

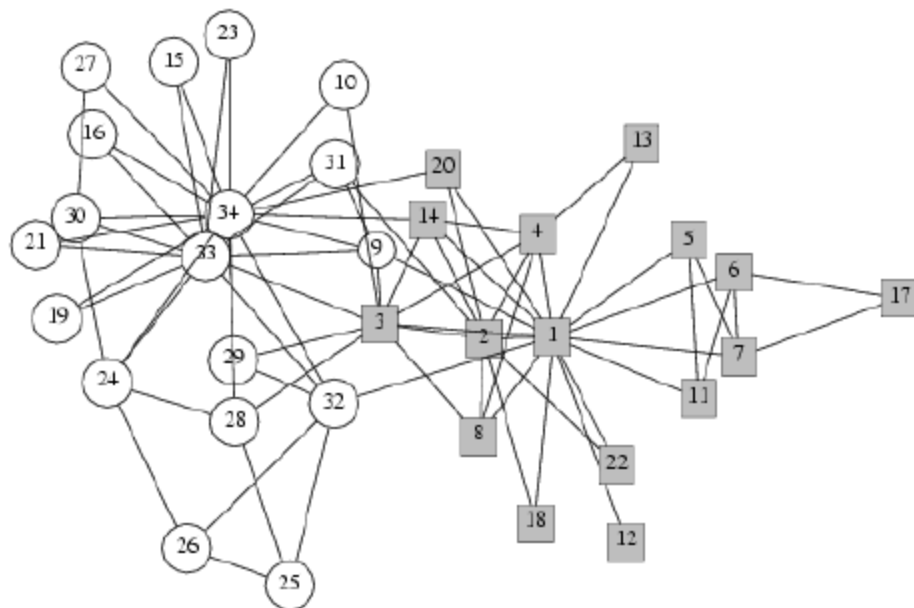
CS190 Part 3: The Social Web

Online Social Network Analysis

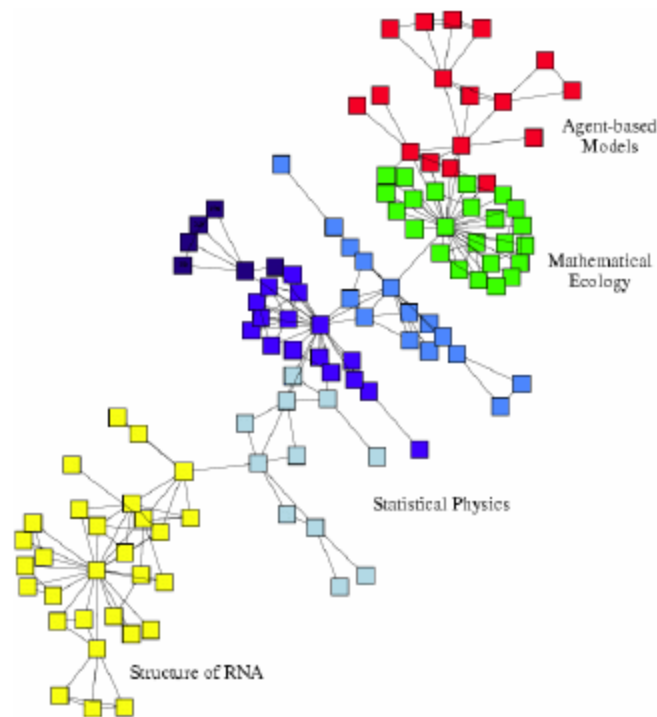
Recap

- All should have a working "Hello World" Facebook App
- Assignment 4 (due **tomorrow/Wed/ night**):
 - Extend to display interesting information using the Facebook Graph API:
<https://developers.facebook.com/tools/explorer?>
 - Silly example:
<http://dutch.mathcs.emory.edu/~eugene/facebook2/>

Social Networks (History)



[Zachary77]



- Individuals and relationships between them
 - E.g., karate club friendships, paper co-authors
- Density and patterns of connectedness as relate to behavior

Social Networks (History, Cont'd)

- Network models of social interactions have 50 year history in academia
 - Been difficult to study except on small scale
 - Now have large-scale data, but often asking simple questions
- Social networking web sites date back several years (e.g., Classmates '99)
 - Varying levels of popularity, boom-bust
 - Recently become mass phenomenon
 - MySpace surpassed Google page views in 2005
 - Lots of visibility, sometimes negative

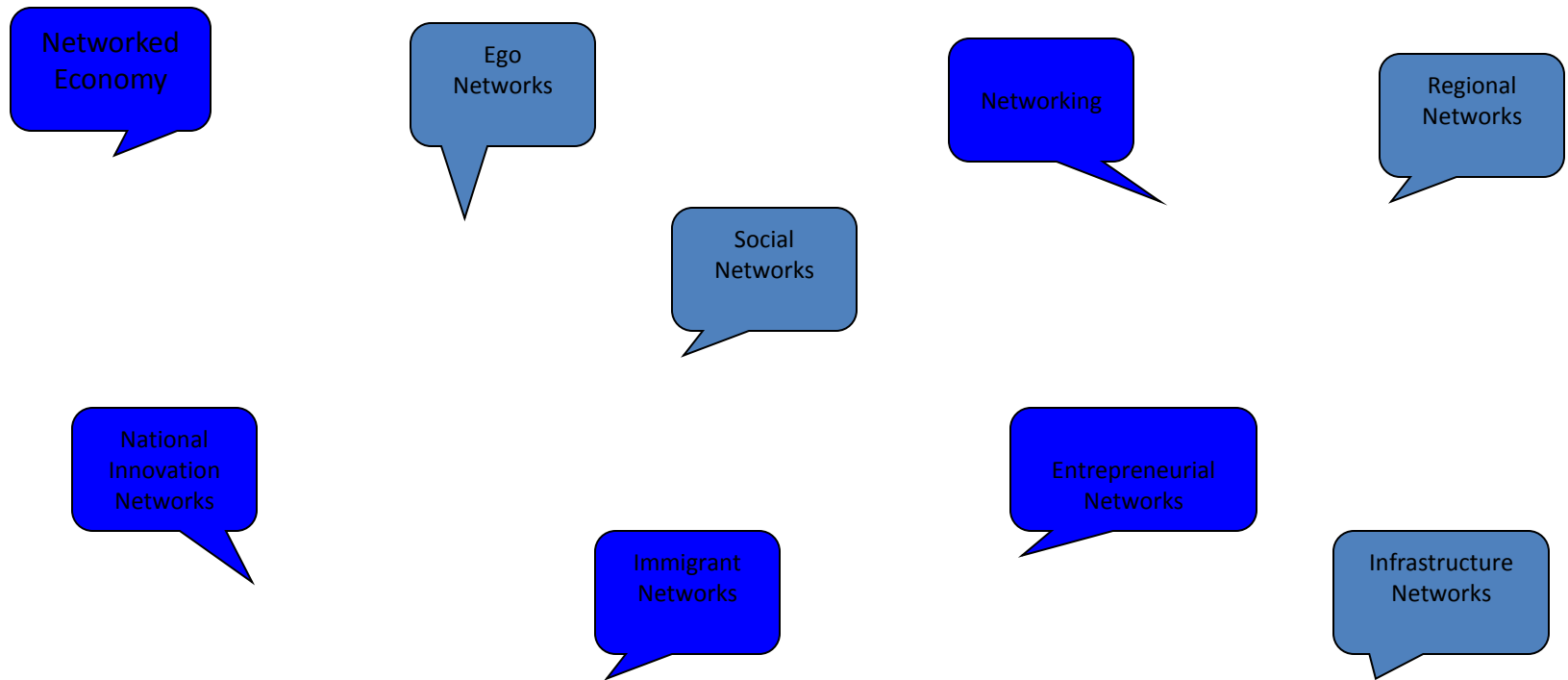
Online Social Networks

- Enables people to connect, rendezvous, collaborate, form communities
 - Content: blogs, wikis, media sharing (video, photo, audio)
 - E.g., Blogger, Wikipedia, YouTube, Flickr
 - Connections: job networking, friend networking
 - E.g., LinkedIn, Facebook
 - Hybrids
 - E.g., MySpace, LiveJournal, Orkut, Xanga
- Replacing other forms? Enhancing?

Index

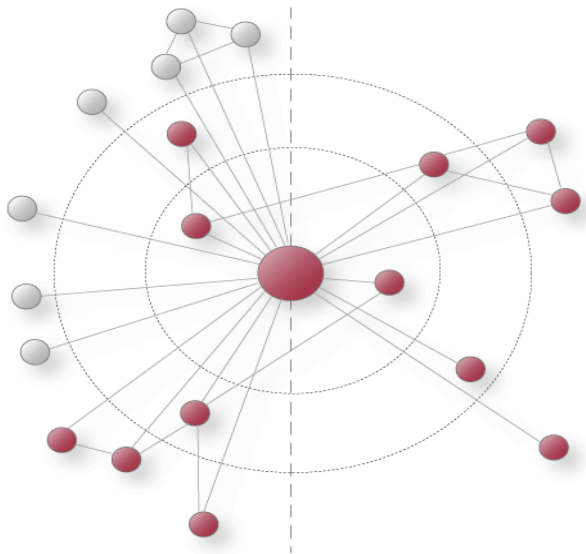
- Introduction to Social Network
- Social Network and KMS
- Social Network Analysis
- Application of Social Network Analysis
- Technology – LinkedIn
- Future of Social Networks.
- References

Everybody talks about Networks?



Social Networks

- How do you explain to say somebody what Social Network is? What Social Network Analysis is?

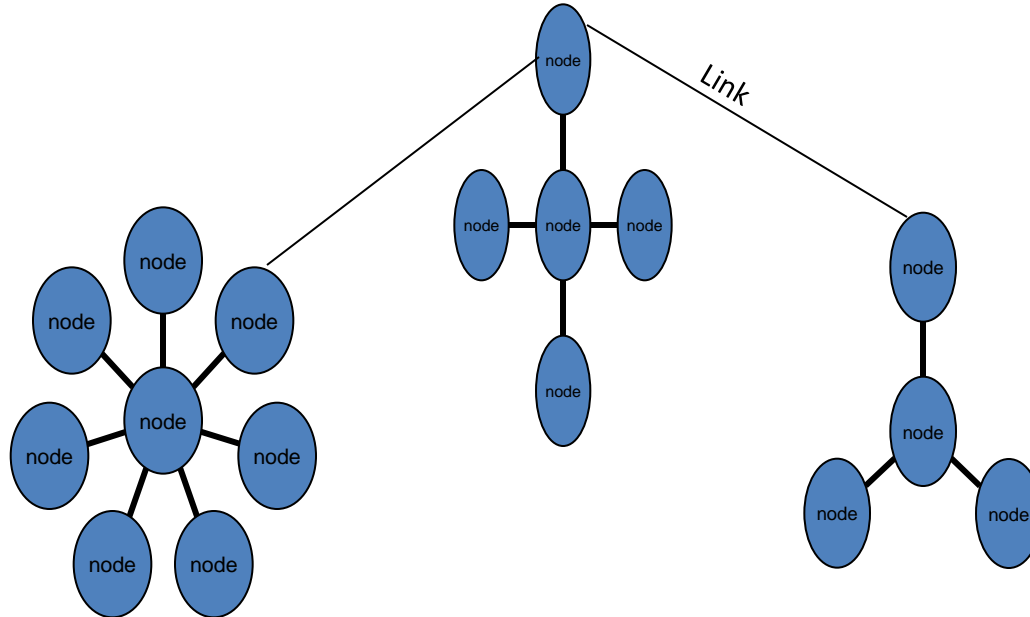


Network Analysis is the keyword
For the 21st Century

Researchers , Politicians , People talk
about Networks around you.

How do you explain what network is?

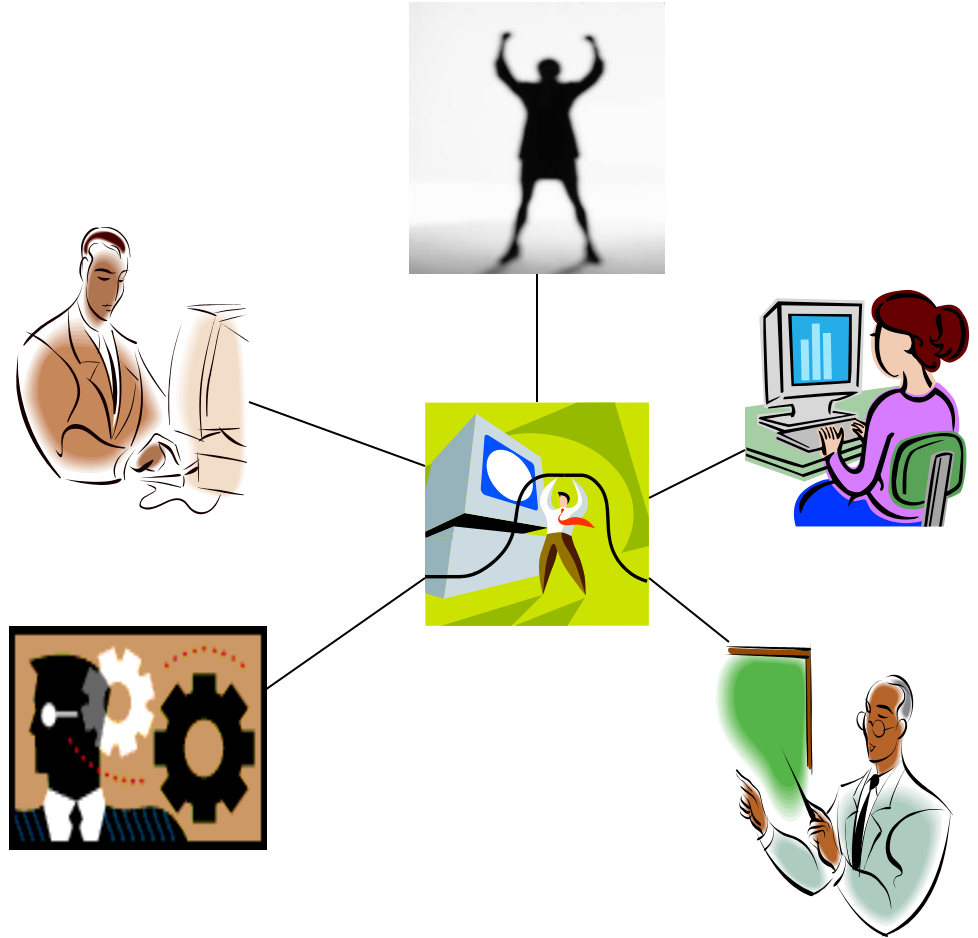
What is a Network?



Web Definition : A set of nodes, points, or locations connected by means of data, voice, and video communications for the purpose of exchange.

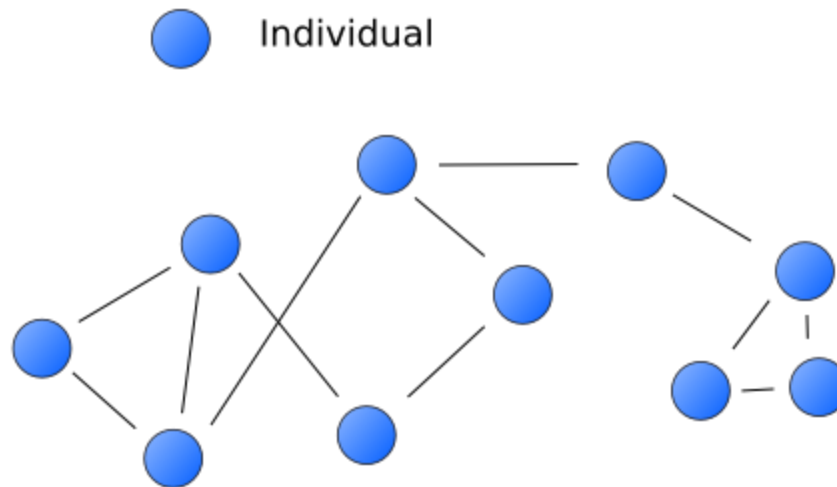
Social Networks

A **social network** is a description of the social structure between actors, mostly individuals or organizations. It indicates the ways in which they are connected through various social familiarities ranging from casual acquaintance to close familiar bonds.



Social Network Analysis

- Social network analysis [SNA] is the mapping and measuring of relationships and flows between people, groups, organizations, computers or other information/knowledge processing entities.
- The nodes in the network are the people and groups while the links show relationships or flows between the nodes.



Social Network Analysis

We measure Social Network in terms of:

1. Degree Centrality:

The number of direct connections a node has. What really matters is where those connections lead to and how they connect the otherwise unconnected.

2. Betweenness Centrality:

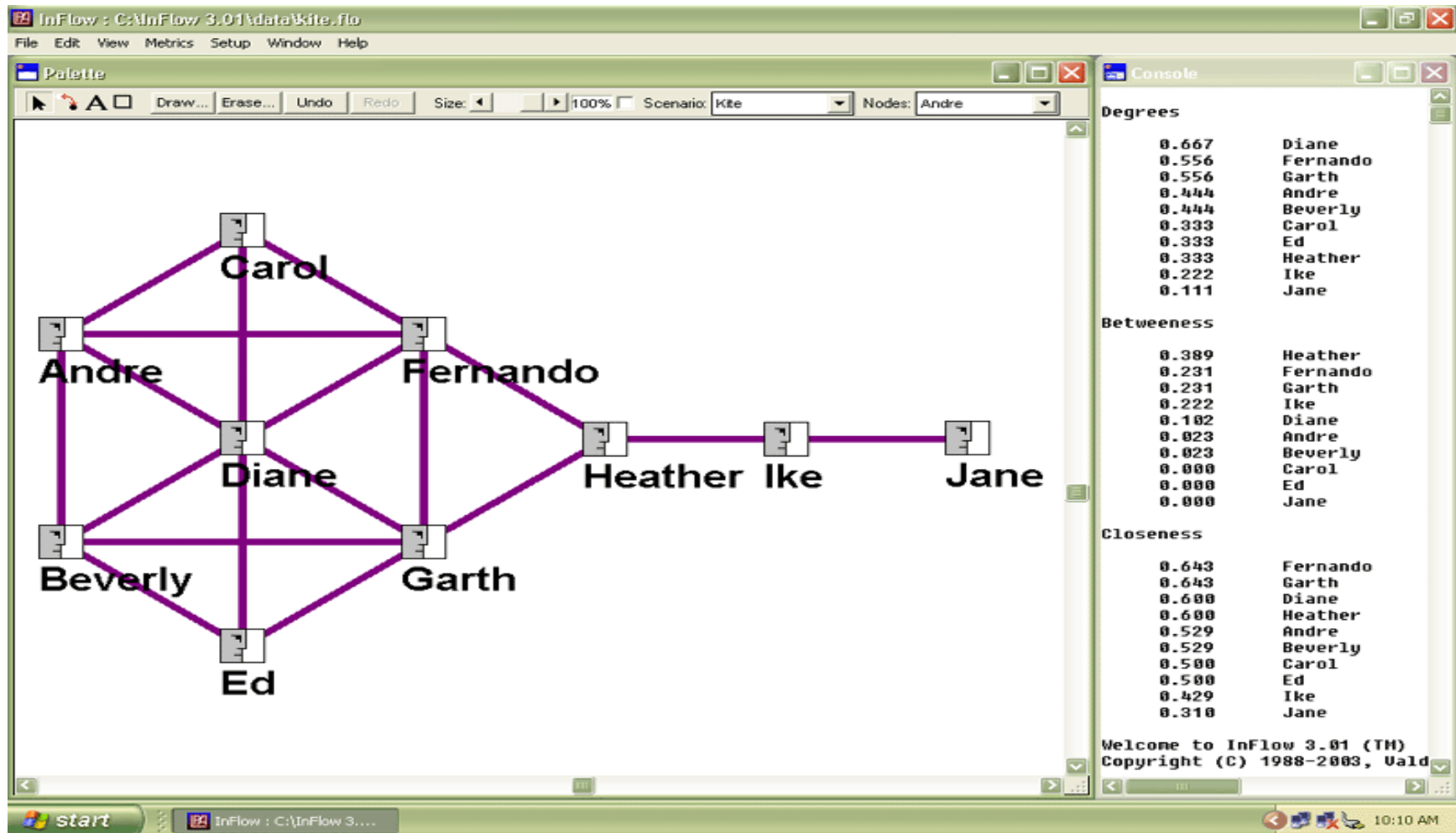
A node with high betweenness has great influence over what flows in the network indicating important links and single point of failure.

3. Closeness Centrality:

The measure of closeness of a node which are close to everyone else.

The pattern of the direct and indirect ties allows the nodes any other node in the network more quickly than anyone else. They have the shortest paths to all others.

Exercise on SNA: Kite Network



Exercise on SNA: Kite Network

- Who is the Connector or Hub in the Network?
- Who has control over what flows in the Network?
- Who has best visibility of what is happening in the Network?
- Who are peripheral players? Are they Important?

SNA and KMS:

SNA helps in analyzing the following facts in a KMS:

- Bottlenecks - Central nodes that provide the only connection between different parts of the network.
- Number of links - Insufficient or excessive links between departments that must coordinate effectively.
- Average distance - Degrees of separation connecting all pairs of nodes in the group.

SNA and KMS (2)

- Short distances transmit information accurately and in a timely way, while long distances transmit slowly and can distort the information.
- Isolation - People that are not integrated well into a group and therefore, represent both untapped skills and a high likelihood of turnover.
- Highly expert people - Not being utilized appropriately.
- Organizational subgroups or cliques - Can develop their own subcultures and negative attitudes toward other groups.

Application of SNA:

- Realizing 9/11 [Al- Qaeda Network](#).
- Build a grass roots political campaign.
- Determine influential journalists and analysts in the IT industry.
- Map executive's personal network based on email flows.
- Discover the network of Innovators in a regional economy.
- Analyze book selling patterns to position a new book and many more.....

6-degrees of Bacon

- <http://oracleofbacon.org/>
- **Searching a social network**
 - (breadth-first, depth-first, etc)

Technology

Various technologies that help in creating Social Networks are:

- 1) Email
- 2) Blogs
- 3) Social Networking Software like Orkut, LinkedIn etc.

Technology : LinkedIn

- **What is Your Network?**

When your connections invite **their** connections, your Network starts to grow.

Your Network is your connections, their connections, and so on out from you at the center.

- **How do you classify users?**

Your Network contains professionals out to “three degrees” — that is, friends-of-friends-of-friends. If each person had 10 connections (and some have many more) then your network would contain 10,000 professionals.

How do you see who is in your Network?

- LinkedIn lets you see your network as one large group of searchable professional profiles.

Technology: LinkedIn (1)



Technology: LinkedIn (2)

The screenshot shows the LinkedIn 'Find People' search page in a Microsoft Internet Explorer browser window. The address bar displays the URL https://www.linkedin.com/search?trk=tab_srh. The page header includes the text 'Find people you need' and 'Reach them through an Introduction or an InMail™'. Below this, there are navigation tabs: 'Get Clients', 'Hire Employees', 'Find Sales Leads', 'Locate References', 'Reach Business Partners', and 'Find Experts'. The main content area is divided into two search panels. The left panel, 'Search by Keywords', includes fields for 'Keywords' (with an example 'ex. retail, purchasing, Linux'), 'Title', 'Company', 'Industry' (a dropdown menu with options like 'Any industry', 'Agriculture', 'Dairy', 'Farming', 'Fishery', and 'Ranching'), 'Location', 'Country', 'US ZIP', 'Interested in', 'Joined your network', and 'Sort by'. The right panel, 'Search by Name', includes a 'Name' field, 'Additional criteria (optional)' for 'Company', 'Location', and 'Country', and a 'US ZIP' field. Both panels have 'Reset' and 'Search' buttons. The browser's taskbar at the bottom shows the Start button and several open applications, including 'Post-it@ Softwa...', 'Microsoft Power...', 'Internet Ex...', 'social networks ...', and 'Inbox - Microsof...'. The system clock in the bottom right corner indicates the time is 6:58 PM.

LinkedIn: Find People - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites

Address https://www.linkedin.com/search?trk=tab_srh

Search Web Search Web My Web Mail My Yahoo! Personals Games Music Sign In

Find people you need
Reach them through an Introduction or an InMail™

Get Clients Hire Employees Find Sales Leads Locate References Reach Business Partners Find Experts

Search by Keywords: [? Tips](#)

Keywords:
ex. retail, purchasing, Linux

Title:

☒ Current titles only

Company:

☒ Current companies only

Industry:
Any industry
Agriculture
Dairy
Farming
Fishery
Ranching

Location:

Country:

US ZIP: [ZIP lookup](#)

Interested in:

Joined your network:

Sort by:

[Reset](#) [Search](#)

Search by Name: [? Tips](#)

Name:
First Name Last Name

Additional criteria (optional):

Company:

Location:

Country:

US ZIP: [ZIP lookup](#)

[Reset](#) [Search](#)

start Post-it@ Softwa... Microsoft Power... 6 Internet Ex... social networks ... Inbox - Microsof... Internet 6:58 PM

How to find people you need ?

Technology : LinkedIn (3)

Finding Jobs

The screenshot shows the LinkedIn Jobs Home page in a Microsoft Internet Explorer browser window. The address bar displays the URL: https://www.linkedin.com/jobs?displayHome=&trk=tab_jobs. The page features a navigation bar with links for Home, Find People, Find Jobs, Find Services, My Profile, and My Contacts. A "Job Search" tab is active. The main content area includes a "Find your next job through LinkedIn" banner with a "See How It Works" button. Below this is a "Search for Jobs" section with fields for Keywords, Location (set to "Anywhere"), Country (set to "United States"), and Job Function (set to "Any Job Function"). A "Search Jobs" button is highlighted. To the right, a "Recent Jobs Posted" section lists several job openings, including "VP, New Product Marketing" and "Market Analyst and Business Strategy Consultant". At the bottom, there are links for "Your Account", "Customer Service/FAQ", and "Tools", along with a copyright notice for LinkedIn Corporation.

LinkedIn: Jobs Home - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address https://www.linkedin.com/jobs?displayHome=&trk=tab_jobs

Welcome, Amit | [Account](#) | [Settings](#) | [Sign Out](#)

[Add Connections](#)

Home Find People Find Jobs Find Services My Profile My Contacts

Jobs Home Job Search

Find your next job through LinkedIn

[See How It Works](#)

Looking to hire?

Recent Jobs Posted

- [VP, New Product Marketing](#) | Baxter
- [Market Analyst and Business Strategy Consultant](#) | Inspior
- [SR. HARDWARE ARCHITECT/DESIGNER \(LAPTOP SYSTEM\)](#) | Apech Inc.
- [DESIGN VERIFICATION & TEST MANAGER](#) | Apech Inc.
- [Software/Web Architects](#) | Apech Inc.

[View all »](#)

Search for Jobs

Keywords:

Location:

Job Function:

Country:

US ZIP: [ZIP lookup](#)

☒ Show jobs in my network first

[Advanced Search](#) [Search Jobs](#)

Powered by [simplyhired](#)

New job-seeking tools

Uncover your inside connection to jobs listed on Monster, Hotjobs, or craigslist!

Download [Jobs Insider](#) now: [for Explorer](#) [for Firefox](#)

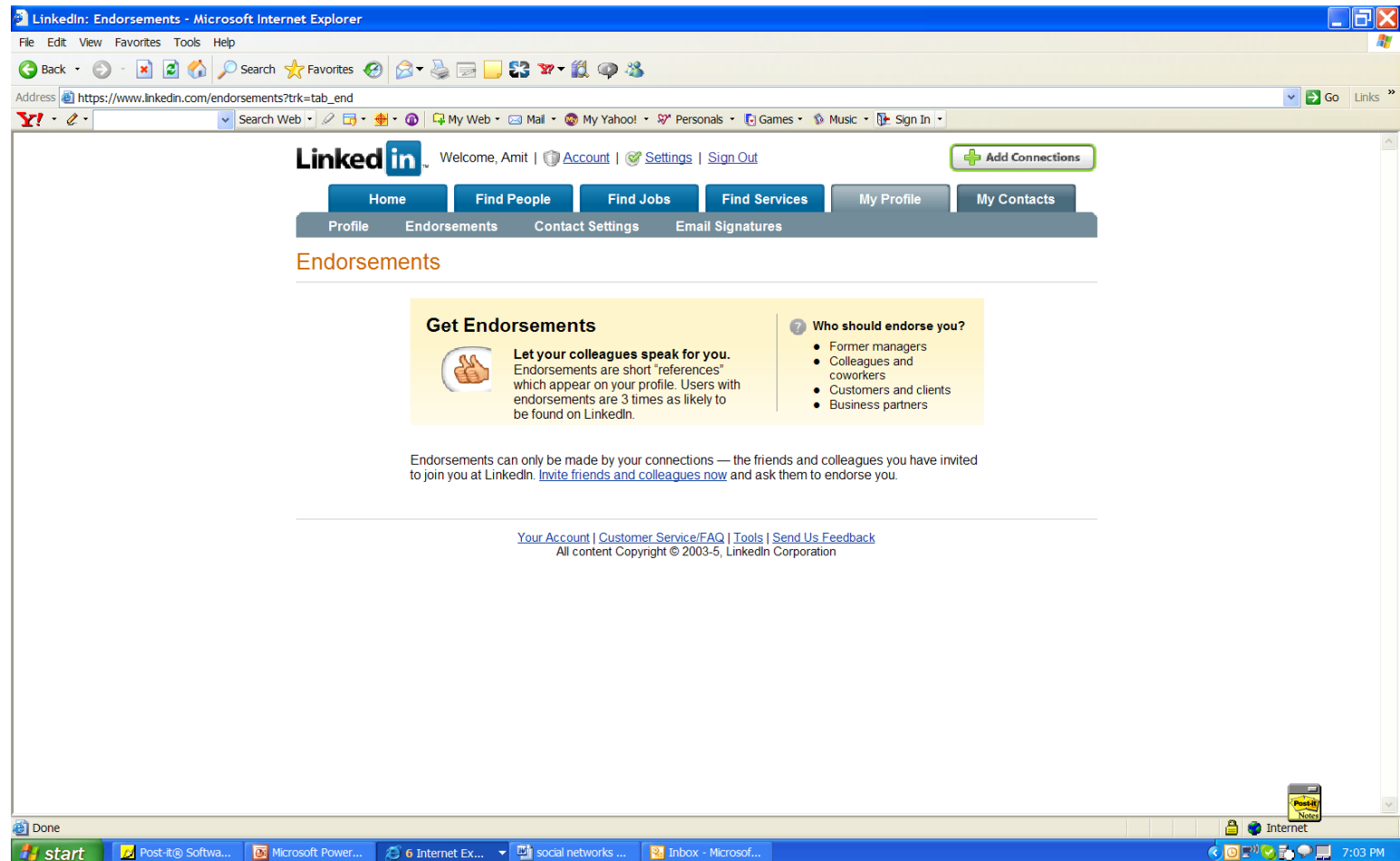
[Your Account](#) | [Customer Service/FAQ](#) | [Tools](#)

All content Copyright © 2003-5, LinkedIn Corporation

LinkedIn Jobs: Let us know what you think! [Send Feedback](#)

Technology: LinkedIn (4)

ENDORSEMENTS: A New and Useful Feature

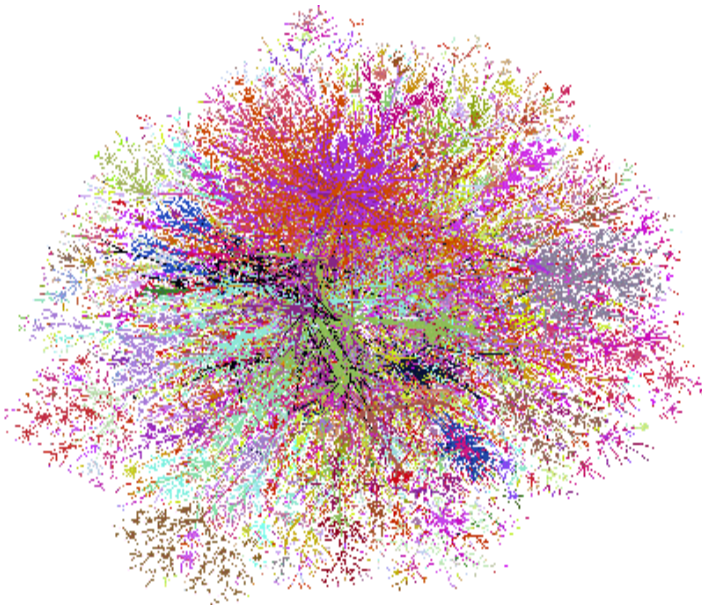


Future of SNA

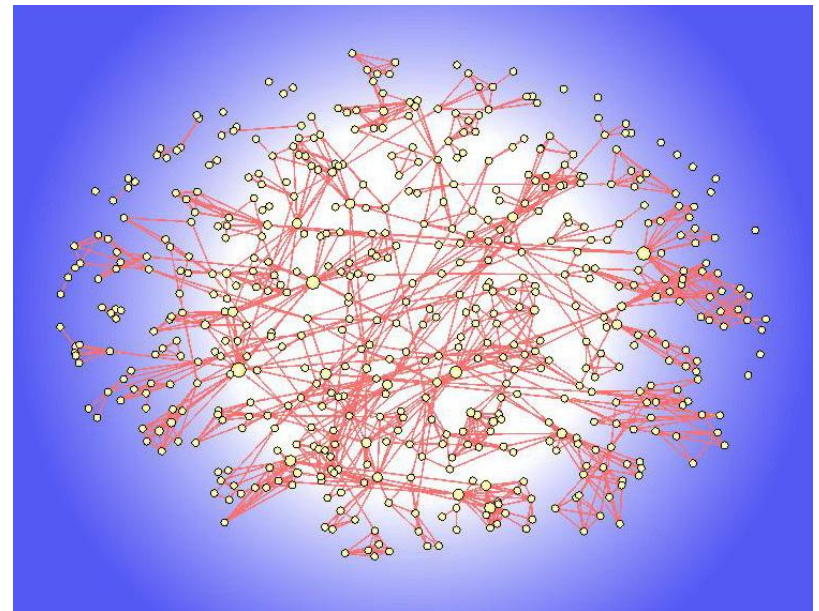
- SNA could help us in following ways in future:
 - 1) Reducing Complexity
 - 2) Visualizing using Geographic Information Modeling

Reducing Complexity

Our Social Networks can be understood at one glance

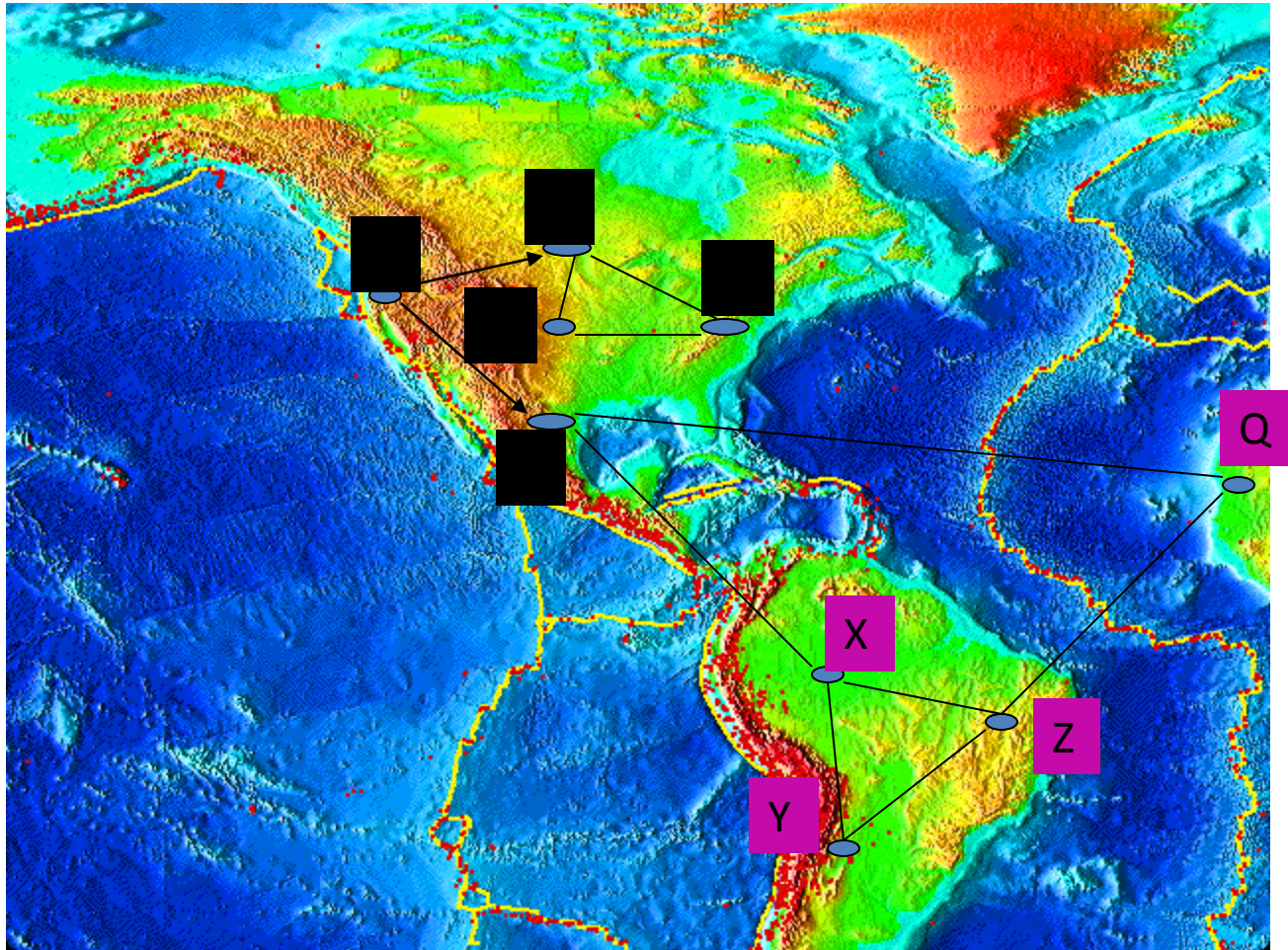


Organization on Web



Reduced Complexity through
Simulation Analysis and Complex
Theory for solving graphs

Geographic Information Modeling



— Key Players

Social influence and correlation

- Role of social ties in shaping the behavior of users
- Examples:
 - Joining LiveJournal communities [Backstrom et al.]
 - Publishing in conferences [Backstrom et al.]
 - Tagging vocabulary on flickr [Marlow et al.]
 - Adoption of paid VOIP service in IM
 - ...

Social influence

- Focus on a particular “**action**” A.
 - E.g.: buying a product, joining a community, publishing in a conference, using a particular tag, using the VOIP service, ...
- An agent who performs A is called “**active**”.
- x has **influence** over y if x performing A causes/increases the likelihood that y performs A.
- Distinguishing factor: **causality** relationship

Identifying social influence

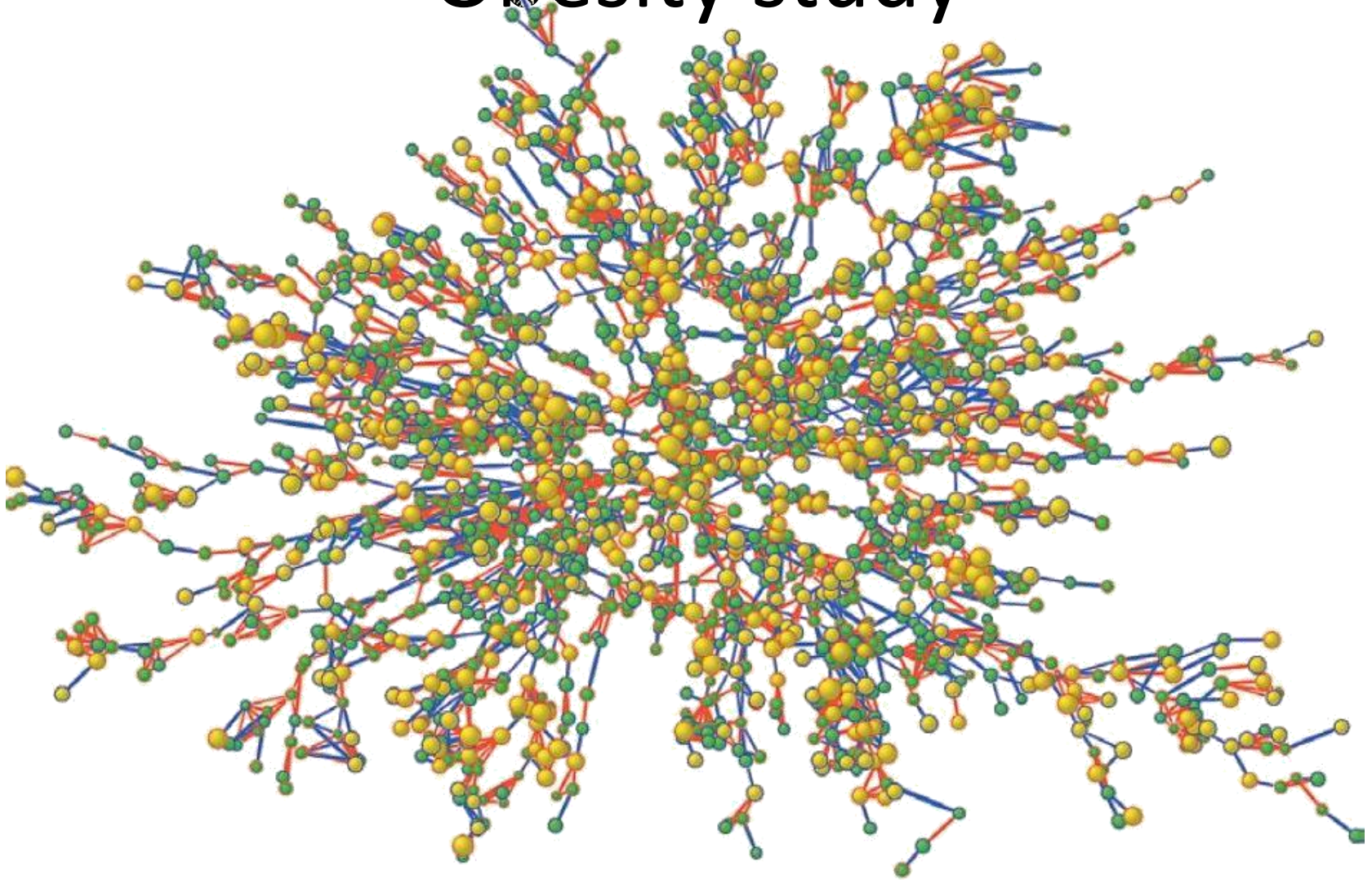
- Why is it important?
- **Analysis:** predicting the dynamics of the system. Whether a new norm of behavior, technology, or idea can diffuse like an epidemic.
- **Design:** for designing a system to induce a particular behavior, e.g.:
 - vaccination strategies (random, targeting a demographic group, random acquaintances, etc.)
 - viral marketing campaigns

Example: obesity study

Christakis and Fowler, “The Spread of Obesity in a Large Social Network over 32 Years”, New England Journal of Medicine, 2007.

- Data set of 12,067 people from 1971 to 2003 as part of Framingham Heart Study

Obesity study



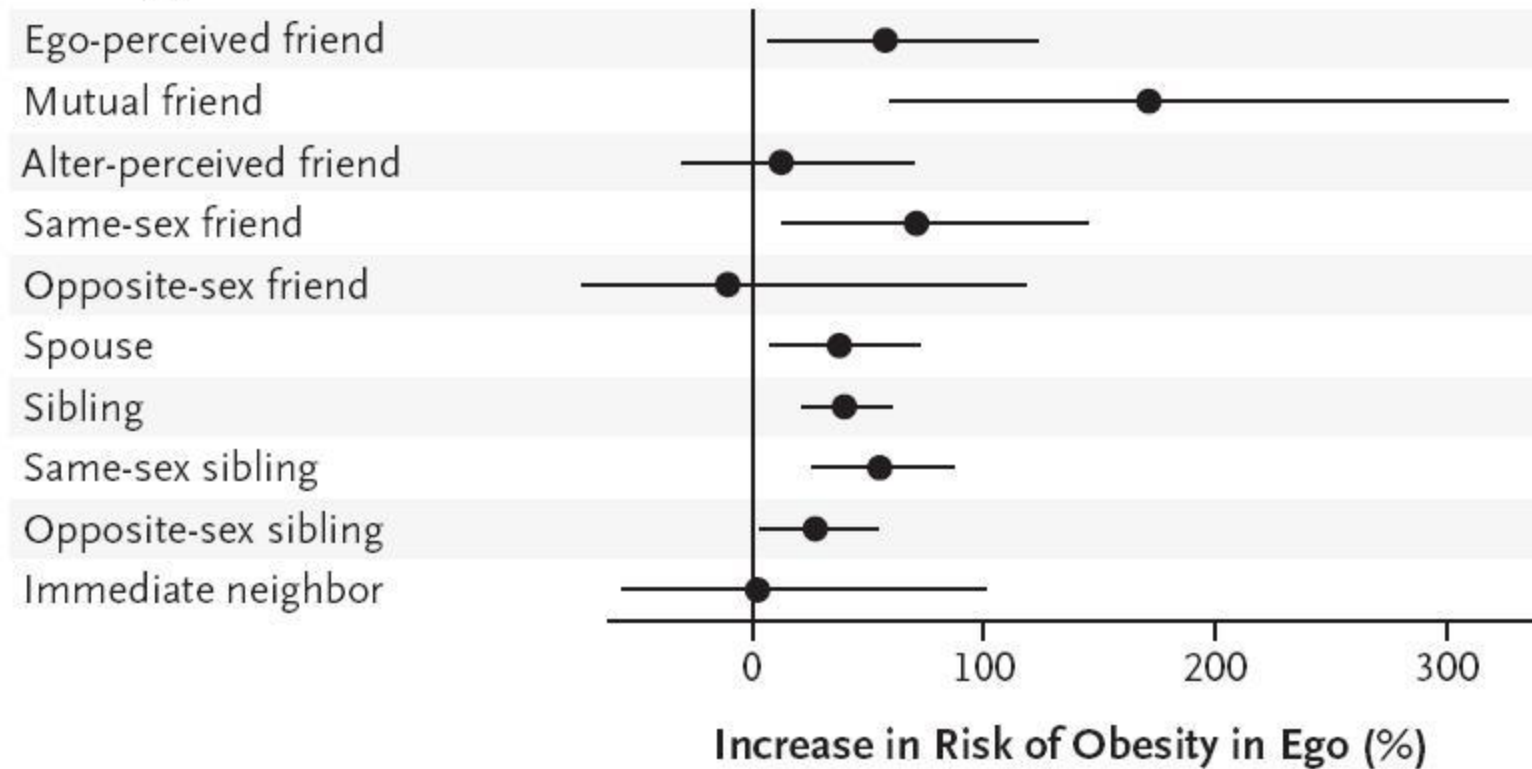
Example: obesity study

Christakis and Fowler, “The Spread of Obesity in a Large Social Network over 32 Years”, New England Journal of Medicine, 2007.

- Data set of 12,067 people from 1971 to 2003 as part of Framingham Heart Study
- Results
 - Having an obese friend increases chance of obesity by 57%.
 - obese sibling ! 40%, obese spouse ! 37%
- Methodology
 - Logistic regression, taking many attributes into account (e.g., age, sex, education level, smoking cessation)
 - Taking advantage of data that is available over **time**
 - “edge reversal test”

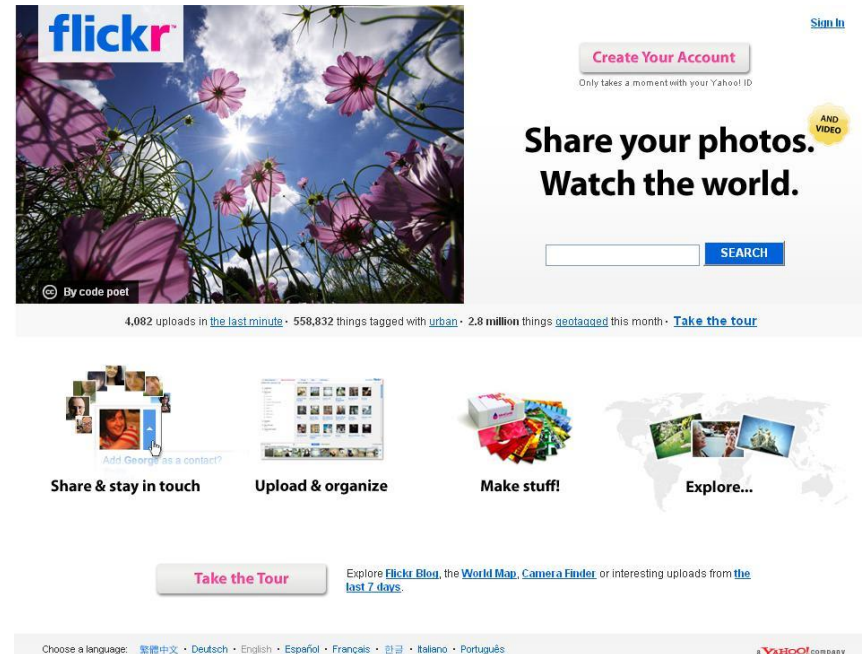
Obesity study

Alter Type



Flickr data set

- Photo sharing website
- 16 month period
- Growing # of users, final number ~800K
- ~340K users who have used the tagging feature
- Social network:
 - Users can specify “contacts”.
 - 2.8M directed edges, 28.5% of edges not mutual.
 - Size of giant component ~160K



Online Social Networking Sites

- Preferences listed and easily accessible

Personal Info

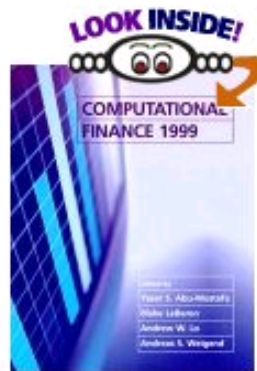
Interests:	Cycling, Scuba diving, Skiing, Travelling, Modern Art, Architecture, Films, Cosmology, Particle Physics
Favorite Music:	House, trance, techno. Pink Floyd, Velvet Underground, David Bowie, Vaya Con Dios, This Mortal Coil, Depeche Mode, Kraftwerk, Malcolm McLaren, The KLF, Leonard Cohen. Nina Simone, Ella Fitzgerald, Miles Davis. Erik Satie.
Favorite TV Shows:	I don't watch TV, but I've seen most episodes of West Wing, Sex and the City and Six Feet Under on DVD
Favorite Movies:	Pulp Fiction, Casablanca, Godfather I, II and III, The Usual Suspects, Memento, The Name of the Rose (Sean Connery rocks!), All Connery Bonds, Rear Window, Vertigo, Cidade de Deus, Citizen Kane, Silence of the Lambs, Sunset Boulevard, The Matrix, Mulholland Drive, Seven, Memento, The Third Man, The Fourth Man, Being John Malkovitch, Requiem for a Dream, LA Confidential, A Clockwork Orange, Donnie Darko, Fargo, Blade Runner, Kill Bill Vol 1 and 2, Amores Perros, Run Lola Run, Manhattan, Stardust Memories, Crimes and Misdemeanors, 8 1/2 ...
Favorite Books:	Bill Bryson's 'A Brief History of Nearly Everything'; Franz Kafka's 'Metamorphosis' and 'The Castle'; Arthur Clarke's 'Childhood's End'
Favorite Quotes:	It always surprises me when people leave New York. I mean, where do they go? -- Samantha Jones, Sex and the City

Customer-generated Reviews

- Amazon.com started with books
- Today there are review sites for almost everything
- In contrast to “favorites” we can get information for less popular products

Computational Finance 1999

by [Yaser S. Abu-Mostafa](#) (Editor), [Blake LeBaron](#) (Editor), [Andrew W. Lo](#) (Editor), [Andreas S. Weigend](#) (Editor)



[Look inside this book](#)

List Price: \$52.00

Price: **\$52.00** &
This item
ships for
FREE with
Super
Saver
Shipping.
[See details.](#)



Availability: Usually
ships within 24 hours

READY TO BUY?



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Buy now with 1-Click®

Ship to:

AMEX to AMZN



☐ Add gift-wrap/note

MORE BUYING CHOICES

10 used & new from
\$20.00

Have one to sell? [Sell yours here](#)

Add to Wish List

Add to Wedding Registry

Don't have one?
We'll set one up for you.

Helpfulness of review
(by other customers)

10 used & new from \$20.00

Edition: Paperback

2 of 6 people found the following review helpful:



This is a great book!!, September 17, 2000

Reviewer: **A reader** from New York, NY, USA

Finally, an insightful, easy-to-read collection that bridges the gap between lofty academics and down-to-earth practitioners!

Rating
(1 ... 5 stars)

Was this review helpful to you?

☐ yes

☐ no

Review

6 of 10 people found the following review helpful:



Great book, June 19, 2000

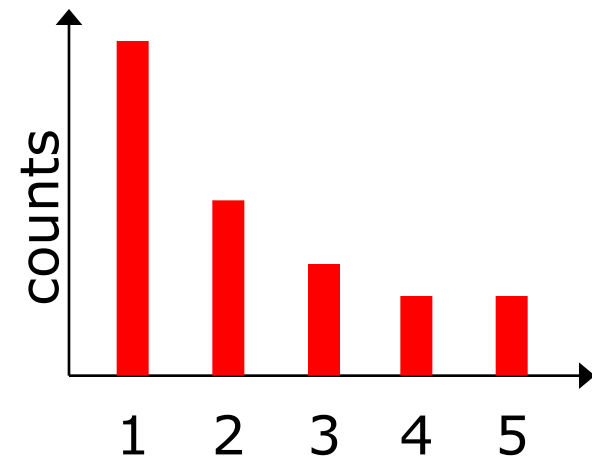
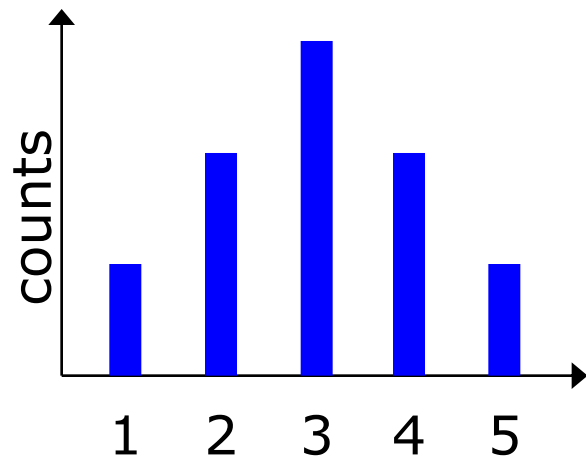
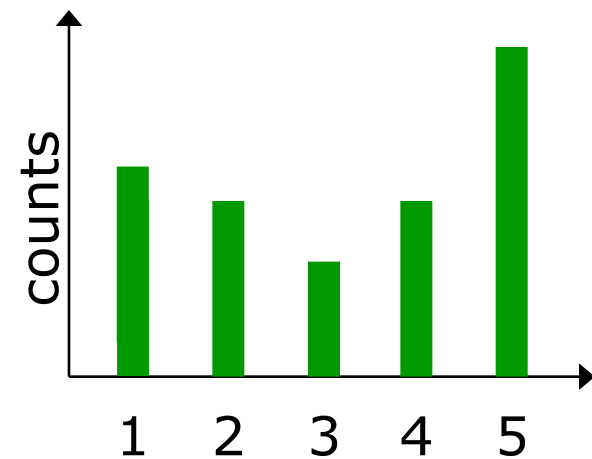
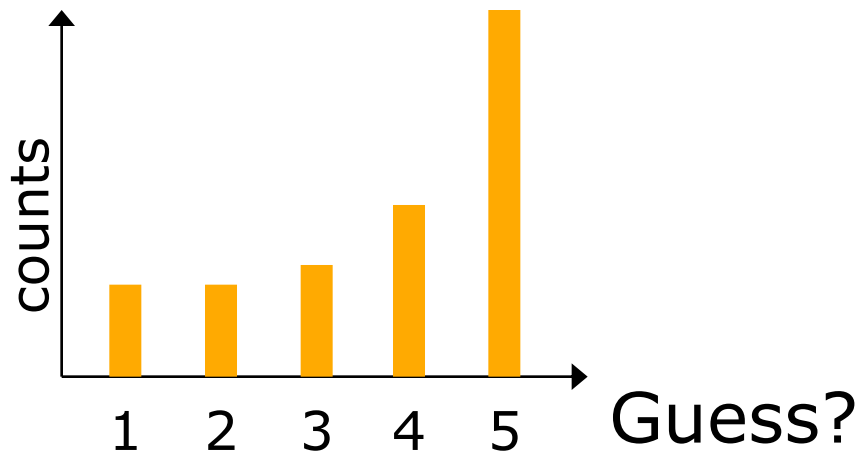
Reviewer: **A reader** from Boston, MA

Do People Trust Reviews?

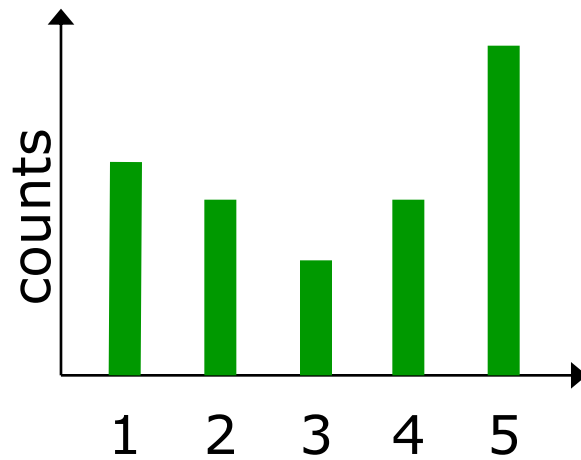
- Law of large numbers: single review no, multiple ones, yes
- Peer feedback: number of useful votes
- Perceived usefulness is affected by:
 - Identity disclosure: Users trust real people
 - Mixture of objective and subjective elements
 - Readability, grammaticality
- Negative reviews that are useful may increase sales! (Why?)

Are Reviews Representative?

What is the Shape of the Distribution of Number of Stars?



Observation 1: Reporting Bias



Why?

Implications for WOM strategy?

Possible Reasons for Biases

- People don't like to be critical
- People do not post if they do not feel strongly about the product (positively or negatively)

Observation 2: The SpongeBob Effect



SpongeBob Squarepants

versus



Oscar

Oscar Winners 2000-2005



[Crash](#)

(2005) **R** **Top 100**



A 36-hour period in the diverse metropolis of post-Sept. 11 Los Angeles is the theme of this unflinching drama that challenges viewers to confront their prejudices. Lives combust when a Brentwood ... [Read More](#)

Add



[Million Dollar Baby](#)

(2004) **PG-13** **Top 100**



This multiple Oscar winner follows a determined young athlete who, through her sheer determination, awakens a long-lost fire within two aging boxers. Despondent over a painful estrangement from his ... [Read More](#)

Add



[Lord of the Rings: The Return of the King](#)

(2003) **PG-13**



The third of the trilogy. As the shadow of Mordor grows, Aragorn (Viggo Mortensen) is revealed as the hidden heir to the ancient kings. As he, Gandalf (Ian McKellen) and the other members of the ... [Read More](#)

Add



[Chicago](#)

(2002) **PG-13**



Roxie Hart (Renee Zellweger) hungers for stardom, but instead ends up in the slammer in 2002's Best Picture winner. Velma Kelly (Catherine Zeta-Jones) is a superstar whose fame flares -- then dims ... [Read More](#)

Add



[A Beautiful Mind](#)

(2001) **PG-13**



John Forbes Nash Jr. (Russell Crowe) was a brilliant economist -- when his mind was clear. But life changed forever with the revelation that he was a schizophrenic. Nash's brilliance persisted ... [Read More](#)

Add



[Gladiator](#)

(2000) **R**



Oscar winner Russell Crowe is Maximus, whom Roman emperor Marcus Aurelius (Richard Harris) had picked to succeed him. But Marcus's son Commodus (Joaquin Phoenix) snatches the throne, ordering ... [Read More](#)

Add



G.A.M.P.A.S.B.

Average Rating 3.7 Stars

SpongeBob DVDs



**Average Rating
4.1 Stars**



SpongeBob SquarePants: Tide and Seek

(1999) NR



Add

How does one explain the charm of a wacky sponge who lives under the sea and works in a burger joint? It's impossible. To understand why this Nickelodeon cartoon series is such a runaway hit, watch ... [Read More](#)



SpongeBob SquarePants: Fear of a Krabby Patty

(2005) NR



Add

Join the lovable yellow sponge and his undersea pals for another series of crazy adventures. In "Fear of a Krabby Patty," when SpongeBob's boss, Mr. Krabs, arranges for the Krusty Krab restaurant to ... [Read More](#)



SpongeBob SquarePants: Season 4: Vol. 1 (2-Disc Series)

(2002) NR



Add

This popular Nickelodeon 'toon follows the zany adventures of SpongeBob SquarePants, a bright-yellow filter feeder who lives in a pineapple under the sea. In the show's fourth season, Mr. Krabs ... [Read More](#)



SpongeBob SquarePants: Tales From the Deep

(2002) NR



Add

Nickelodeon's popular animated series chronicles the wacky adventures of everyone's favorite good-hearted, enthusiastic sea sponge and his undersea pals, Squidward, Patrick the Starfish and Sandy ... [Read More](#)



SpongeBob SquarePants: Lost at Sea

(1999) NR



Add

Get ready for another zany underwater adventure with SpongeBob Squarepants and his friends, Squidward, Patrick the Starfish and Sandy the Squirrel. This DVD features nine episodes – including "The ... [Read More](#)

And the Winner is... SpongeBob!



If SpongeBob effect is common, then ratings do not accurately signal the quality of the resource

What is Happening Here?

- People choose movies they think they will like, and often they are right
 - Ratings only tell us that “fans of SpongeBob like SpongeBob”
 - **Self-selection**
- Oscar winners draw a wider audience
 - Rating is much more representative of the general population
- When SpongeBob gets a wider audience, his ratings drop

Title	# Ratings	Ave
SpongeBob Season 2	3047	4.12
Tide and Seek	3114	4.05
SpongeBob the Movie	21,918	3.49
Home Sweet Pineapple	2007	4.10
Fear of a Krabby Patty	1641	4.06

Effect of Self-Selection: Example

- 10 people see SpongeBob's 4-star ratings
 - 3 are already SpongeBob fans, rent movie, award 5 stars
 - 6 already know they don't like SpongeBob, do not see movie
 - Last person doesn't know SpongeBob, impressed by high ratings, rents movie, rates it 1-star

Result:

- Average rating remains unchanged: $(5+5+5+1)/4 = 4$ stars
- 9 of 10 consumers did not really need rating system
- Only consumer who actually used the rating system was misled