Why a Ph.D.?

- Many times the Ph.D is the person in charge – leading exciting projects!
- Research expands the frontiers of human knowledge
- Significant research achievements advance human civilization, and improve the quality of our lives
- Leave a mark behind
- In today’s world, PhD is a requirement to pursue a career in research or University level teaching
Why a PhD in CS?

- All science is impacted by computer science
- Since CS touches on all scientific disciplines, it offers vast and rich opportunities for multidisciplinary research
- CS touches on business, entertainment and politics.
- In fact, it affects our lives very directly, since computers touch almost all human activities
- Practical and usable research
- One can pursue multiple research programs
- Young field: tremendous opportunities for important discoveries
- One of the fastest growing research areas
- Offers FUN + FUTURE + IMPACT
Career Flexibility – Ph.D. Creates Options:

- Research in corporate or university labs
- Advanced product development
- Start-up company based on your Ph.D. research
- Academic career – University-level research/teaching
- Academic career – Undergraduate teaching emphasis
Research in Core Computer Science

• Can we build computers based upon novel principles and will they be more powerful?
• Is there a cryptosystem that is absolutely secure?
• Can we ensure privacy?
• What are the limits on computers inferring patterns from examples?
Research Excitement - Examples

- Build a 1000 node wireless sensor network to detect earthquakes or tornadoes
- Search the internet based on meaning
- Instrument wearable “health shirts” to keep people healthy
- Create realistic 3D graphics for flying through models of the human body or to support video games
- Control robots for use in chemical spill cleanups
- Create solutions for pervasive computing
- Invent the next microprocessor
- Make the Internet look like one large global computer
- Improve computer security so that identity theft is a thing of the past
- Invent new algorithms that save millions of dollars
Interdisciplinary Research Opportunities

- Robotic Operating Rooms
- Agile and Just-in-Time Manufacturing
- Efficient Transportation Systems
- Predicting Hurricanes
- Financial Services on the WEB
- Bioinformatics
- Intelligent Tutoring Systems
- Emergency Response Systems
Have a Significant Impact on Society

- Improve safety of systems
- Improve health systems
- Improve financial transactions
- Support environmental studies
Characteristics of C.S. Ph.D. Positions

- On average, provides greater lifelong freedom of movement and more independence
- Typically less involved in corporate hierarchies
- More emphasis on individual creativity
- More self-starting and internally motivated
- More focused on ideas and less on process, politics, or economics
- Working on leading edge ideas and future products
- Very comfortable financially
- Use a wide range of skills (design, analysis, synthesis, working with others, ...)
Characteristics of Academic Jobs at Research Institutions

- Provide tremendous satisfaction in helping others (students) develop their skills
- Immediate means to leverage ideas – graduate students
- Variety – teach, research, write, give talks, raise funds, travel
- Some amount of pressure, especially prior to tenure
- Freedom to pursue your ideas
- Satisfaction in invention, publications and impact of work
- Relatively high job security and stability
- Comfortable to very good salaries
- Consulting is possible
Characteristics of Academic Jobs – at Undergraduate Teaching Institutions

- Modest research and publication expectations
- Higher teaching loads than other academic positions
- Typically lower salaries than other academic positions
- Provide tremendous satisfaction in helping others (students) develop their skills
- Ability to work more closely with undergraduates
- Ability to concentrate on teaching
Characteristics of Research Lab Jobs

- Research focus, but with eye towards company products
- More time for research (no teaching)
- Programming skills utilized
- Some interaction with a few full-time students and interns
- Must provide value to company, hence somewhat less freedom than in academia
- No fundraising (usually)
- Well-equipped labs
- Usually long-term security
Characteristics of Advanced Development Jobs

• See your ideas become products
• Rewards programming skills
• Consider major concerns of customers and economics
• Develop an understanding of business issues while working with sophisticated technologies
• Opportunity to publish and attend conferences
Fascinating CS People – Past and Present

- Alan Turing – Founder of Computer Science
- Ivan Sutherland – Creator of Computer Graphics
- John Hennessy – President of Stanford
- Grace Hopper – Admiral U.S. Navy
- Vint Cerf and Bob Kahn – Fathers of the Internet
- Bill Wulf – President of the National Academy of Engineering
- Maria Klawe – Dean, Princeton
- Seymore Cray – Computer Architect; Founder of Supercomputer Company
- Eric Schmidt – CEO Google
- Anita Jones – Former Director of Defense Research and Engineering
Starting Salaries

- **Top Research Universities:**
  - $84K for 9 months + pay for two or three summer months + consulting + lecture fees + book royalties
- **Research Labs:**
  - $70K to $120K for 12 months + sometimes stock options
- **Teaching University/College:**
  - Salaries lower than research universities
- **Advanced Product Development:**
  - Salaries may start higher than research labs
Advice to Graduate Students

• Master the basics
• Explore several areas of interest in depth
  – You **MUST** be excited about what you are doing
  – OK to change area
  – Choose school where this is possible
• Become an expert in your area
  – Ultimately know more than your advisor
• Identify a “good” research area
  – Good = achievable + novel
• Focus, Focus, Focus
  – You need not solve the world’s problems
• Work hard!
Graduate Student Stipends

- ALMOST ALL PHD STUDENTS IN CS DO NOT PAY FOR GRADUATE SCHOOL. INSTEAD THEY RECEIVE FREE TUITION AND A STIPEND!!
  - Duties for stipend include:
    - Research Assistant – typically on projects that contribute towards your PhD
    - Teaching Assistant – may include grading, holding office hours, teaching problem sessions, and in some cases teaching class

- Stipends for research and teaching assistants vary from school to school, but are typically in the range of $1,500 - $2000 per month.

- Fellowships are also available

- Travel stipends support trips to conferences
Graduate Student’s life
Graduate Student Life

- Average time to PhD is from 4 to 6 years after an undergraduate degree
  - You must be committed
- Students come directly from undergraduate program OR after some time in industry
  - So, if you go into industry consider returning to grad school after a year or two (or more)

- Piled Higher and Deeper … Comic Strips on PhD
Application Process

• Step 1: Find grad programs interesting to you (use the WEB)
  – Do you have a research focus?
  – Get advice from your undergraduate advisor

• Step 2: Take GRE tests (Verbal, Quantitative, Analytical, and Subject)

• Step 3: Find three (faculty) letter writers
  – Not just “I did very well in the course this instructor taught” but
    “This instructor knows me very well and can write a strong
    recommendation letter.”
  – If you did research or applicable summer job you can use your boss
    as one letter writer

• Step 4: Work on personal statements
  – Significantly more research oriented than UG application essays

• Step 5: Apply via on-line application forms