

Lecture 10

CSE 331

Sep 17, 2014

Online OH tonight @9pm

note ☆

0 views

Actions

Online OH #2 at 9pm tomorrow (Wed)

I will have my second online office hour tomorrow (Sep 17) from 9-10pm. Any and all 331 related questions are welcome: just remember to use tag your questions with folder 'onlineoh2'

I have added the above to the Google calendar for the class.

onlineoh2

edit good note

Just now by Alri Pludra

Mini Project choice due Oct 8

Wed, Oct 1
Fri, Oct 3
Mon, Oct 6
Wed, Oct 8
Fri, Oct 10
Mon, Oct 13

(HW 4 in, HW 5 out)
(Team Composition Due)
(HW 5 in)
(Quiz 1)

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

Gale-Shapley Algorithm

Initially all men and women are **free**

Linked list of free women

While there exists a free woman who can propose

Array Next[w]

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**

Today

w remains **free**

Else

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

ManPref[m,j]
WomanPref[w,j]

Output the engaged pairs as the final output

Implementation Steps

(1) How to represent the input?

(2) How do we find a free woman w ?

Init: $O(n)$, Query/Update: $O(1)$

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

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

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

Overall running time

$O(n) + \text{Init}(3-5)$



$n^2 \times (O(1) + \text{Query/Update}(3-5))$

Questions?



Puzzle

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

Main Steps in Algorithm Design

Problem Statement



Problem Definition



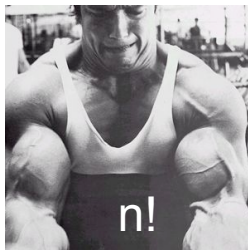
Algorithm



“Implementation”

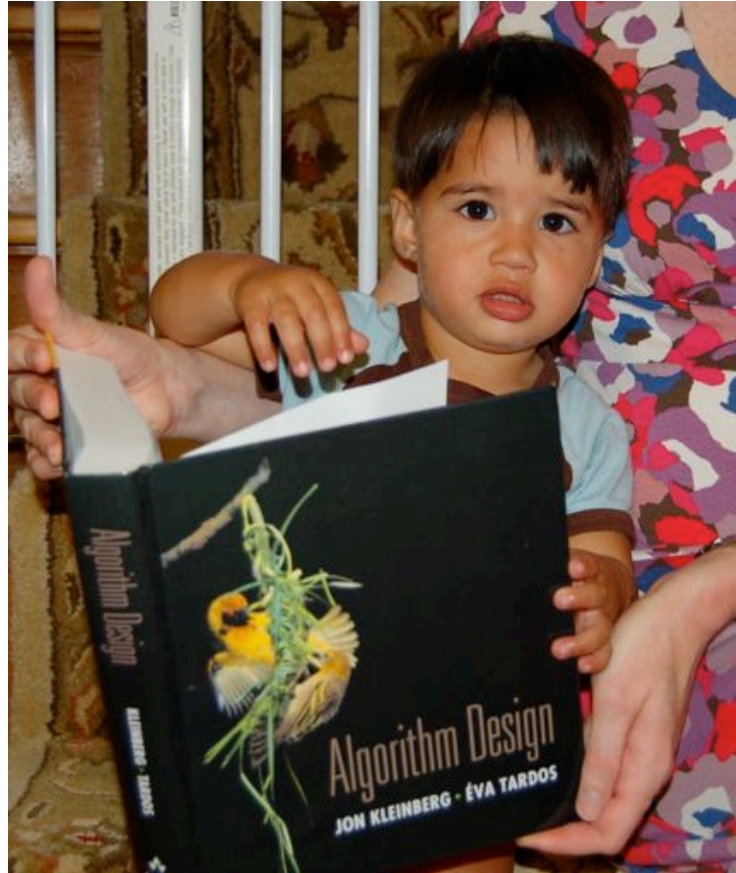


Analysis



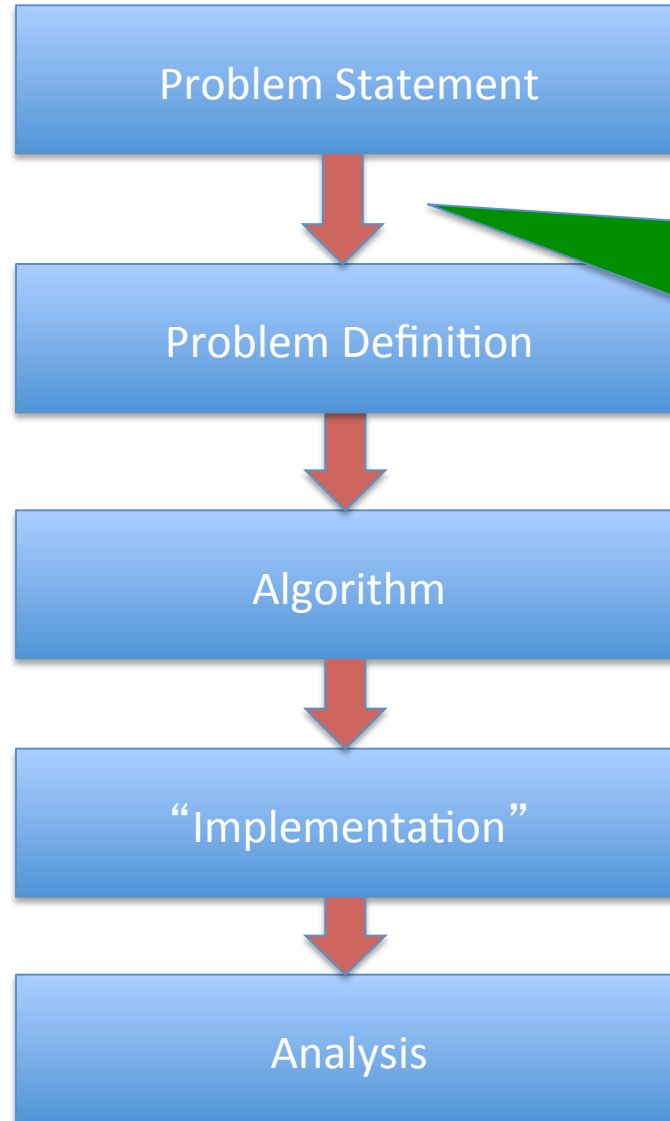
Correctness Analysis

Reading Assignments



Sec 1.1 and Chap. 2 in [KT]

Up Next....



A generic tool
to abstract
out problems

Graphs

Representation of relation

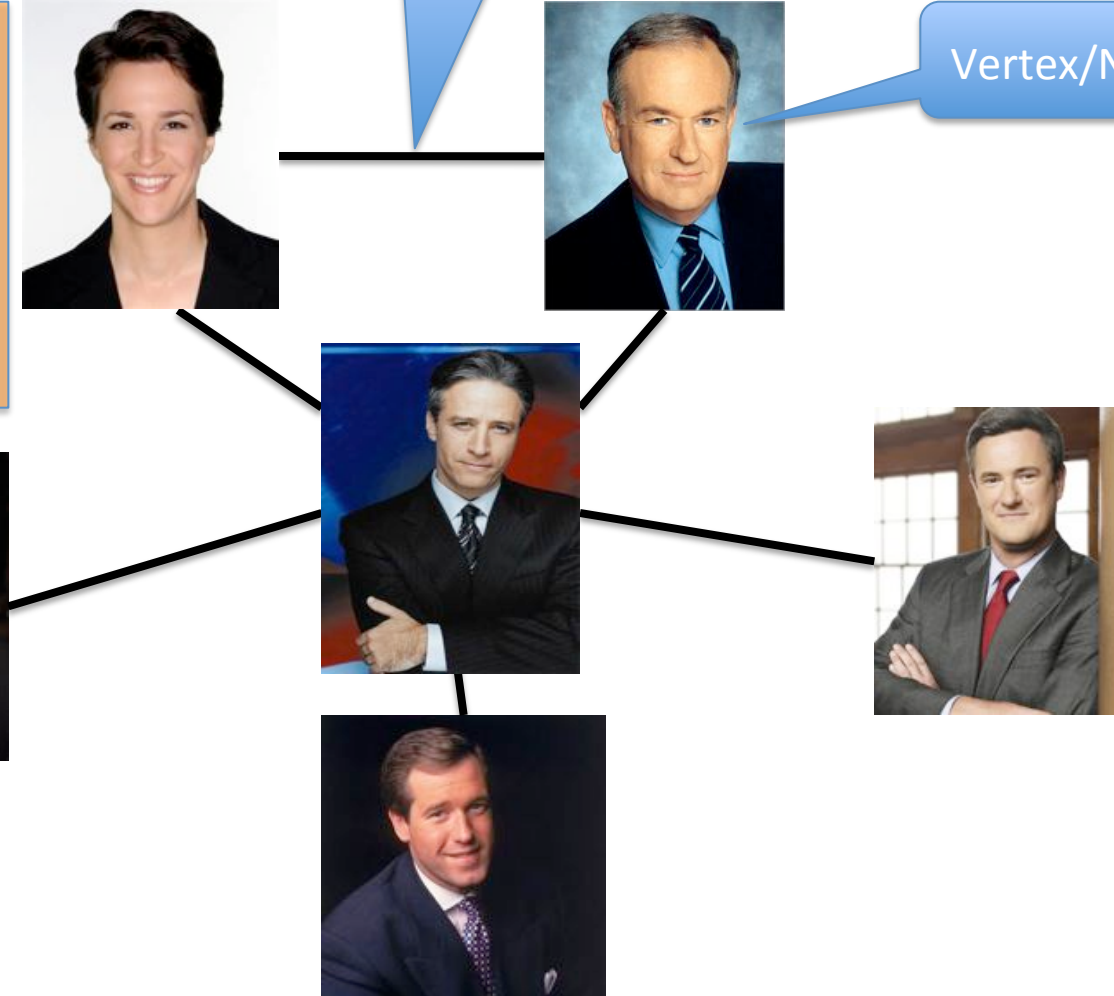
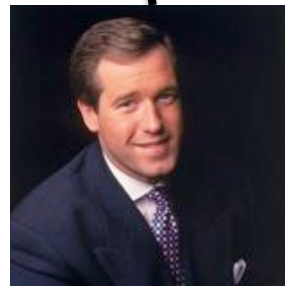
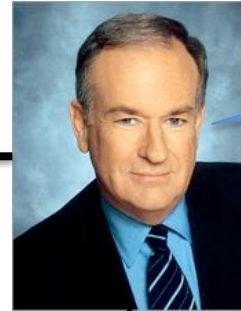
Edge

Pairs of entities/elements

Entities: News hosts

Relationship: Mention
in other's program

Vertex/Node



Graphs are omnipresent

Airline Route maps

jetBlue

HAPPY JETTING

Español • Help • Speak up

Book travel

Manage your flights

Travel deals

Where we jet

TrueBlue® program

Buffalo, NY [BUF]

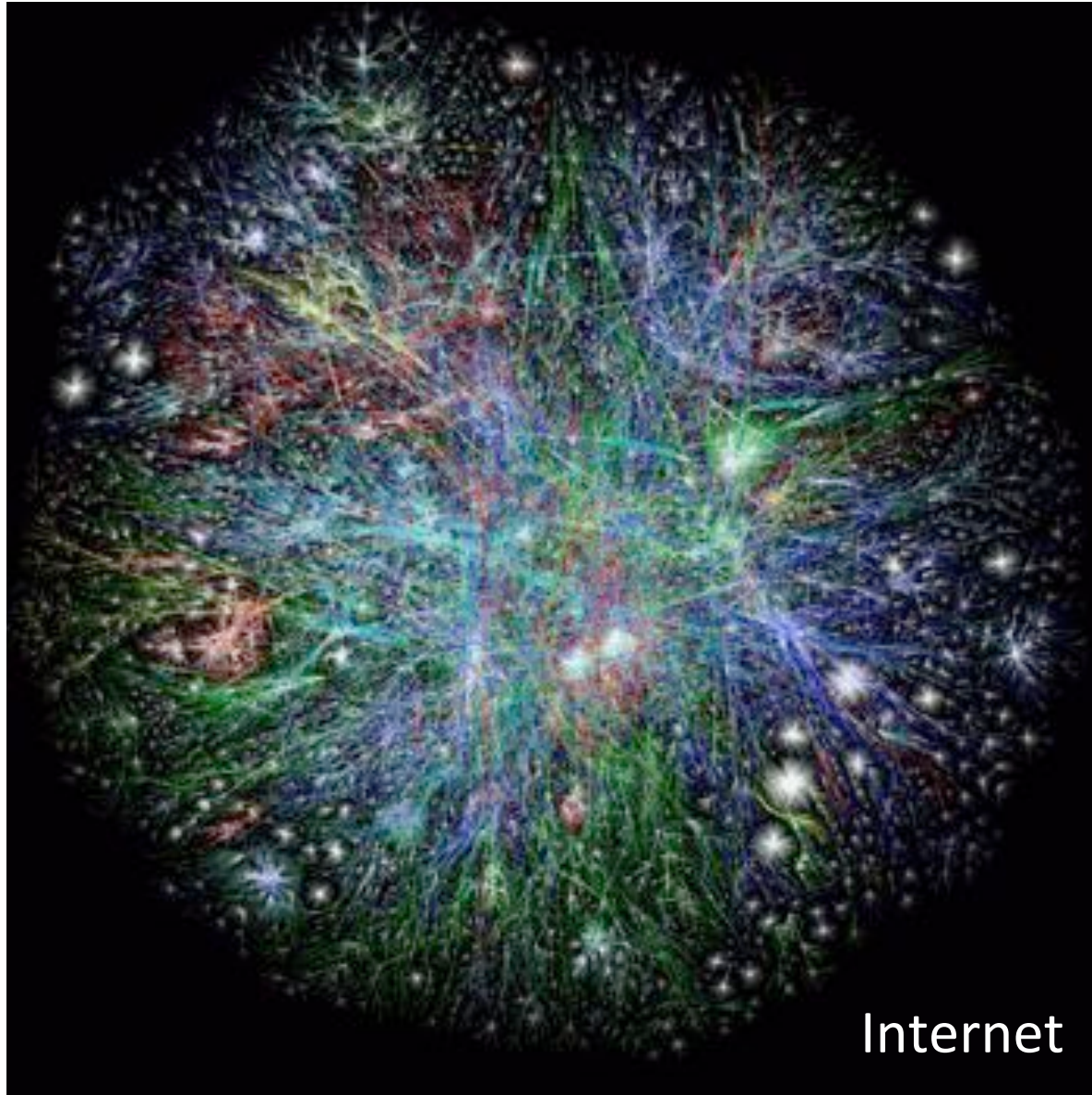
All Destinations

Nonstop Flights Only

Clear Map

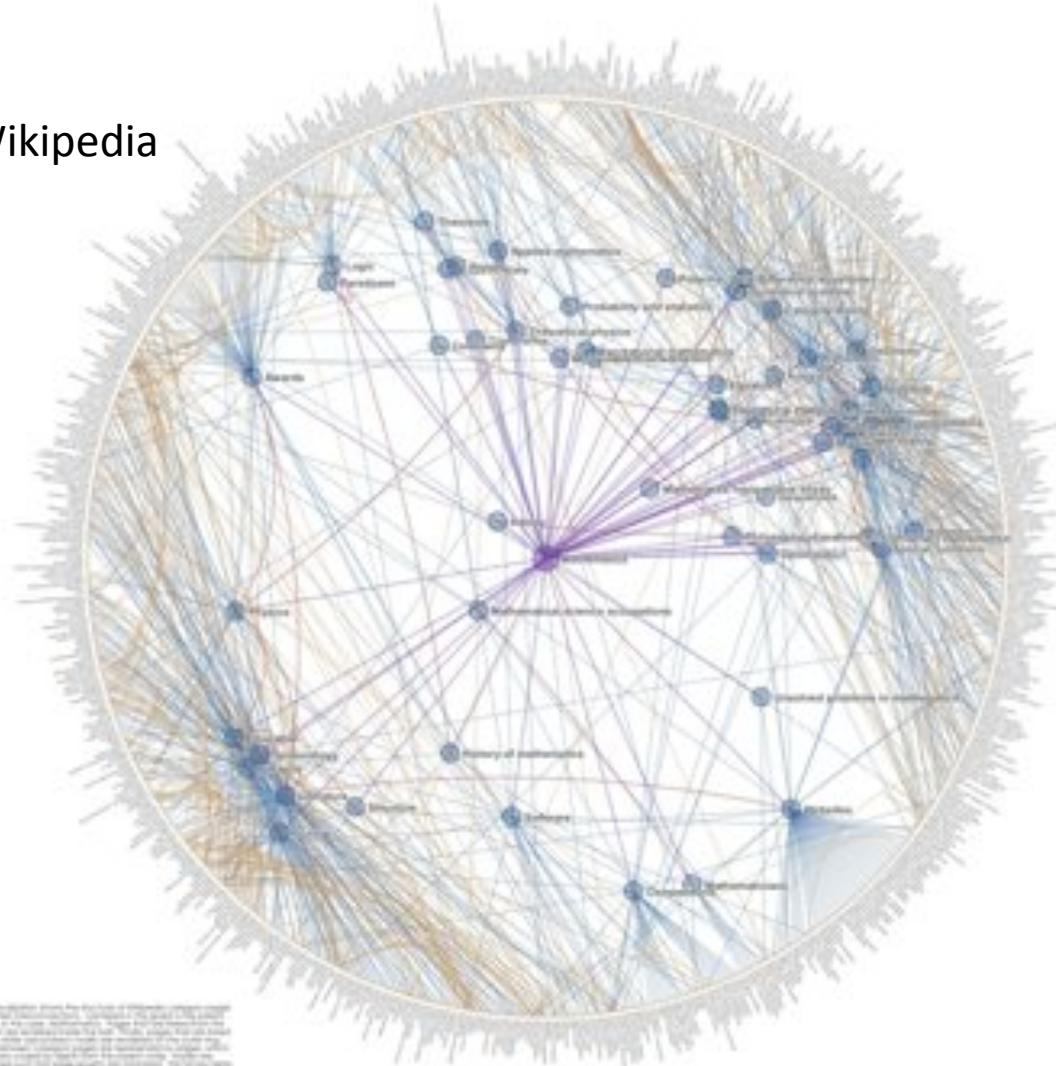


What does this graph represent?



And this one?

Math articles on Wikipedia



Chris Harrison is a mathematician and a member of the Wikimedia Foundation. He is the author of the book "The Mathematics of the Internet" and the creator of the "Mathematics of the Internet" project. He is also a member of the Wikimedia Foundation's Board of Directors. He is currently working on a project to improve the quality of the English Wikipedia's mathematics articles. He is also a member of the Wikimedia Foundation's Board of Directors. He is currently working on a project to improve the quality of the English Wikipedia's mathematics articles.

ChrisHarrison.net

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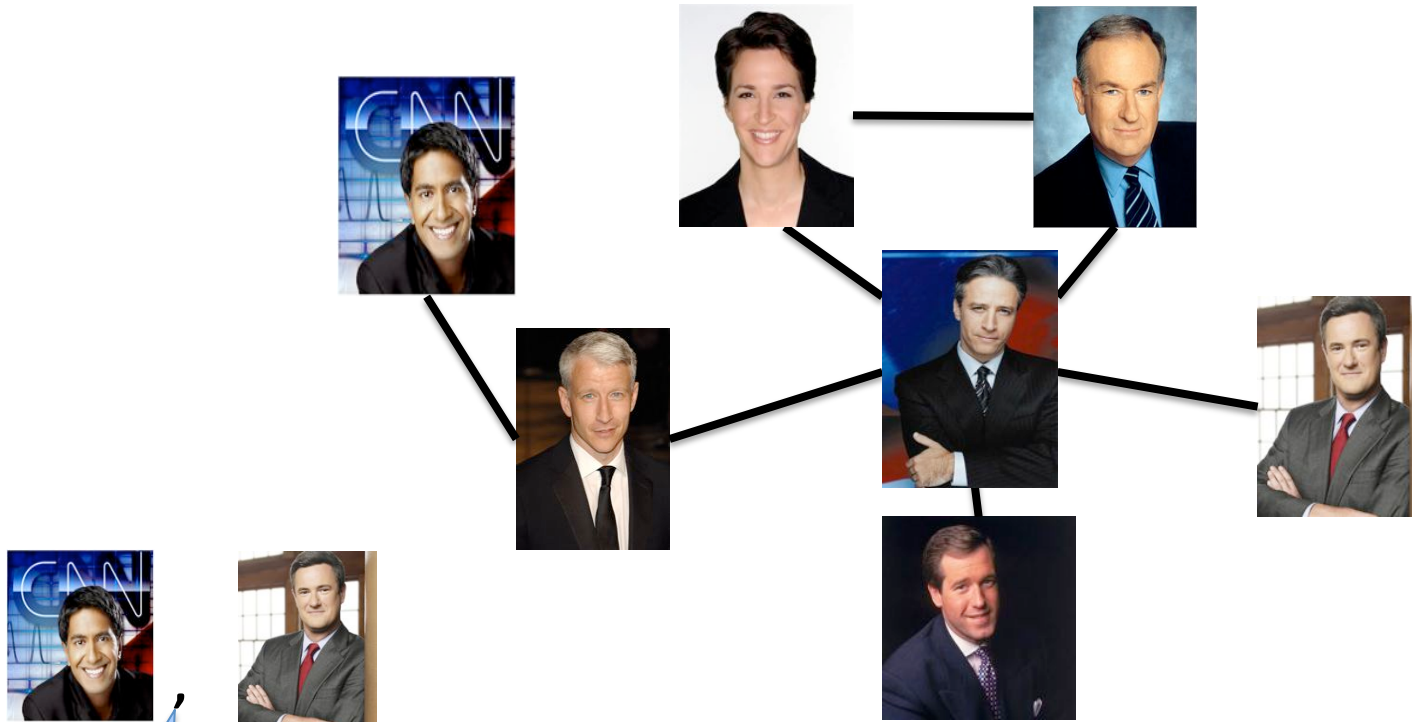
And this one?



Rest of today's agenda

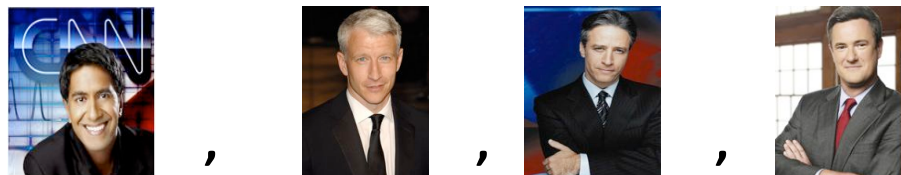
Basic Graph definitions

Paths



Sequence of vertices connected by edges

Connected



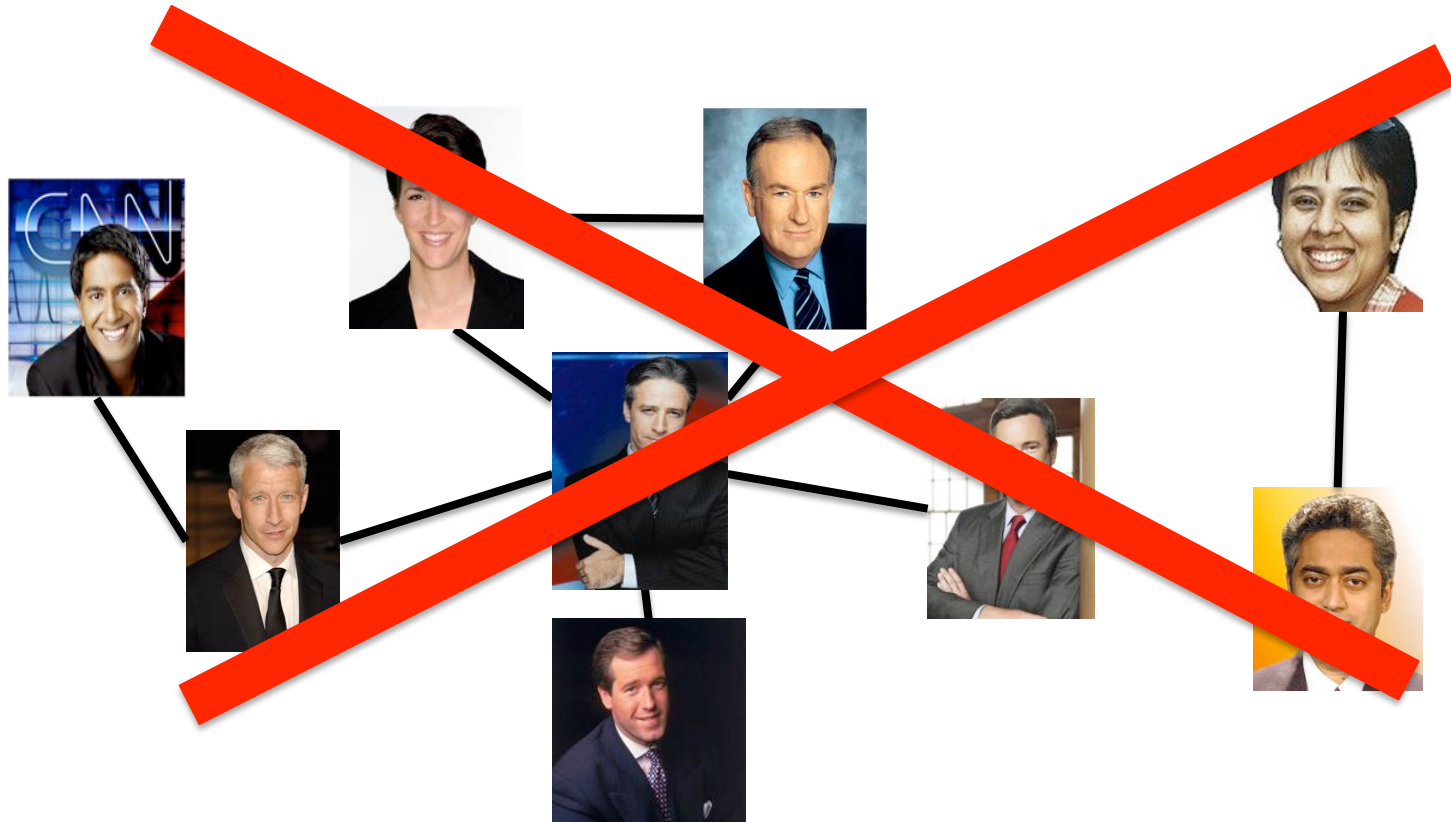
Path length 3

Connectivity

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

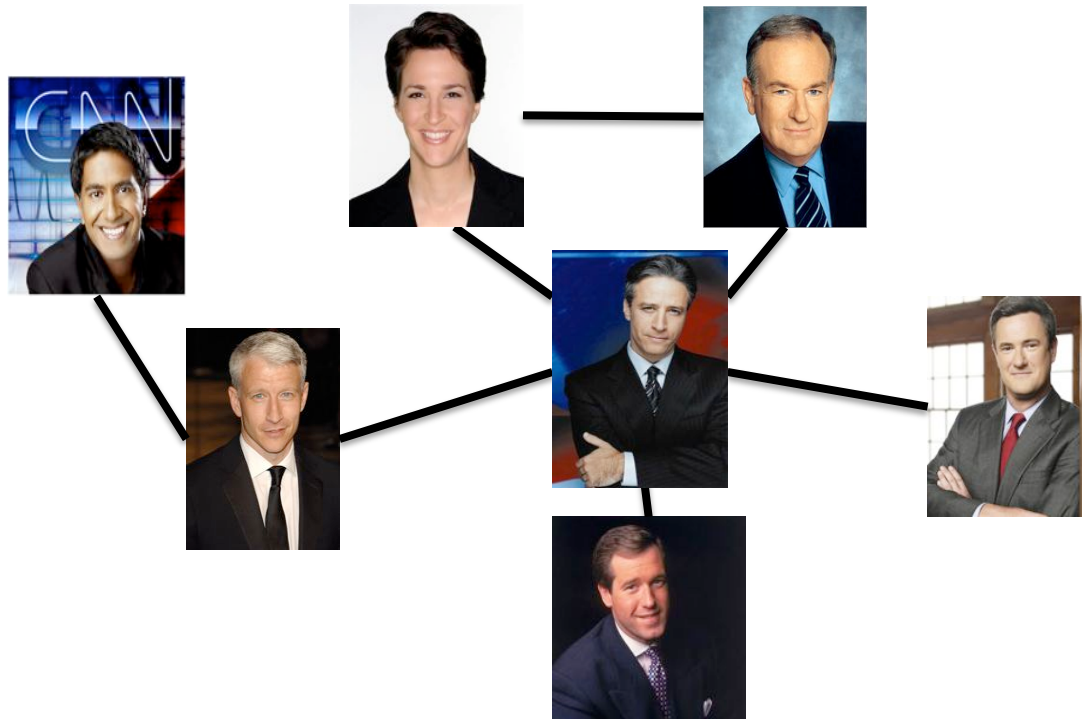
A graph is connected iff all pairs of vertices are connected

Connected Graphs



Every pair of vertices has a path between them

Cycles

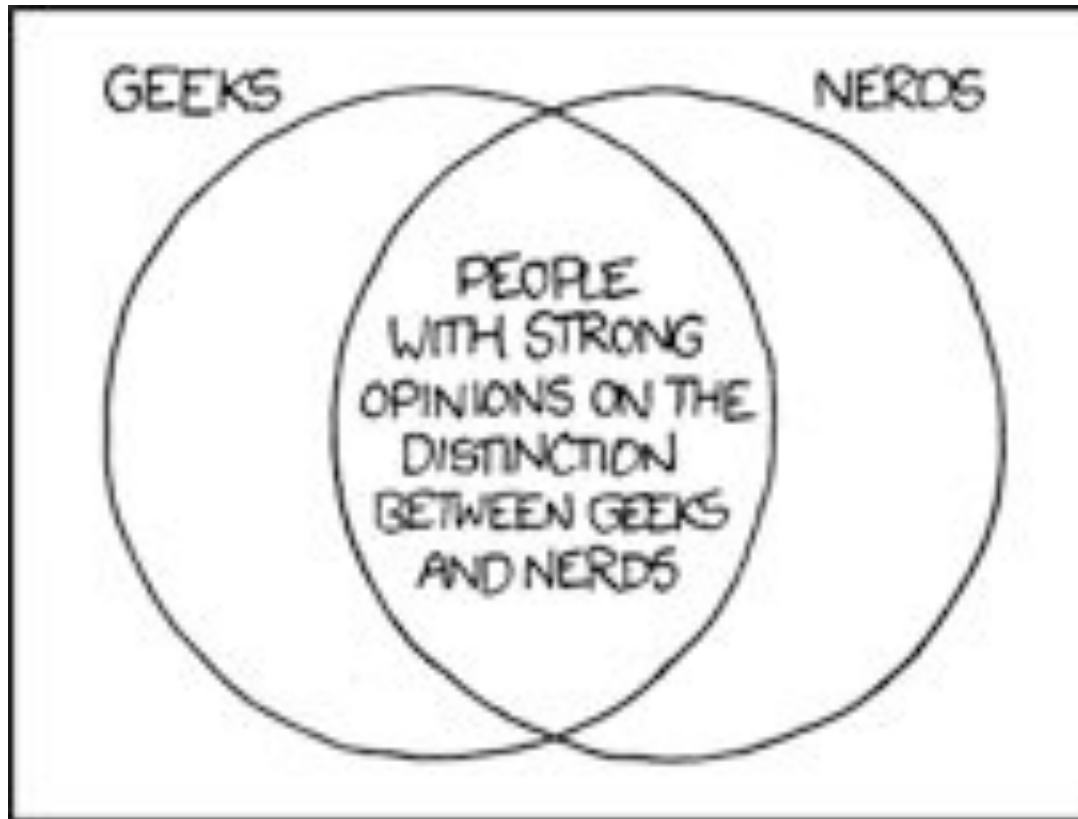


Sequence of k vertices connected by edges, first $k-1$ are distinct





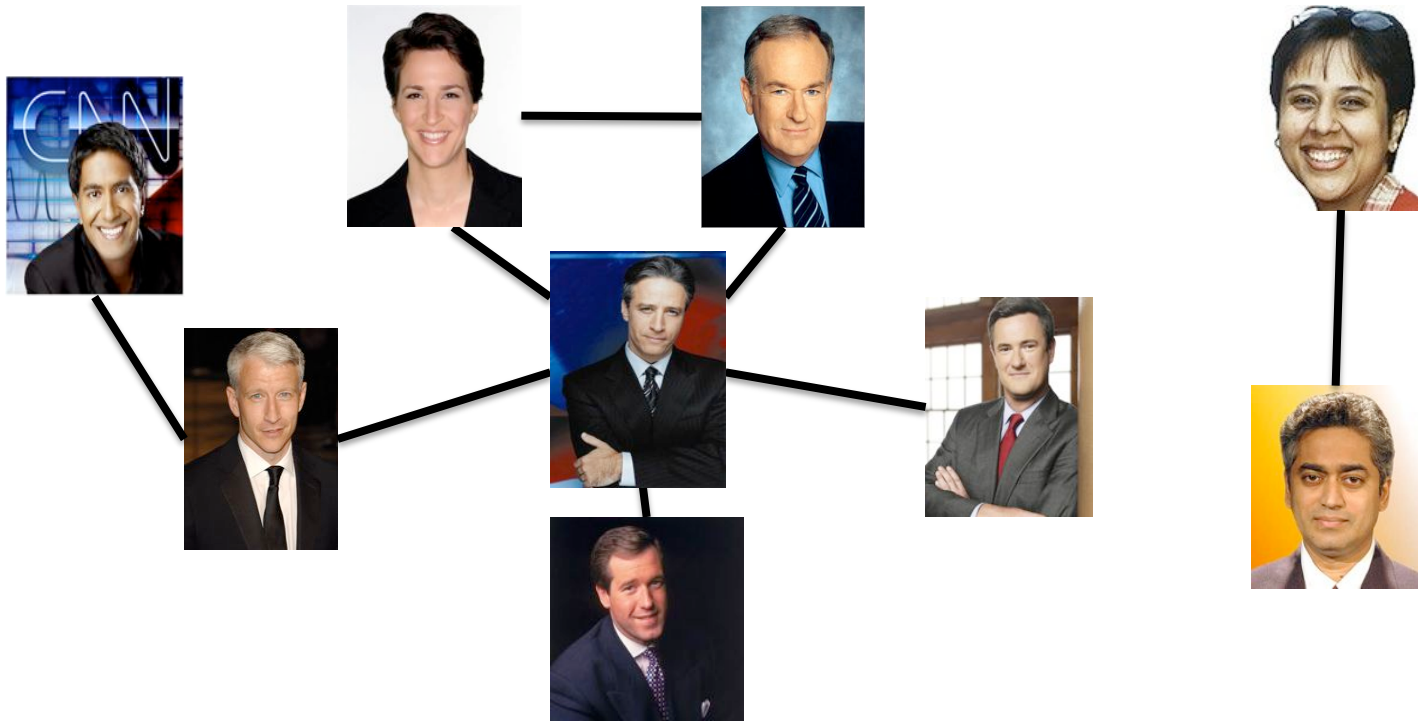
Formally define everything



http://imgs.xkcd.com/comics/geeks_and_nerds.png

Tree

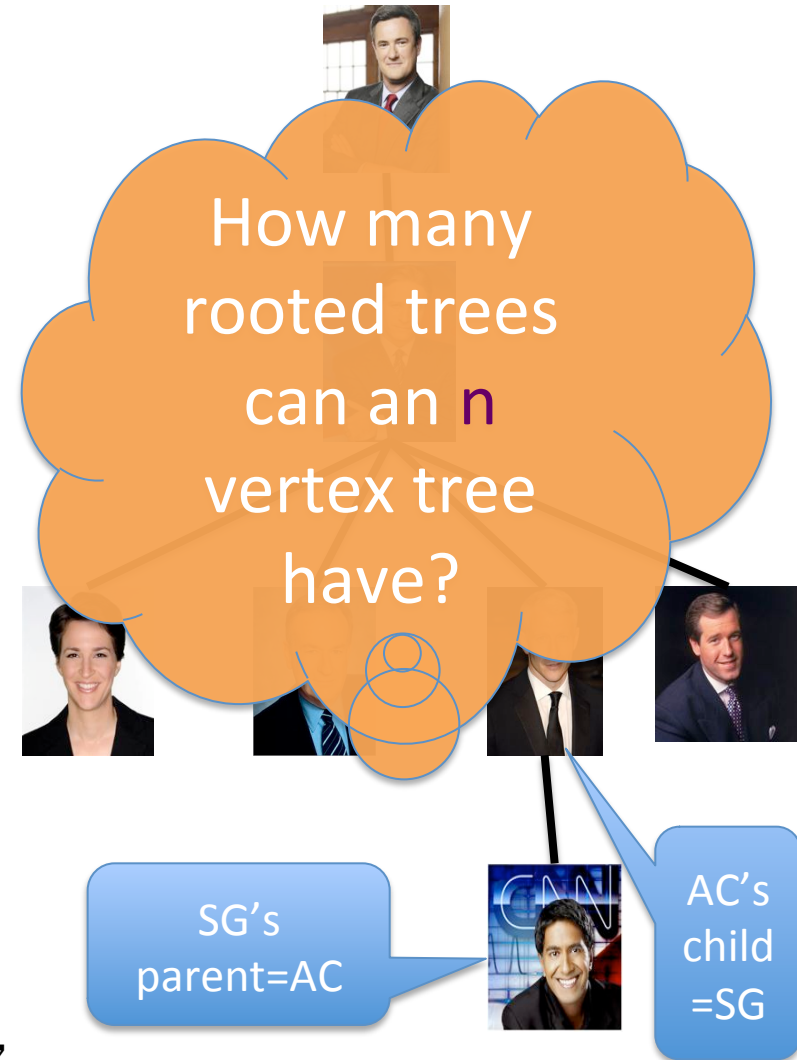
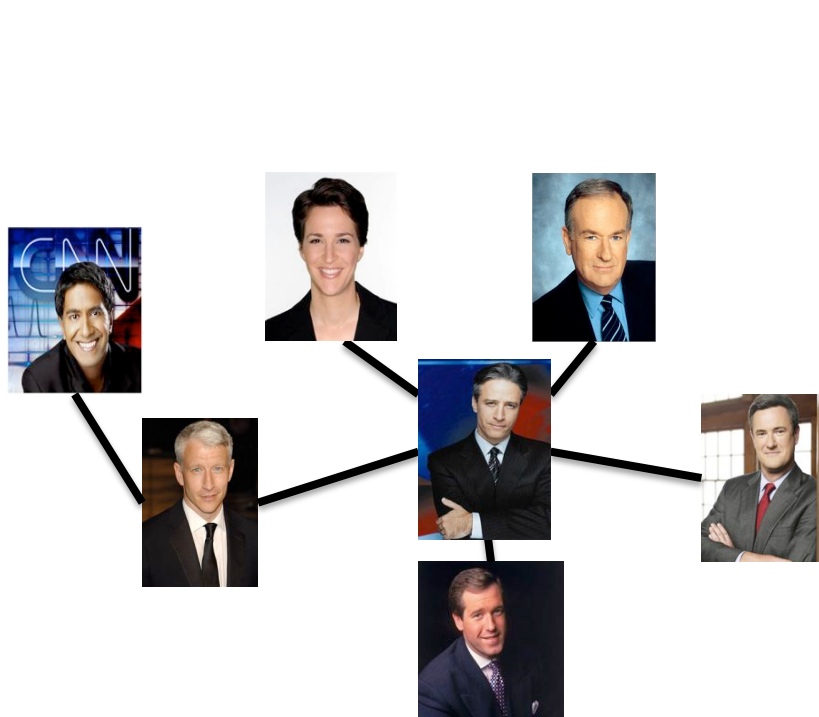
Connected undirected graph with no cycles



Rooted Tree



A rooted tree



Pick any vertex as root

Let the rest of the tree hang under “gravity”

Rest of Today's agenda

Prove n vertex tree has $n-1$ edges

Algorithms for checking connectivity