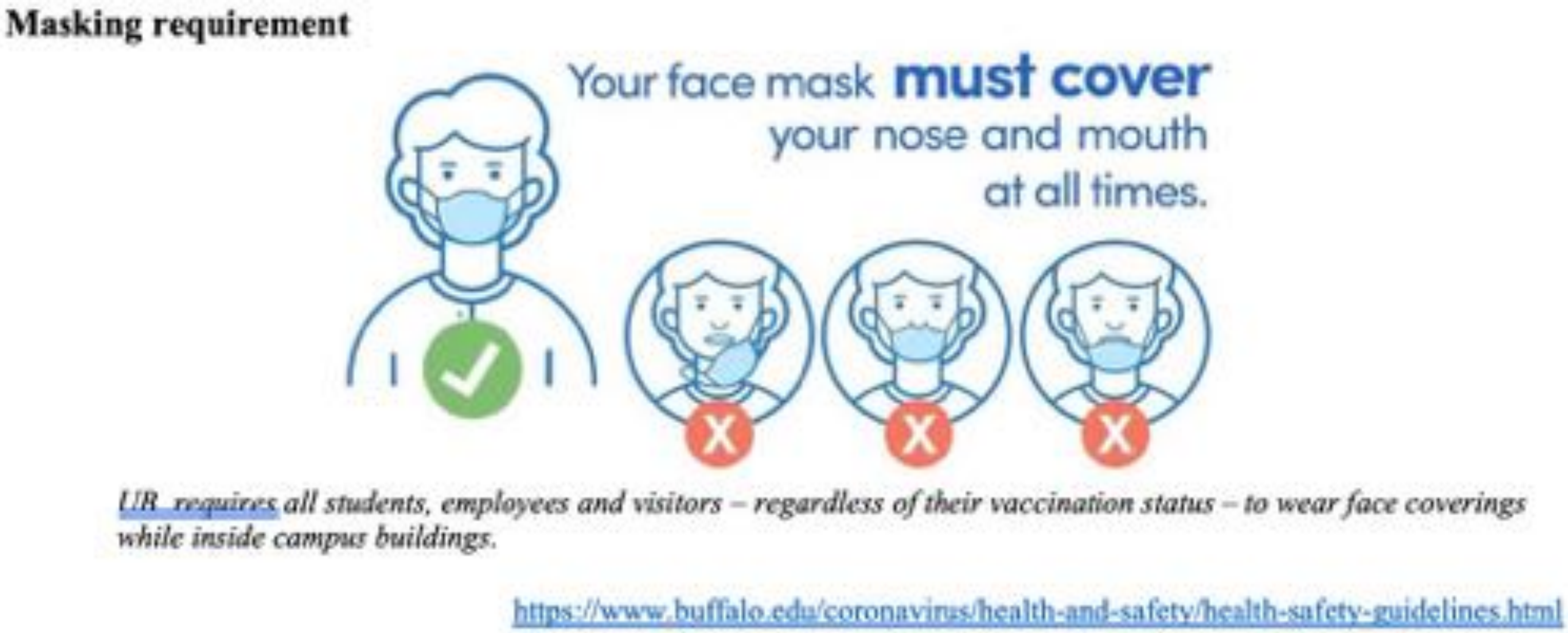
Lecture 21

CSE 331

Oct 22, 2021

Please have a face mask on



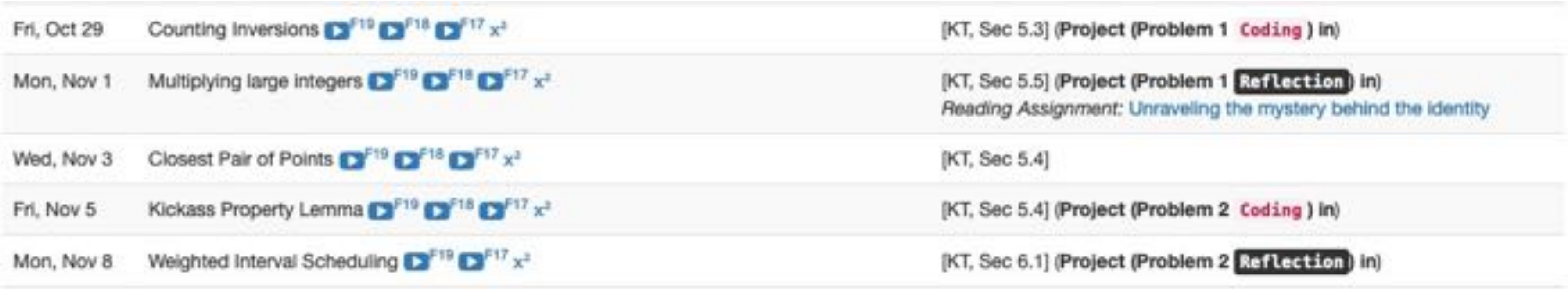
Masking requirement

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

UR requires all students, employees and visitors – regardless of their vaccination status – to wear face coverings while inside campus buildings.

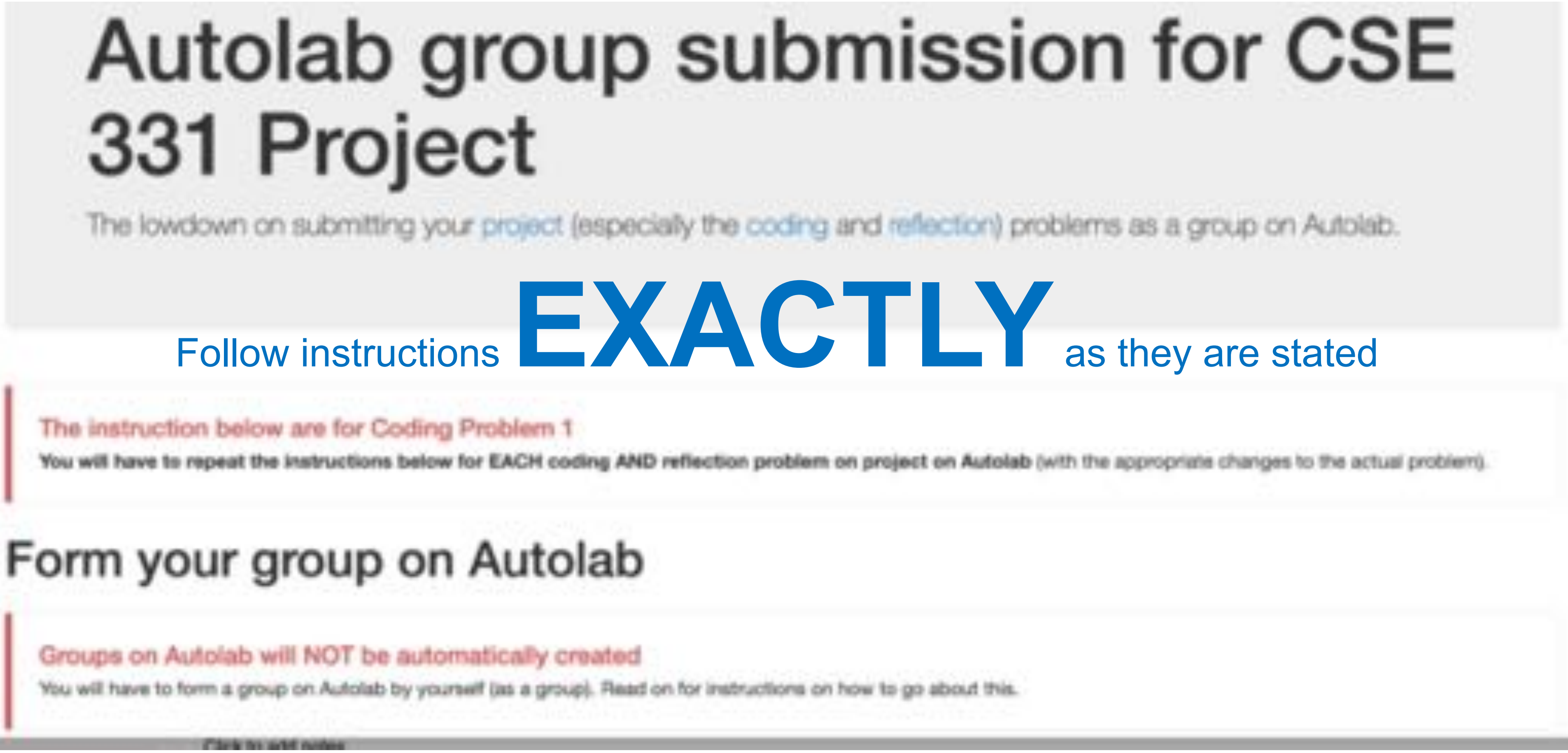
https://www.buffalo.edu/coronavirus/health-and-safety/health-safety-guidelines.html

Project deadlines coming up



Fri, Oct 29	Counting Inversions ▶^{F19} ▶^{F18} ▶^{F17} x^2	[KT, Sec 5.3] (**Project (Problem 1** `Coding` **) in**)
Mon, Nov 1	Multiplying large integers ▶^{F19} ▶^{F18} ▶^{F17} x^2	[KT, Sec 5.5] (**Project (Problem 1** `Reflection` **) in**) *Reading Assignment:* Unraveling the mystery behind the identity
Wed, Nov 3	Closest Pair of Points ▶^{F19} ▶^{F18} ▶^{F17} x^2	[KT, Sec 5.4]
Fri, Nov 5	Kickass Property Lemma ▶^{F19} ▶^{F18} ▶^{F17} x^2	[KT, Sec 5.4] (**Project (Problem 2** `Coding` **) in**)
Mon, Nov 8	Weighted Interval Scheduling ▶^{F19} ▶^{F17} x^2	[KT, Sec 6.1] (**Project (Problem 2** `Reflection` **) in**)

Group formation instructions



Autolab group submission for CSE 331 Project

The lowdown on submitting your project (especially the coding and reflection) problems as a group on Autolab.

Follow instructions **EXACTLY** as they are stated

The instruction below are for Coding Problem 1

You will have to repeat the instructions below for EACH coding AND reflection problem on project on Autolab (with the appropriate changes to the actual problem).

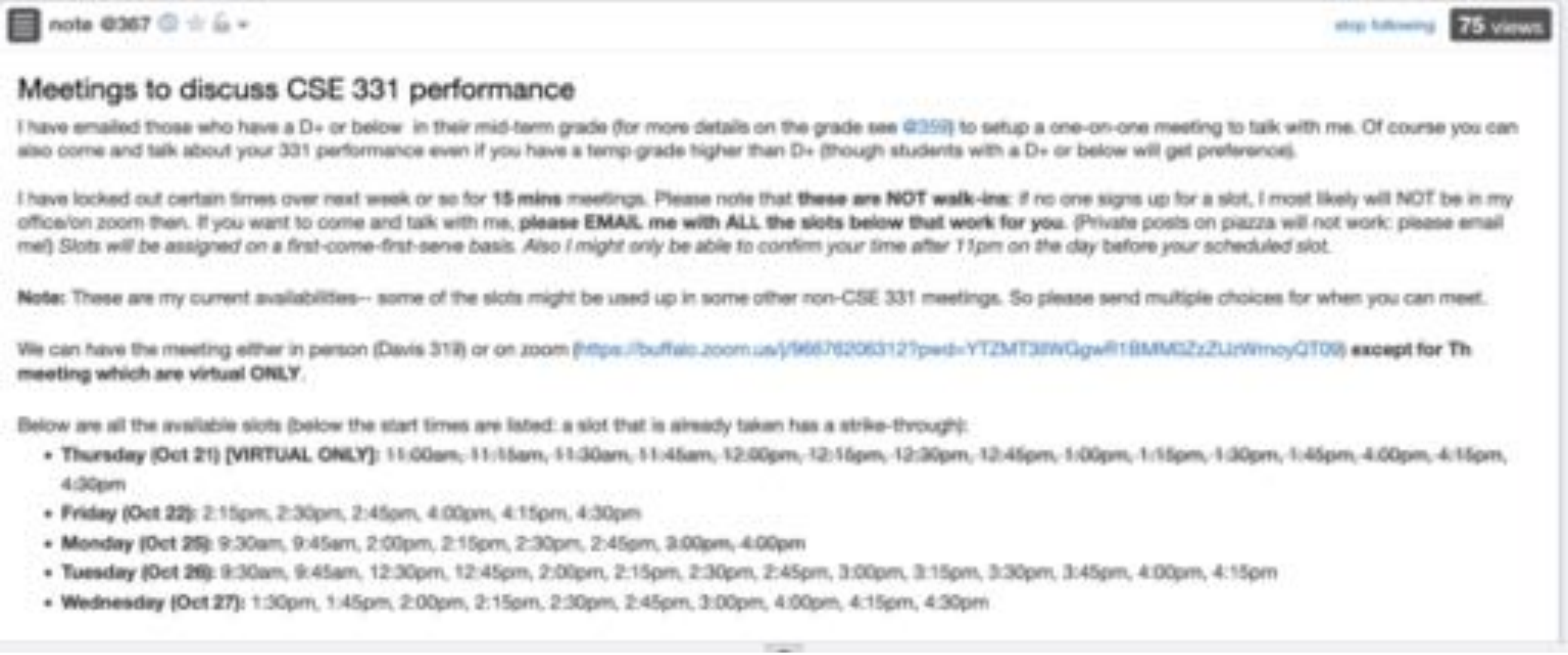
Form your group on Autolab

Groups on Autolab will NOT be automatically created

You will have to form a group on Autolab by yourself (as a group). Read on for instructions on how to go about this.

Click to add notes

1 on 1 meetings



Meetings to discuss CSE 331 performance

I have emailed those who have a D+ or below in their mid-term grade (for more details on the grade see @359) to setup a one-on-one meeting to talk with me. Of course you can also come and talk about your 331 performance even if you have a temp grade higher than D+ (though students with a D+ or below will get preference).

I have locked out certain times over next week or so for **15 mins** meetings. Please note that **these are NOT walk-ins**: if no one signs up for a slot, I most likely will NOT be in my office/on zoom then. If you want to come and talk with me, **please EMAIL me with ALL the slots below that work for you**. (Private posts on piazza will not work: please email me!) *Slots will be assigned on a first-come-first-serve basis. Also I might only be able to confirm your time after 11pm on the day before your scheduled slot.*

Note: These are my current availabilities-- some of the slots might be used up in some other non-CSE 331 meetings. So please send multiple choices for when you can meet.

We can have the meeting either in person (Davis 319) or on zoom (https://buffalo.zoom.us/j/96676206312?pwd=YTZMT38WGgwR1BMM0ZzZUzWmoyQT09) **except for Th meeting which are virtual ONLY**.

Below are all the available slots (below the start times are listed: a slot that is already taken has a strike-through):

- **Thursday (Oct 21) [VIRTUAL ONLY]:** ~~11:00am~~, ~~11:15am~~, ~~11:30am~~, ~~11:45am~~, ~~12:00pm~~, ~~12:15pm~~, ~~12:30pm~~, ~~12:45pm~~, ~~1:00pm~~, ~~1:15pm~~, ~~1:30pm~~, ~~1:45pm~~, ~~4:00pm~~, ~~4:15pm~~, 4:30pm
- **Friday (Oct 22):** 2:15pm, 2:30pm, 2:45pm, 4:00pm, 4:15pm, 4:30pm
- **Monday (Oct 25):** 9:30am, 9:45am, 2:00pm, 2:15pm, 2:30pm, 2:45pm, 3:00pm, 4:00pm
- **Tuesday (Oct 26):** 9:30am, 9:45am, 12:30pm, 12:45pm, 2:00pm, 2:15pm, 2:30pm, 2:45pm, 3:00pm, 3:15pm, 3:30pm, 3:45pm, 4:00pm, 4:15pm
- **Wednesday (Oct 27):** 1:30pm, 1:45pm, 2:00pm, 2:15pm, 2:30pm, 2:45pm, 3:00pm, 4:00pm, 4:15pm, 4:30pm

Questions/Comments?

Minimum Spanning Tree Problem

Input: Undirected, connected $G = (V,E)$, edge costs c_e

Output: Subset $E' \subseteq E)$, s.t. $T = (V,E')$ is connected
$C(T)$ is minimized

If all $c_e > 0$, then T is indeed a tree

Kruskal’s Algorithm

Joseph B. Kruskal

Input: $G=(V,E)$, $c_e> 0$ for every e in E

```
$T = \emptyset$

Sort edges in increasing order of their cost

Consider edges in sorted order

    If an edge can be added to $T$ without adding a cycle then add it to $T$
```

Prim’s algorithm

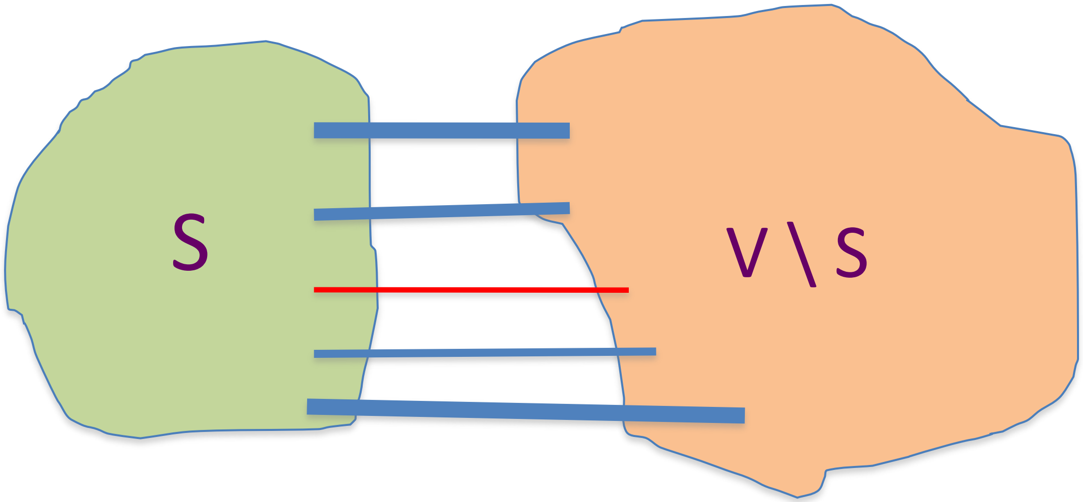
Similar to Dijkstra’s algorithm

Robert Prim

```
Input: $G=(V,E)$, $c_e > 0$ for every $e$ in $E$
$S = \{s\}$, $T = \emptyset$
While $S$ is not the same as $V$
    Among edges $e= (u,w)$ with $u$ in $S$ and $w$ not in $S$, pick one with minimum cost
    Add $w$ to $S$, $e$ to $T$
```

Cut Property Lemma for MSTs

Condition: S and V\S are non-empty



Cheapest crossing edge is in **all** MSTs

Assumption: All edge costs are distinct

Questions/Comments?

Today’s agenda

Optimality of Prim’s algorithm

Prove Cut Property Lemma

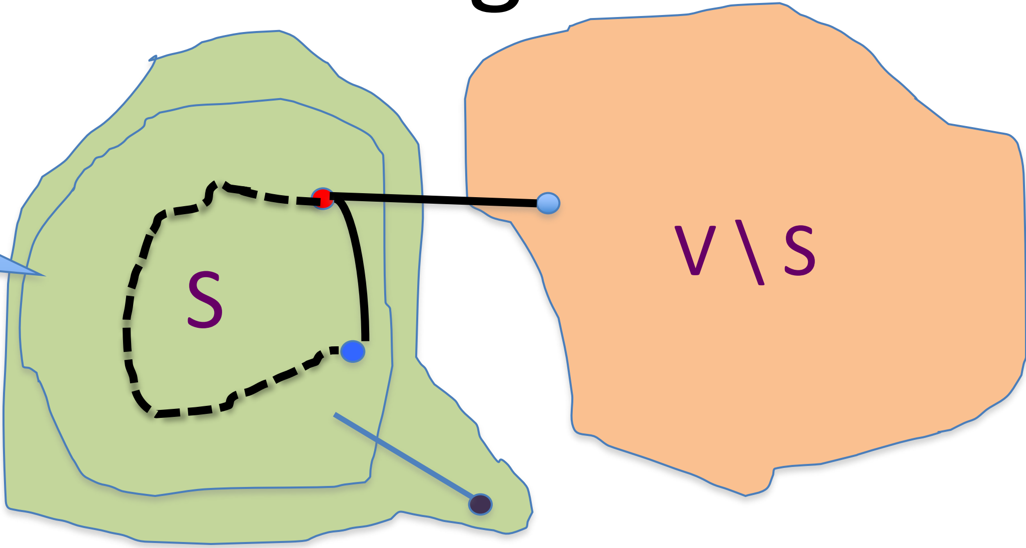
Optimality of Kruskal’s algorithm

Remove distinct edge weights assumption

On to the board…

Optimality of Kruskal's Algorithm

Nodes connected to red in (V,T)



Input: $G=(V,E)$, $c_e > 0$ for every e in E

$T = \emptyset$

Sort edges in increasing order of their cost

Consider edges in sorted order

If an edge can be added to T without adding a cycle then add it to T

S is non-empty

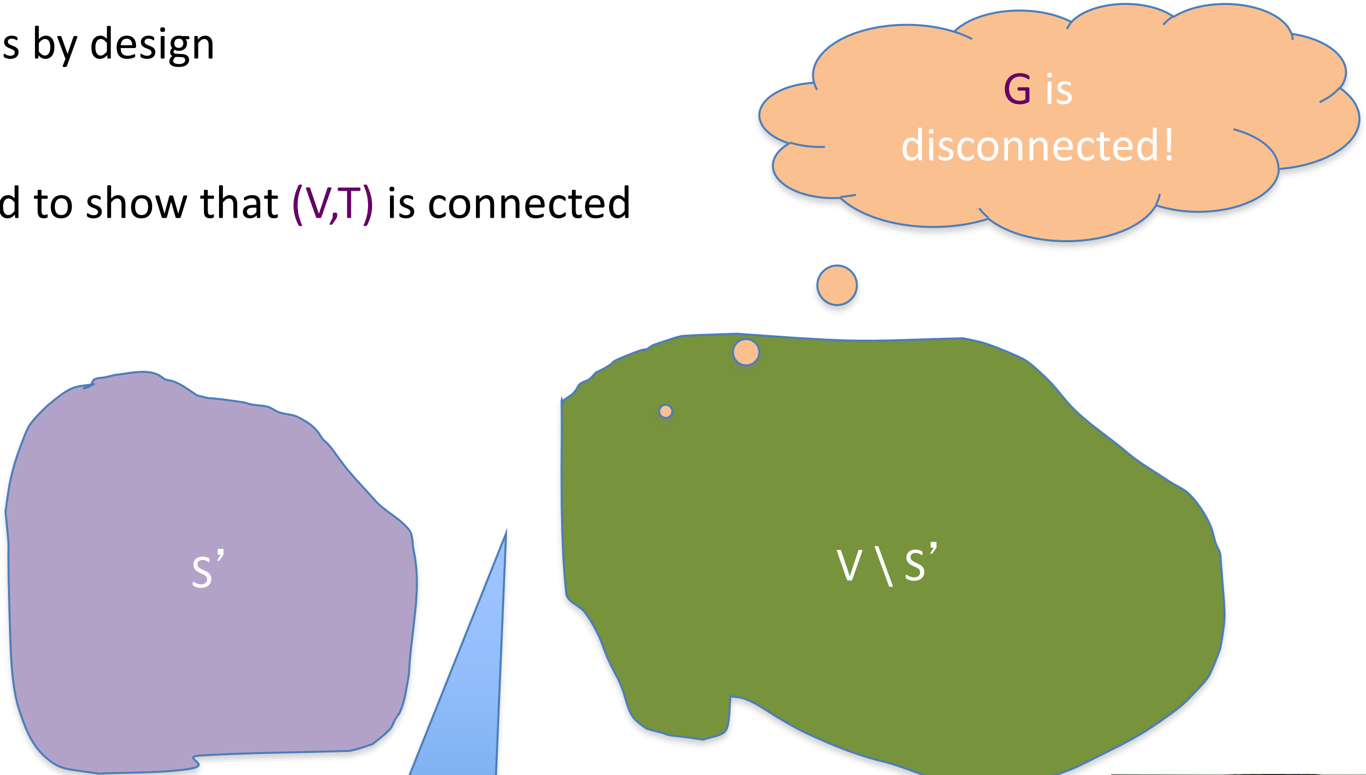
V\S is non-empty

First crossing edge considered

Is (V,T) a spanning tree?

No cycles by design

Just need to show that (V,T) is connected



No edges here