More Social Networks

Limitations and

Potential of

computation

Announcement

- Bonus 5 due today
- T-shirt size choice: S, M, L, XL
- T-shirt design ideas
- Sign up for demo session on Thursday 15 minutes: 10 people

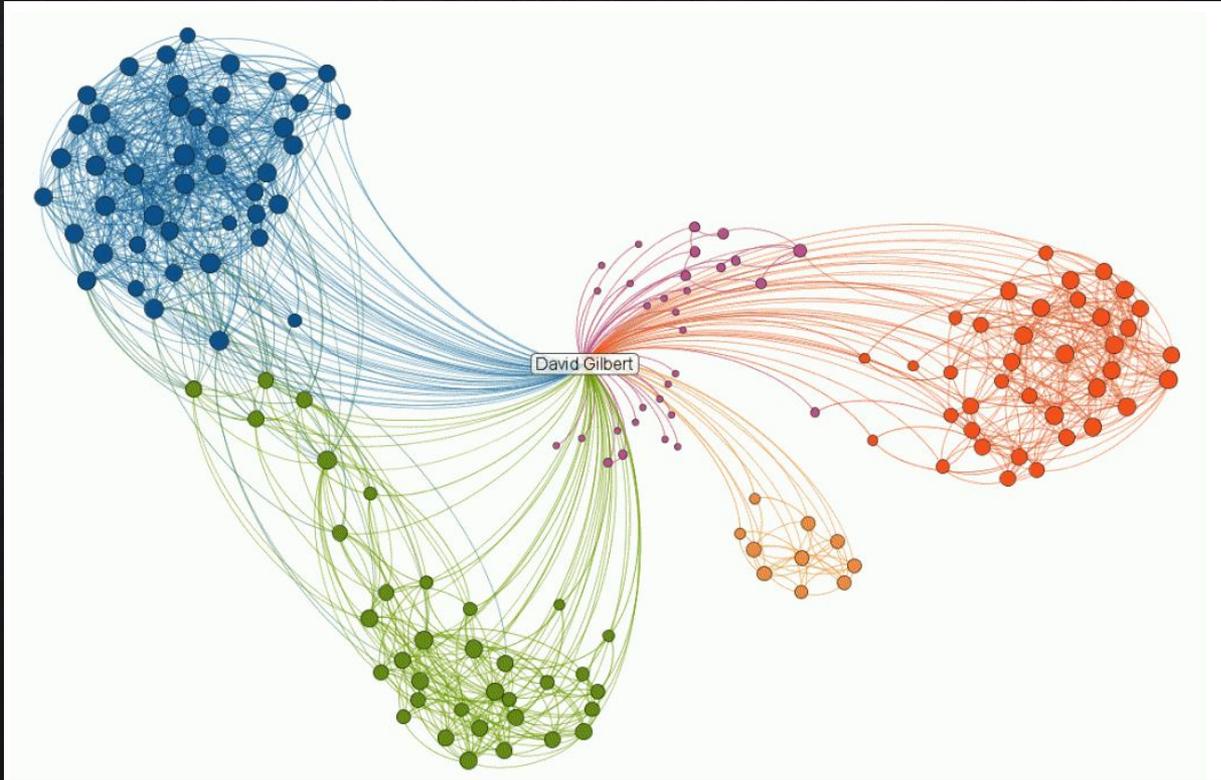# More Social Networks

Why graphs are useful for analytics?

Easily understood, interpretable information

Obtain Insight

Improve performance for some learning algorithms

Social networks revisited

Model Social Networks as Graphs

http://randomwire.com/linkedin-inmaps-visualises-professional-connections/

Centrality

Identification of vertices that play the most important role

https://www.youtube.com/watch?v=NgUj8DEH5Tc

Clustering and connectedness

Detection of communities in a network

https://www.youtube.com/watch?v=20a7mef77nM

Limitations and Potential of computation

What a computer Can Not Do?

- We've studied computers
  - What they are
  - What they can do
  - How to use them to solve problems
- Discussion: What are the limits of computers?
- Discussion: What are new directions for computing?

Hardware Limitations

- Representation of information is finite
    - Must fit in physical memory
        - Round–off error

Example:

- There is room for 3 digits per number
- Add 100 + 1.5 = 100.5
- Stores 100 as answer

Example: ⅓ = 0.33333333333….

Hardware limitations

- Binary conversion in real life
- In Excel, try
    - $A = 1.12$, $B = -1.23$, $C = 0.11$
    - $A + B + C = 1.249\text{E}{-}16$
    - $A + C + B = 0$
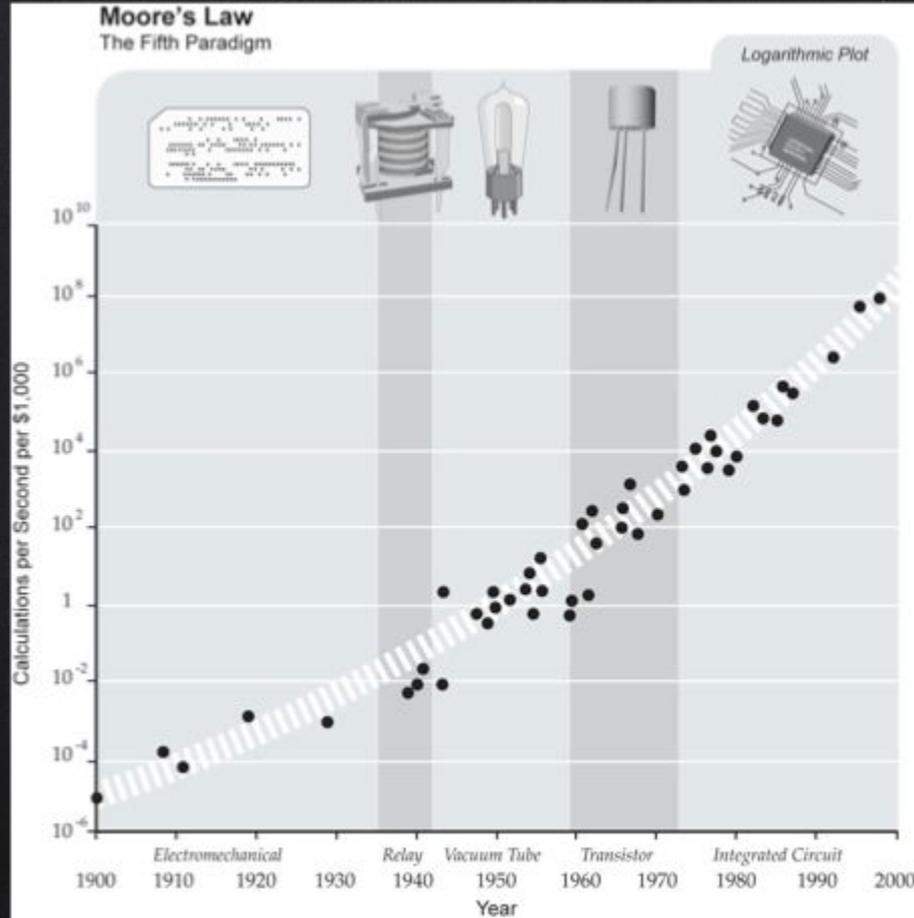   - $A + B + C$ not equals to $A + C + B$

Is this a real problem?

Limitation in Computing Power

- Advances in computer power has been one of the great successes of all time
  - Computers become faster and cheaper
- Moore's law
  - Transistor density doubles every year to 18 months
  - Transistor: signal amplifying
- Osborne portable
  - 1982
  - Vs. iPhone

Not Just for Computer Chips

Problems with Moore's Law

Source: Anandtech

Transistor Size

- Computer chips made up of billions of transistors
    - Insulating layer is only a few atoms thick!
    - How can Moore's law continue?
    - 2012: single-atom transistor shown in lab
        - No practical for production
        - Is this the limit?

Is this the limit? – (start at 2:13) https://www.youtube.com/watch?v=bm6ScvNygUU

Is this the limit?

- Biological computers
- Optical transistors
- Nanomagnet transistors
- Quantum computers
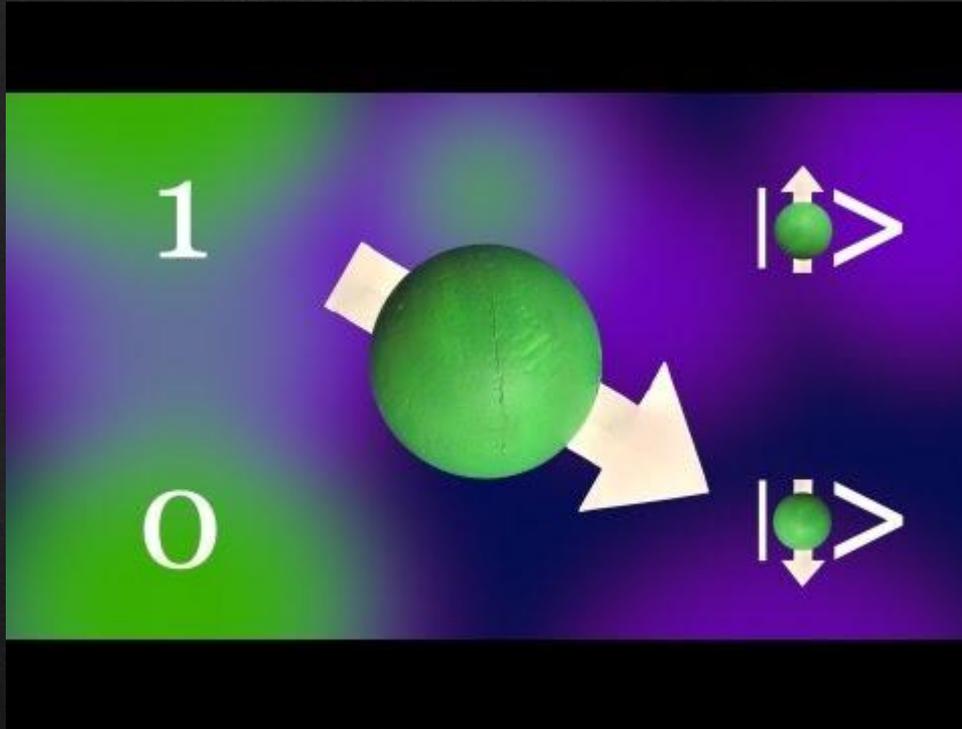
https://www.youtube.com/watch?v=g_IaVepNDT4

Software Limitations

- Computers must be programmed
- Computer software (programs) may contain errors
- Humans design, write and check software
  - Software verification
  - Software engineers
  - There are important branches of computer science
  - Crypto verification
- How does open-source software development affect software quality?

Bad bugs

- Notorious software errors
  - At&T down
    - Error triggered by bug in software update
  - Therac-25 radiation therapy machine
    - Overflow error
  - Mars Climate Orbiter burn up
    - English vs metric units
  - Heartbleed security bug

https://www.youtube.com/watch?v=dXFFXknE6Gk

Software Limitations

- Are there fundamental limits to the problems we can solve on computers?
  - We had some discussion about intelligence
  - Can we prove anything about problems computers can or cannot solve?
- Alan Turing gave an example of a problem computer can not solve
  - Halting problem

https://www.youtube.com/watch?v=92WHN-pAFCs
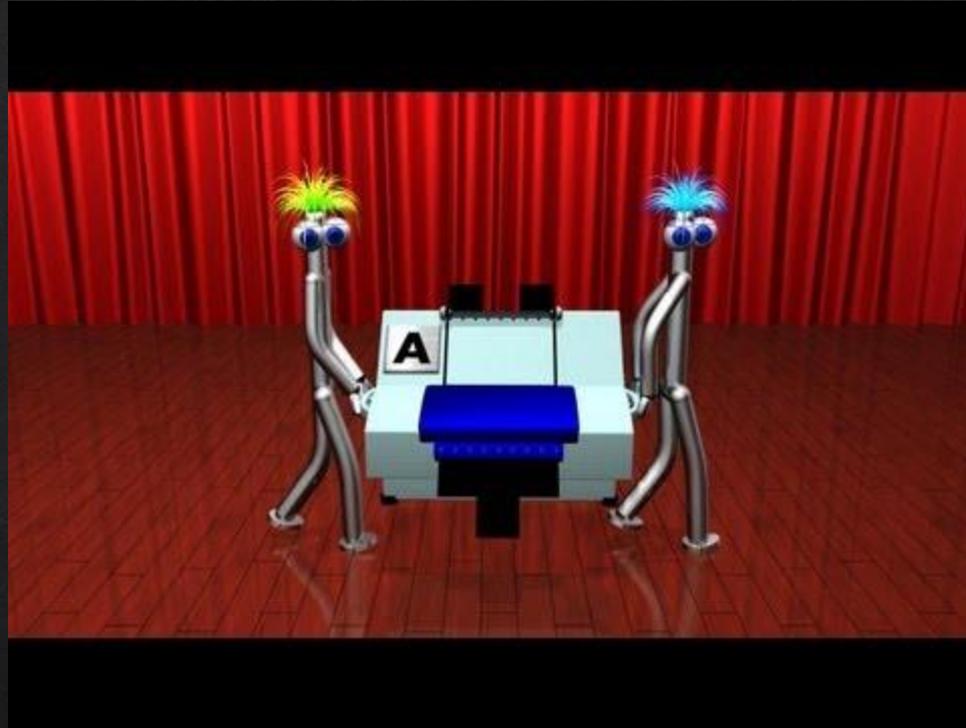
THANKS!

Any questions?

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http://www.sci.utah.edu/~beiwang/teaching/cs1060.html

CREDITS

Special thanks to all the people who made and released these awesome resources for free:

- Presentation template by SlidesCarnival
- Photographs by Unsplash