Lecture 14

CSE 331

Sep 27, 2024

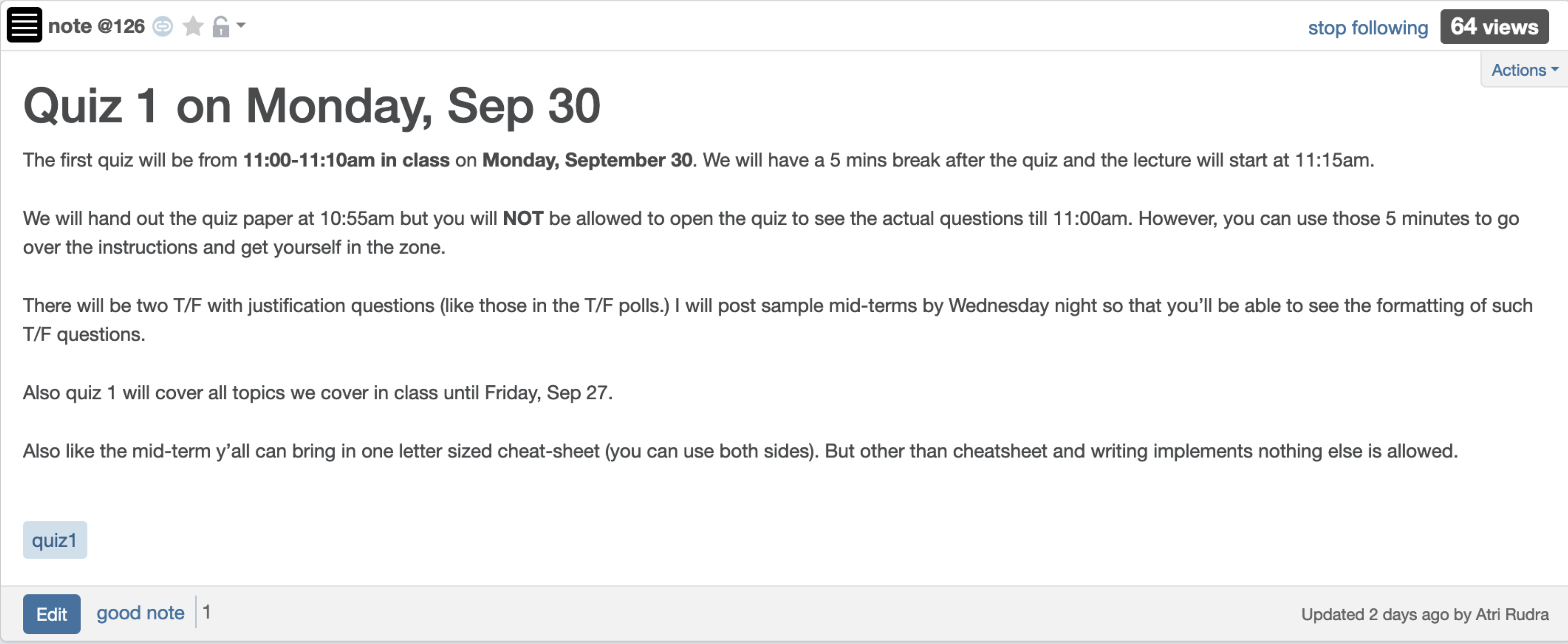
Upcoming quiz/exams

Quiz 1 on MONDAY

Mid-term 1 Mon Oct 7

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

Bit more on Quiz 1



Quiz 1 on Monday, Sep 30

The first quiz will be from **11:00-11:10am in class** on **Monday, September 30**. We will have a 5 mins break after the quiz and the lecture will start at 11:15am.

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.

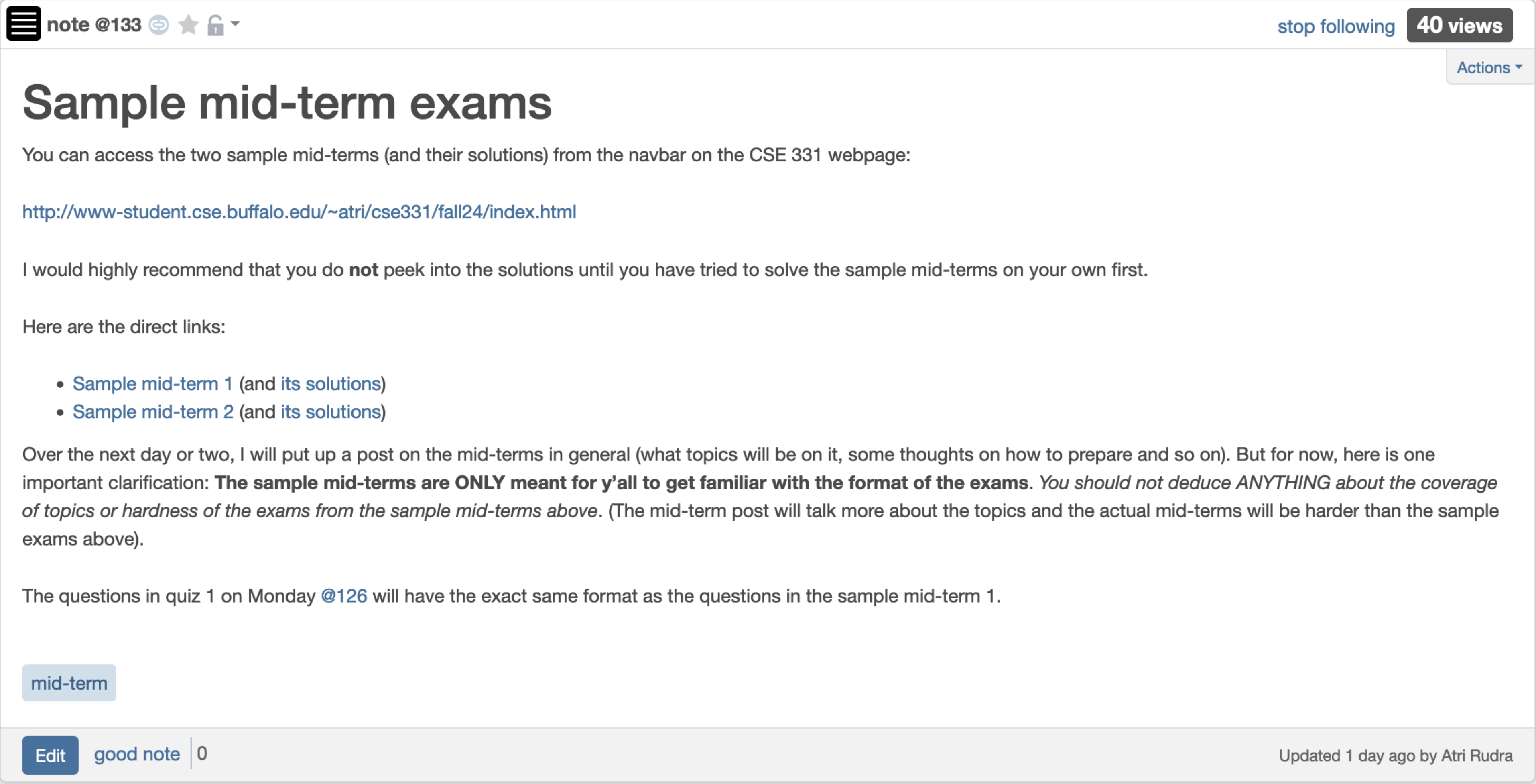
There will be two T/F with justification questions (like those in the T/F polls.) I will post sample mid-terms by Wednesday night so that you'll be able to see the formatting of such T/F questions.

Also quiz 1 will cover all topics we cover in class until Friday, Sep 27.

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.

Updated 2 days ago by Atri Rudra

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/fall24/index.html

I would highly recommend that you do **not** peek into the solutions until you have tried to solve the sample mid-terms on your own first.

Here are the direct links:

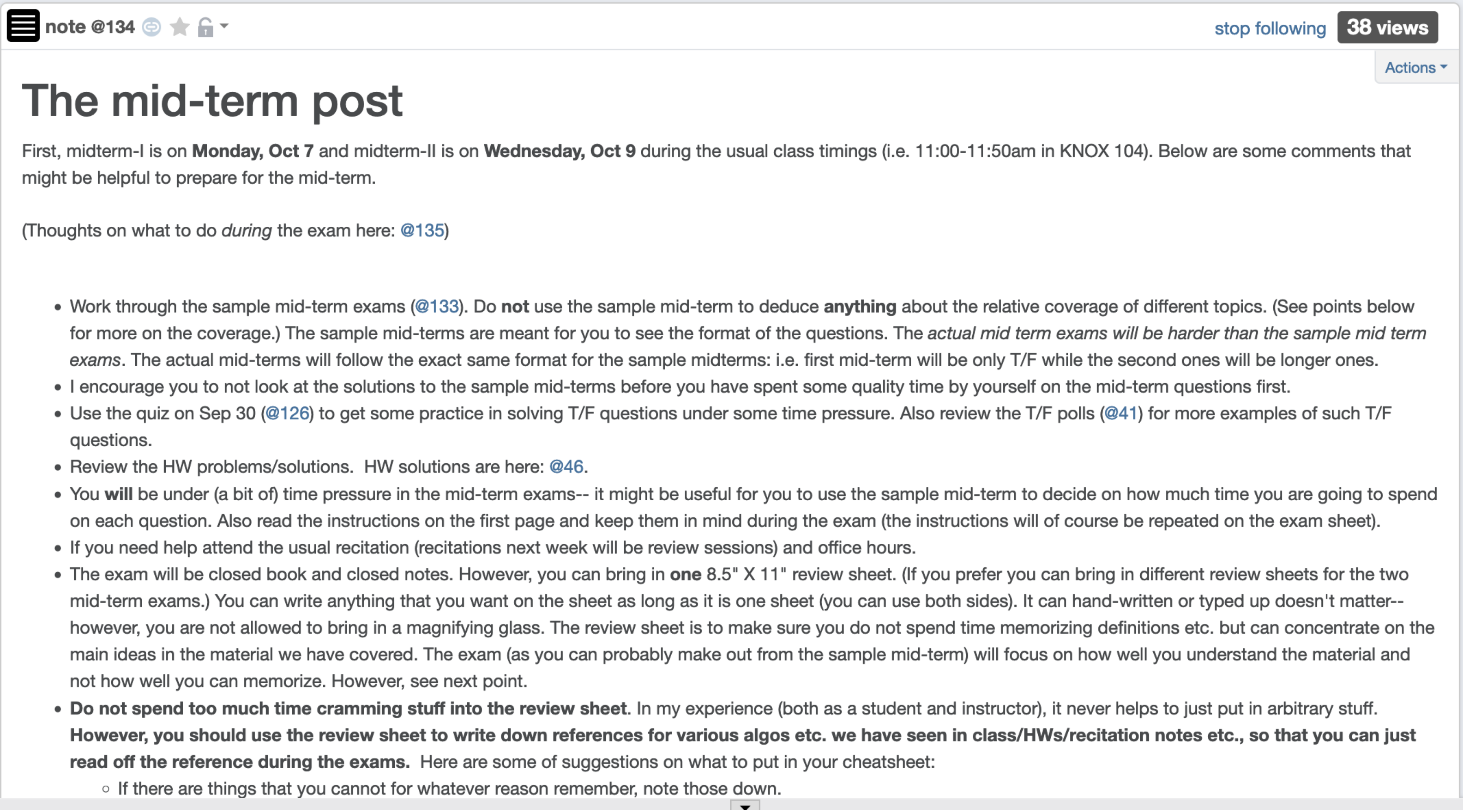
- Sample mid-term 1 (and its solutions)
- Sample mid-term 2 (and its solutions)

Over the next day or two, 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).

The questions in quiz 1 on Monday @126 will have the exact same format as the questions in the sample mid-term 1.

Updated 1 day ago by Atri Rudra

Mid-term post 1



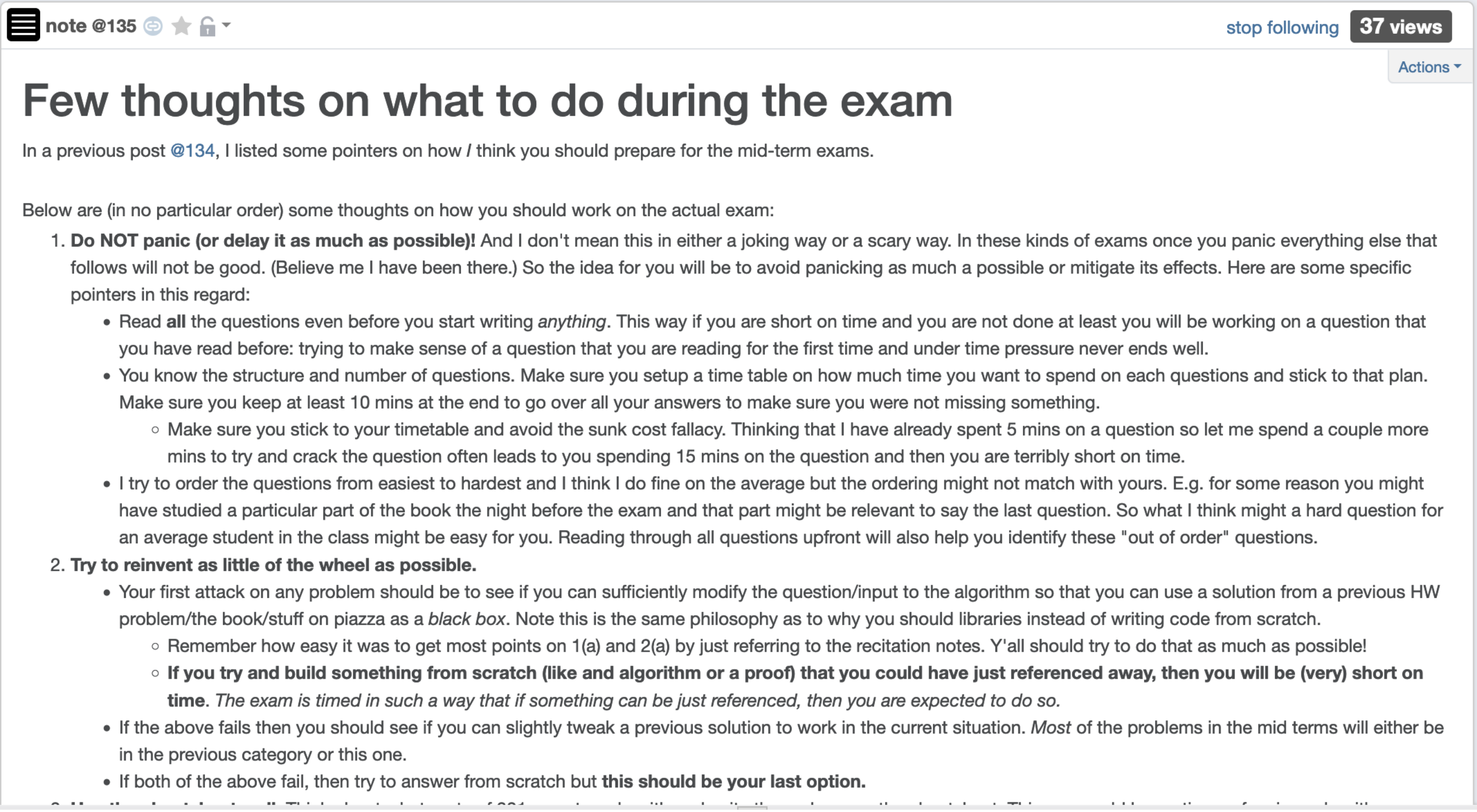
The mid-term post

First, midterm-I is on **Monday, Oct 7** and midterm-II is on **Wednesday, Oct 9** during the usual class timings (i.e. 11:00-11:50am in KNOX 104). Below are some comments that might be helpful to prepare for the mid-term.

(Thoughts on what to do *during* the exam here: @135)

- Work through the sample mid-term exams (@133). Do **not** use the sample mid-term to deduce **anything** about the relative coverage of different topics. (See points below for more on the coverage.) The sample mid-terms are meant for you to see the format of the questions. The *actual mid term exams will be harder than the sample mid term exams*. The actual mid-terms will follow the exact same format for the sample midterms: i.e. first mid-term will be only T/F while the second ones will be longer ones.
- I encourage you to not look at the solutions to the sample mid-terms before you have spent some quality time by yourself on the mid-term questions first.
- Use the quiz on Sep 30 (@126) to get some practice in solving T/F questions under some time pressure. Also review the T/F polls (@41) for more examples of such T/F questions.
- Review the HW problems/solutions. HW solutions are here: @46.
- You **will** be under (a bit of) time pressure in the mid-term exams-- it might be useful for you to use the sample mid-term to decide on how much time you are going to spend on each question. Also read the instructions on the first page and keep them in mind during the exam (the instructions will of course be repeated on the exam sheet).
- If you need help attend the usual recitation (recitations next week will be review sessions) and office hours.
- The exam will be closed book and closed notes. However, you can bring in **one** 8.5" X 11" review sheet. (If you prefer you can bring in different review sheets for the two mid-term exams.) You can write anything that you want on the sheet as long as it is one sheet (you can use both sides). It can hand-written or typed up doesn't matter-- however, you are not allowed to bring in a magnifying glass. The review sheet is to make sure you do not spend time memorizing definitions etc. but can concentrate on the main ideas in the material we have covered. The exam (as you can probably make out from the sample mid-term) will focus on how well you understand the material and not how well you can memorize. However, see next point.
- **Do not spend too much time cramming stuff into the review sheet**. In my experience (both as a student and instructor), it never helps to just put in arbitrary stuff. **However, you should use the review sheet to write down references for various algos etc. we have seen in class/HWs/recitation notes etc., so that you can just read off the reference during the exams.** Here are some of suggestions on what to put in your cheatsheet:
    - If there are things that you cannot for whatever reason remember, note those down.

Mid-term post 2



Few thoughts on what to do during the exam

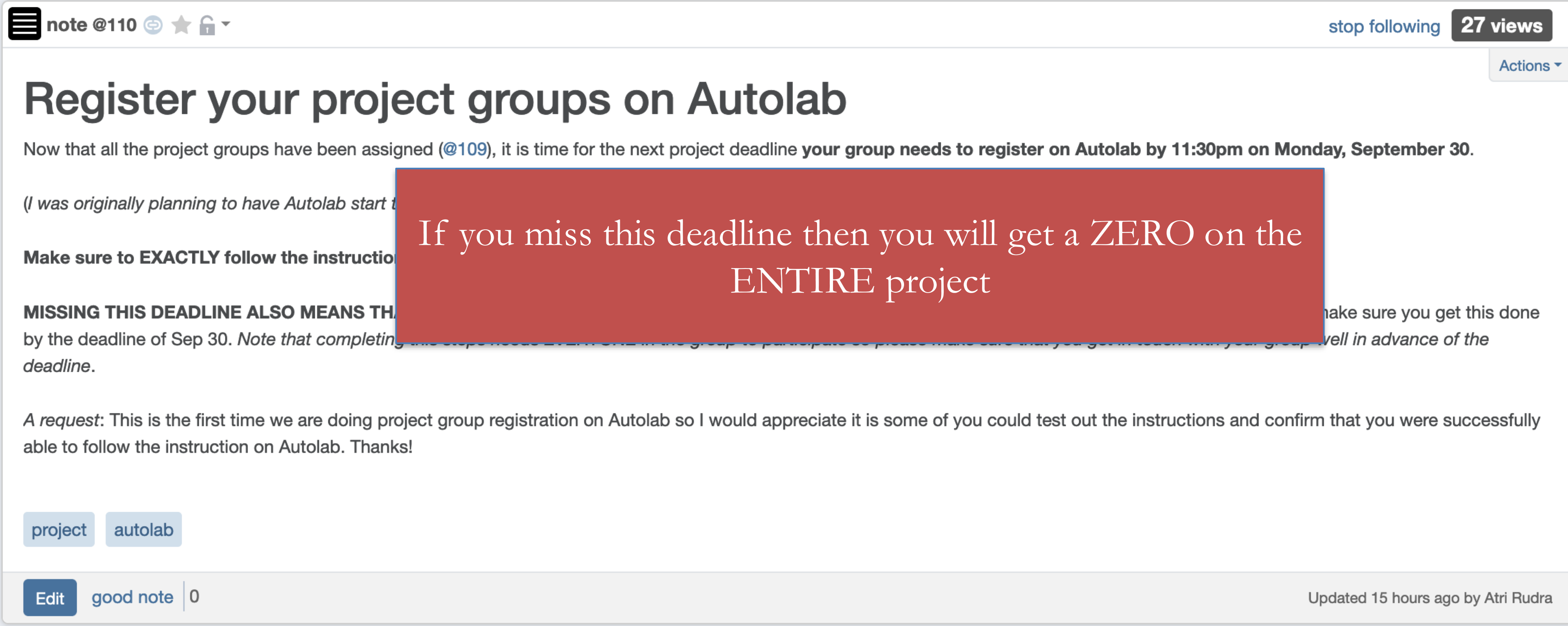
In a previous post @134, I listed some pointers on how *I* think you should prepare for the mid-term exams.

Below are (in no particular order) some thoughts on how you should work on the actual exam:

1. **Do NOT panic (or delay it as much as possible)!** And I don't mean this in either a joking way or a scary way. In these kinds of exams once you panic everything else that follows will not be good. (Believe me I have been there.) So the idea for you will be to avoid panicking as much a possible or mitigate its effects. Here are some specific pointers in this regard:
    - Read **all** the questions even before you start writing *anything*. This way if you are short on time and you are not done at least you will be working on a question that you have read before: trying to make sense of a question that you are reading for the first time and under time pressure never ends well.
    - You know the structure and number of questions. Make sure you setup a time table on how much time you want to spend on each questions and stick to that plan. Make sure you keep at least 10 mins at the end to go over all your answers to make sure you were not missing something.
        - Make sure you stick to your timetable and avoid the sunk cost fallacy. Thinking that I have already spent 5 mins on a question so let me spend a couple more mins to try and crack the question often leads to you spending 15 mins on the question and then you are terribly short on time.
    - I try to order the questions from easiest to hardest and I think I do fine on the average but the ordering might not match with yours. E.g. for some reason you might have studied a particular part of the book the night before the exam and that part might be relevant to say the last question. So what I think might a hard question for an average student in the class might be easy for you. Reading through all questions upfront will also help you identify these "out of order" questions.
2. **Try to reinvent as little of the wheel as possible.**
    - Your first attack on any problem should be to see if you can sufficiently modify the question/input to the algorithm so that you can use a solution from a previous HW problem/the book/stuff on piazza as a *black box*. Note this is the same philosophy as to why you should libraries instead of writing code from scratch.
        - Remember how easy it was to get most points on 1(a) and 2(a) by just referring to the recitation notes. Y'all should try to do that as much as possible!
        - **If you try and build something from scratch (like and algorithm or a proof) that you could have just referenced away, then you will be (very) short on time.** *The exam is timed in such a way that if something can be just referenced, then you are expected to do so.*
    - If the above fails then you should see if you can slightly tweak a previous solution to work in the current situation. *Most* of the problems in the mid terms will either be in the previous category or this one.
    - If both of the above fail, then try to answer from scratch but **this should be your last option.**

Autolab Project Group Registration

Also due Monday



note @110

stop following

27 views

Register your project groups on Autolab

Now that all the project groups have been assigned (@109), it is time for the next project deadline **your group needs to register on Autolab by 11:30pm on Monday, September 30**.

(I was originally planning to have Autolab start t

Make sure to EXACTLY follow the instructio

MISSING THIS DEADLINE ALSO MEANS TH ake sure you get this done by the deadline of Sep 30. *Note that completin* *vell in advance of the deadline*.

A request: This is the first time we are doing project group registration on Autolab so I would appreciate it is some of you could test out the instructions and confirm that you were successfully able to follow the instruction on Autolab. Thanks!

Updated 15 hours ago by Atri Rudra

If you miss this deadline then you will get a ZERO on the ENTIRE project

Submission stats on HW 2

Q1(a) submissions: 110 (FA 22: 150)

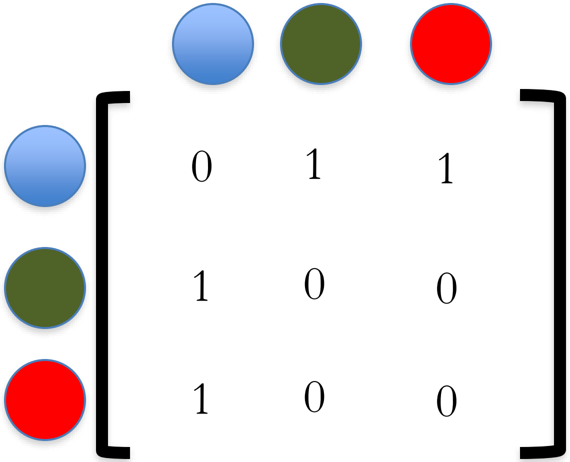
Q1(b) submissions: 97 (FA 22: 130)

Q2(a) submissions: 80 (FA 22: 112)

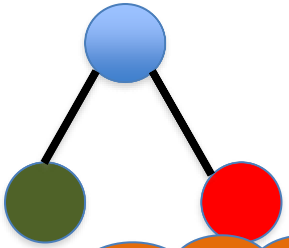
Q2(b) submissions: 46 (FA 22: 83)

Questions?

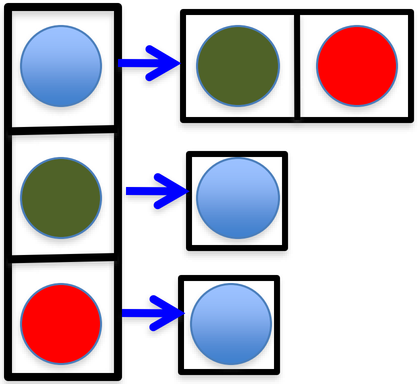
Graph representations



$$\begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$$



Better for
sparse graphs
and traversals



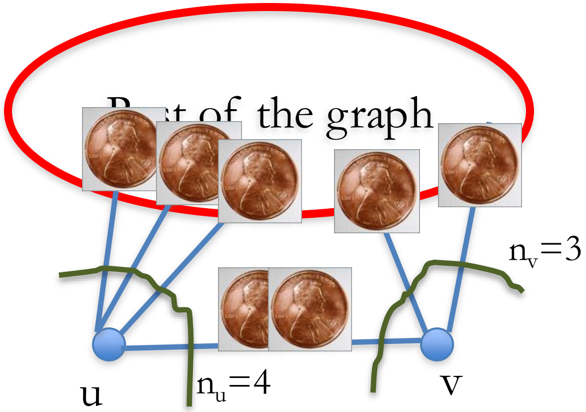
Adjacency matrix		Adjacency List
$O(1)$	(u,v) in E?	$O(n)$ [$O(n_v)$]
$O(n)$	All neighbors of u?	$O(n_u)$
$O(n^2)$	Space?	$O(m+n)$

2 # edges = sum of # neighbors

$$2m = \Sigma_{u \text{ in } V}\, n_u$$

Give 2 pennies to each edge

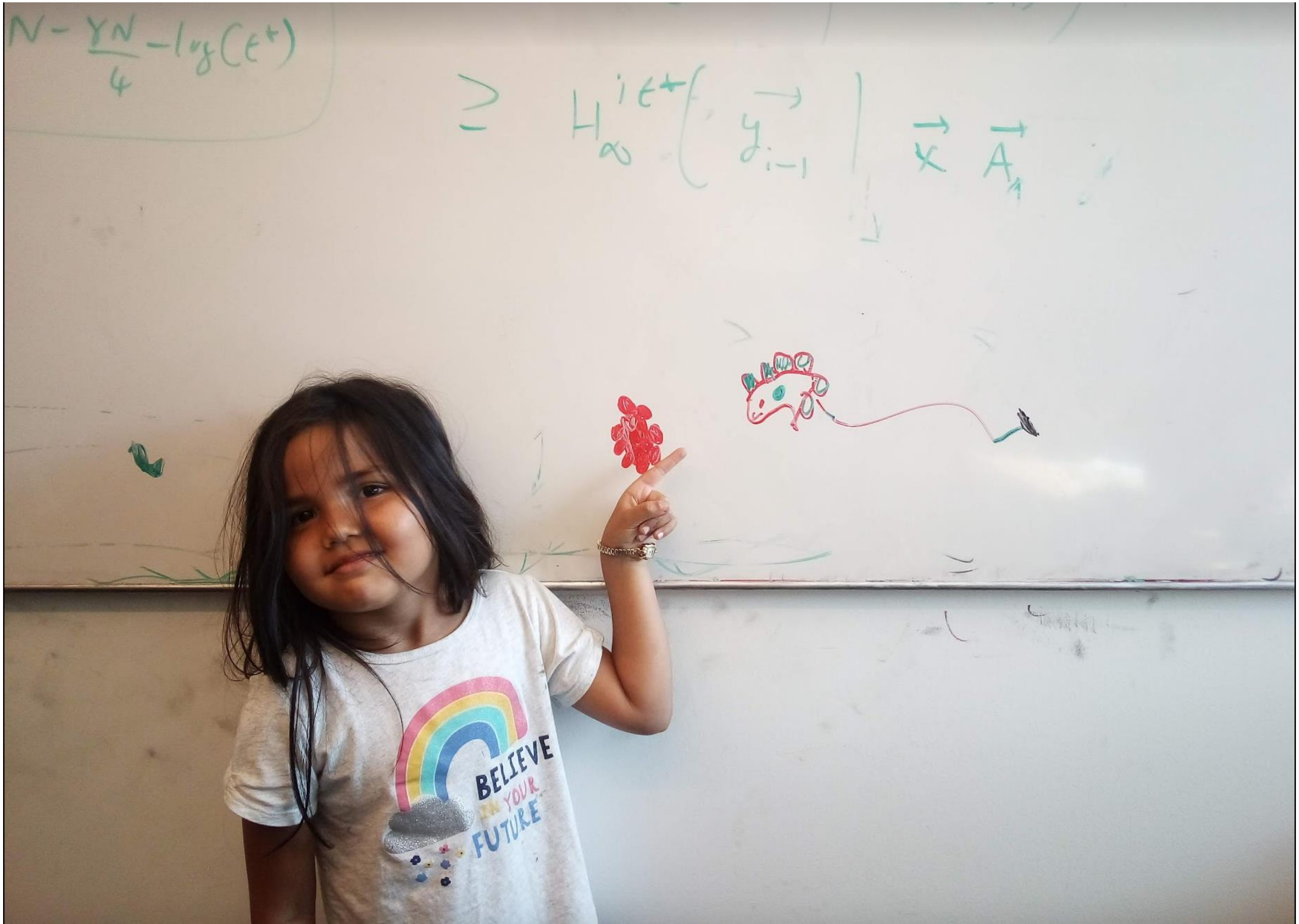
Total # of pennies = 2m



Each edges gives one penny to its end points

# of pennies u receives = n_u

Questions/Comments?



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

Quick run time analysis for BFS

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

Helping you schedule your activities for the day

Initial BFS analysis on the board…

O(m+n) BFS Implementation

```
BFS(s)

CC[s] = T and CC[w] = F for every w≠ s
Set i = 0
Set $L_0$= {s}
While $L_i$ is not empty
        $L_{i+1}$ = Ø
        For every u in $L_i$
                For every edge (u,w)
                If CC[w] = F then
                        CC[w] = T
                        Add w to $L_{i+1}$
        i++
```

Array

Linked List

Input graph as Adjacency list

Version in KT also computes a BFS tree

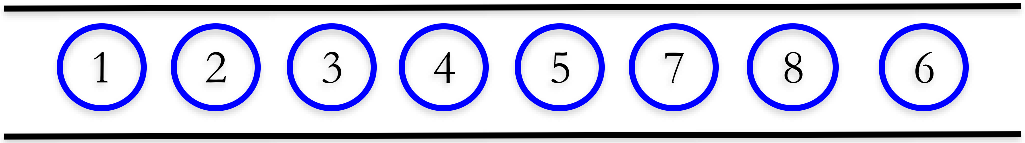
All the layers as one

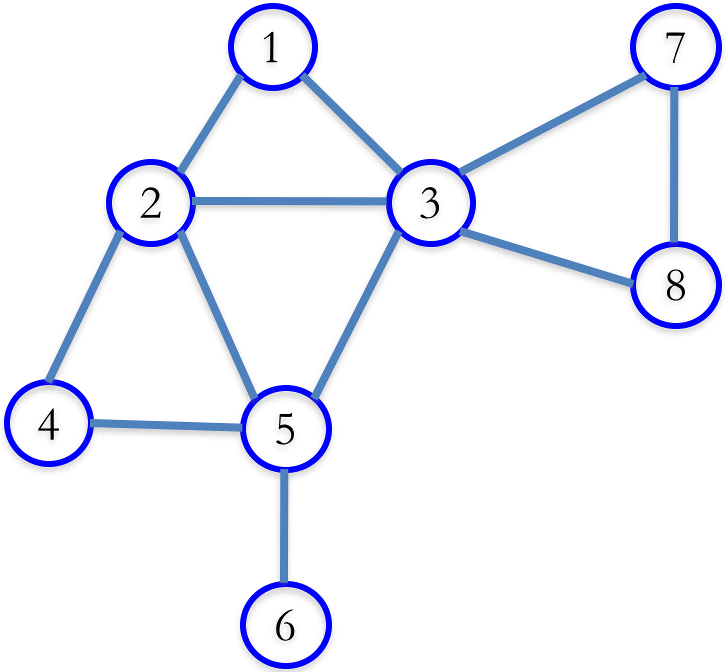
```
BFS(s)
    CC[s] = T and CC[w] = F for every $w \neq s$
    Set $i = 0$
    Set $L_0 = \{s\}$
    While $L_i$ is not empty
        $L_{i+1} = \emptyset$
        For every u in $L_i$
            For every edge (u,w)
            If CC[w] = F then
                CC[w] = T
                Add w to $L_{i+1}$
        i++
```

All layers are considered in first-in-first-out order

Can combine all layers into one queue: all the children of a node are added to the end of the queue

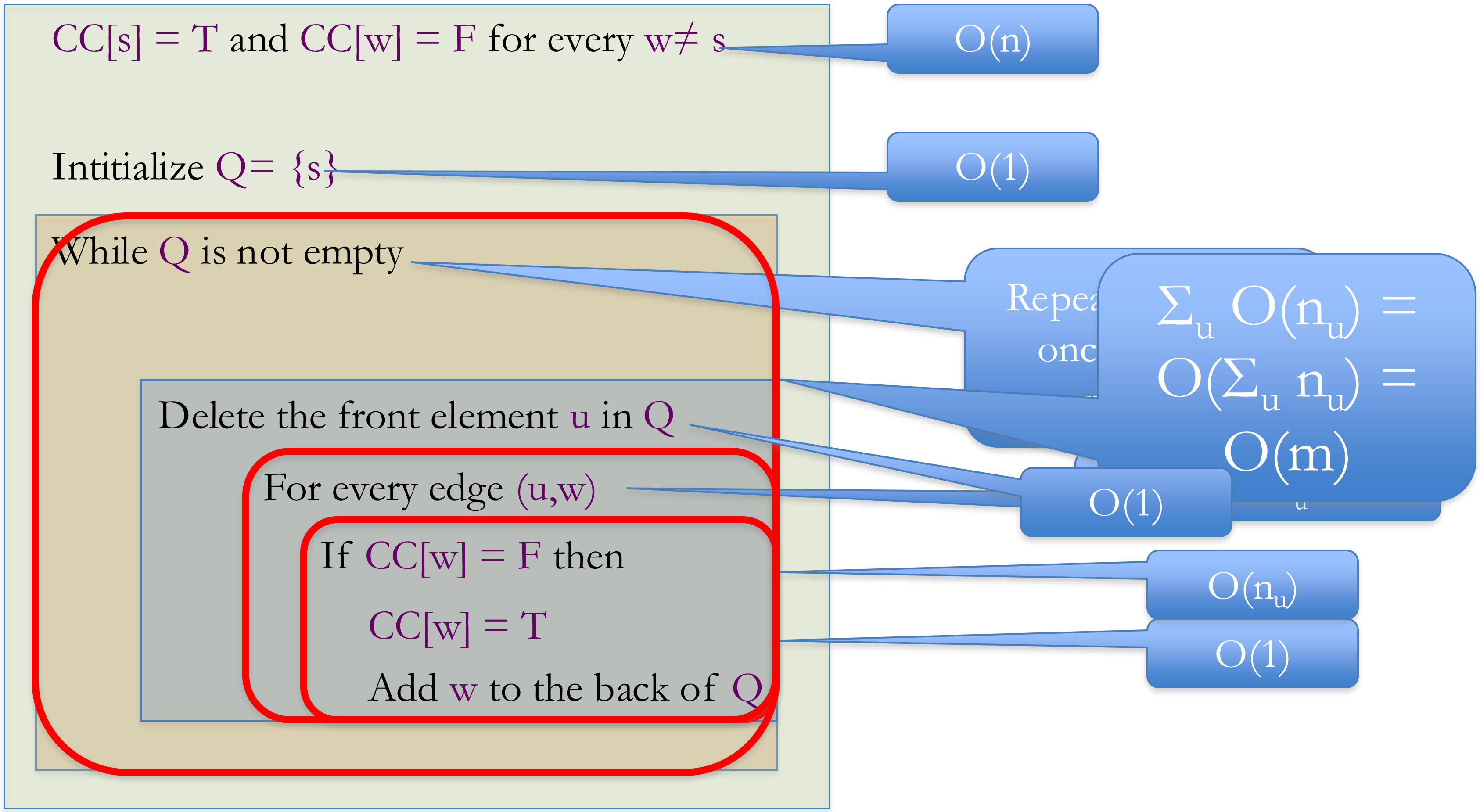
An illustration





Queue O(m+n) implementation

BFS(s)



```
CC[s] = T and CC[w] = F for every w≠ s
Intitialize Q= {s}
While Q is not empty
    Delete the front element u in Q
        For every edge (u,w)
            If CC[w] = F then
                CC[w] = T
                Add w to the back of Q
```

O(n)

O(1)

Repea

onc

$\Sigma_u O(n_u) = O(\Sigma_u n_u) = O(m)$

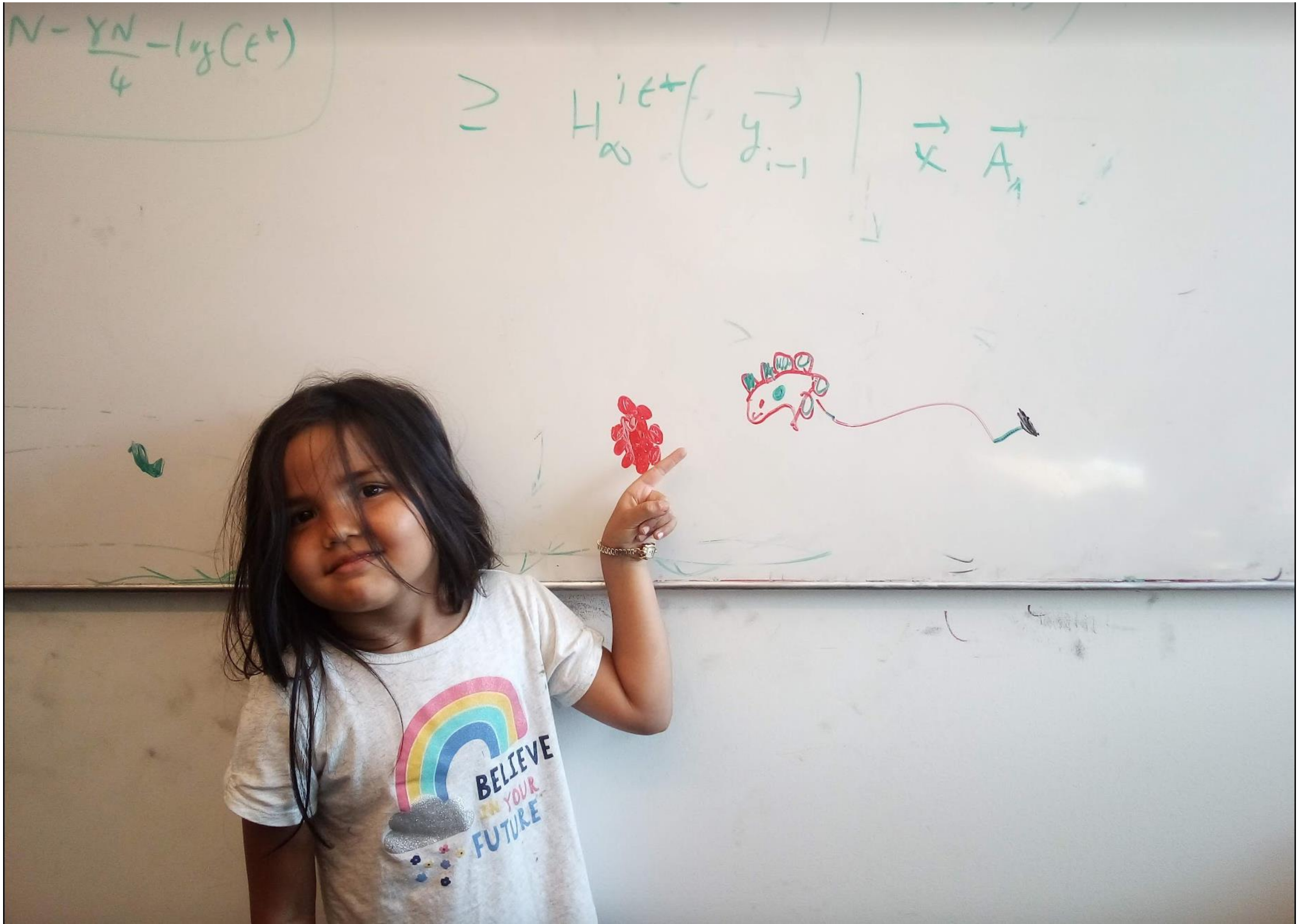
O(1)

u

$O(n_u)$

O(1)

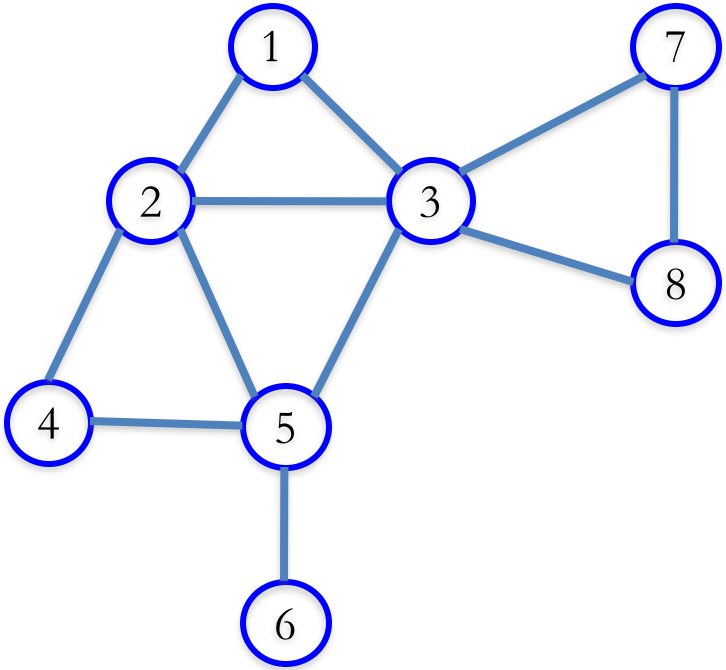
Questions/Comments?

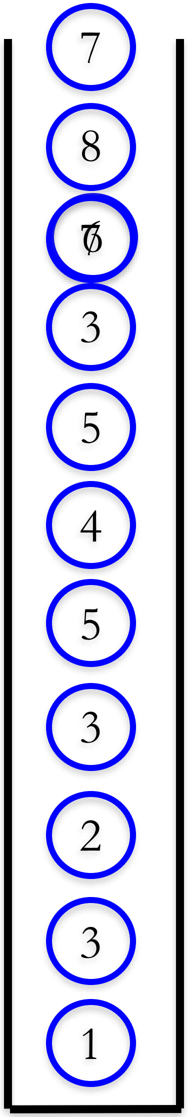


Implementing DFS in $O(m+n)$ time

Same as BFS except stack instead of a queue

A DFS run using an explicit stack

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