Lecture 21

CSE 331

Oct 21, 2022

Project deadlines coming up

Fri, Oct 28	Counting Inversions F21 F19 F18 F17 x^2	[KT, Sec 5.3] (**Project (Problem 1 `Coding`) in**)
Mon, Oct 31	Multiplying large integers F21 F19 F18 F17 x^2	[KT, Sec 5.5] (**Project (Problem 1 `Reflection`) in**) *Reading Assignment:* Unraveling the mystery behind the identity
Wed, Nov 2	Closest Pair of Points F21 F19 F18 F17 x^2	[KT, Sec 5.4]
Fri, Nov 4	Kickass Property Lemma F21 F19 F18 F17 x^2	[KT, Sec 5.4] (**Project (Problem 2 `Coding`) in**)
Mon, Nov 7	Weighted Interval Scheduling F21 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

Mid-term temp grade assigned

note @323

stop following 80 views

Actions

Mid-term temp grade

(For details on grading of mid-term exam, see @311 and @319. More details on one-on-one meetings see @324)

Your temp letter grades have been assigned. To calculate your grade, you must first calculate your raw score R as follows:

- Add up your HW scores from HW1-3 to calculate H (out of a max of 300)
- Let Q be your quiz 1 score (out of a max of 10)
- Let M be your mid-term score (out of a max of 100).

Then R is calculated as follows (out of a maximum possible of 55):

$$R = \frac{[\text{illegible}]}{300} \cdot H + Q \cdot \frac{1}{10} + \frac{[\text{illegible}]}{100} \cdot M.$$

(I know the above does not fully follow the grading rubric since it does not drop any HW score and does not substitute the quiz score with the HW score if you do better on the latter. However, since this is just supposed to give you an idea of where you stand in the course, I think the above is fine as a proxy.)

Here are the stats of the raw score:

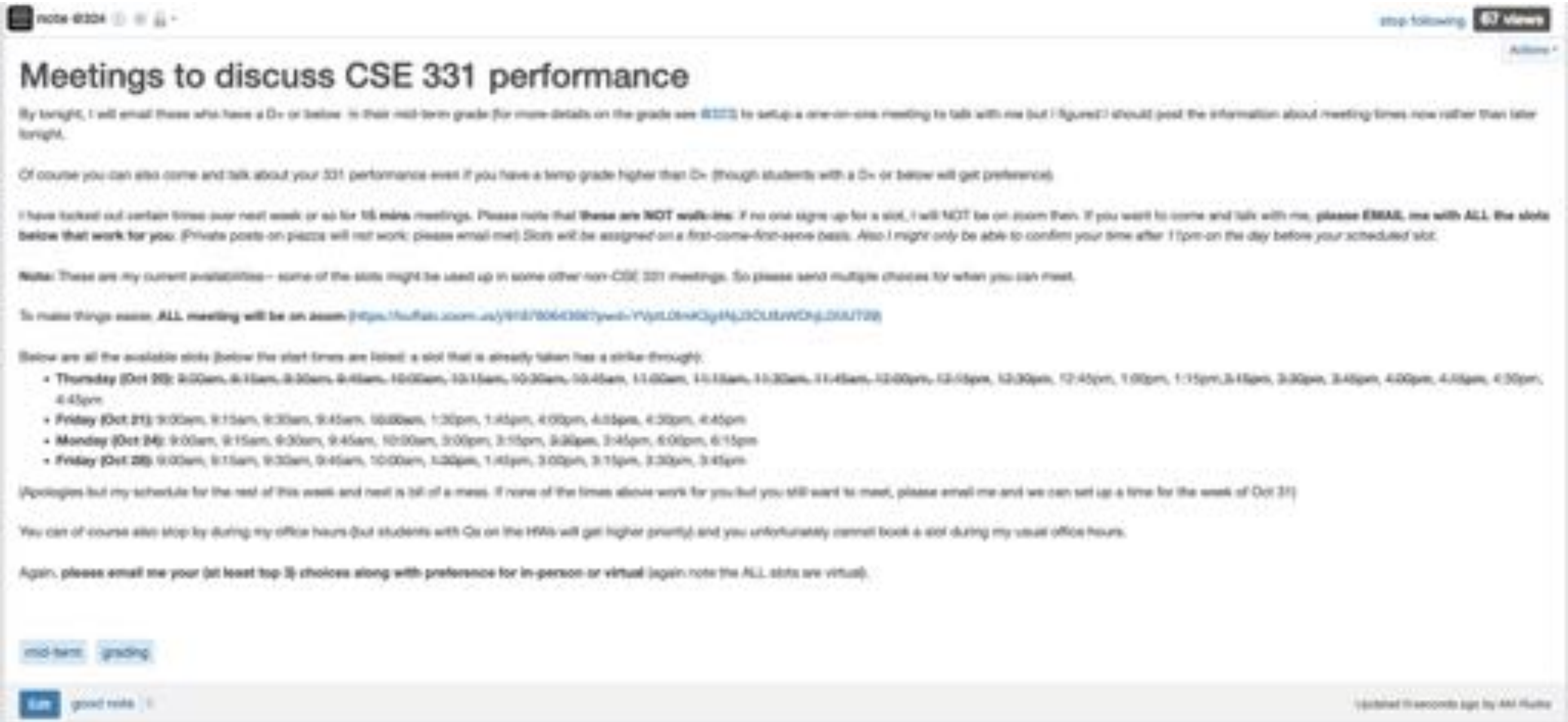
- Average: 21.1
- Median: 19.1
- Std. Dev: 13.57
- Max: 47.86

(For those who are interested the median raw score is essentially the same as last year.)

Now to calculate your letter grade, read it off from the following map:

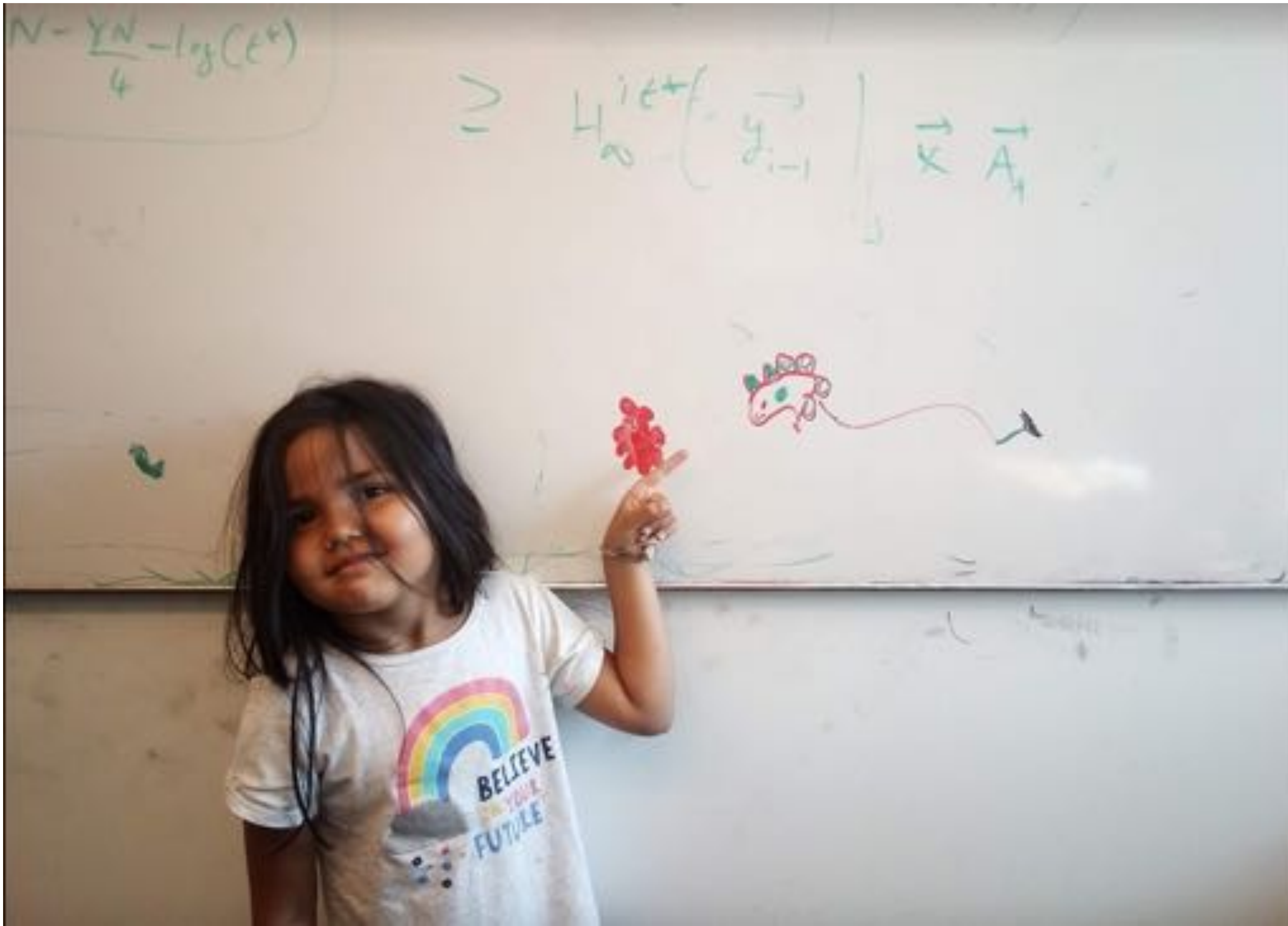
- A: $R \in [49.5, 55]$

1-on-1 meetings



Meetings to discuss CSE 331 performance

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

$S = \{s\}$, $T = \emptyset$

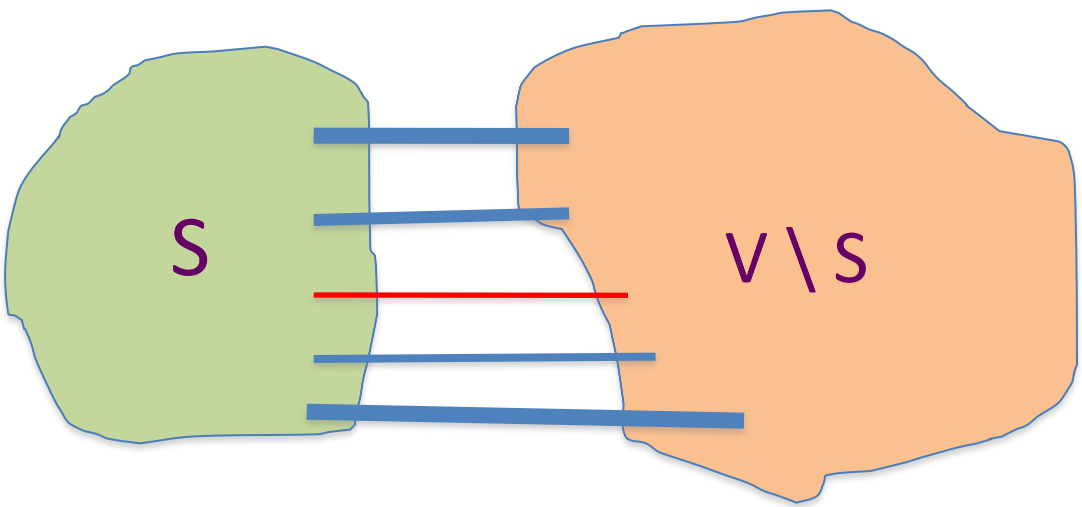
While S is not the same as V

  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

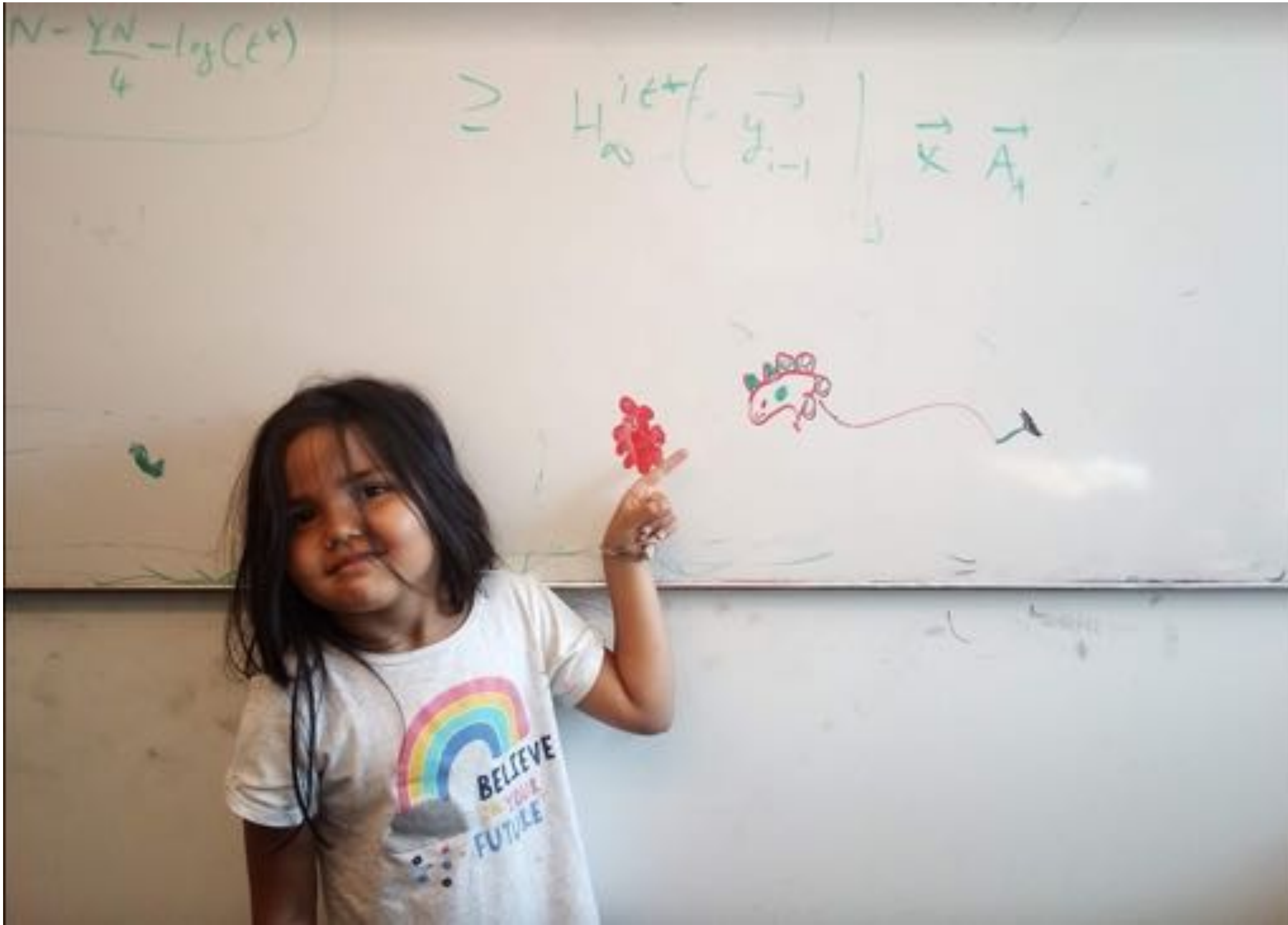
Condition: S and V\S are non-empty



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

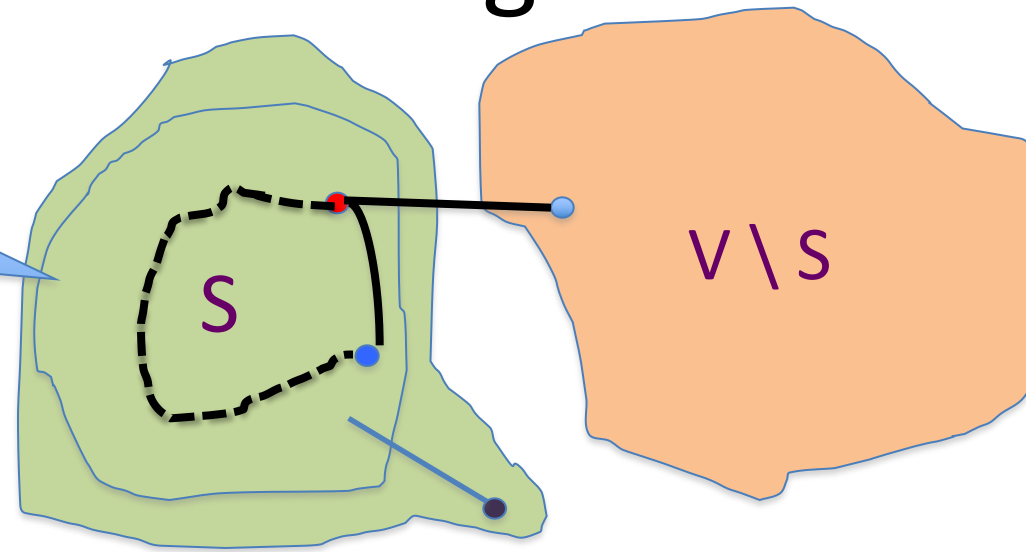
Optimality of Kruskal's algorithm

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 = Ø

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