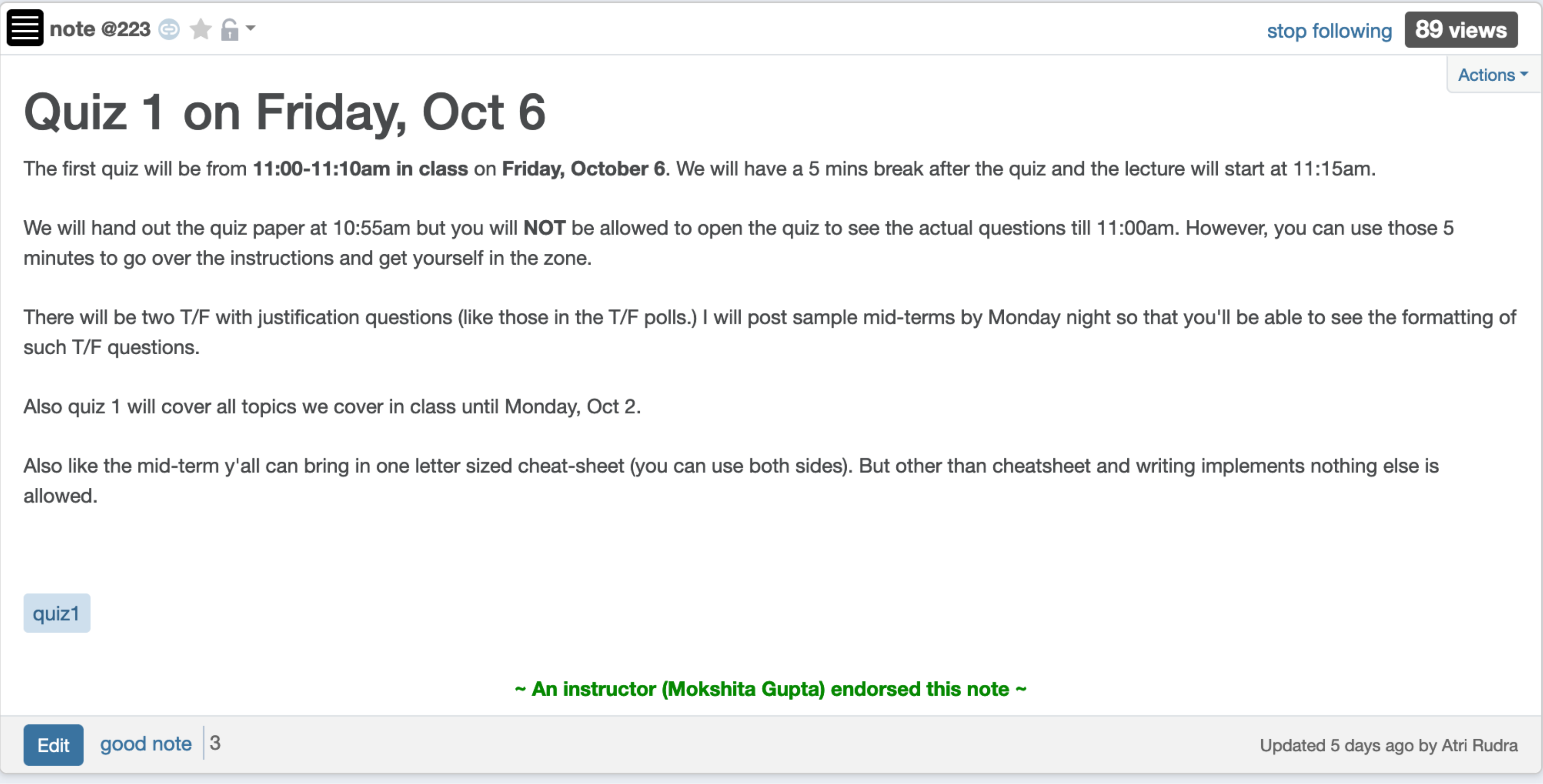
Lecture 16

CSE 331

Oct 4, 2023

Quiz 1 this FRIDAY



Quiz 1 on Friday, Oct 6

The first quiz will be from **11:00-11:10am in class** on **Friday, October 6**. 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 Monday 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 Monday, Oct 2.

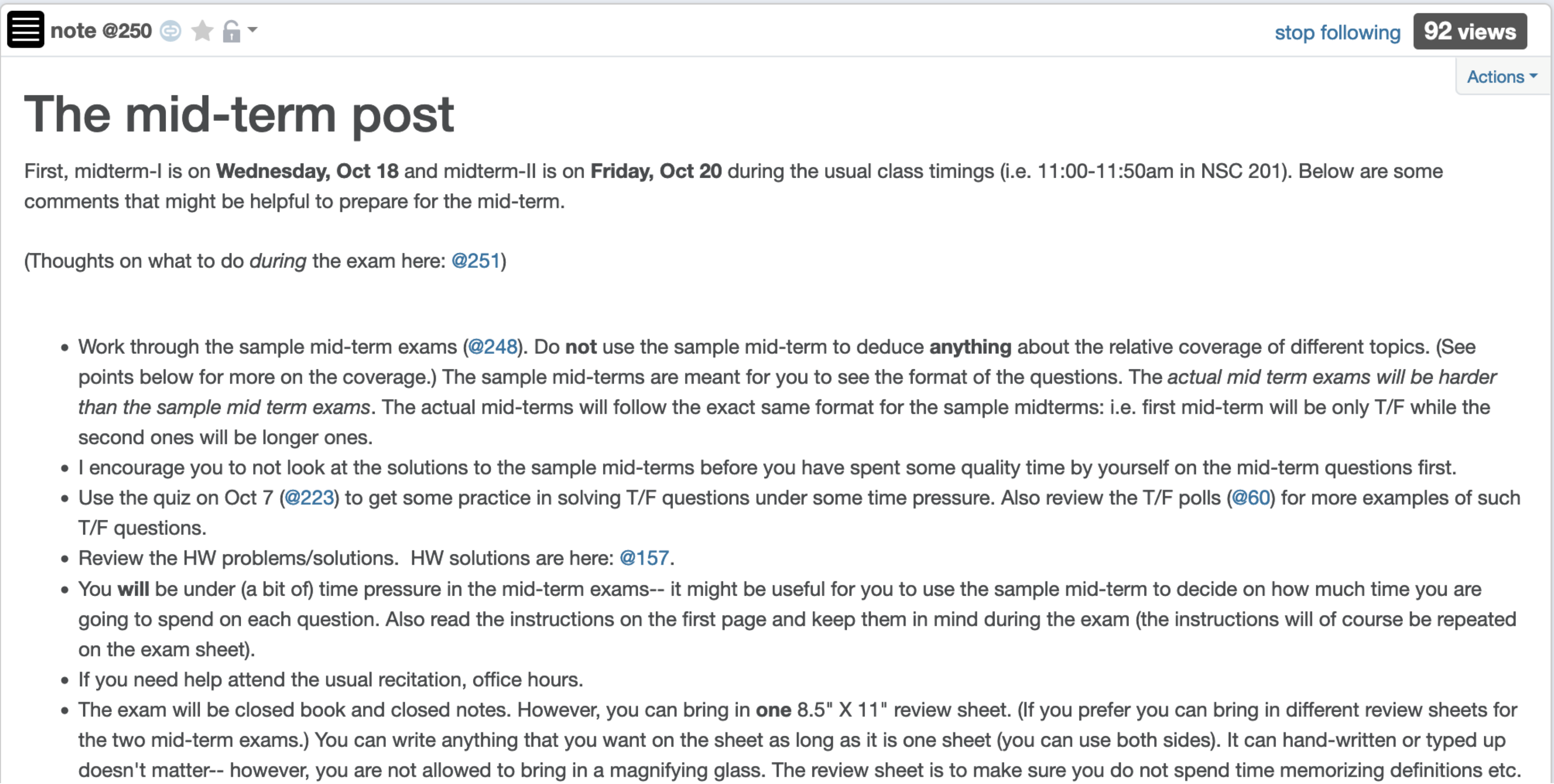
Also like the mid-term y'all can bring in one letter sized cheat-sheet (you can use both sides). But other than cheatsheet and writing implements nothing else is allowed.

quiz1

~ An instructor (Mokshita Gupta) endorsed this note ~

Updated 5 days ago by Atri Rudra

Mid-term post 1



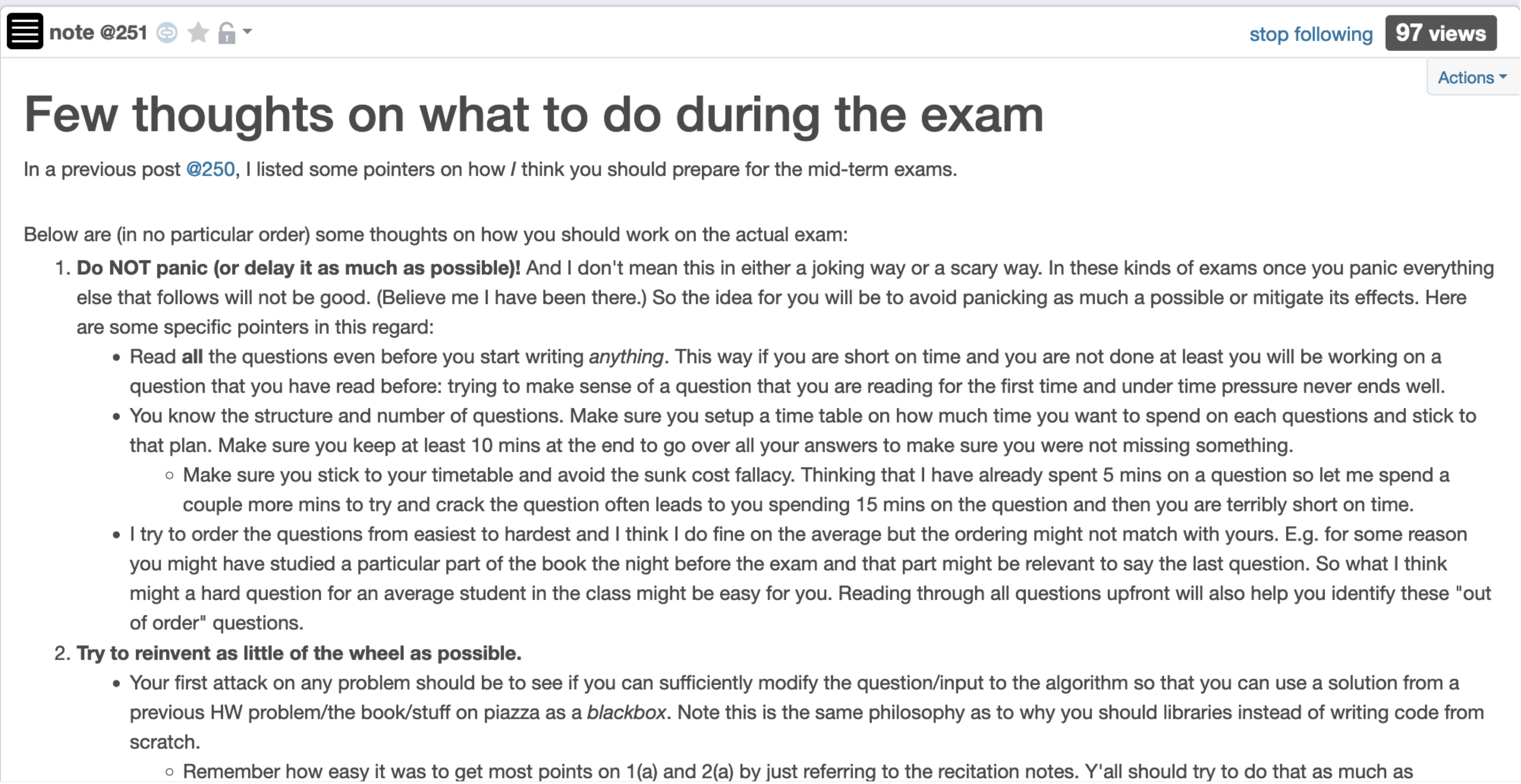
The mid-term post

First, midterm-I is on **Wednesday, Oct 18** and midterm-II is on **Friday, Oct 20** during the usual class timings (i.e. 11:00-11:50am in NSC 201). Below are some comments that might be helpful to prepare for the mid-term.

(Thoughts on what to do *during* the exam here: @251)

- Work through the sample mid-term exams (@248). 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 Oct 7 (@223) to get some practice in solving T/F questions under some time pressure. Also review the T/F polls (@60) for more examples of such T/F questions.
- Review the HW problems/solutions. HW solutions are here: @157.
- 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, 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.

Mid-term post 2



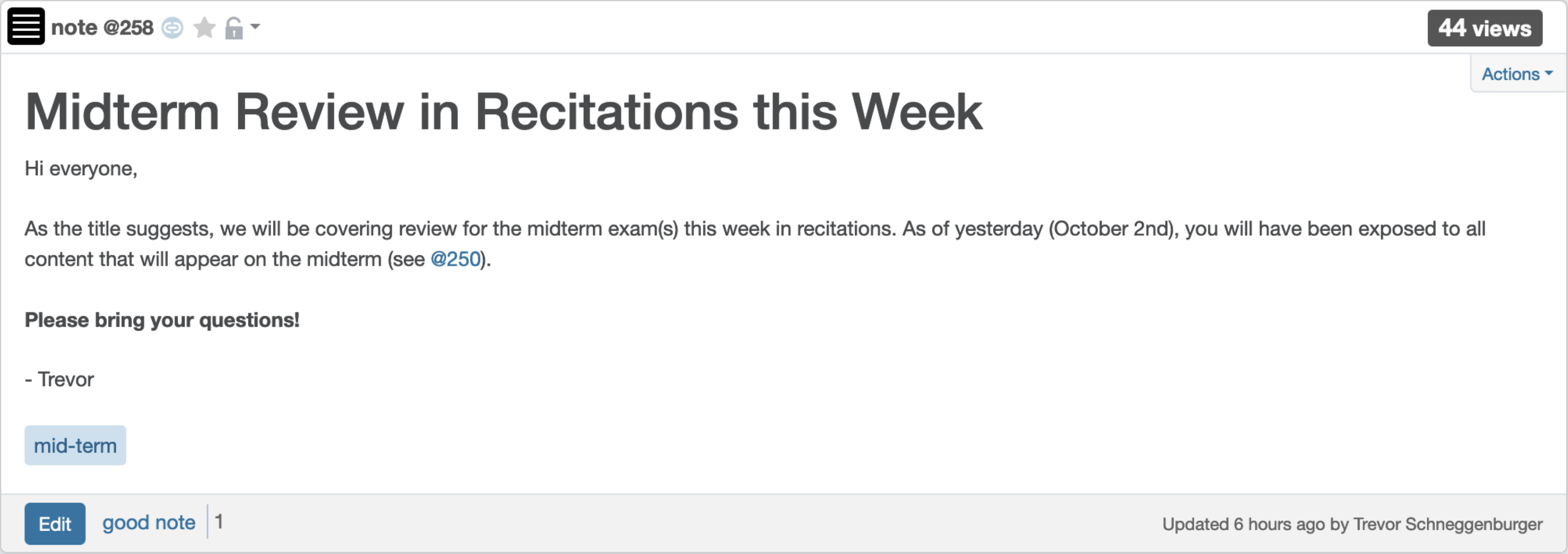
Few thoughts on what to do during the exam

In a previous post @250, 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 *blackbox*. 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

Recitation this week



Midterm Review in Recitations this Week

Hi everyone,

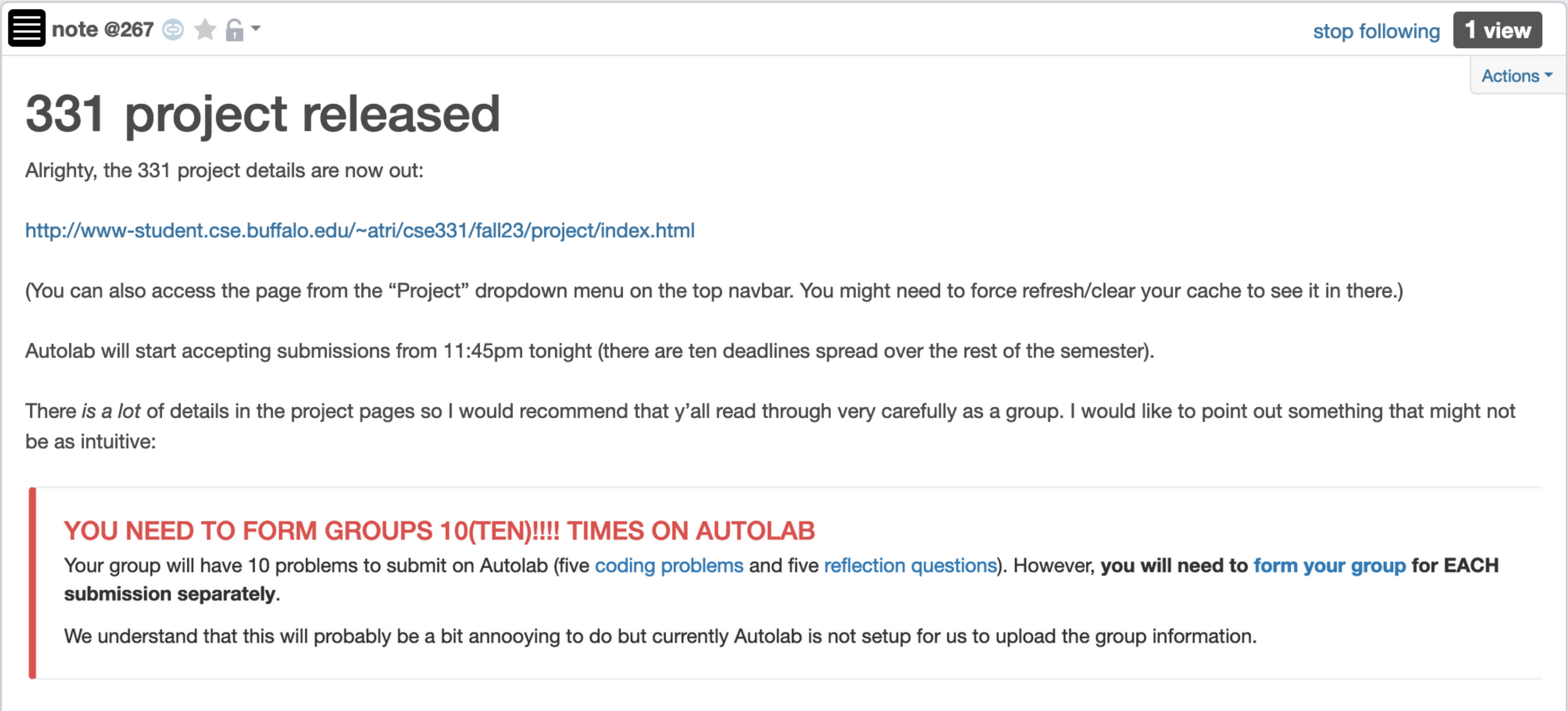
As the title suggests, we will be covering review for the midterm exam(s) this week in recitations. As of yesterday (October 2nd), you will have been exposed to all content that will appear on the midterm (see @250).

Please bring your questions!

- Trevor

Updated 6 hours ago by Trevor Schneggenburger

Project released



331 project released

Alrighty, the 331 project details are now out:

http://www-student.cse.buffalo.edu/~atri/cse331/fall23/project/index.html

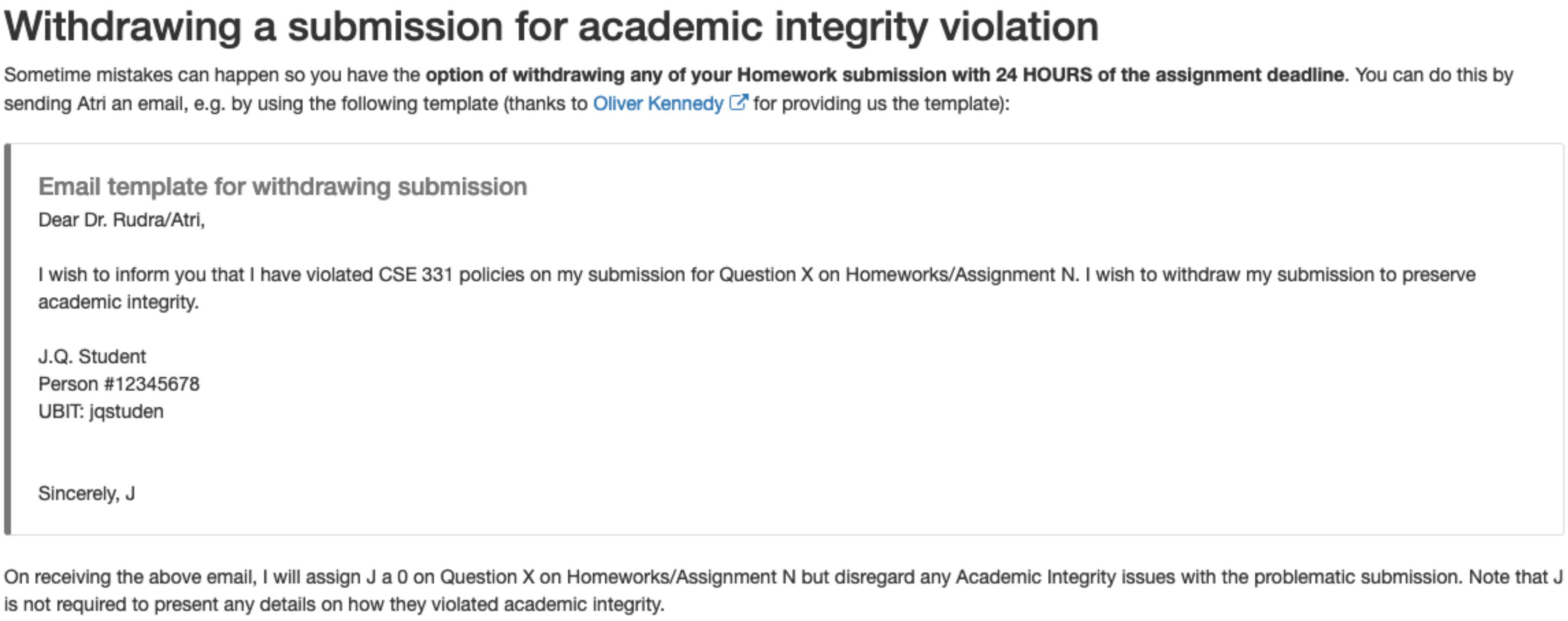
(You can also access the page from the “Project” dropdown menu on the top navbar. You might need to force refresh/clear your cache to see it in there.)

Autolab will start accepting submissions from 11:45pm tonight (there are ten deadlines spread over the rest of the semester).

There *is a lot* of details in the project pages so I would recommend that y’all read through very carefully as a group. I would like to point out something that might not be as intuitive:

> **YOU NEED TO FORM GROUPS 10(TEN)!!!! TIMES ON AUTOLAB**
>
> Your group will have 10 problems to submit on Autolab (five coding problems and five reflection questions). However, **you will need to form your group for EACH submission separately**.
>
> We understand that this will probably be a bit annooying to do but currently Autolab is not setup for us to upload the group information.

Withdraw submission due to AI



Withdrawing a submission for academic integrity violation

Sometime mistakes can happen so you have the **option of withdrawing any of your Homework submission with 24 HOURS of the assignment deadline**. You can do this by sending Atri an email, e.g. by using the following template (thanks to Oliver Kennedy for providing us the template):

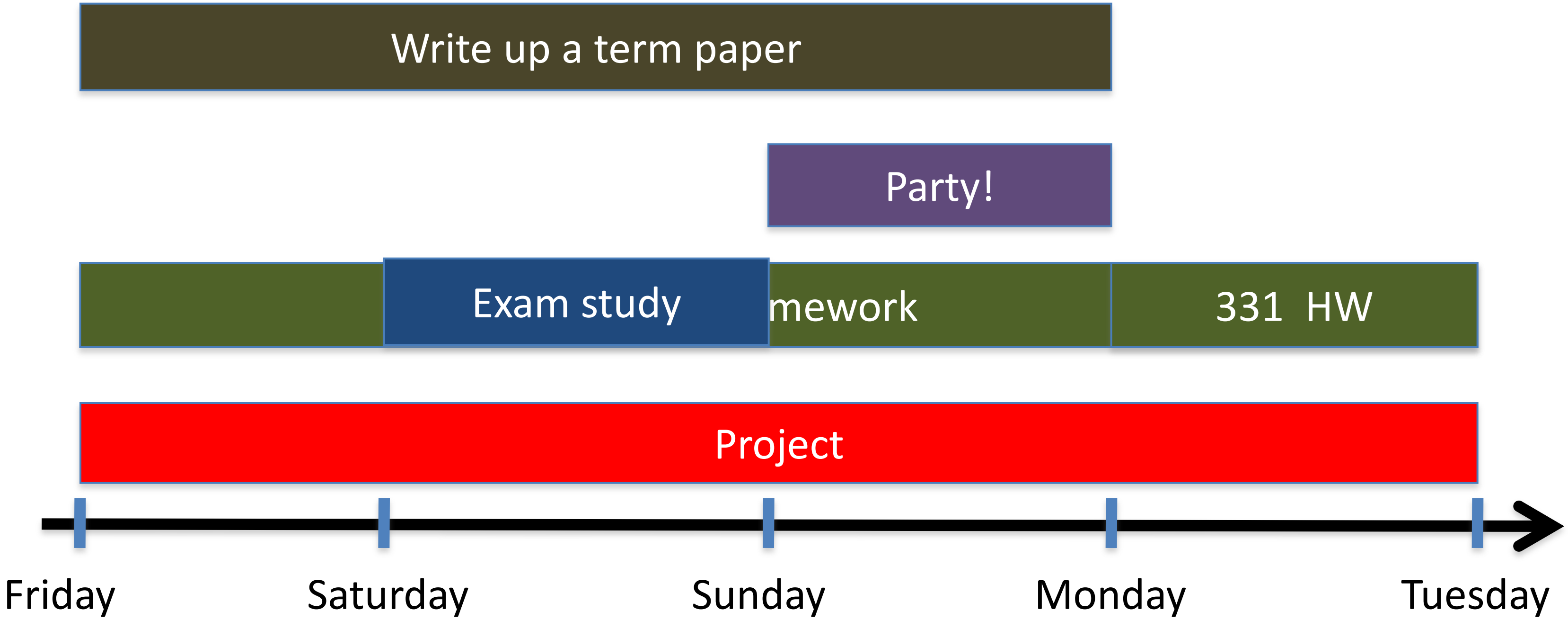
> ### Email template for withdrawing submission
>
> Dear Dr. Rudra/Atri,
>
> I wish to inform you that I have violated CSE 331 policies on my submission for Question X on Homeworks/Assignment N. I wish to withdraw my submission to preserve academic integrity.
>
> J.Q. Student
> Person #12345678
> UBIT: jqstuden
>
> Sincerely, J

On receiving the above email, I will assign J a 0 on Question X on Homeworks/Assignment N but disregard any Academic Integrity issues with the problematic submission. Note that J is not required to present any details on how they violated academic integrity.

Questions?

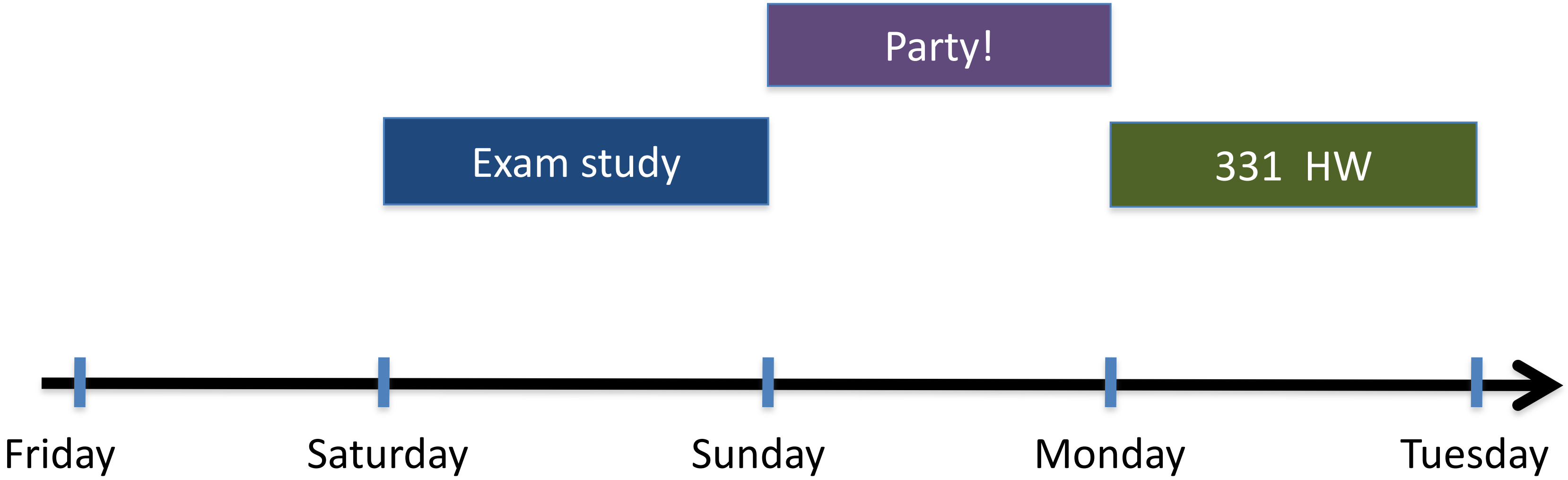
End of Semester blues

Can only do one thing at any day: what is the maximum number of tasks that you can do?



The optimal solution

Can only do one thing at any day: what is the maximum number of tasks that you can do?



Interval Scheduling Problem

Input: n intervals $[s(i), f(i))$ for $1 \le i \le n$

$\{ s(i), \ldots ,f(i)-1 \}$

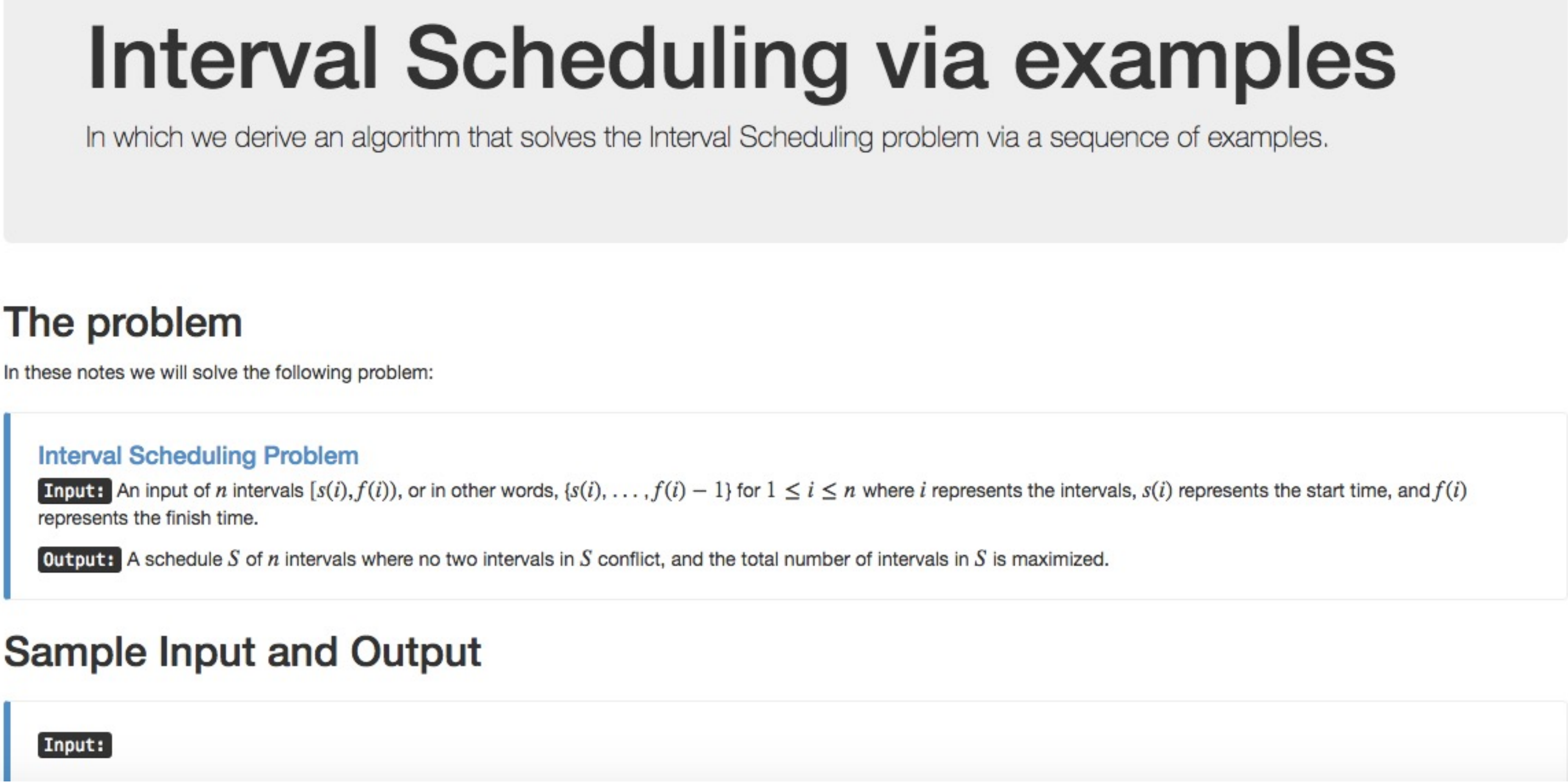
Output: A *schedule* S of the n intervals

No two intervals in S conflict

$|S|$ is maximized

Questions?

Algorithm with examples



Interval Scheduling via examples

In which we derive an algorithm that solves the Interval Scheduling problem via a sequence of examples.

The problem

In these notes we will solve the following problem:

Interval Scheduling Problem

`Input:` An input of n intervals $[s(i), f(i))$, or in other words, $\{s(i), \ldots, f(i) - 1\}$ for $1 \leq i \leq n$ where i represents the intervals, $s(i)$ represents the start time, and $f(i)$ represents the finish time.

`Output:` A schedule S of n intervals where no two intervals in S conflict, and the total number of intervals in S is maximized.

Sample Input and Output

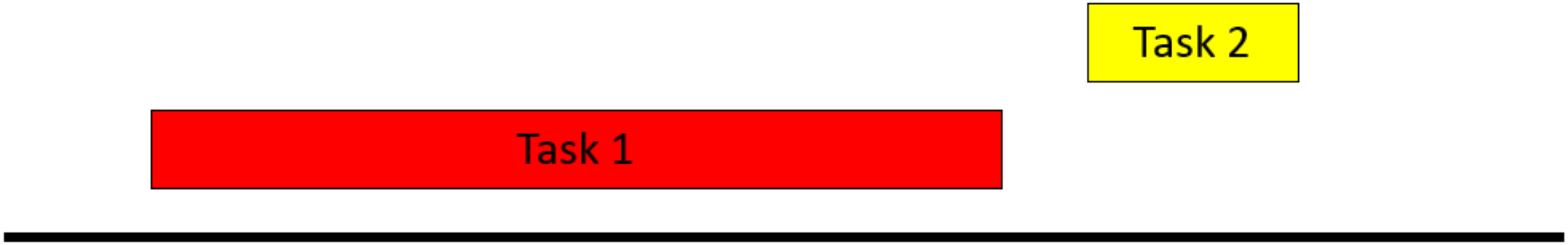
`Input:`

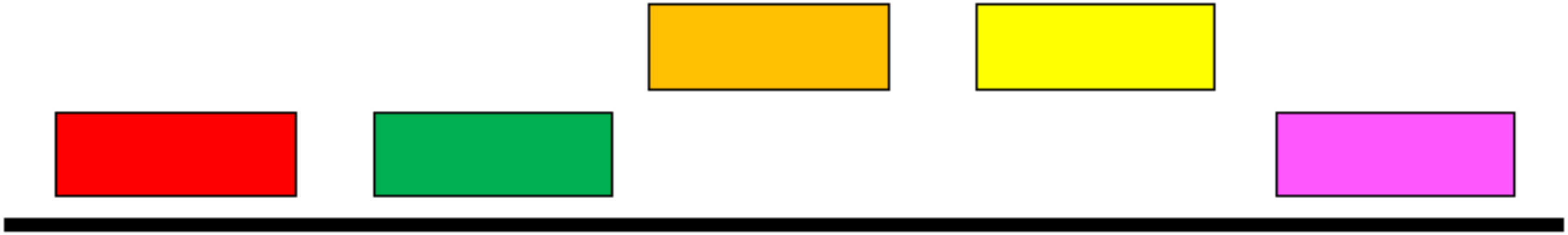
Re-define problem on the board…

$\frac{r}{k} \leq D^{k+}(f) \leq D^{1+}(f) \leq r \log\left(\frac{n}{r}\right)$
x_1
x_2
x_3
x_4
x_5

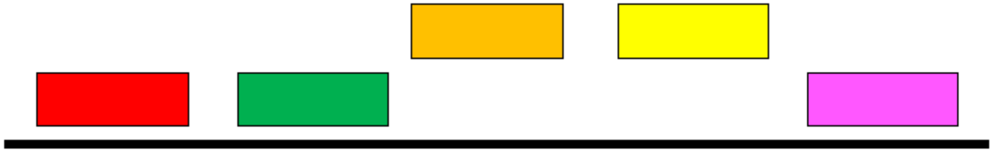
Example 1

No intervals overlap





Algorithm?

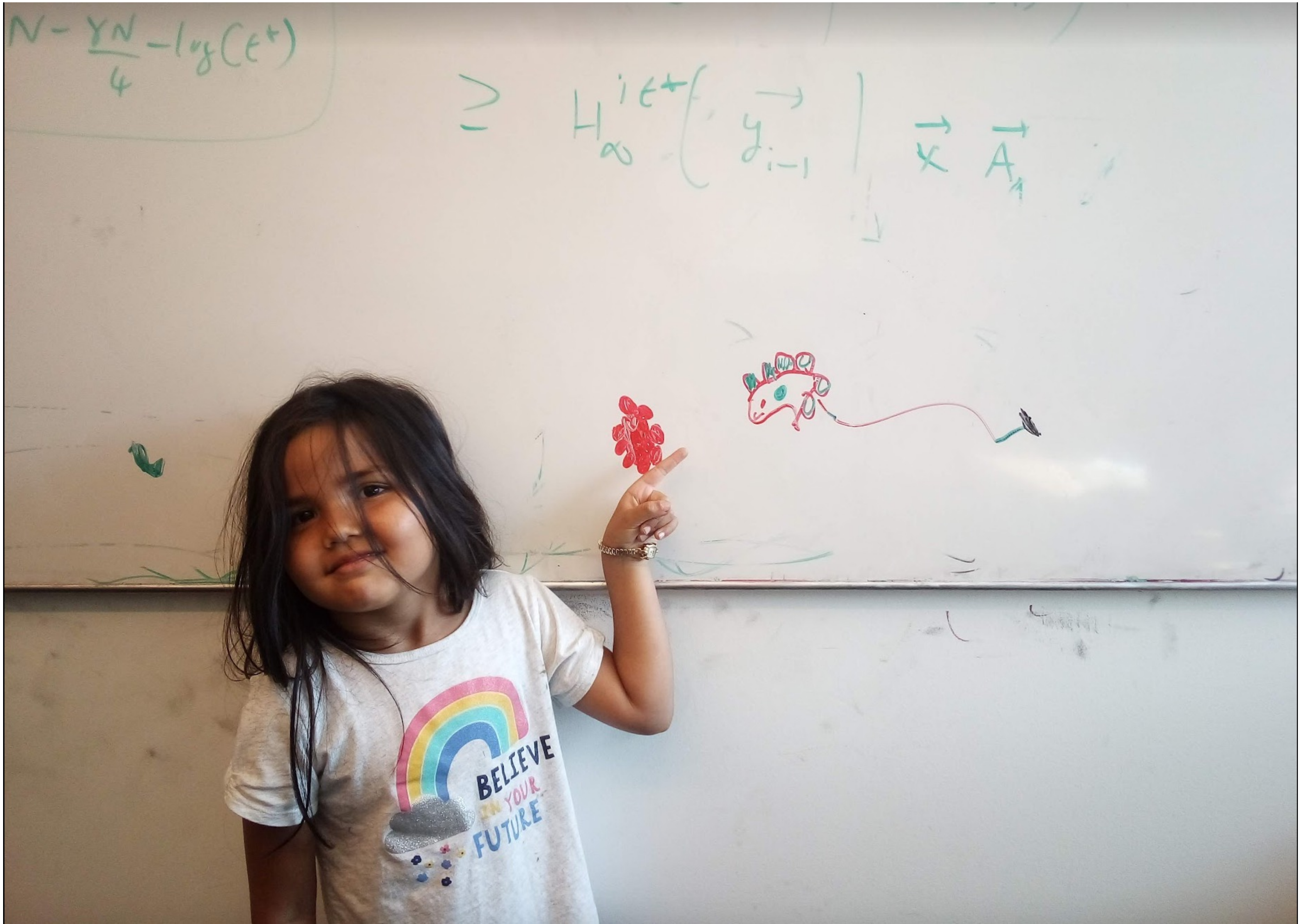


No intervals overlap

R: set of requests

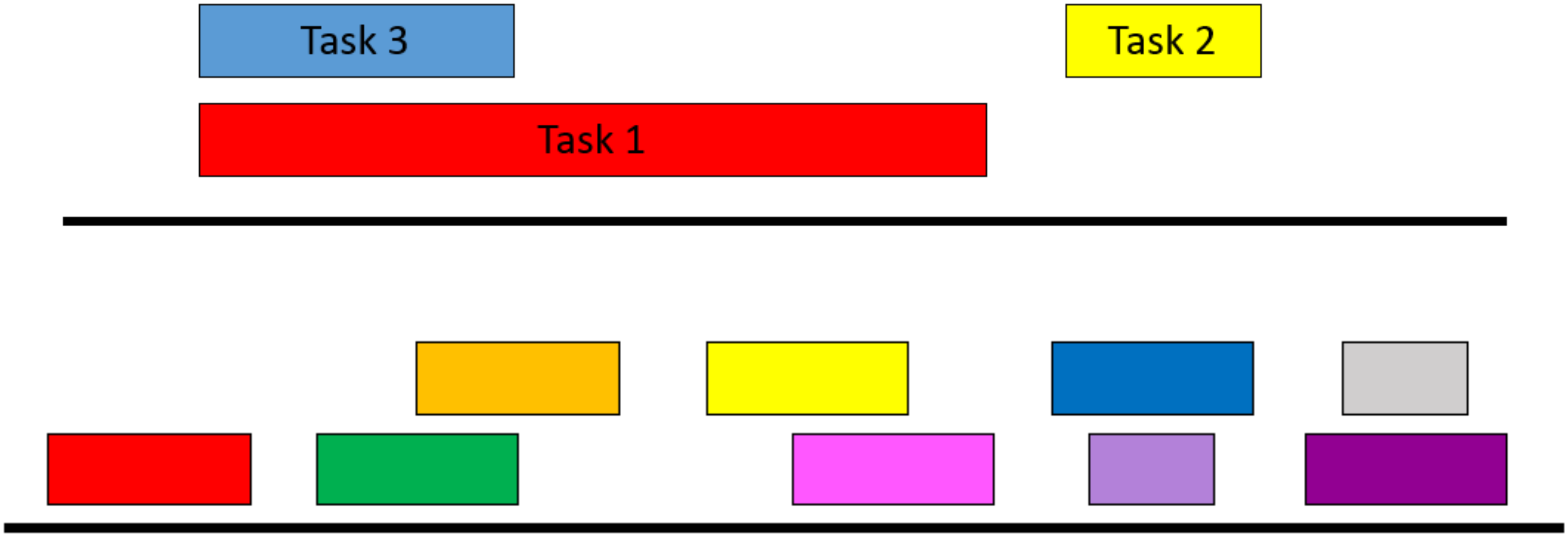
```
Set S to be the empty set

While R is not empty

    Choose i in R

    Add i to S

    Remove  i from R

Return $S^*$= S
```

Questions/Comments?

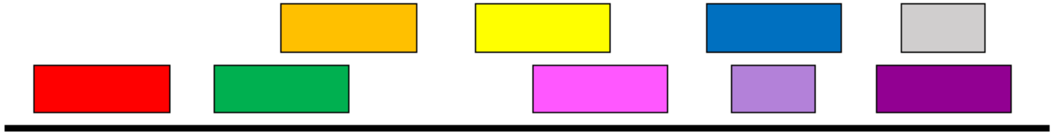

$N - \frac{YN}{4} - \log(\epsilon^{+})$
$\geq H_{\infty}^{i\epsilon+}(\vec{y}_{i-1} \mid \vec{x}\ \vec{A}_{1}$
BELIEVE IN YOUR FUTURE

Example 2

At most one overlap/task



Algorithm?



At most one overlap

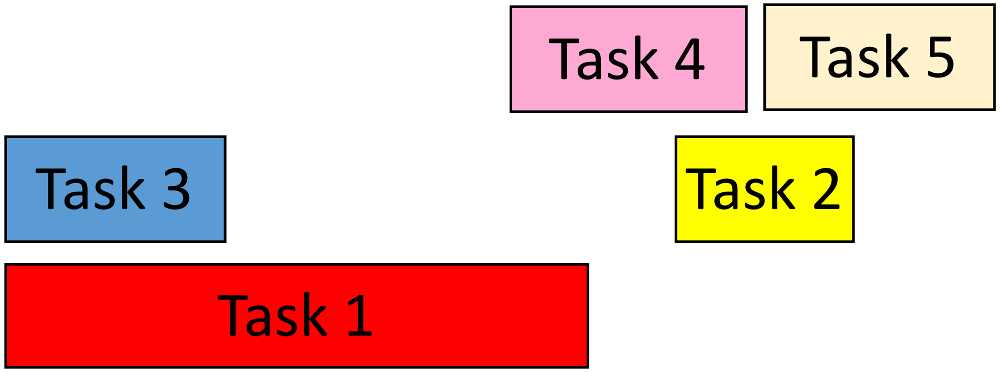
R: set of requests

```
Set S to be the empty set

While R is not empty

        Choose i in R

        Add i to S

        Remove all tasks that conflict with  i from R

Return S$^*$= S
```

Remove i from R

Example 3

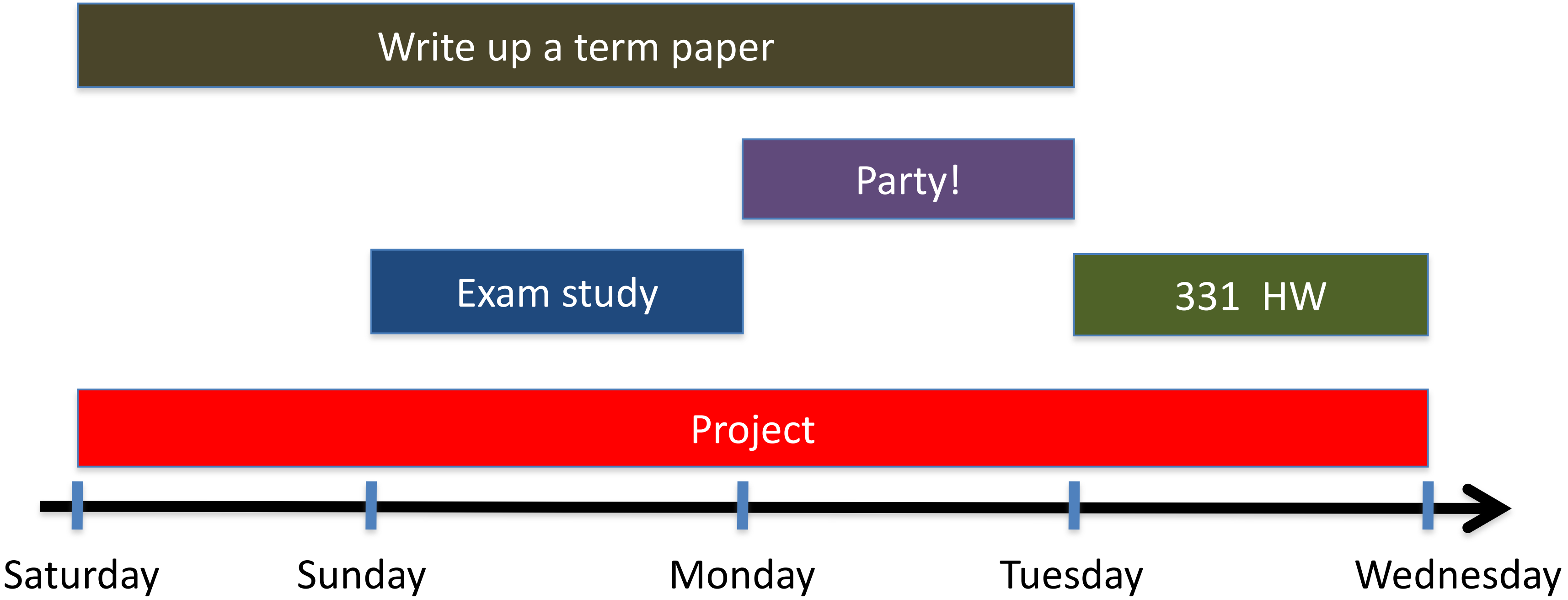
More than one conflict



```
Set S to be the empty set
While R is not empty
        Choose i in R
        Add i to S
        Remove all tasks that conflict with  i from R
Return S*= S
```

Greedily solve your blues!

Arrange tasks in some order and iteratively pick non-overlapping tasks



Write up a term paper

Party!

Exam study

331 HW

Project

Saturday

Sunday

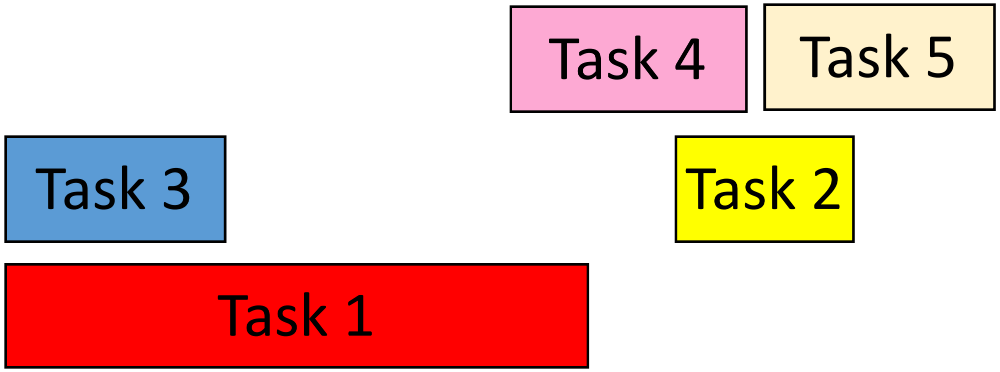
Monday

Tuesday

Wednesday

Making it more formal

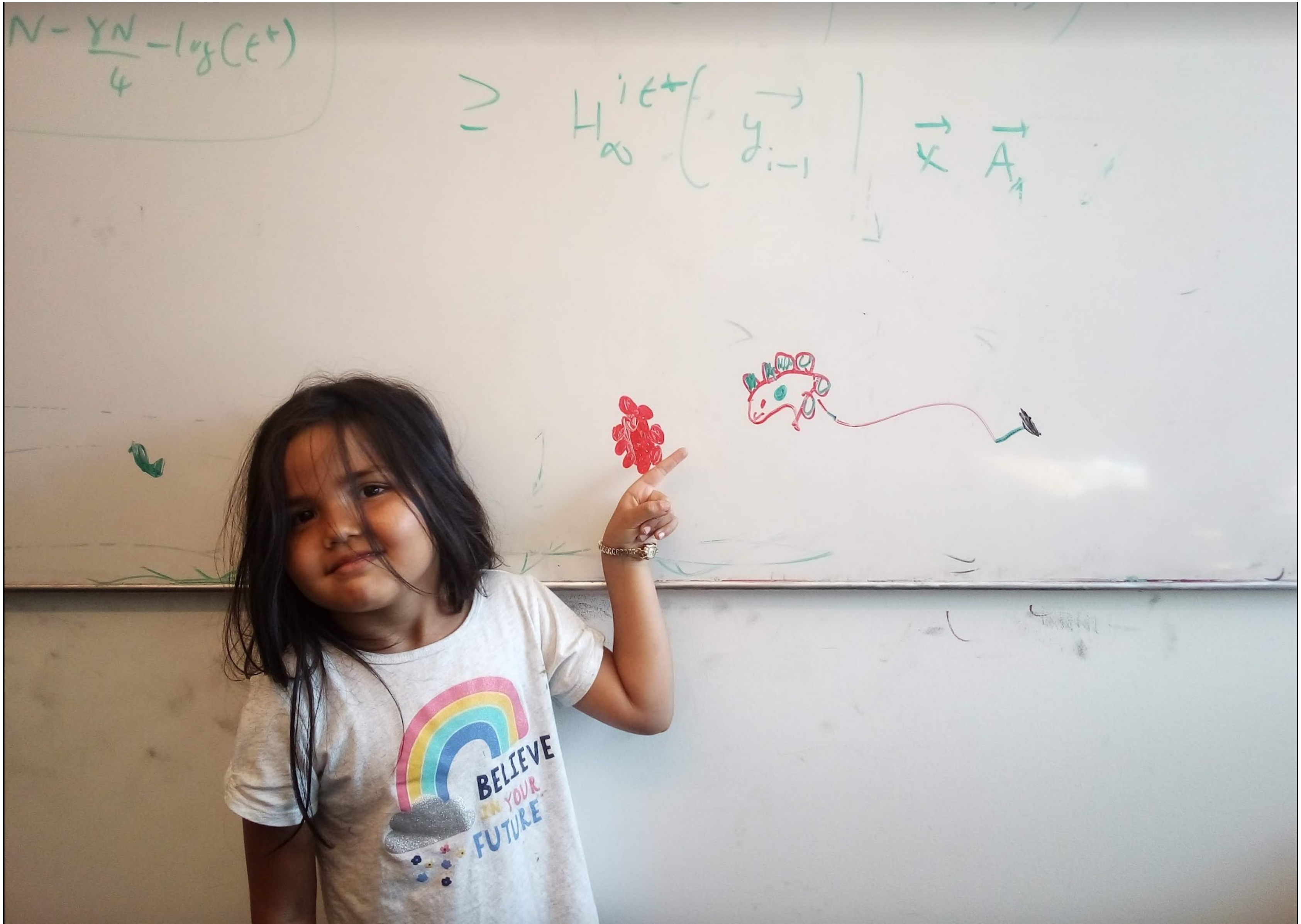
More than one conflict



```
Set S to be the empty set
While R is not empty
        Choose i in R that minimizes v(i)
        Add i to S
        Remove all tasks that conflict with  i from R
Return $S^*$= S
```

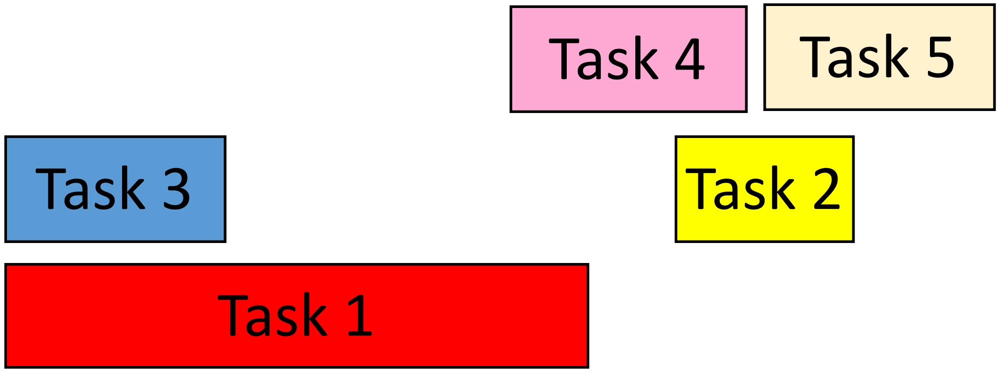
Associate a value v(i) with task i

Questions/Comments?


$N - \frac{YN}{4} - \log(\varepsilon^+)$
$\geq H_\infty^{i\varepsilon^+}(\vec{y}_{i-1} \mid \vec{x}\ \vec{A}_1$
BELIEVE
IN YOUR
FUTURE

What is a good choice for v(i)?

More than one conflict

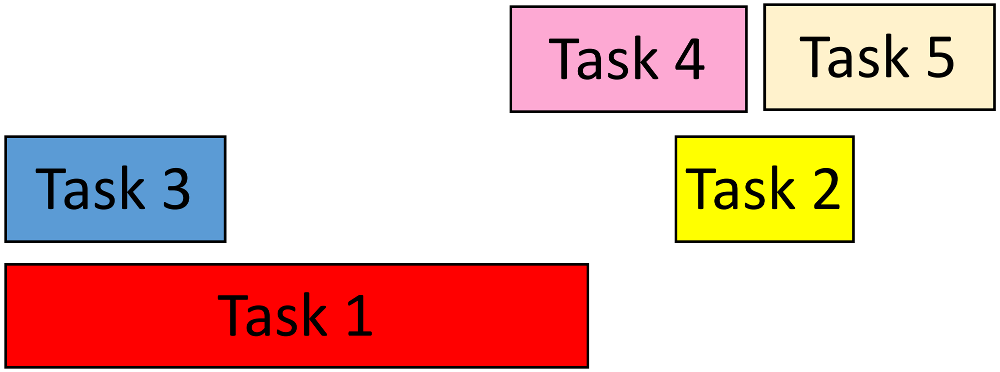


```
Set S to be the empty set
While R is not empty
        Choose i in R that minimizes v(i)
        Add i to S
        Remove all tasks that conflict with  i from R
Return S* = S
```

Associate a value v(i) with task i

$v(i) = f(i) - s(i)$

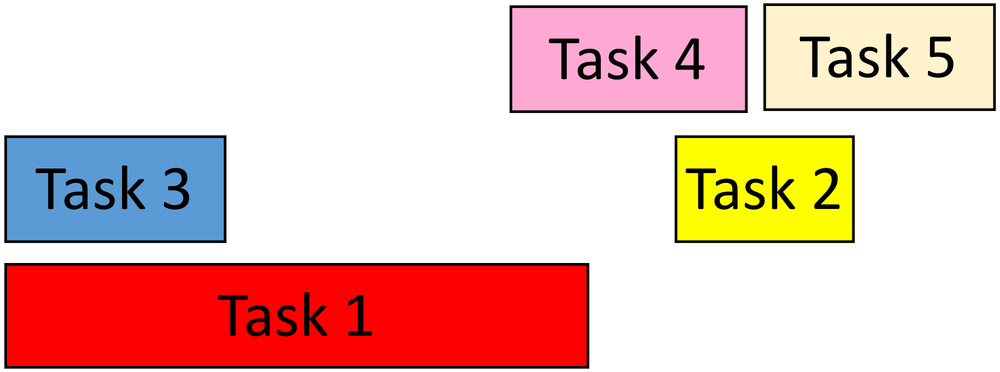
Smallest duration first



```
Set $S$ to be the empty set
While $R$ is not empty
    Choose $i$ in $R$ that minimizes $f(i) - s(i)$
    Add $i$ to $S$
    Remove all tasks that conflict with $i$ from $R$
Return $S^* = S$
```

$v(i) = s(i)$

Earliest time first?

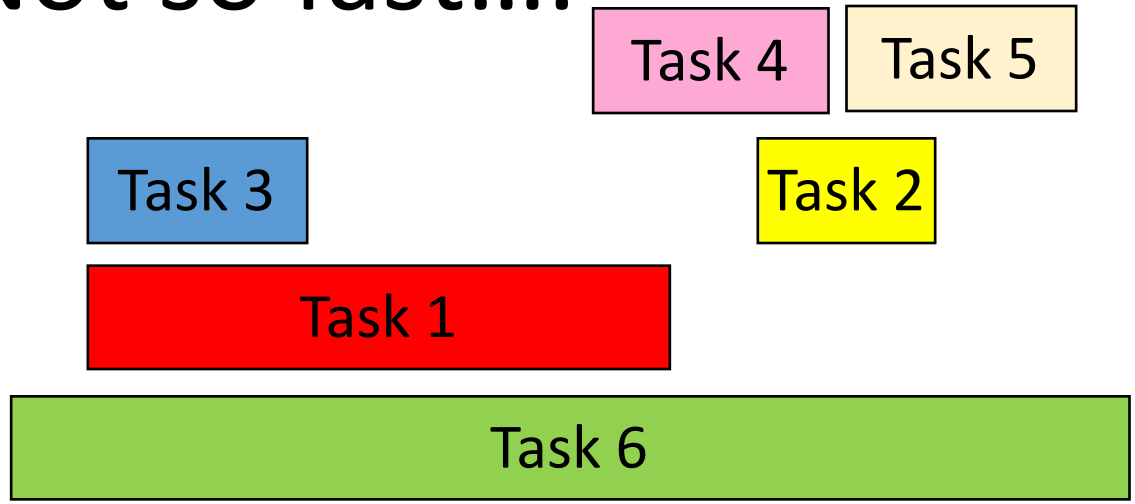


```
Set $S$ to be the empty set
While $R$ is not empty
        Choose $i$ in $R$ that minimizes $s(i)$
        Add $i$ to $S$
        Remove all tasks that conflict with $i$ from $R$
Return $S^* = S$
```

So are we done?

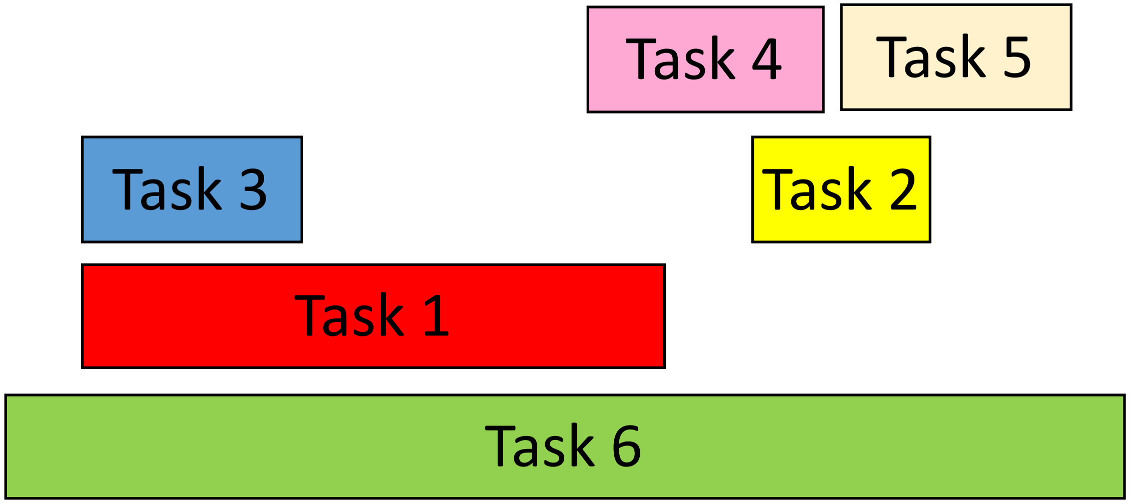
Not so fast….

Earliest time first?



```
Set S to be the empty set
While R is not empty
        Choose i in R that minimizes s(i)
        Add i to S
        Remove all tasks that conflict with  i from R
Return S* = S
```

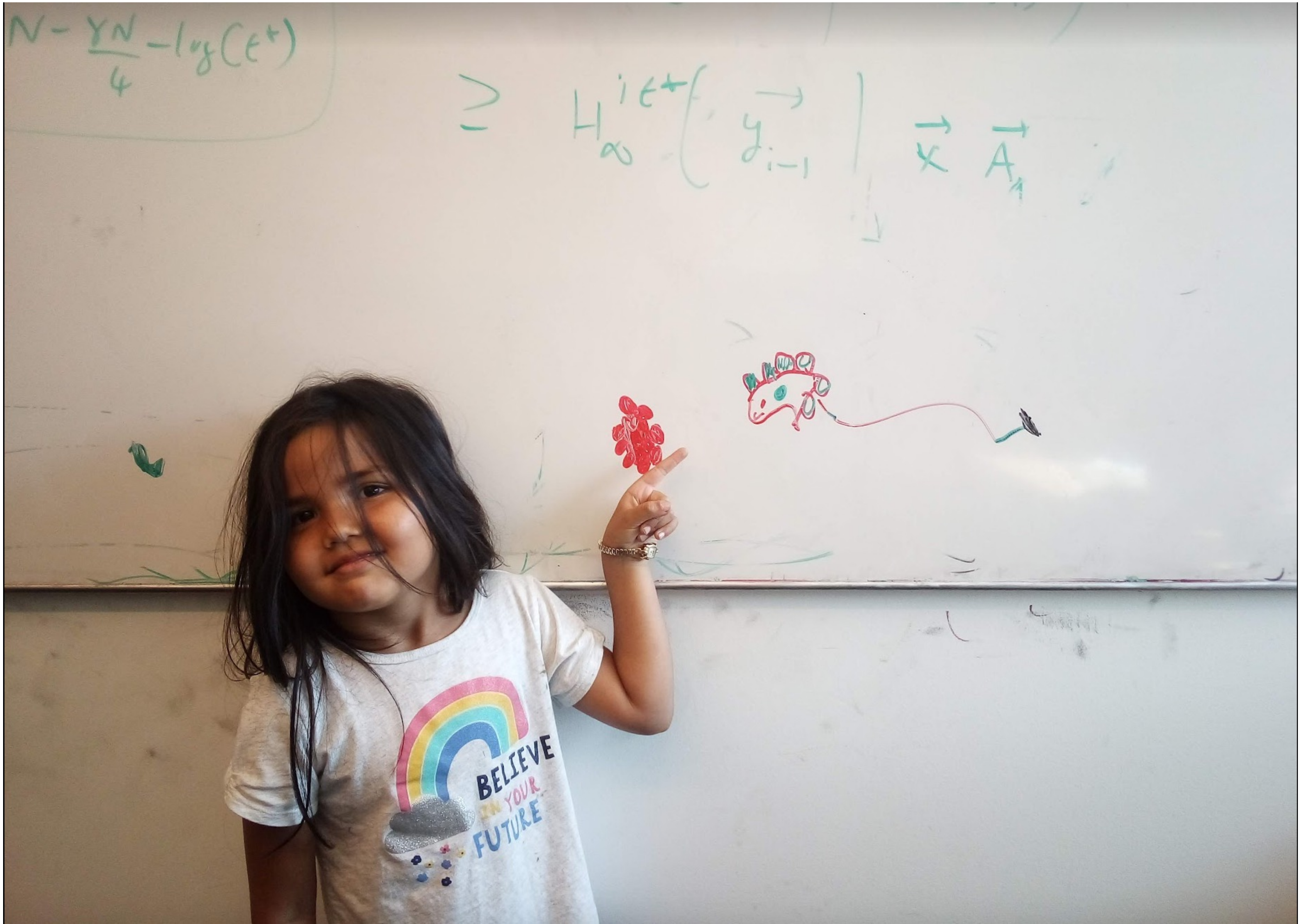
Pick job with minimum conflicts



```
Set S to be the empty set
While R is not empty
        Choose i in R that has smallest number of conflicts
        Add i to S
        Remove all tasks that conflict with  i from R
Return $S^*$= S
```

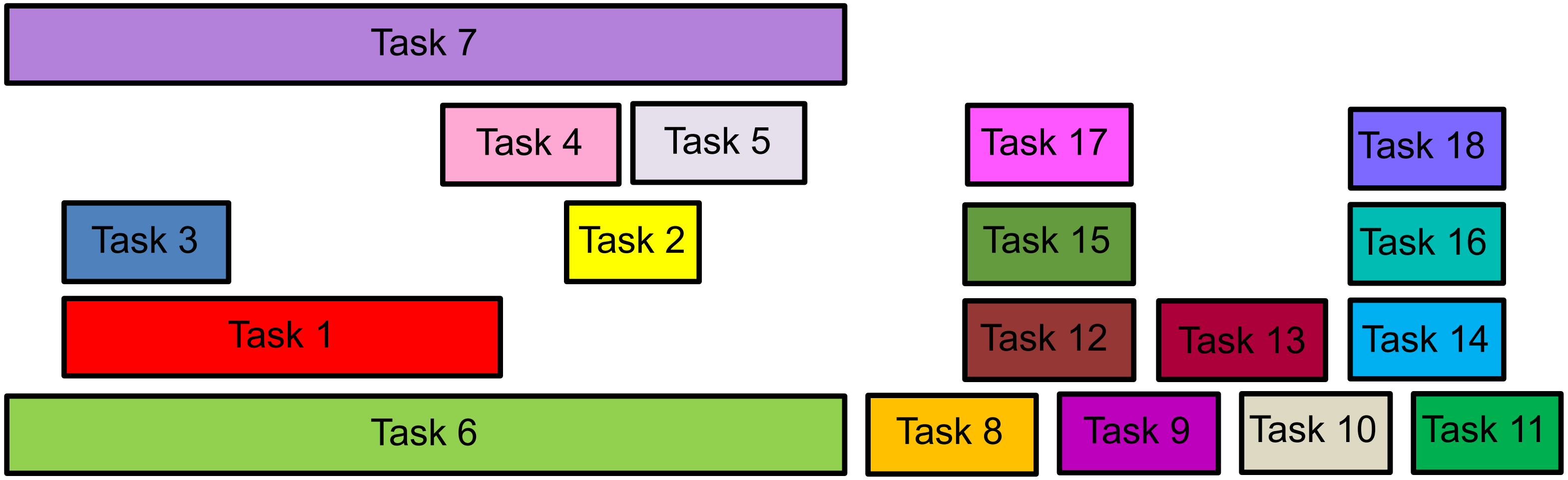
So are we done?

Questions/Comments?


$N - \frac{YN}{4} - \log(\epsilon^+)$
$\geq H_\infty^{i\epsilon^+}(\vec{y}_{i-1} \mid \vec{x}\ \vec{A}_1)$
BELIEVE
IN YOUR
FUTURE

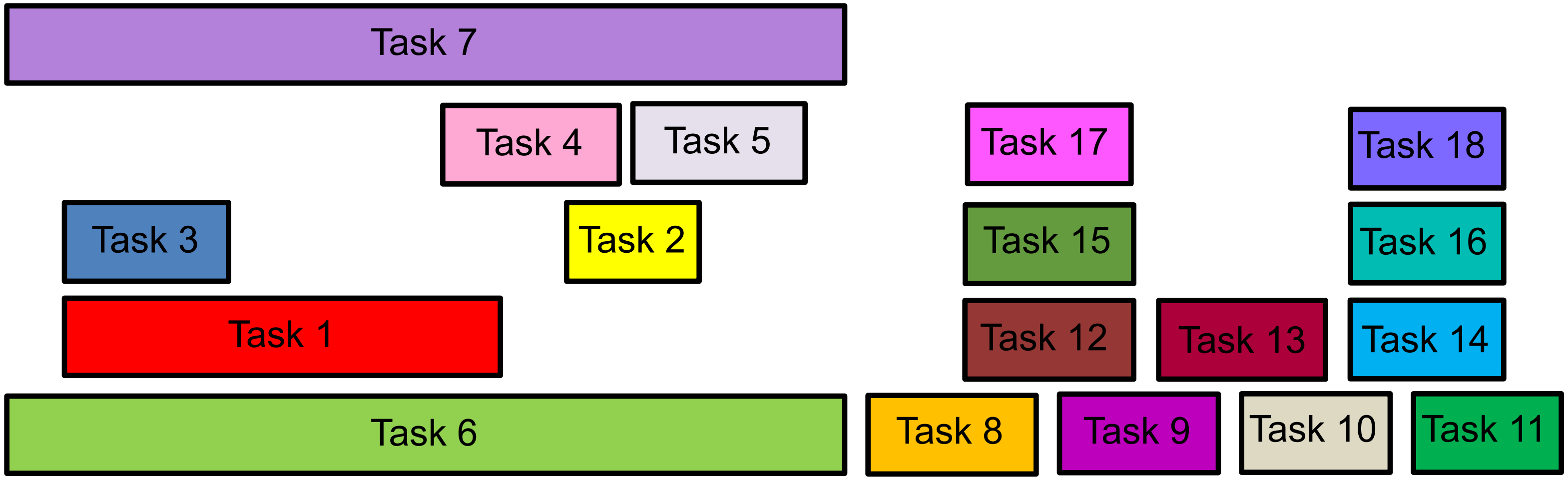
Nope (but harder to show)

```
Set S to be the empty set
While R is not empty
        Choose i in R that has smallest number of conflicts
        Add i to S
        Remove all tasks that conflict with  i from R
Return $S^* = S$
```



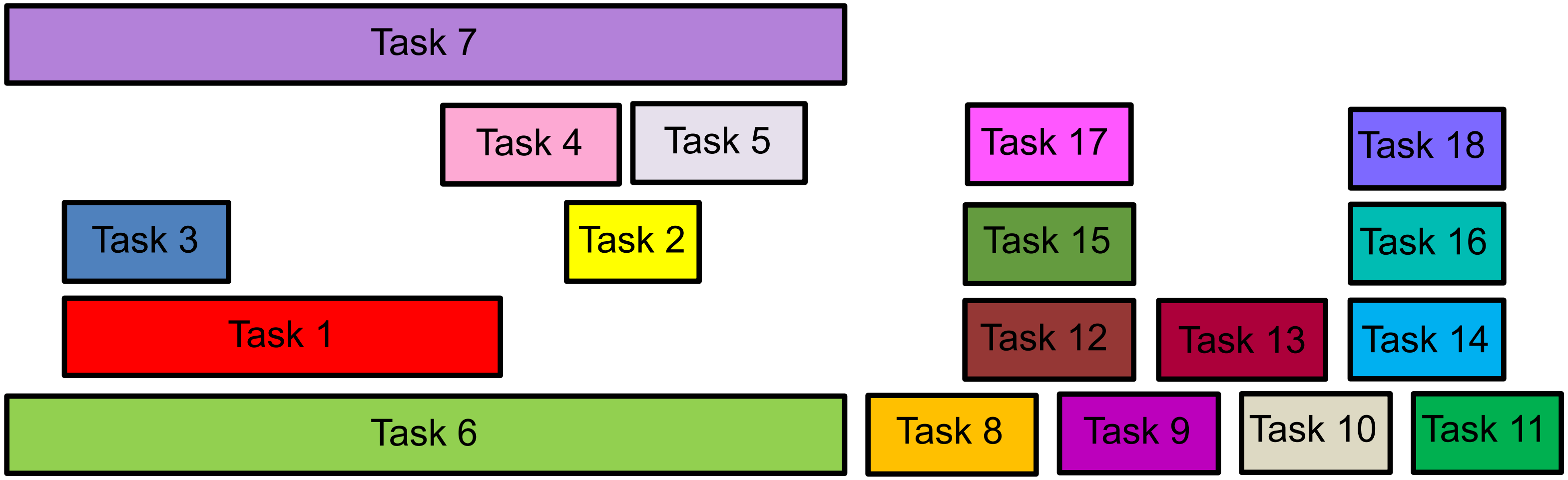
```
Set S to be the empty set

While R is not empty

        Choose i in R that has smallest number of conflicts
        Add i to S

        Remove all tasks that conflict with  i from R

Return $S^*= S$
```

Algorithm?



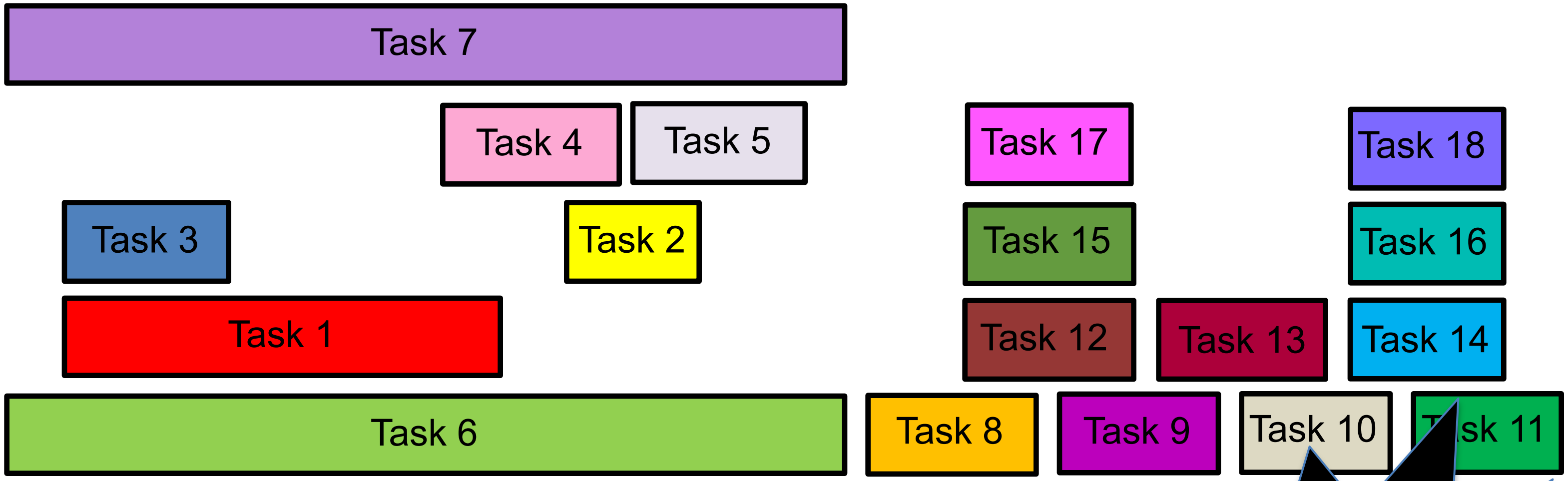
```
Set S to be the empty set
While R is not empty
        Choose i in R that minimizes v(i)
        Add i to S
        Remove all tasks that conflict with  i from R
Return $S^{*}$= S
```

Earliest finish time first



```
Set S to be the empty set
While R is not empty
        Choose i in R that minimizes f(i)
        Add i to S
        Remove all tasks that conflict with  i from R
Return $S^*$= S
```

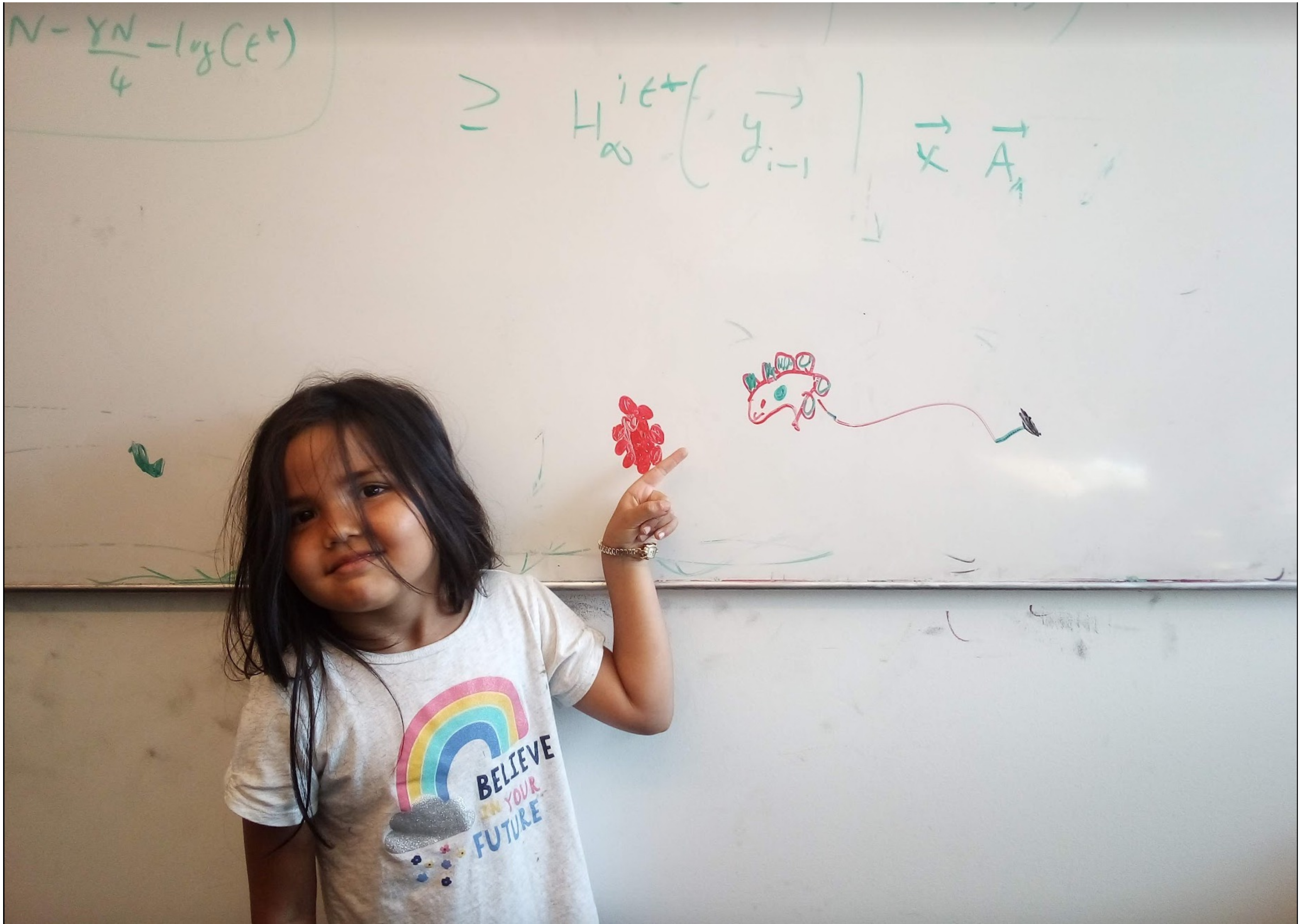
Find a counter-example?



```
Set S to be the empty set
While R is not empty
        Choose i in R that minimizes f(i)
        Add i to S
        Remove all tasks that conflict with  i from R
Return S*= S
```

It works!

Questions/Comments?



Today’s agenda

Prove the correctness of the algorithm

Final Algorithm

R: set of requests

```
Set S to be the empty set

While R is not empty

    Choose i in R with the earliest finish time

    Add i to S

    Remove all requests that conflict with i from R

Return $S^* = S$
```

Argue correctness on the board…

$\frac{r}{k} \le D^{k+}(f) \le D^{1+}(f) \le r \log\left(\frac{n}{r}\right)$
x_1
x_2
x_3
x_4
x_5