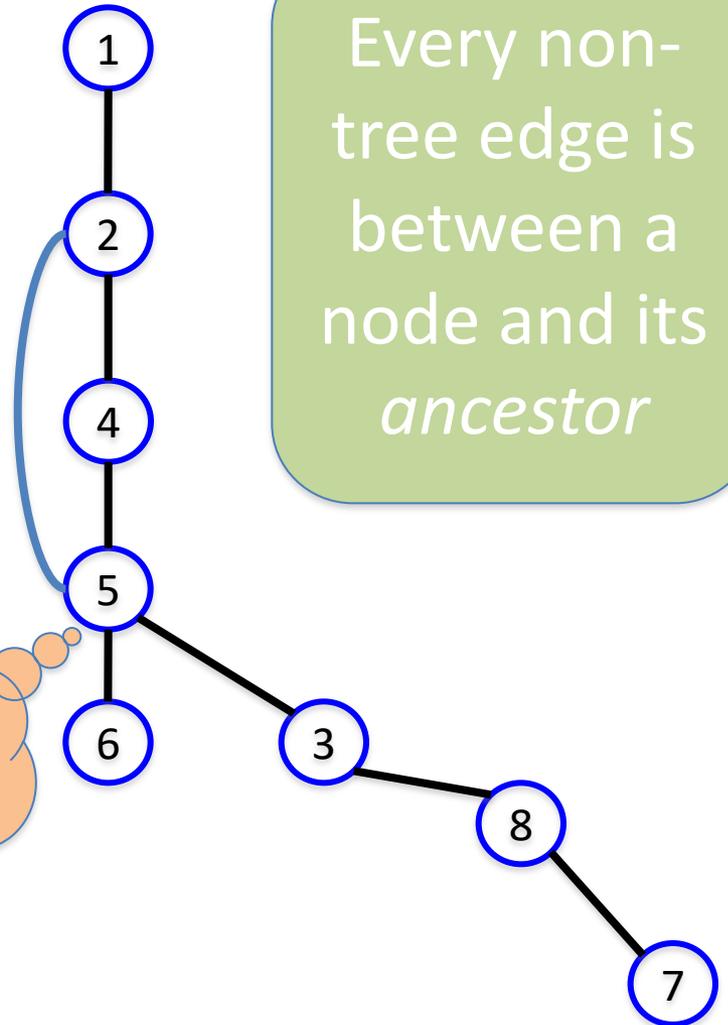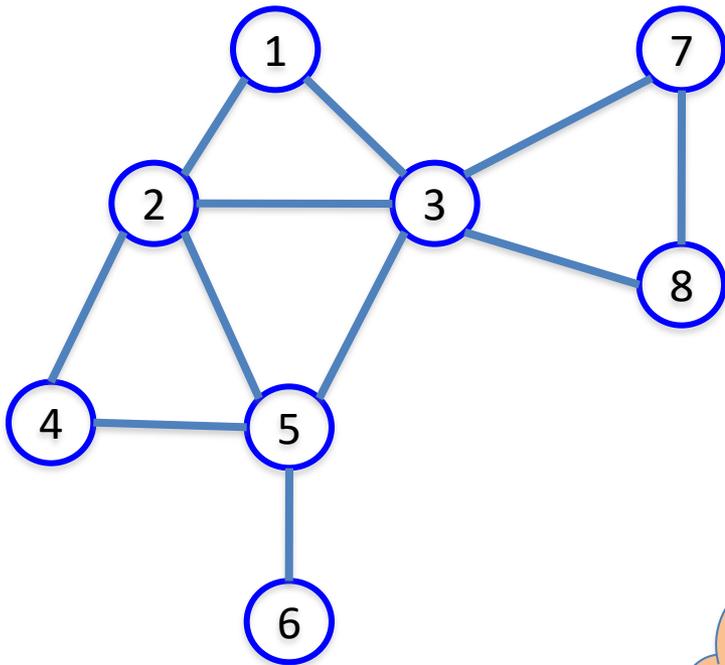
Questions?

Depth First Search (DFS)

http://xkcd.com/761/

DFS(u)

Mark u as explored and add u to R

For each edge (u,v)

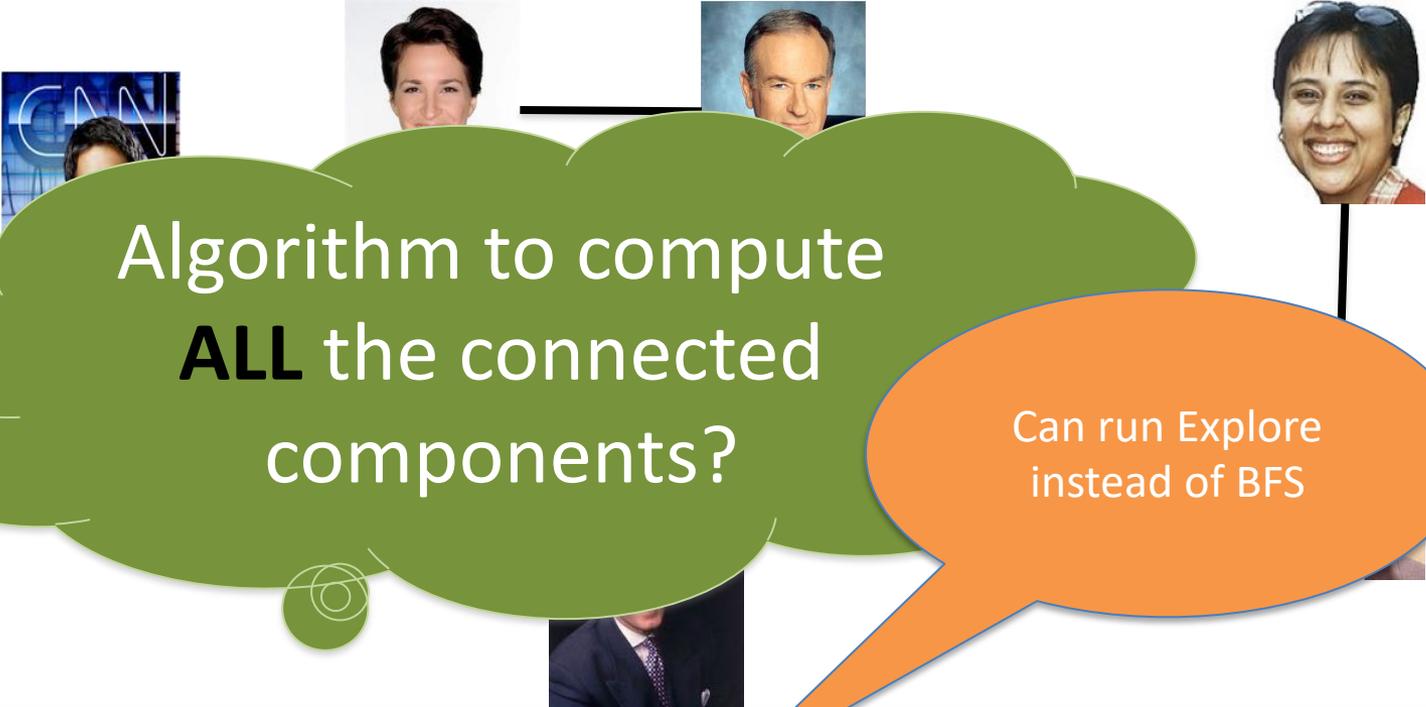   If v is not explored then DFS(v)

A DFS run

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

DFS tree

Connected components are disjoint

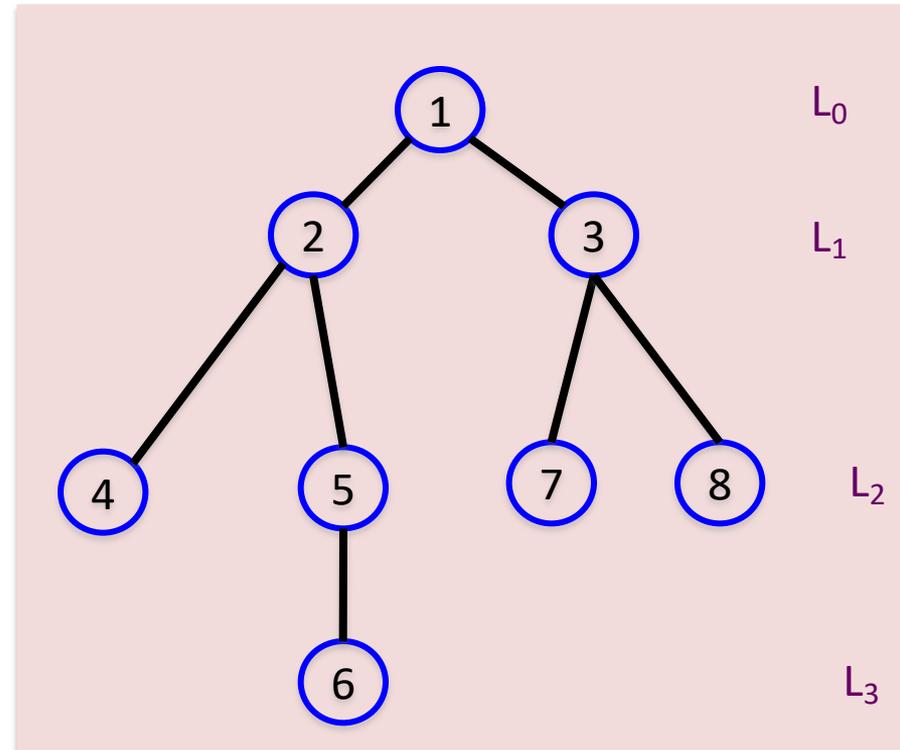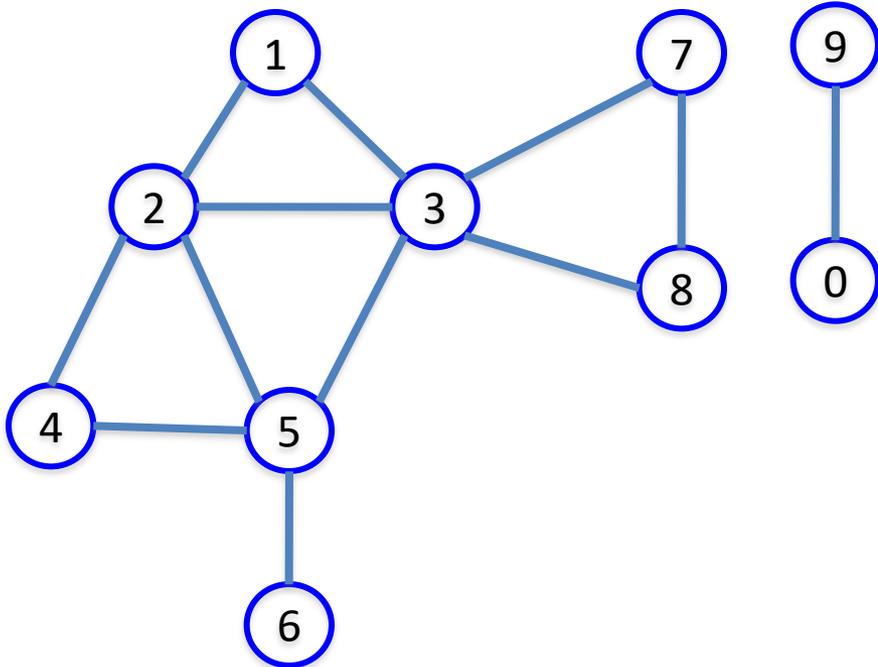Either Connected components of s and t are the same or are disjoint
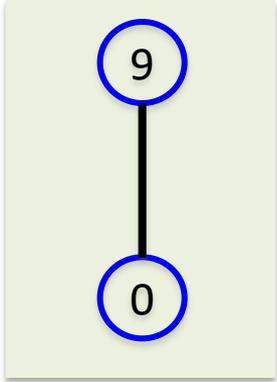

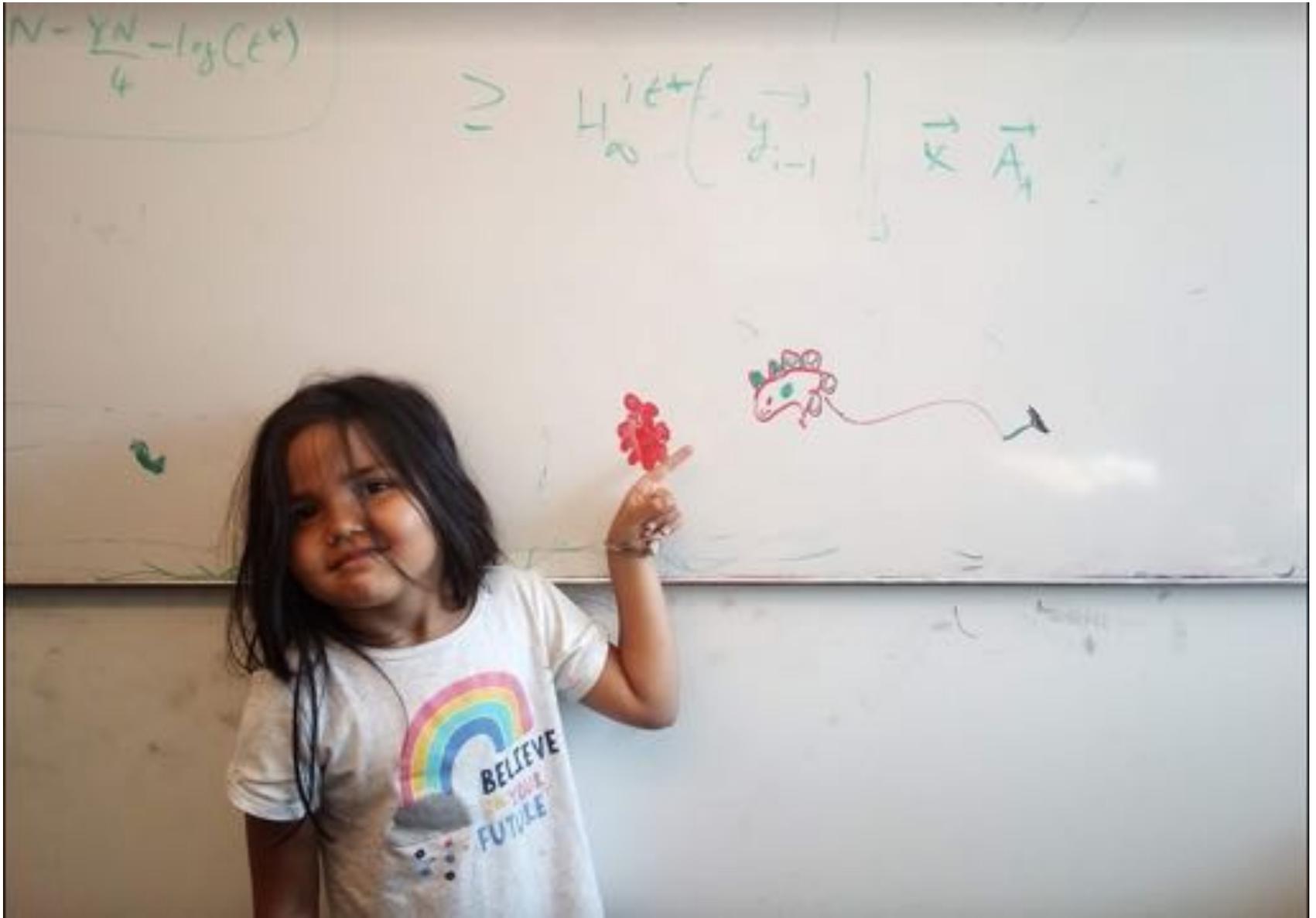Algorithm to compute **ALL** the connected components?

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

Questions/Comments?

Today's agenda

Run-time analysis of BFS (DFS)
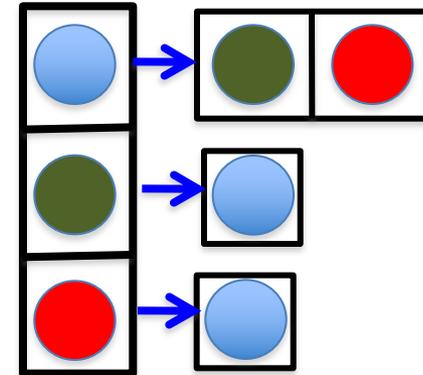
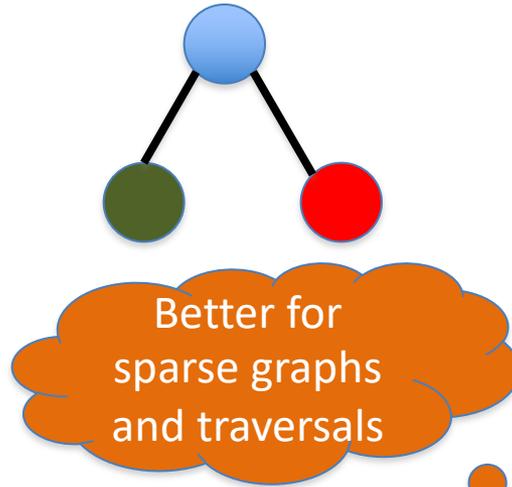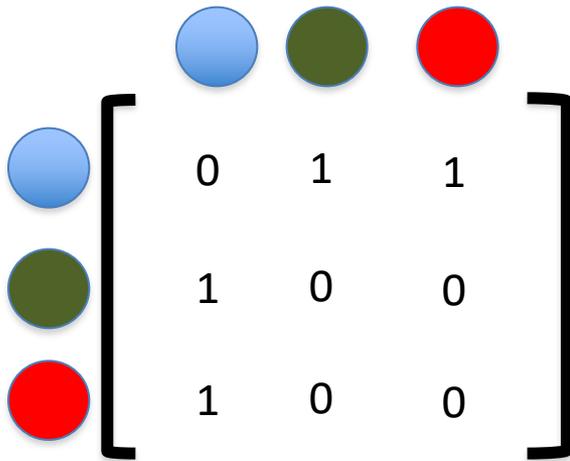# Stacks and Queues
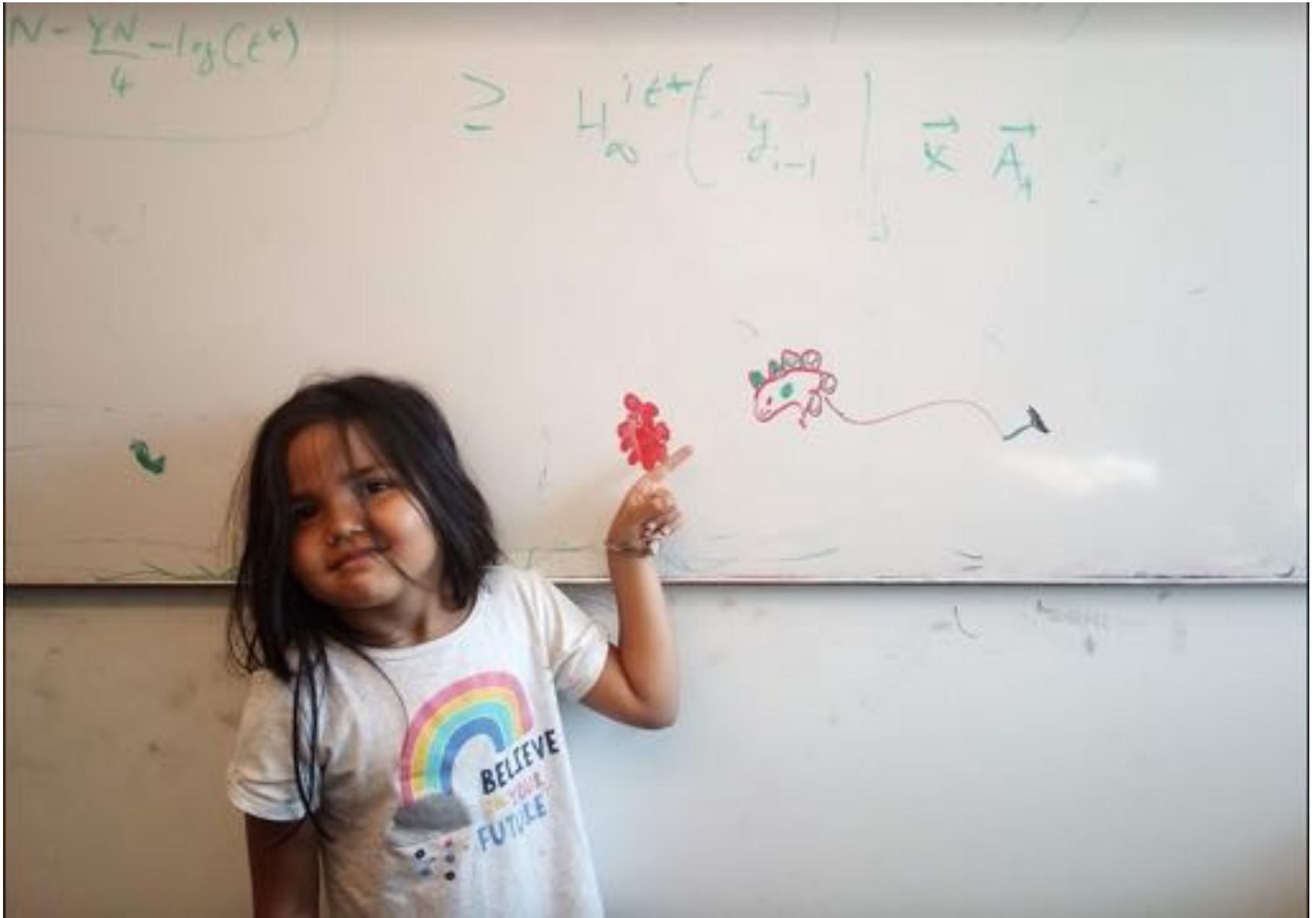

Last in First out

First in First out

But first…

How do we represent graphs?

Graph representations

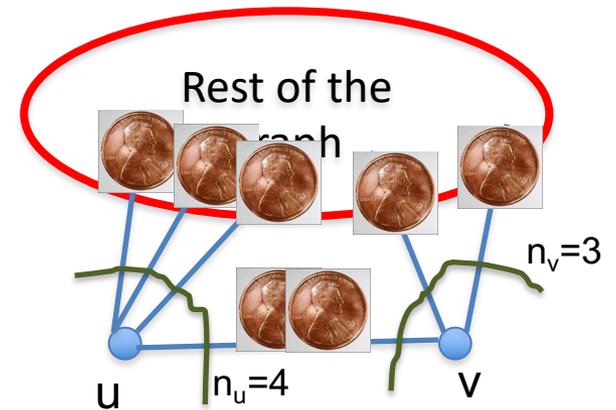| Adjacency matrix		Adjacency List
O(1)	(u,v) in E?	O(n) [O(n_v)]
O(n)	All neighbors of u?	O(n_u)
O(n^2)	Space?	O(m+n)

Questions/Comments?

2·# edges = sum of # neighbors

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

Give 2 pennies to each edge

Total # of pennies = 2m

Rest of the graph

$n_v = 3$

$n_u = 4$

u   v

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 $L_0, .., L_j$ 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)