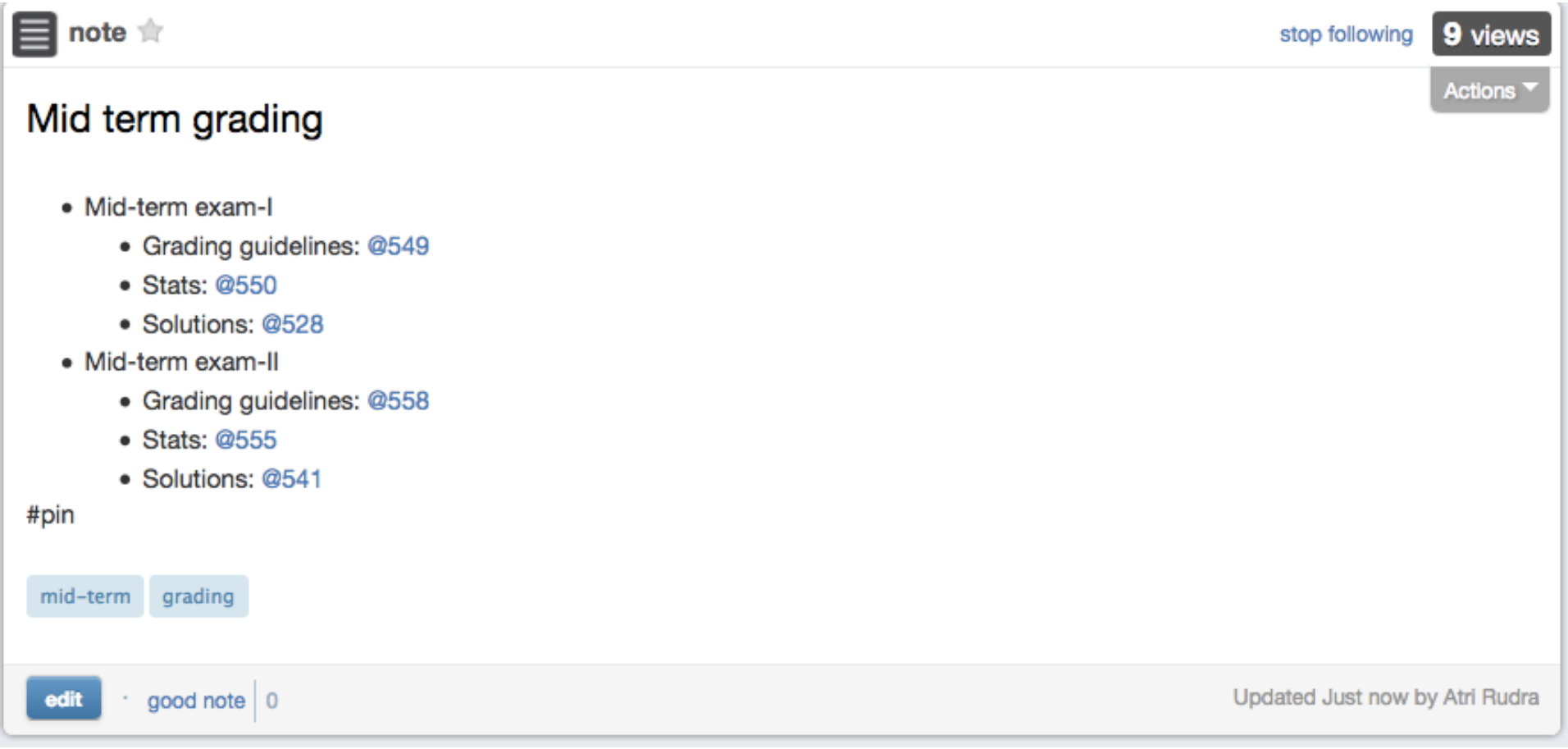
# Lecture 24

CSE 331

Oct 28, 2016

# Mid-term related stuff




A post over the weekend on temporary mid-term grade

# And back to our HW schedule..

# Homework 6

Due by **12:30pm, Friday, November 4, 2016**.

Make sure you follow all the homework policies.

All submissions should be done via Autolab.

## Question 1 (Programming Assignment) [40 points]

**</> Note**

This assignment can be solved in either Java, Python or C++ (you should pick the language you are most comfortable with). Please make sure to look at the supporting documentation and files for the language of your choosing.

**The Problem**

The `TennisSuperVillian` is hell-bent on destroying earth. Humans have one last hope: the great tennis player Serena Williams:

# Chunming's 2nd annual address

note

0 views

## Chunming's 2nd annual chair's address

Chunming will be giving his second annual chair's address to CSE majors on **Wednesday, Nov 2** at **5pm** in **Davis 101**.

The idea behind these addresses is to increase the interaction between the department and the undergraduate students. We are changing the format slightly this year. Instead of addressing different years separately this address is for all years together. Also this meeting will be more in a town hall setting, so please add in your questions in the form below!

Also **THERE WILL BE FREE PIZZA**.

To help us plan better for pizza and to submit your question, please fill in this Google form:

https://docs.google.com/forms/d/e/1FAIpQLSflvIo7tWxoD19dLdhHYTWQifhi0bM6a1w0SkWnvimAv7LipQ/viewform

I know this is bit of a short notice but I hope you can make it!

logistics

edit · good note | 0

Updated 1 minute ago by Atri Rudra

# Dijkstra's shortest path algorithm

$d'(v) = \min_{e=(u,v) \text{ in } E,\ u \text{ in } R} d(u)+l_e$

Input: Directed $G=(V,E)$, $l_e \geq 0$, $s$ in $V$

$R = \{s\}$, $d(s) = 0$

While there is a $v$ not in $R$ with $(u,v)$ in $E$, $u$ in $R$

Pick $w$ that minimizes $d'(w)$
Add $w$ to $S$
$d(w) = d'(w)$

At most $n$ iterations

$O(m)$ time

$O(mn)$ time bound is trivial

$O(m \log n)$ time implementation with priority Q

# Reading Assignment

Sec 4.4 of [KT]

# Building a fiber network

Lay down fibers to connect n locations

All n locations should be connected

Laying down a fiber costs money


What is the cheapest way to lay down the fibers?

# Today's agenda

Minimum Spanning Tree (MST) Problem

Greedy algorithm(s) for MST problem

# Kruskal's Algorithm

Joseph B. Kruskal

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

$T = \emptyset$

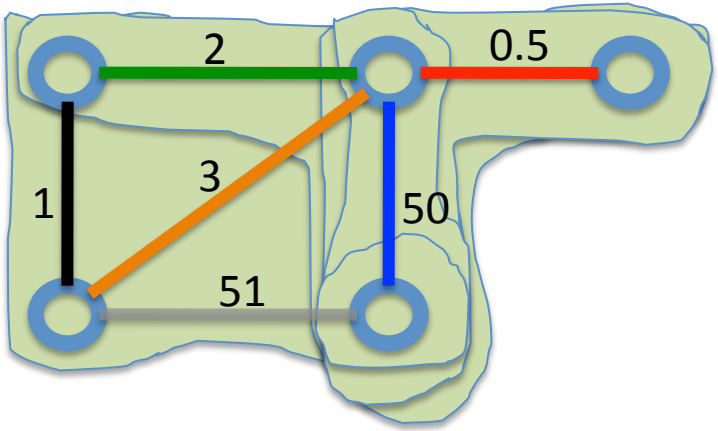
Sort edges in increasing order of their cost

Consider edges in sorted order

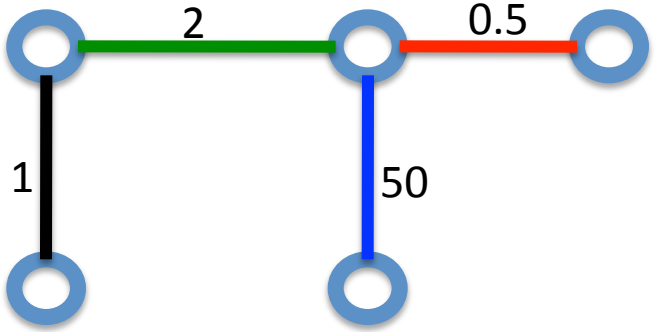
If an edge can be added to $T$ without adding a cycle then add it to $T$

# Prim's algorithm

Similar to Dijkstra's algorithm




Robert Prim




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

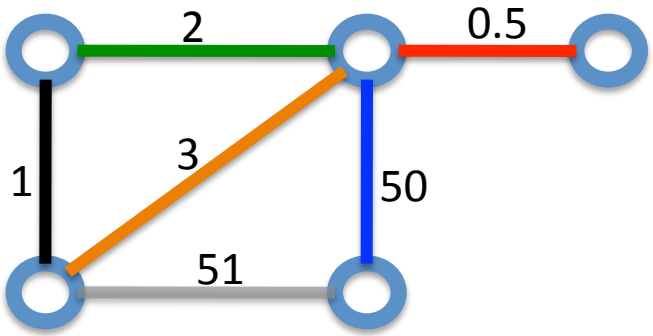
$S = \{s\}$, $T = \emptyset$

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 $T$

# Reverse-Delete Algorithm



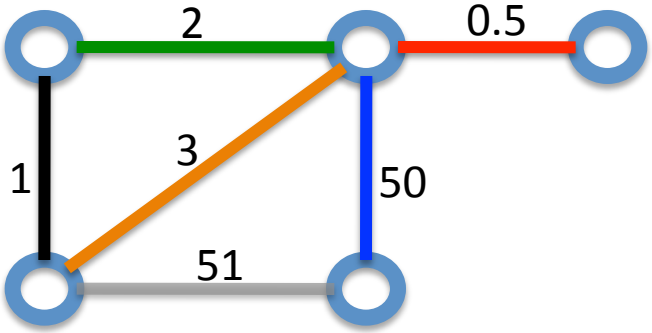

Input: G=(V,E), $c_e > 0$ for every e in E

T = E

Sort edges in decreasing order of their cost

Consider edges in sorted order

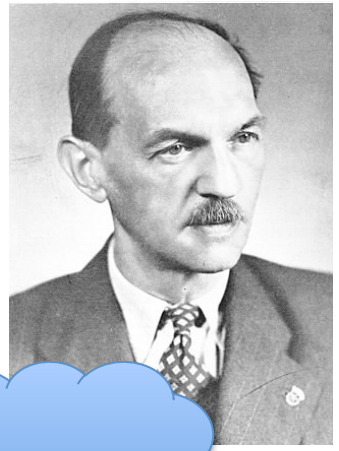
If an edge can be removed T without disconnecting T then remove it



# (Old) History of MST algorithms

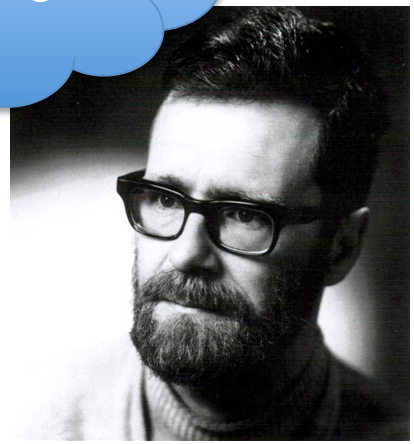
1920: Otakar Borůvka

1930: Vojtěch Jarník



Same algo!

1956: Kruskal



1957: Prim

1959: Dijkstra