CSCI0150
(AKA CS15)
A Gateway to Computer Science
Computer Science (1/2)

- CS15 is your start to understanding computer science
  - for your own intellectual interest
  - for its enrichment of other fields
  - for its combination of scientific, engineering, art and design concepts and practices, and as a “mode of thought” – “computational thinking”
Computer Science (2/2)

- IT, or information technology including CS, is key to the “knowledge economy”

- Some examples of CS in action, to illustrate the breadth of our field and its applications, follow
Stunning Special Effects

WALL-E

Avatar
Immersive Virtual Reality (1/2)

In the past, researchers were restricted to maps and models for studying the surface of Mars.
Immersive Virtual Reality (2/2)

- Now, they can create fully immersive 3D environments via head-tracked stereo glasses, enabling realistic “field geology” on Mars!

- A state-of-the-art new “Cave”, the YURT (YURT Ultimate Reality Theater), at 180 George Street about to be generally available
  - much higher quality (e.g., 100Mpixels) and much more comfortable than Oculus Rift and other VR gear
  - but way more expensive!
The Internet and Social Networks

● Facebook
  ○ 1.5 billion active users worldwide
  ○ over 70 billion pieces of content (links, pictures, etc.) shared each month
  ○ 150,000 messages sent per minute
  ○ open source API allows users to write their own Facebook applications
Dilemmas of the Digital Age (1/4)

- Machines continue to replace human labor and decision-making
  - machines have increased human productivity while reducing demand for routine, repetitive jobs
  - as middle-skilled, task-intensive jobs disappear, income gap widens
  - but new jobs are being created, old jobs “upskilled” to be more interesting
    - education is key to economic survival
Dilemmas of the Digital Age (2/4)

- Dangers of yielding too much control to algorithms, some too complex to be understood by most people
  - instability in the stock market due to trading algorithms
  - self-piloting vehicles (autopilot on planes, driverless cars…)
  - nuclear power plans
- Cyberfraud, Cybercrime, Cyberwarfare
  - offense has the advantage over defense
  - schools in Russia, China, North Korea (at least) teach hacking…we’ve gone well beyond amateur hacking
- Brown is strong in cybersecurity technology and policy
Dilemmas of the Digital Age (3/4)

- **Big Data**
  - “data mining”, “machine learning”, statistics-based algorithms for detecting patterns, anomalies, etc.
  - search
  - real-time language translation
  - face recognition
  - gesture recognition for user interfaces
  - credit card fraud detection
  - crime and terrorism anticipation
  - But what about privacy?!?

Spielberg’s “Minority Report” with Tom Cruise
Dilemmas of the Digital Age (4/4)

● Big data & personal privacy
  ○ information now more accessible than ever
  ○ threat to privacy represented by increasing storage of personally identifiable information – is there any real “anonymous data”?!?
  ○ Google search results influencing voter decision-making
  ○ NSA/Snowden Controversy; what about Google, Facebook, Microsoft and their data collection and use of that data – digital stuff is permanent, and you have no control over how it is used (Sun’s Scott McNealy – “privacy is dead, get over it!”

● Need an educated government, citizenry
Guest Speakers

Robot-Human Communication

Scientific Visualization

Computational Biology

Stefanie Tellex

David Laidlaw

Ben Raphael
Computer Science at Brown Works on Hard Questions (1/6)

• What technologies will help to shrink the size of computers?
• How can we make computers more secure?
• What policies will reduce cybercrime and avoid cyberwar?
Computer Science at Brown Works on Hard Questions (2/6)

- How do we make programming easier and more user-friendly?

User Interfaces

Steven Reiss
Computer Science at Brown Works on Hard Questions (3/6)

- How can computers understand language to answer questions and hold conversations?

Natural Language Understanding

Eugene Charniak
Computer Science at Brown Works on Hard Questions (4/6)

- How do we let users quickly and efficiently analyze large data sets with modest computing resources?

Distributed and Cloud Computing

Ugur Cetintemel
Computer Science at Brown Works on Hard Questions (5/6)

• How can we understand and model the way humans interact with computers?
Computer Science at Brown Works on Hard Questions (6/6)

• How do we build new programming languages?
• How can we improve domains like security and networking?
• How can we improve teaching computer science?
CS: So Much More Than Programming! (1/2)

• Computers are our only universal machine, through the magic of software...

• Programming is a means to an end, much like mathematics is…but they are both also fascinating topics in their own right!

• Big push to learn how to “code”, but there is no “royal road” to programming or CS – it requires serious, sustained effort
CS: So Much More Than Programming! (2/2)
Why Should You Study Computer Science?

- For fun and intellectual excitement
- A really exciting era is just beginning
  - CS is still a young discipline, computers are just starting to act intelligently
- Fundamental “mode of thought”
- An increasingly important component of all other fields
- Despite outsourcing, plenty of interesting jobs for qualified people, in established companies and start-ups, in research labs and academia