

# Lecture 9

CSE 331

Sep 18, 2017

# Mini Project choice due Sep 25

note ☆ 1 views

## Mini project needs groups of size EXACTLY 3

A gentle reminder that your group composition is due in just over a week (11:50pm on Monday, Sep 25).

The important thing to note is that you need to send me **groups of size EXACTLY three**. This means you are responsible for finding two other students in 331 to form your group. I will **not** make any group assignments.

Feel free to use the comments on this post to try and find others who are still looking to form a group.

[mini\\_project](#)

[edit](#) - good note | 0 Updated Just now by Atri Rudra

# TA office hours location change

## Salvador Lounge by default

note ☆ stop following 20 views Actions ▾

### TA Office hours location change

Starting from Monday (Sep 18), all TA office hours will be in the **Salvador Lounge** (this is the lounge on the 2nd floor overlooking Grace Plaza) with the following **exceptions**:

- In case the Salvador lounge has an event then the Office hour will move back to Davis 302 (and the adjoining TA area)
  - If this happens there will be a post on piazza.
- The following Office hours will **always** be in **Davis 113Y**:
  - Anand and Dhruv's office hours on Tuesdays from 5-6pm
  - Aishani's Wed 5-6pm office hours
- The following office hours will move to **Davis 113 Y** if **Salvador lounge is full**
  - Sravanika's Wed 5-6pm office hour
  - Katie's Th 5-6pm office hour.
  - If this move happens then there will be a post on piazza.

As usual, the [syllabus](#) has the above updated information.

#pin

[office\\_hours](#)

# HW policy violations for HW 1

You can only use one of the five (5) allowed sources

You can only collaborate with 2 other students on Q2/Q3 on a HW

If you did not follow either, have till Friday to withdraw your submission

note ☆

1 views

Actions

## You can only use allowed sources + collaborate with 2 other students

I would like to remind you that you can only use the **five allowed** sources that are mentioned on this page (this holds for both programming and non-programming questions):

<http://www-student.cse.buffalo.edu/~atr/cse331/fall17/policies/hw-policy.html>

Further, for each HW you can collaborate with two other students for Q2 or Q3 (and no collaboration what-so-ever is allowed on Q1).

There have been couple of HW1 submissions that seem to have used sources that are beyond the allowed ones or did not have the proper set of collaborators.

**As a one time offer, you can withdraw your HW1 solutions by the end of this week:** email me your withdrawal (an email with the question(s) where the HW policies were not followed and a statement saying you are withdrawing your submission) and I'll make a note of your withdrawal from Autolab (and you will not receive any penalty other than a 0 on that question).

# Gale-Shapley Algorithm

Initially all men and women are **free**

At most  $n^2$  iterations

While there exists a free woman who can propose

Let  $w$  be such a woman and  $m$  be the best man she has not proposed to

$w$  proposes to  $m$

If  $m$  is free

$(m,w)$  get **engaged**

Else  $(m,w')$  are engaged

If  $m$  prefers  $w'$  to  $w$

$w$  remains **free**

Else

$(m,w)$  get **engaged** and  $w'$  is **free**

$O(1)$  time  
implementation

Output the engaged pairs as the final output

# Implementation Steps

(0) How to represent the input?

(1) How do we find a free woman  $w$ ?

(2) How would  $w$  pick her best unproposed man  $m$ ?

(3) How do we know who  $m$  is engaged to?

(4) How do we decide if  $m$  prefers  $w'$  to  $w$ ?

# Overall running time

Init(1-4)



$n^2$  X ( Query/Update(1-4) )

# Questions?





# Puzzle

Prove that **any** algorithm for the SMP takes  $\Omega(n^2)$  time

# Main Steps in Algorithm Design

Problem Statement



Problem Definition



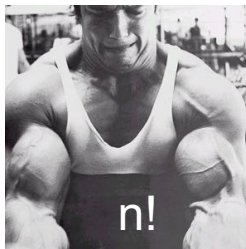
Algorithm



“Implementation”

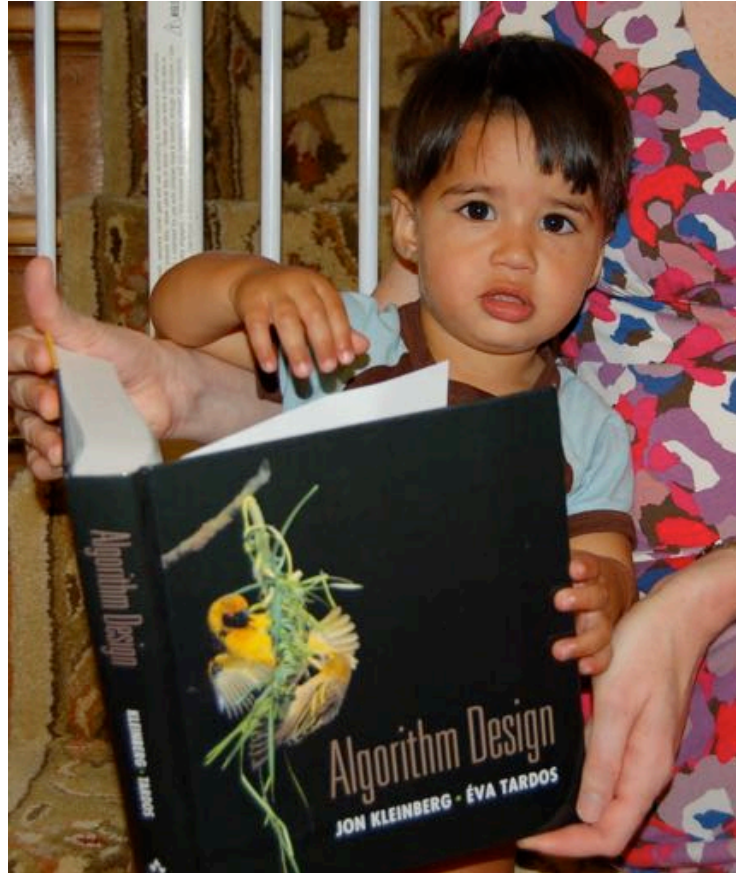


Analysis



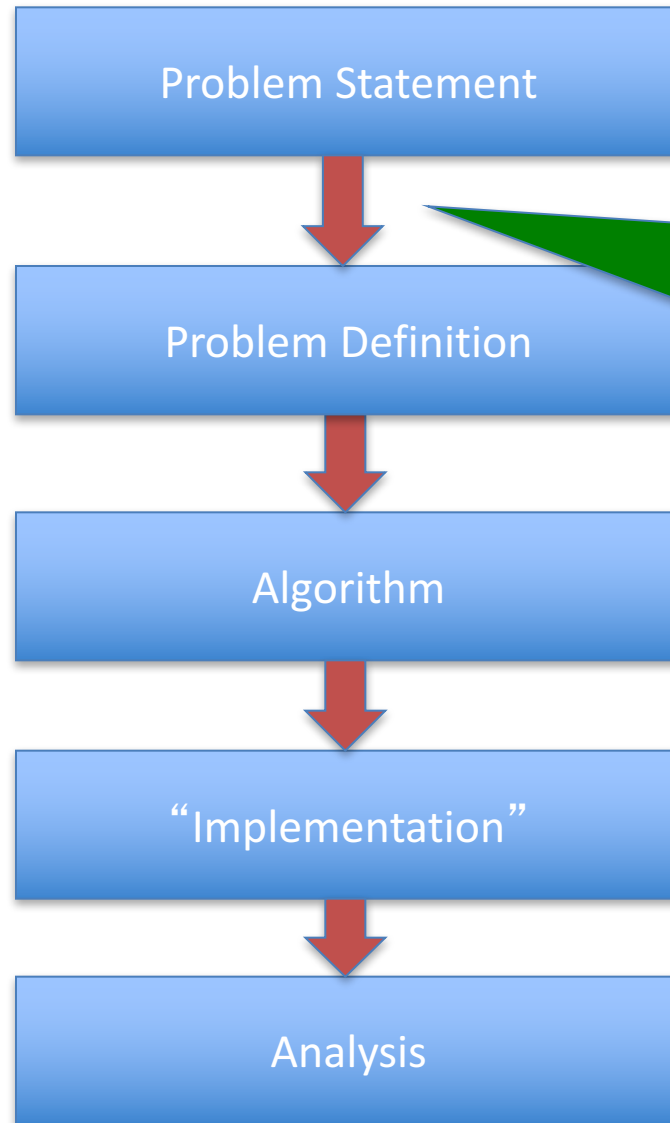
Correctness Analysis

# Reading Assignments



Sec 1.1 and Chap. 2 in [KT]

# Up Next....

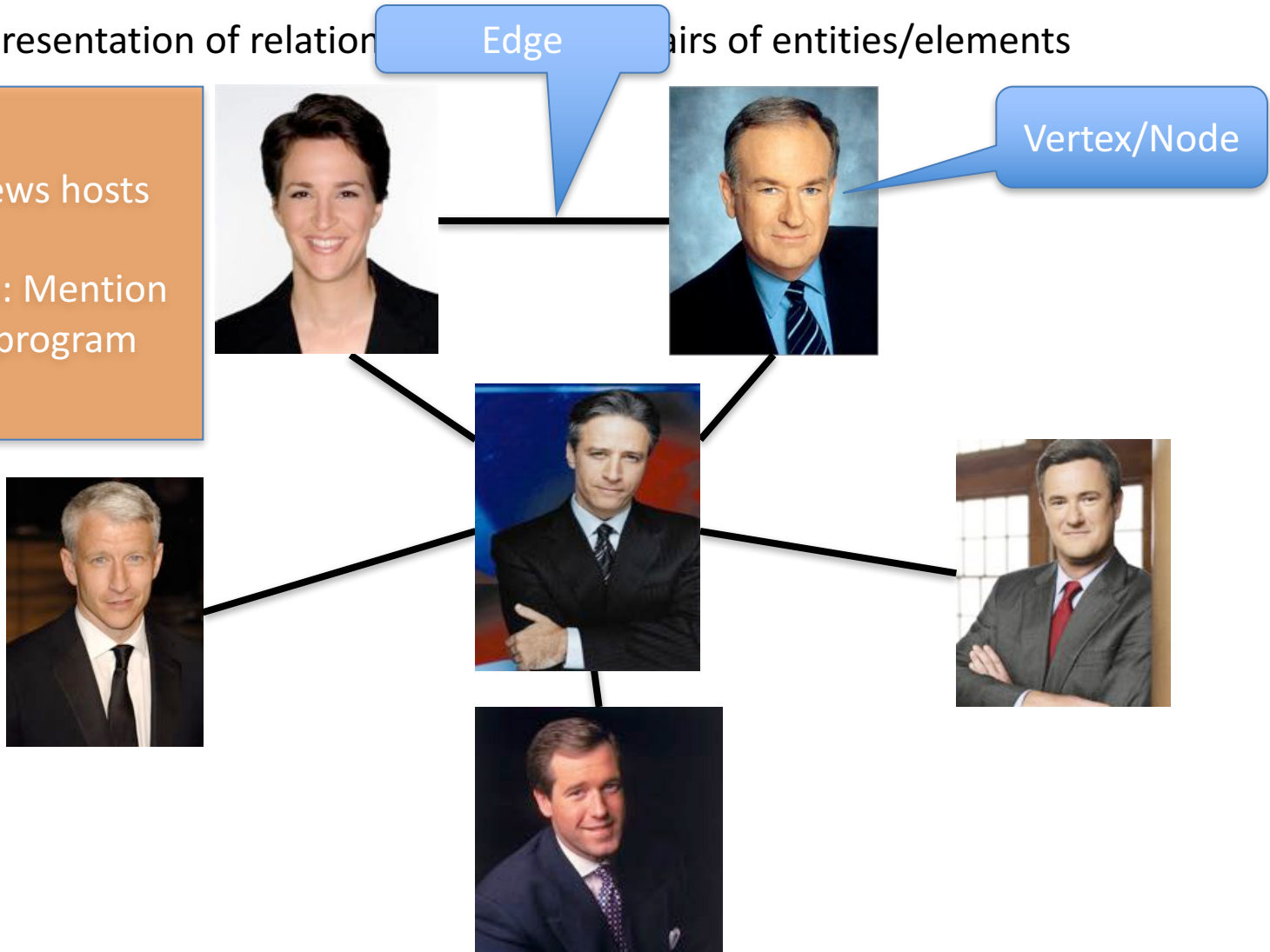


A generic tool  
to abstract  
out problems

# Graphs

Representation of relationships between pairs of entities/elements

Entities: News hosts  
Relationship: Mention in other's program



# Graphs are omnipresent



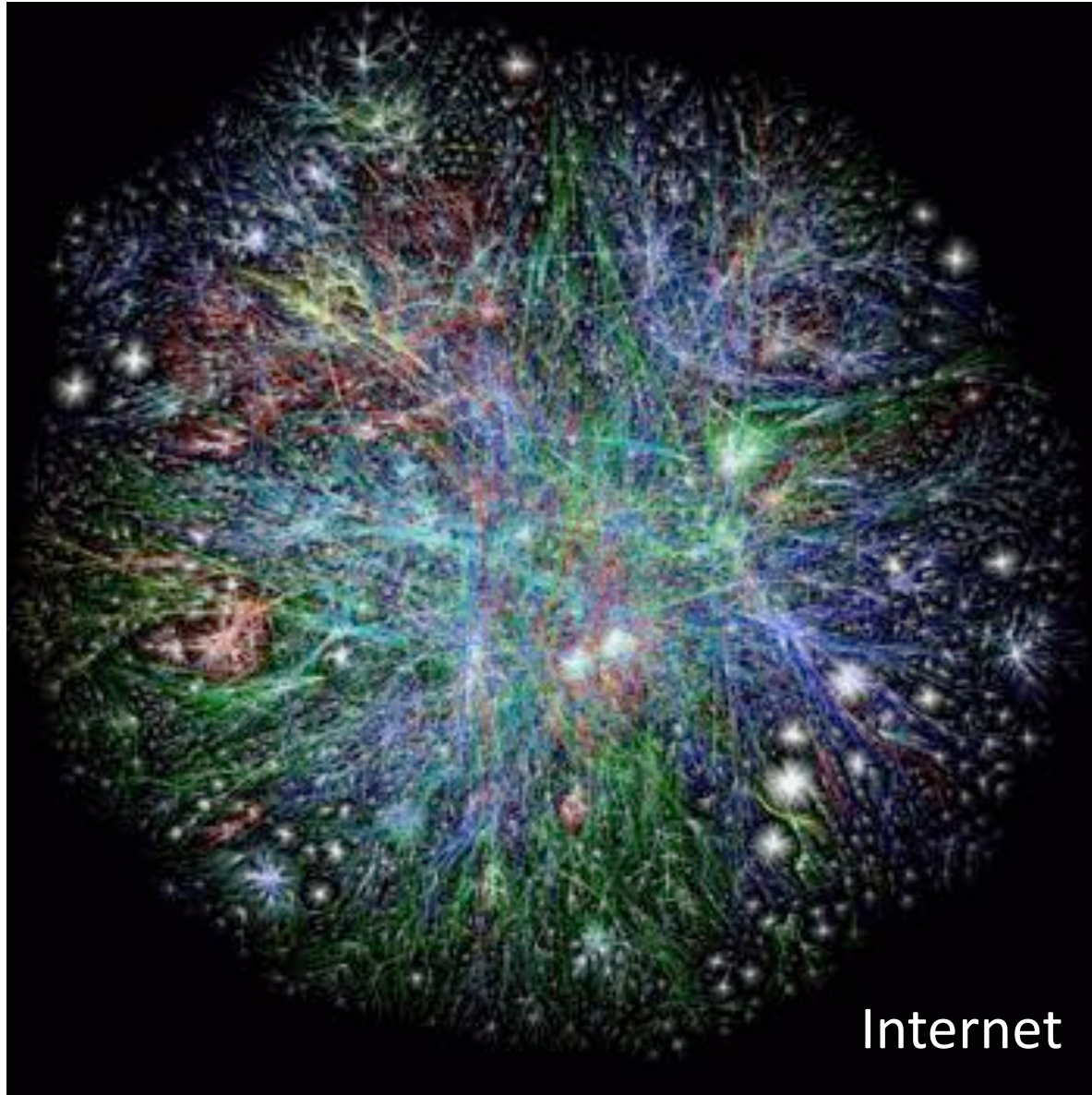
Español • Help • Speak up

## Airline Route maps



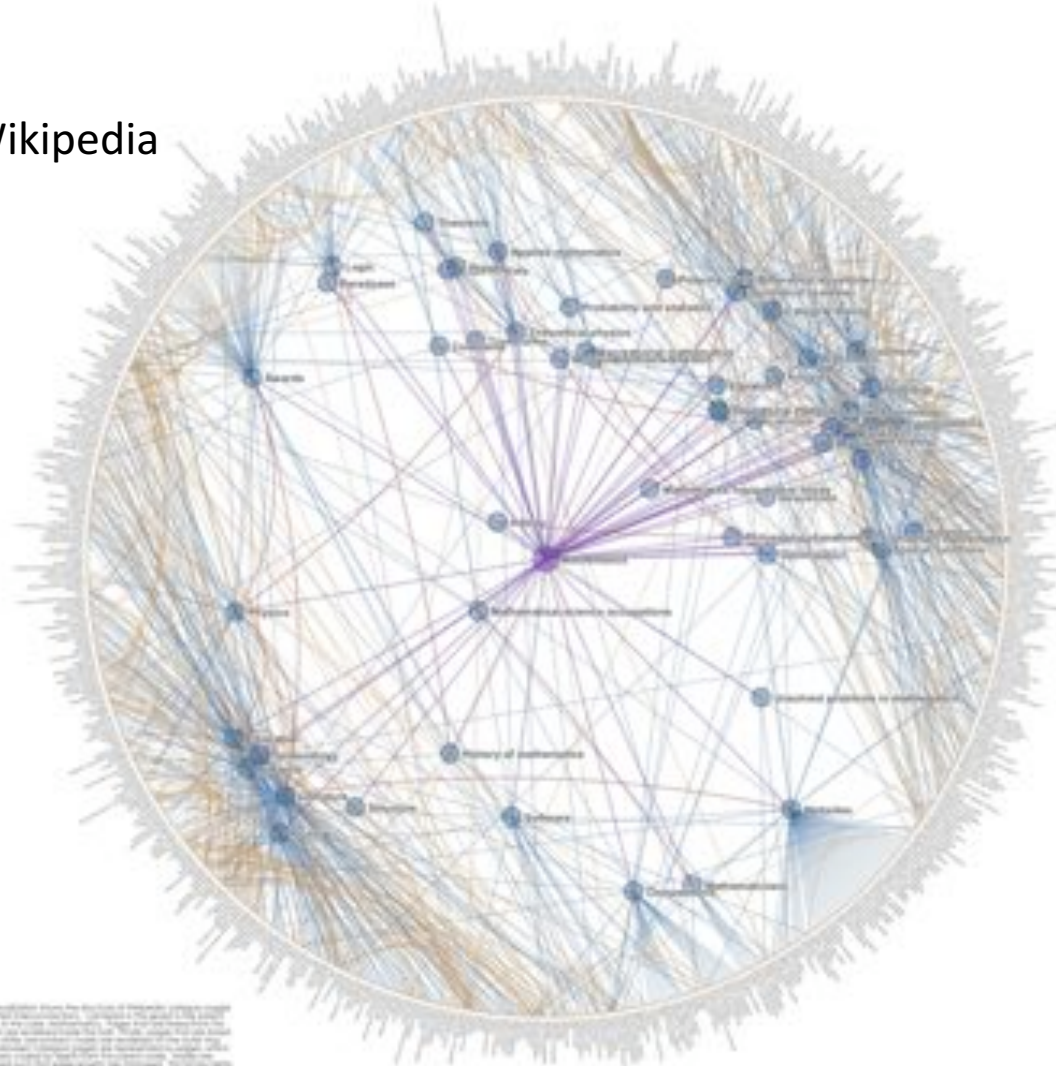


# What does this graph represent?



# And this one?

Math articles on Wikipedia



Visualization of the network of relationships between math articles on Wikipedia. The nodes represent the articles and the edges represent the relationships between them. The graph is circular and shows a dense network of connections. A central node is highlighted in purple, and several other nodes are highlighted in blue.



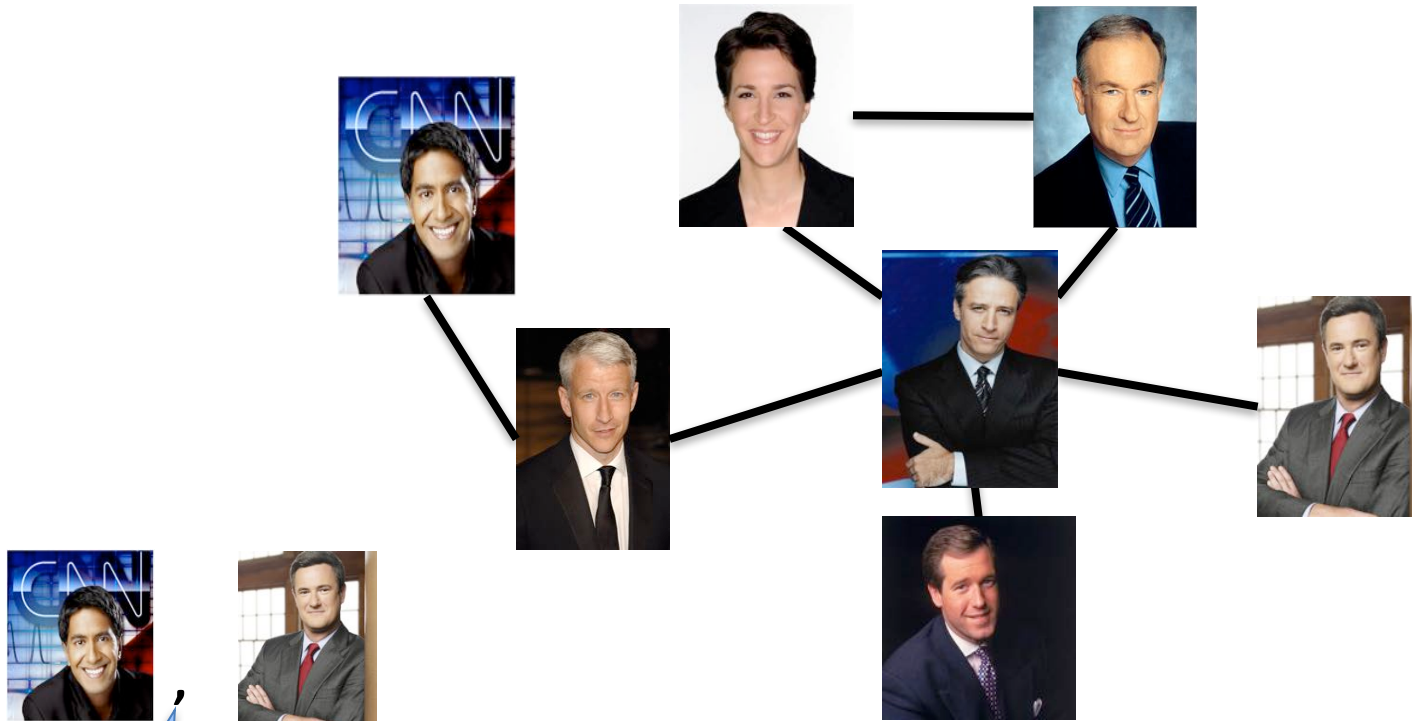
And this one?



# Rest of today's agenda

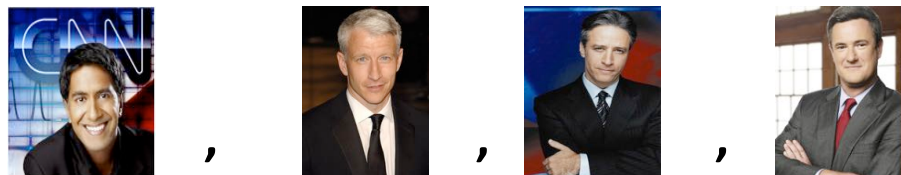
Basic Graph definitions

# Paths



Sequence of vertices connected by edges

Connected



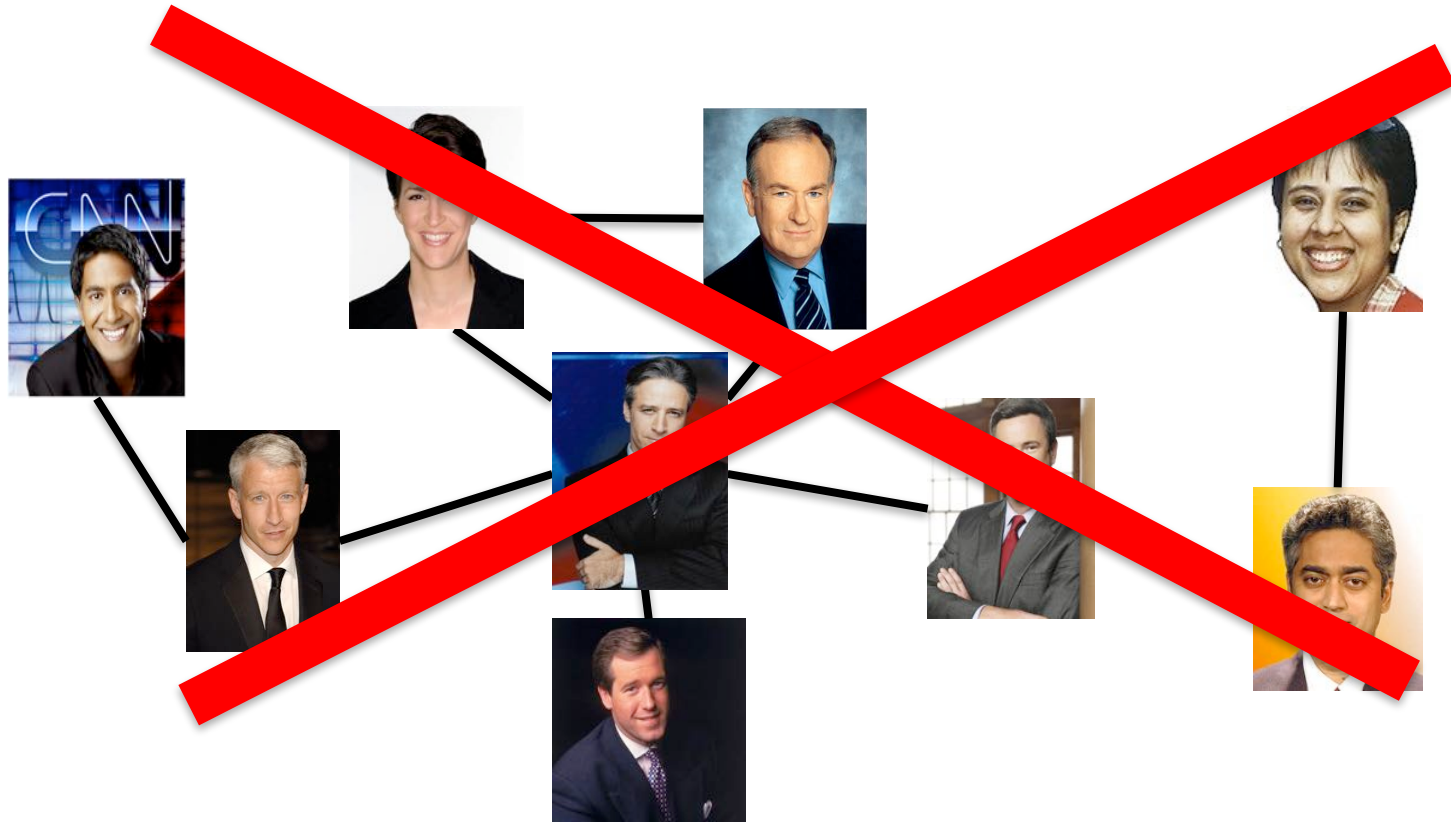
Path length 3

# Connectivity

$u$  and  $w$  are connected iff there is a path between them

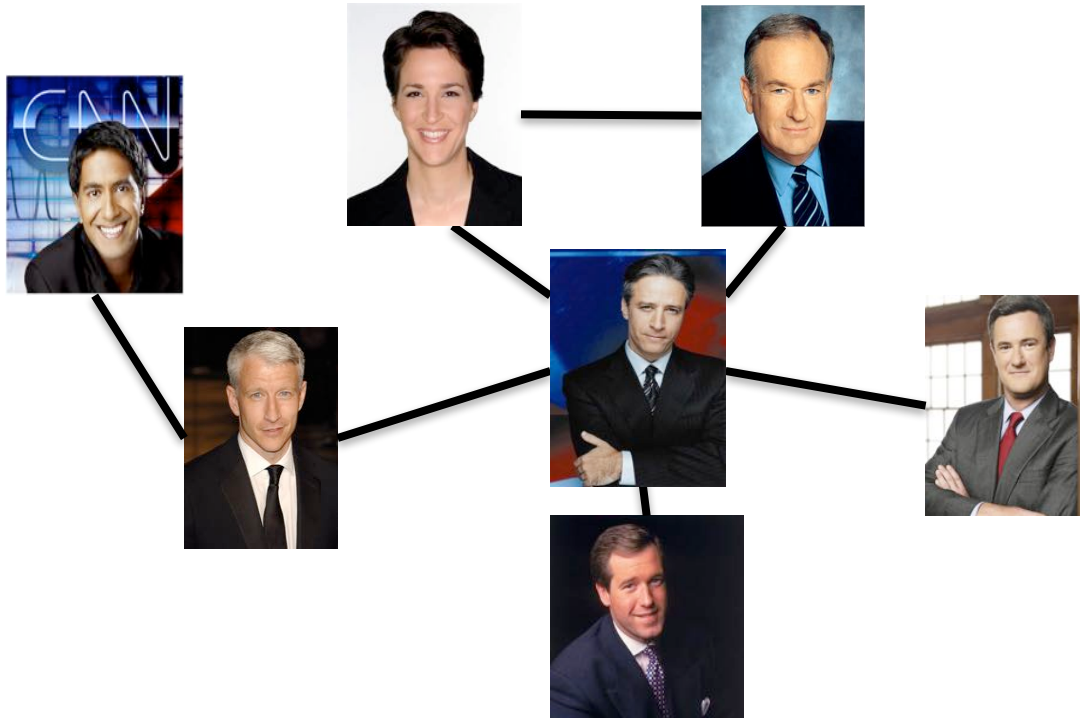
A graph is connected iff all pairs of vertices are connected

# Connected Graphs



Every pair of vertices has a path between them

# Cycles

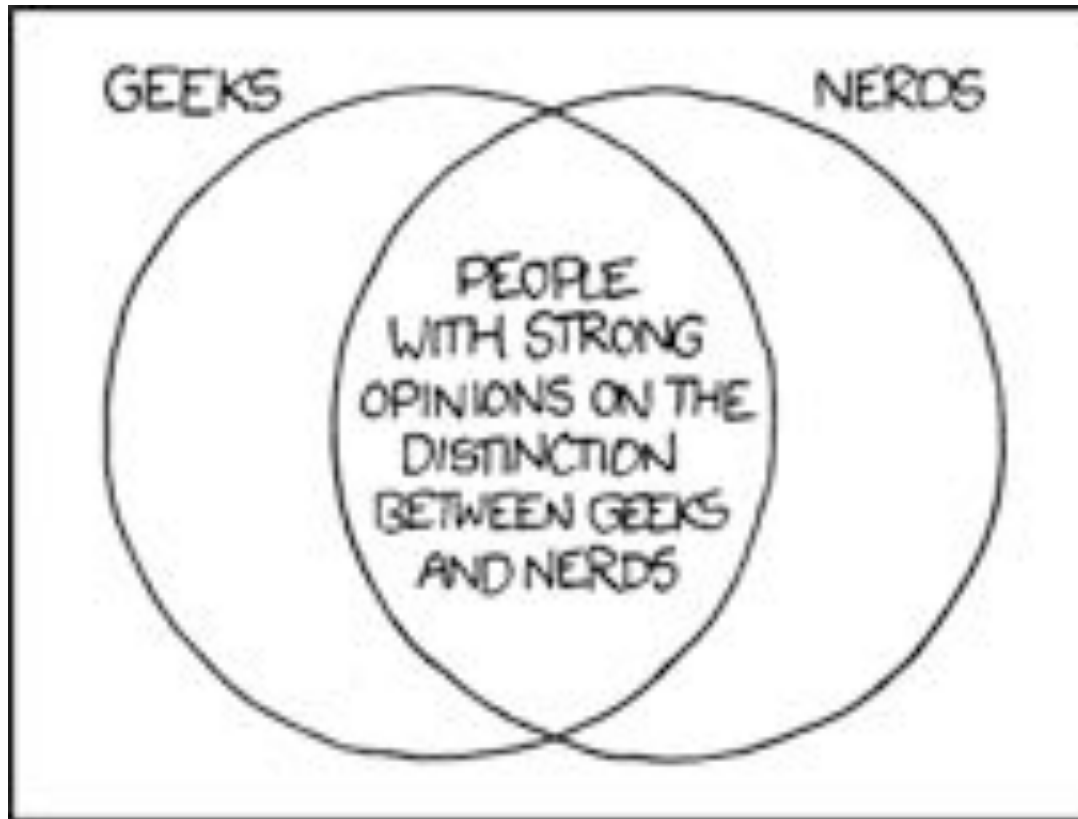


Sequence of  $k$  vertices connected by edges, first  $k-1$  are distinct





# Formally define everything

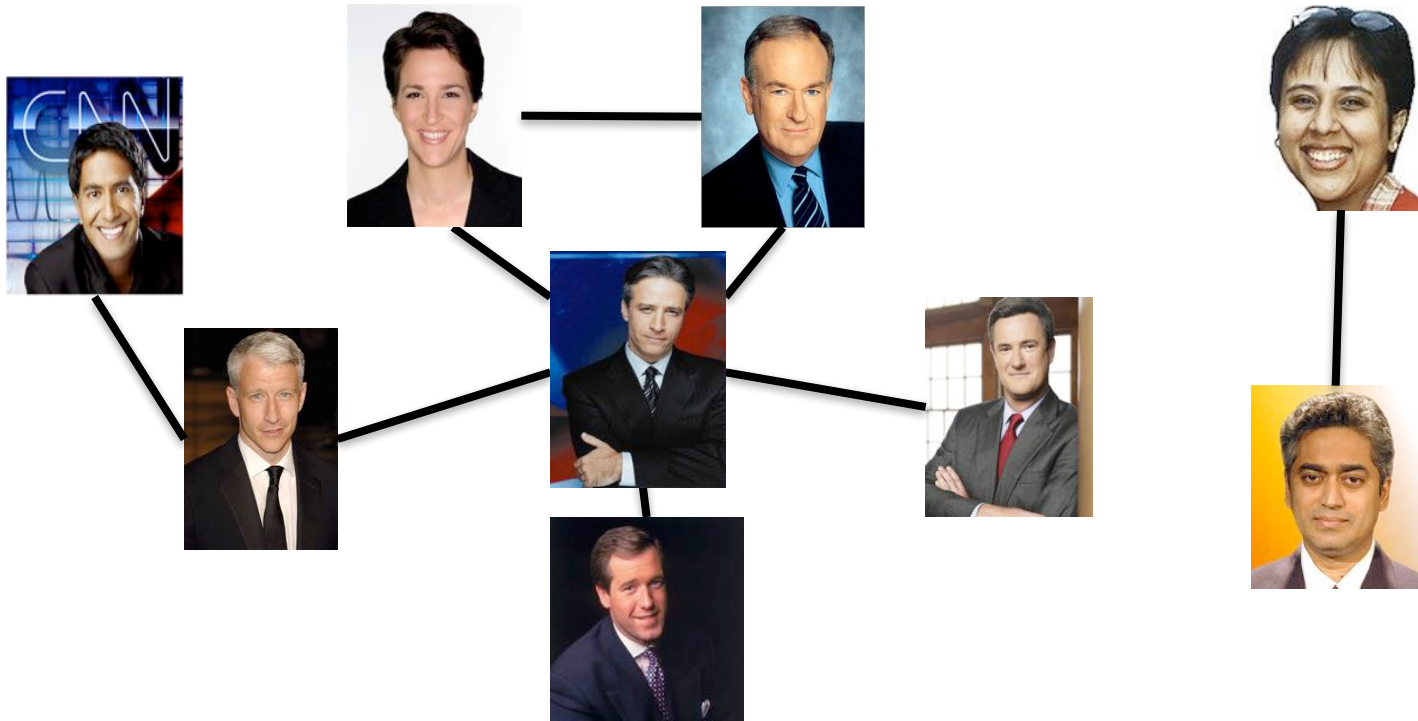


[http://imgs.xkcd.com/comics/geeks\\_and\\_nerds.png](http://imgs.xkcd.com/comics/geeks_and_nerds.png)



# Tree

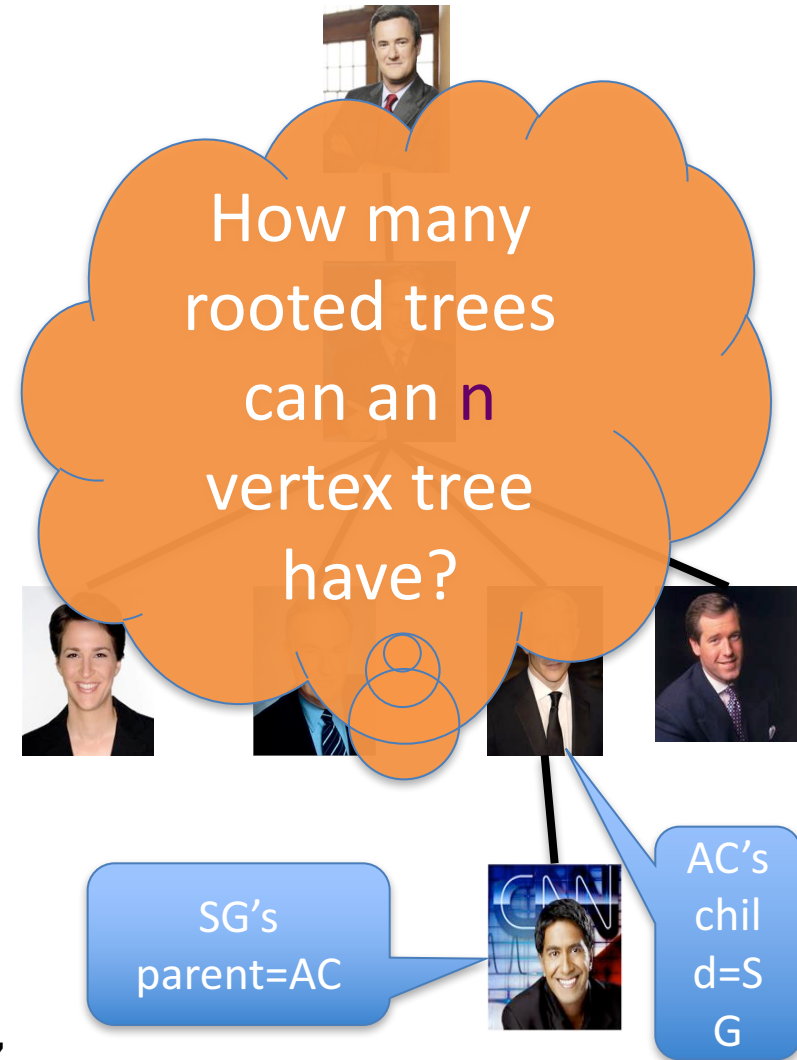
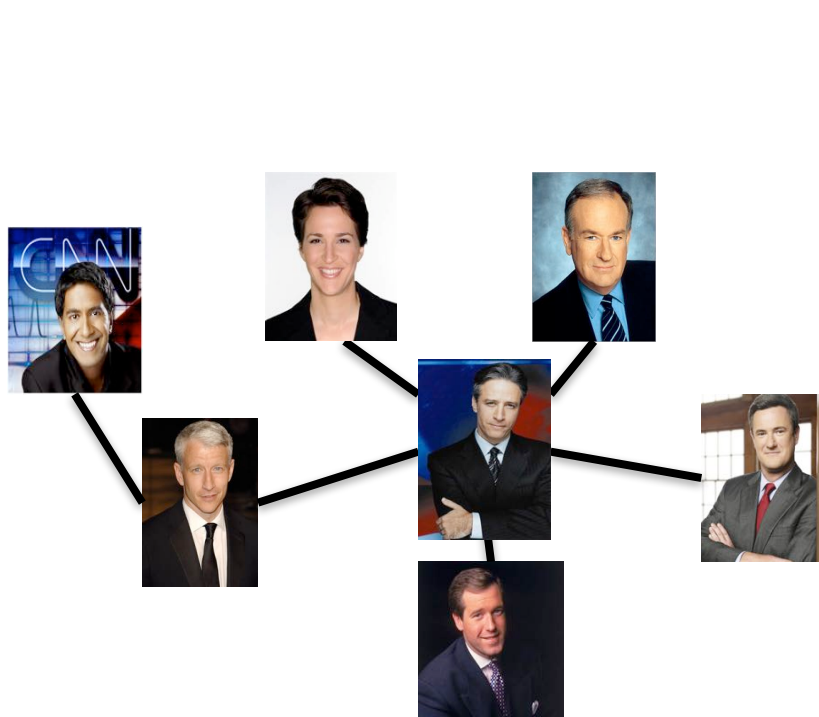
Connected undirected graph with no cycles



# Rooted Tree



# A rooted tree



Pick any vertex as root

Let the rest of the tree hang under “gravity”