CSE 91: What did we do and where do you go from here?

CSE 91 Last Lecture
George Varghese
CSE 91 Goal 1: Essence

1) To convince you that Computer Science is not just programming but creatively solving the world’s problems using computers

– Spam (Savage): understanding money chain
– Pollution (Griswold): network of cheap cell phone sensors
– Elder Care (Ettinger): Automatic cameraman
– Online Cosmetics (Kriegman): Makeover site
– Buying rare stuff (Elkan): Recommendation via learning
– Cancer detection (Bafna): Placing primers optimally
– Underwater sensors (Kastner): Underwater modems
– Web sites for masses (Yannis): Automatic DB schemas
Enabling technologies for solving problems with computers

- **Programming hard** (Rondon): Program on web
- **Security poor** (Savage, Bellare): Public key crypto
- **Stuff Fails** (Marzullo): Byzantine generals
- **Too much Power** (Agrawal): Green computing: Cell2Notify
- **Interact with world** (Gupta): Embedded systems: Boards
- **Too slow** (Dasgupta): Algorithms: Dijkstra’s
- **Often buggy** (Graham): Discrete math: Probability trees
- **Need platforms** (Varghese): HW, Arch, OS: Time sharing
Common theme: abstractions

End User Abstractions

• Programming abstractions (Rondon): circle
• Face makeover abstractions (Kriegman): PaintLip
• Camera operating commands (Ettinger): Clap
• Recommendation systems (Elkan): NetFlix Recommends
• Search (Varghese): Google box

Programmer Abstractions

• Abstract Data Types (Dasgupta): Graphs, shortest paths
• Operating System: (Varghese) Virtual Memory, Windows API
• Architecture: x86 Instruction Set for OS programmer
So what is Computer Science?

- Study of **abstractions** to enable people to creatively solve the world’s problems and to build better tools for programmers.
- Also, effort to make these abstractions more **useful** (secure, reliable, correct, efficient, low power)
- Also a **way of thinking** (e.g., algorithm, program, virtual) that can transform other fields: math, science, social studies
- Programming is how we **use** the abstractions but gives you no insight on how to **build** better abstractions!
- This is why its worth taking Undergraduate CSE courses
CSE 91 Goal 2: Startup exposure

2) Startups: To give you a glimpse of how CSE ideas can convert to business opportunities

CSE91 Examples:

- Taaz (Kriegman), finding right business model
- NetSift (Varghese), startup story
- Google, ad words business model
- App2You (Yannis), filling a need
- Homework on business models and cap table
CSE 91 Goal 3: Showcase UCSD CSE

- **UCSD CSE:** To show you that UCSD CSE has a number of cool professors doing cool work
  - **Kriegman:** interacts with fashion designers
  - **Savage:** works with Interpol on Internet Security
  - **Bellare:** helped designer modern crypto systems
  - **Elkan:** helped design NetFlix Prize contest
  - **Marzullo:** helped designed NTP, plays ukelele
  - **Graham:** won Steele Prize in math, juggler
  - **Kastner:** dives in Tahiti to do his research
  - Lots of other award winning faculty (Oscars etc!)
CSE 91 Goal 4, Students like you

- **Students:** To showcase students like you:
  - 3 lectures by students (Rondon, Ettinger, Agrawal)
  - Satya Mallick (co-founder of Taaz)
  - Sumeet Singh (co-founder of NetSift)
  - Keith Kowalczykowski (President, App2You)
  - NetFlix prize idea due to UCSD student
  - Savage, Griswold, Kastner, Gupta all work with undergraduates
CSE 91 Goal 5, Career Opportunities

• **Careers**: To show there are exciting career options that can change the world
  – Build great products at Google, Microsoft etc.
  – Do interdisciplinary work (Biology, Cog Science)
  – Start a Company
  – Help some world cause
  – Be researcher or work on cutting edge products
Option 1, Build Great Products

• Possible next steps:
  – Become a tutor for a programming course
  – Join programming contests
  – Take the Games Class and the Rendering Class
  – Learn useful technologies (e.g., learning theory, algorithms, hardware, vision) you need
  – Do internships early
Option 1, Example

- Lindsey De Salvo: UCSD CSE 2005
- Software engineer, Amazon
- Academic coordinator Tau Beta Pi, volunteered for San Diego Rescue Mission
Option 2, Interdisciplinary Work

• **Possible next steps:** (e.g., CSE and Theater)
  – Consider double majoring and using BA in CS
  – Check out programs in Bioengineering and User Interfaces from Cognitive Science
  – Check out opportunities at CALIT next door
  – Learn stuff in other area, take courses
  – Do internships in other area
Option 2 Example

- Khwaja Shams: UCSD CSE 2006
- Works at NASA Jet Propulsion Lab
- Software for rovers and landers on MARS
Option 3, Start a Company

• Possible next steps:
  – Check out opportunities and courses at Von Liebig center
  – Try out entrepreneurship challenge (OK to fail)
  – Check out opportunities at Rady School
  – Learn or read books on startups, accounting, sales
  – Do internships at a startup (Taaz had one)
  – Make allies with folks with complementary skills
Option 4, Example

- **Example**: Nadav BenHaim, co-founded license recognition startup after undergrad with UCSD Vision Professor Serge Belongies
Option 4, Help the World

• Possible next steps:
  – Find some cause you really care about
  – Figure out how computers can help cause
  – Try to meet people working in this cause and find what the real needs are.
  – Take field trips (e.g., to Africa)
  – Write a tool for cause as a prototype
Option 5, Do Cutting Edge Research

• Possible next steps:
  – Find a research opportunity at department, CALIT, SDSC, anybody who will take you
  – Try to do well at some courses (projects, extra mile) so they will write you recco letters
  – Try to write a paper
  – Try and find an area you are passionate about
  – Apply to Grad School, get an MS or PhD
Option 5 Example

• Angelina Lee: UCSD CSE 2003
• Ph.D. candidate at MIT under Charles Leiserson
• Parallel processing that can handle errors well
CSE Jobs

• So its exciting , but are there good jobs? Yes!
  – 80,000 new CSE jobs in California, more than any other degree (CA Labor Market Analysis 2007)
  – 59% of all new job openings 2004-2014 vs life science 4% (US Bureau of Labor, 2005)
  – Median salary $70,000 (labor statistics) 2\textsuperscript{nd} highest
  – Unemployment 3% is low versus US average 6%. 91% of employers report shortage
UCSD Engineering
Starting Salaries
Graduate School: Why, how and when

Stefan Savage
UC San Diego
Really?

- I’ve been in school for 13 years so far… (K-12)
- I have another four to go… (BS/BA)
- And you want me to spend another:
  - 2-3 years (M.S.)
  - 5-6 years (Ph.D.)
- No, really?
YES

Maybe
Why you might want to go to grad school

Fluctuations in Grad Student Enrollment (Science & Engineering) vs. Fluctuations in the Unemployment Rate

Correlation Coefficient: $\rho = 0.75583$ (that's pretty high)

Guess Who’s Coming to Grad School?

Sources: NSF/Bureau of Labor Statistics. Fluctuations obtained by subtracting the mean regression line from the absolute values.

WWW.PHDCOMICS.COM
Why you might want to go to grad school (really)

• Passion for the material
  – And its much more fun than undergrad...

• Opportunity to work on cutting edge problems

• Interested in research, teaching, or starting a company (grad school required or big help)

• Better job prospects
  – MS ➔ a good financial investment (esp in down mkt)
  – PhD ➔ opportunity to work on cutting edge problems for rest of career
What’s cool about grad school?

• Problem space is open
  – You define problem and solution
  – Doesn’t need to make money in 2 quarters
• Combine technologies and ideas before a market even exists (or may not exist)
  – E.g., technologies focused on social good
• Focused on the prototyping the idea; not the making a bulletproof product
Grad student lifecycle

• Two years of classes, but
  – Usually no more than 2 classes @ time
  – Grades are different
How to Apply to Graduate School

• Applications usually due in December
  – Allocate time to them early so it is not a rush

• Components
  – Letters of recommendation, GRE scores, GPA, statement of purpose, research/work experience

• The single most important thing are your letters of recommendation
  – Hmmm....
Letters of Recommendation

• Supervisor from internship
  – Fine, but count less if not famous researcher

• Senior grad student
  – Can be worthwhile, in addition to faculty letter, if you worked with them

• Professor
  – Took their class (ok, but won’t be personal)
  – Worked with professor on research (ideal!)
How do you get research experience?

• Find out what’s going on
  – Identify other undergraduates who have had research experience
  – Talk to your TA’s, Rick Ord, anyone who will listen, etc...

• Talk to faculty who you’re interested in
  – Schedule a time to talk to them
    • Explain what you’re good at, what excited about
  – Ideally, they’ll give you a well-defined project
  – If so, take it seriously; have to be motivated
The Ideal Graduate School Applicant (and undergrad researcher)

- Hard working
- Creative
- Excellent communication skills
- Team player
- Intelligent
- Broad interests and knowledgeable in target area
  - Math, systems building, etc.
- Broad interests
Where to Go

• Lots of great choices, apply widely
  – Important to have strength in your areas of interest (ask letter writers for advice)
  – Ok to switch area, but understand that grad school is focused on specialization

• Visit the school after admitted
  – School enthusiasm for your being there is important

• Who your adviser is matters much more than the “brand/ranking” of school
Decision Process

• Make sure file is complete (remind letter writers)
• Lots of noise in the process
  – Many applications
  – No need in your particular area
• Well-timed note after application is complete matters
• Financial offer
  – Most PhD programs offer some form of support, MS funding opportunities too (more TA than RA)
    • Lots of noise here as well
  – Best indicator is to talk to current students in program
CSE Stereotypes

- Type, type, program, program, CSE = Java
  - No: about solving problems creatively using computers
- Got to love computers as its all about ‘em
  - No: just as astronomy is not merely about telescopes
- Got to sit behind a desk in a dark room all day
  - No: lots of work outdoors as with sensors
- Work by yourself; interact only with machines
  - No: very much a social process today, lots of schmoozing
- Jobs mostly writing games, no world impact
  - No: huge variety – robotics, bioinformatics, helping blind
- No intellectual challenge
  - No: very hard problems: vision, AI, P = NP problem
Women in Computing

- Women were first programmers
- Grace Hopper and others were pioneers
- Two Turing Award winners (Fran Allen) and last (Barbara Liskov). Bios on Wikipedia
- UCSD has a Women in Computing Group with a Facebook page. They love to have UGs
- National association also has conferences and support groups http://gracehopper.org
- Great environment: lots of jobs that are part-time, telecommuting if you need them
Unsure of your major?

• Choose CSE because
  – The content is intellectually rich, world-impacting, and is a substrate for work in many other fields
  – The people are cool, diverse, and fun
  – The jobs are high paying, plentiful, & enjoyable

• Choose CSE@UCSD because
  – The program has great courses, great opportunities, and is a bargain
  – The faculty are world-changers, cool, and really teach classes
  – Our students are already changing the world

• If you are unsure, try a CSE class at UCSD
How we did CSE 91

• Various areas of CSE in each lecture and how they can solve the world’s problems

• Each lecture was an appetizer:
  – Homework made you take a few bites
  – Lectures pointed to full meal (later courses)
  – It’s an incredibly rich banquet

• You’ve taken the course, now stay the distance, and come change the world with us
Computers have changed the world

- Libraries → Google
- Barnes and Noble → Amazon
- Credit Unions → Online banking
- Drop in at neighbor → Visit Facebook Page
- Soapbox in park → Blog to world
- Math with paper → Mathematica, Maple
- Hand drawing in art, movies → Graphics, Pixar
- Biology in wet lab only → DNA analysis
- ? → Its your turn
You, too, can make the world better . .