

Graduate Studies in Computer Science & Engineering

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Reasons to Consider Grad School

- You want to have an impact on the way software and computer systems are built and used.
 - novel applications
 - transformational technologies (cell phones, youtube, google, WWW)
- You want to be a technical manager, Chief Technical Officer, Chief Scientist
 - MS: technical manager
 - PhD: CTO, Chief Scientist
- You love ideas and want to understand computer science more deeply.
- You want to be a professor and teach computer science to others.

Careers with MS

- Senior Software Engineer -- design and implement the key components of a system.
- Technical lead -- design technical approaches to solving problems. Designing new products and services.
- Technical project manager -- lead a team of people to produce a product.
- Technical Program Manager (Microsoft concept) -- primary designer of the user experience for a product. Author and owner of the specification. Coordinate the design and engineering; user studies.
- Technical editor/Technical writer
- Teacher (K-12 or Community College)
- CEO (combined with experience; MBA)

Careers with PhD

- Management
 - Technical Project Manager/Program Manager
 - VP of Engineering
 - Chief Technical Officer
 - Chief Scientist
 - CEO
- Research
 - Professor
 - Industrial Researcher (MSR; Google; Yahoo; top accounting firms; Fair Isaac; internet security)
 - Defense Industry contract research organizations (SRI International, ISI, BBN, Boeing, Lockheed-Martin, BAE, etc.)
 - Consultant
- Research Management
 - Grant Program Manager (NSF, DARPA, Private Foundations)
 - In-house researcher at VC firm (not entry level)

Preparing for MS Programs

- Rigorous Course Work
 - Communications skills
- Engineering-oriented Capstone Project
- Engineering internship
- Tool mastery
 - IDEs, Java, C++, C#, Matlab, R
 - Frameworks
 - Scripting languages
 - Version control and issue tracking
 - Databases
- Read industry magazines and blogs

Typical MS Program Content

- Approx. 10 courses (12 months of coursework)
 - 3 courses in your area
 - Remaining courses distributed across topic areas
 - Theoretical computer science
 - Algorithms and Data Structures
 - Computational Complexity
 - Computability
 - Languages and systems
 - Functional programming, logic programming, object-oriented programming
 - System architecture, distributed systems, networking, data-center computing
 - Real-World Computing
 - Artificial intelligence, graphics, vision, HCI, database systems
- MS Thesis vs. Project vs. Course-Only

Preparing for PhD Programs

- Rigorous Course Work
- Broad Course Work
- Research-oriented Capstone Project
- Research internship
- Read the literature

Rigorous Course Work

- Computer science research =
idea +
experiments +
mathematical analysis
- Take as much math as you can
 - Linear algebra, numerical linear algebra
 - Optimization (linear programming, convex optimization, non-linear optimization)
 - Probability and statistics (probability theory, theory of statistics)
 - Functional analysis
 - Theoretical Computer Science

Broad Course Work

- Computer science solves other peoples' problems. It is extremely valuable to know the vocabulary:
 - biology
 - ecology
 - chemistry
 - medicine
 - physics
 - psychology
 - business (advertising, marketing, economics)

Examples of fields I've worked in

- Accounting
- Chemistry
- Molecular biology + protein structure
- Grasshopper infestations
- Weather data analysis
- Computer network traffic + intrusion detection
- Personal information systems
- Mechanical design
- Entomology
- Drug design
- Computer vision, graphics
- Computer games
- HCI
- Remote sensing
- Bird song analysis
- Species distribution modeling

Research-Oriented Capstone Project

- Try to solve a problem relevant to some faculty member
 - get a letter of reference
 - maybe get a publication

Research Internship

- Formal NSF Research Experiences for Undergraduates
 - paid research experience (hourly)
 - formal summer programs, advertised on web and at NSF
- OSU REU
 - paid research experience with a faculty member
 - get foot in the door by volunteering
- Often results in publications and good letters of reference
 - some OSU REUs are now famous professors

Read the Literature

- Identify hot topics by looking at CS conferences
 - each area in CS research has a few high-quality conferences
 - look at the topics of invited speakers
 - look at the topics of associated workshops
- Read papers and see who is doing good work
 - who is helping define the problem?
 - who is doing the rigorous experiments?
 - who is able to apply the best mathematical tools?
 - who is doing a good job of training grad students?
 - students giving talks, winning “best paper” awards
 - students getting good jobs (read web pages)
- Attend the EECS Colloquium
 - Mondays 4-5pm KEC 1001
 - job talks during recruiting season

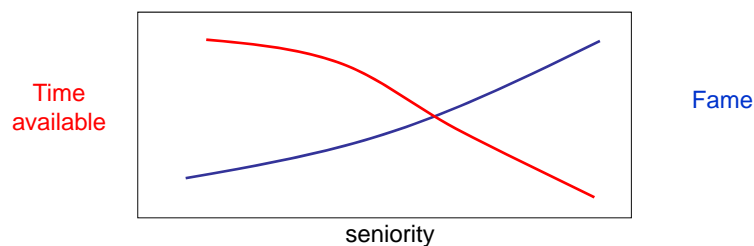
Applying to Grad School

- Choose good programs.
 - Find out what exams are required
 - GRE general test (CS subject test?)
- Choose your 3 letter writers carefully
- Write a good statement of purpose (get feedback from faculty members)
- Apply for NSF Fellowship
 - Get advice from faculty member about likelihood of success
 - Deadline: 5:00pm November 4 (see www.nsf.gov)
- Other (more specialized) fellowships:
 - NDSEG (National Defense Science and Engineering Graduate Fellowship) (<http://ndseg.asee.org/>)
 - DOE Office of Science Graduate Fellowship (emphasizes supercomputing) (<http://www.scied.science.doe.gov/SCGF.html>)

Life in Grad School

- It's Fun!
- Someone else pays!
 - Graduate Teaching Assistantship
 - grading, recitation sections, fill-in lectures
 - Graduate Research Assistantship
 - software development, algorithm design, experimentation, writing
 - Covers tuition
 - Provides stipend (e.g., \$1900 per month; NSF Fellowships are \$2500 per month)
- Conferences are fun!

Choosing an Advisor



- Works on important problems
- Can teach you key techniques
 - algorithmic, mathematical, software tools
- Is easy to work with
- Has the time to work with you
- Has a good team of students who help each other
- Can help you get good job interviews
- Has funding

Grad School Activities

- Research
 - Choosing a good problem
 - Reading
 - Exploratory Experiments (“Formative User Studies”)
 - Developing and pursuing alternative approaches to solving it
 - Constructing and proving theorems
 - Designing algorithms
 - Developing software tools, languages
 - Building prototype systems
 - User studies
 - Comparative benchmarking
 - Writing papers, attending conferences, giving talks
- Internships at research labs
- Research visits to other groups
- Collaborations with other researchers
- Coursework: a means to an end
- Programming: a means to an end

Schedule

	Year 1	Year 2	Year 3	Year 4	Year 5
Courses	XXX	XX	XX		
Research	X	XX	XX	XXXX	XX
Internships		XX			
Thesis Writing				XX	XXXX
Job Search					XXX



Qualifying Exam



Prelim / Proposal



Thesis Defense

Other Resources

- See pointers on my web page
 - <http://web.engr.orst.edu/~tgd>
- How to be a successful grad student:
 - <http://www.cs.cmu.edu/afs/cs.cmu.edu/user/mleone/web/how-to.html>