The Master of Engineering Program
In
Computer Science

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W 11:15-12:00

Stephanie’s Office Hours
M-F 10:00 - 11:30
M-F 2:00 - 4:00
Themes in this Presentation

- The MEng – Why?
- Taking full advantage of Cornell
- Requirements
- Thinking about Courses
- Thinking about the Project
- Practical Matters
Requirements--Briefly

A total of at least 30 credit hours that includes a 3-6 credit hour project and at least 15 credit hours of CS coursework.

Most courses are four credit hours so this roughly translates into six courses and the project.
You have the freedom to structure your course selection and project so that what you learn resonates with your career aspirations.
What you can emerge with...

- A broader set of CS-related skills.
- A deeper knowledge of an application area.
- An ability to work with others.
- A set of entrepreneurial skills.
- An ability to communicate technical ideas in everyday language.

... depends on what you enter with. Everybody enters the program with their own mix of strengths.
What you can emerge with…

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From the job point of view, there is a shortage of computer scientists.
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From the job point of view, there is an **acute** shortage of computer scientists **who can do one other thing**.
Impact of Nearby Degree Programs

The CS Undergraduate Program
The CS PhD Program
The CS MEng Program

The 5th year idea.
Foreground building

Foreground snapshots
How research works
The University is particularly famous for

1. The way it achieves the aims of liberal education.

2. The way it promotes interdisciplinary research.

Breadth is the common denominator. And it can be an attribute of YOUR MEng if you choose.
The CS MEng is a professional degree program that emphasizes the practical application of CS ideas.
Executive Summary With Perspective

The CS MEng is a professional degree program that emphasizes the practical application of CS ideas.

True but…

Being professionally strong means more than just being technically strong. Refine your communication skills and your ability to work with others.
The CS MEng is a professional degree program that emphasizes the practical application of CS ideas.

True but...

Practical applications sometimes require theoretical foundations.
Pay attention to your mathematical, statistical, and logical talents.
Mindsets that Relate to the MEng

The Entrepreneurial Mindset…

Being able (a) to identify CS problems of interest to society and (b) to develop solutions that have economic value.

Think: Start-Up Company
Mindsets that Relate to the MEng

The Algorithmic Mindset...

Being able (a) to identify CS problems of interest to scientists and engineers and (b) to develop efficient algorithms for their solution.

Think: Being the CS person in a lab.
Mindsets that Relate to the MEng

The Intrapreneurial Mindset…

Being able (a) to identify CS problems of interest to your company and (b) to develop solutions that have economic value.

Think: Working in development for a big company
Mindsets that Relate to the MEng

The Social Entrepreneurial Mindset...

Being able (a) to identify CS problems of interest to society and (b) to develop solutions that have social value.

Think: Laptops for education in poverty areas.
A total of at least 30 credit hours that includes a 3-6 credit-hour project and at least 15 credit-hours of CS coursework.

1. All courses must be at the 4000-level or higher and approved.
2. At least two of the CS courses must be at the 5000-level or higher.
3. CS seminars and independent studies do not qualify as CS coursework.
4. At least 28 of the credit hours must be for a letter grade.
5. For a course to count, the grade earned must be C- or higher.
6. For the project to count the project grade must be B or better.
7. Overall grade point must be 2.5 or higher.

With the exception of several JGSM and STS courses, all approved courses are technical. A list of approved courses is on the MEng website.
How long do I have?

- Most students finish in 2 semesters.
- A few students need 3 semesters to fill gaps in their background. This is better than trying to take courses when you aren’t prepared.
- Maximum of 4 semesters, but very rare for a full-time student to take this long.
- Some Cornell students complete Ugrad+MEng in 9 semesters.
Thinking about Courses

- Carefully balance breadth versus depth.
- Carefully balance compute-intensive courses with those that are not.
- At the start, you should map out a course plan that covers both semesters.
- Take every opportunity to develop both your writing and your presentation skills.
Some CS Courses (Spring 2013)

CS 4152 - Advanced Topics in Computer Game Architecture
CS 4758 - Robot Learning
CS 4820 - Introduction to Analysis of Algorithms
CS 4850 - Mathematical Foundations for the Information Age
CS 5114 - Network Programming Languages
CS 5223 - Numerical Analysis: Linear and Nonlinear Problems
CS 5300 - The Architecture of Large - Scale Information Systems
CS 5430 - System Security
CS 5540 - Computational Techniques for Analyzing Clinical Data
CS 5625 - Interactive Computer Graphics
CS 5643 - Physically Based Animation for Computer Graphics
CS 5740 - Introduction to Natural Language Processing
Some CS Courses (Spring 2013)

CS 6110 - Advanced Programming Languages
CS 6700 - Advanced Artificial Intelligence
CS 6702 - Topics in Computational Sustainability
CS 6766 - Reasoning about Uncertainty

6000-level CS courses are typically for PhD students and exceptionally well-prepared ugrads and MEng students.

exceptionally well-prepared = taken a related Ugrad version of the course and done well.
Some CS Courses (Fall 2012)

CS 5110 - Programming Languages and Logics
CS 5150 - Software Engineering
CS 5320 - Introduction to Database Systems
CS 5321 - Practicum in Database Systems
CS 5414 - Distributed Computing Principles
CS 5420 - Parallel Computer Architecture
CS 5620 - Introduction to Computer Graphics
CS 5621 - Computer Graphics Practicum
CS 5670 - Introduction to Computer Vision
CS 5722 - Heuristic Methods for Optimization
CS 5724 - Evolutionary Computation
CS 5780 - Machine Learning
# Some CS Courses (Fall 2012)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 5110</td>
<td>Programming Languages and Logics</td>
</tr>
<tr>
<td>CS 5150</td>
<td>Software Engineering</td>
</tr>
<tr>
<td>CS 5320</td>
<td>Introduction to Database Systems</td>
</tr>
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<td>CS 5321</td>
<td>Practicum in Database Systems</td>
</tr>
<tr>
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<tr>
<td>CS 5620</td>
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<tr>
<td>CS 5621</td>
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</tr>
<tr>
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<td>Machine Learning</td>
</tr>
</tbody>
</table>

Most courses are 4 credits.

Notable exceptions are lecture/practicum pairs where the lecture is 3 credits and the (optional) practicum is 2 credits.
Some CS Courses (Fall 2012)

CS 4210 - Numerical Analysis and Differential Equations
CS 4300 - Information Retrieval
CS 4302 - Web Information Systems
CS 4410 - Operating Systems
CS 4411 - Practicum in Operating Systems
CS 4420 - Computer Architecture
CS 4700 - Foundations of Artificial Intelligence
CS 4701 - Practicum in Artificial Intelligence
CS 4812 - Quantum Information Processing
CS 4860 - Applied Logic
Some CS Courses (Fall 2012)

- CS 6118 - Types and Semantics
- CS 6210 - Matrix Computations
- CS 6320 - Advanced Database Systems
- CS 6410 - Advanced Systems
- CS 6640 - Computational Photography
- CS 6740 - Advanced Language Technologies
- CS 6810 - Theory of Computing
- CS 6820 - Analysis of Algorithms

6000-level CS courses are typically for PhD students and exceptionally well-prepared ugrads and Meng students.
Course Numbering Review

- **4000-level** CS courses are typically for juniors, seniors and MEng students who wish to fill a gap in their background.

- **5000-level** CS courses are “classic” Meng courses. Note, some are doubly listed, e.g., CS 4740 and CS 5740. Usually exactly the same course. Take the 5000 “version”.

- **6000-level** CS courses are typically for PhD students and exceptionally well-prepared ugrads and Meng students.
The Weekly CS Colloquium

CS 7090 – Computer Science colloquium.

This can be taken each semester for one credit hour.

Time: Thursday 4:15-5:15

Preceded by an atrium reception.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Seminar Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 7190</td>
<td>Seminar in Programming Languages</td>
</tr>
<tr>
<td>CS 7290</td>
<td>Seminar on Scientific Computing and Numerics</td>
</tr>
<tr>
<td>CS 7390</td>
<td>Database Seminar</td>
</tr>
<tr>
<td>CS 7490</td>
<td>Systems Research Seminar</td>
</tr>
<tr>
<td>CS 7670</td>
<td>Special Topics in Computer Vision</td>
</tr>
<tr>
<td>CS 7690</td>
<td>Computer Graphics Seminar</td>
</tr>
<tr>
<td>CS 7790</td>
<td>Seminar in Artificial Intelligence</td>
</tr>
<tr>
<td>CS 7794</td>
<td>Seminar in Natural Language Understanding</td>
</tr>
<tr>
<td>CS 7800</td>
<td>Topics in Theory of Computing</td>
</tr>
<tr>
<td>CS 7890</td>
<td>Seminar in Theory of Algorithms and Computing</td>
</tr>
<tr>
<td>CS 7893</td>
<td>Cryptography Seminar</td>
</tr>
</tbody>
</table>

Semester-long participation in the (white) lunch seminars is recommended. Usually no credit unless you give a talk.
Use Cornell

There are many non-CS courses that you can take for credit to strengthen your MEng record.

Nearby areas include…

- Information Science
- Electrical and Computer Engineering
- Operations Research and Industrial Engineering
- Mathematics
- Johnson Graduate School of Management
- Science and Technology Studies
Information Science

INFO 4400  Human-Computer Interaction Design
INFO 4500  Language and Technology
INFO 5150  Culture, Law, and Politics of the Internet
INFO 6140  Cognitive Psychology
INFO 6648  Speech Synthesis by Rule
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 5220</td>
<td>Nonlinear System Analysis and Computations</td>
</tr>
<tr>
<td>ECE 5470</td>
<td>Computer Vision</td>
</tr>
<tr>
<td>ECE 5480</td>
<td>Digital Image Processing</td>
</tr>
<tr>
<td>ECE 5660</td>
<td>Fundamentals of Networks</td>
</tr>
<tr>
<td>ECE 5670</td>
<td>Digital Communications</td>
</tr>
<tr>
<td>ECE 5750</td>
<td>Advanced Microprocessor Architecture</td>
</tr>
<tr>
<td>ECE 5780</td>
<td>Computer Analysis of Biomed Images</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Name</td>
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<tr>
<td>OR&amp;IE 4350</td>
<td>Introduction to Game Theory</td>
</tr>
<tr>
<td>OR&amp;IE 4370</td>
<td>Computational Optimization</td>
</tr>
<tr>
<td>OR&amp;IE 5140</td>
<td>Applied Systems Engineering</td>
</tr>
<tr>
<td>OR&amp;IE 6500</td>
<td>Applied Stochastic Processes</td>
</tr>
</tbody>
</table>
Mathematics

- MATH 4240 Wavelets and Fourier Series
- MATH 4330 Honors Linear Algebra
- MATH 4340 Honors Introduction to Algebra
- MATH 4370 Computational Algebra
- MATH 4410 Introduction to Combinatorics I
- MATH 4420 Introduction to Combinatorics II
- MATH 4520 Classical Geometries
- MATH 4540 Introduction to Differential Geometry
- MATH 4550 Applicable Geometry
<table>
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<tr>
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<tbody>
<tr>
<td>NCC 5500</td>
<td>Financial Accounting</td>
</tr>
<tr>
<td>NCC 5530</td>
<td>Marketing Management</td>
</tr>
<tr>
<td>NCC 5560</td>
<td>Managerial Finance</td>
</tr>
<tr>
<td>NBA 5070</td>
<td>Entrepreneurship for Scientists and Engineers</td>
</tr>
<tr>
<td>NBA 5640</td>
<td>Entrepreneurship and Business Ownership</td>
</tr>
<tr>
<td>NBA 6010</td>
<td>Electronic Commerce</td>
</tr>
</tbody>
</table>
Science and Technology Studies

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<tr>
<td>STS 4071</td>
<td>Law, Science, and Public Values</td>
</tr>
<tr>
<td>STS 6241</td>
<td>Science, Technology, and International Security</td>
</tr>
<tr>
<td>STS 6261</td>
<td>Seminar in the History of Technology</td>
</tr>
<tr>
<td>STS 6321</td>
<td>Inside Technology</td>
</tr>
<tr>
<td>STS 6661</td>
<td>Public Engagement in Science</td>
</tr>
</tbody>
</table>
“But I already know everything”

Well then....

- Take a course in Information Science, ECE, Operations Research, or the Business School.
- Take a research-oriented CS6xxx course, provided you are exceptionally well-prepared.
- Take a CS4xxx class in some totally new direction that you don’t know anything about.
- Take a more modern version of a course that you took as an undergrad.
The MEng Project

- At least 3 credit hours and no more than 6 credit hours via CS 5999.
- If you take (say) 10 credit hours of CS 5999, only 6 can count towards your degree.
- Typically an application of computer science techniques to practice.
- All projects must be supervised by a Computer Science faculty member or researcher.
- All projects must include a final report.
Types of Projects

- Participate in a faculty member’s research group
- Build upon a project started within an advanced course, perhaps in collaboration with other students from that course
- A few faculty members advertise one-on-one project openings—this might either be a smaller project or a test-run for a larger initiative
- Work as a member of one of the College’s large team efforts—there are an increasing number of these relatively high-profile projects
Types of Projects

- A team project designed to explore an idea for a startup (often from business courses)
- Systems built on behalf of non-CS groups with challenging problems
- Projects brought to Cornell from company or military or government settings, with appropriate permissions
- Ideas of your own, but for this you still need a faculty supervisor.
Finding a Project is Your Responsibility

- Stephanie keeps an online directory of projects submitted by faculty from CS and other departments.
- Every MEng project must be approved by a CS faculty member. Complete a Project Approval form and have the project advisor sign to insure your expectations match.
- If you are interested in doing a project with a faculty member not in the CS “field”, you will need to get a supervising CS advisor. (Check with Stephanie)
- It is helpful to talk to other MEng students, about projects.
- If you enjoy a course project, you can often find ways to grow it into a more ambitious MEng project.
## A Sample Schedule

<table>
<thead>
<tr>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 4700 Artificial Intelligence</td>
<td>CS 4758 Robot Learning</td>
</tr>
<tr>
<td>CS 5670 Intro to Computer Vision</td>
<td>CS 5223 -Lin &amp;Nonlinear Probs</td>
</tr>
<tr>
<td>CS 5780 Machine Learning</td>
<td>CS 5740 Natural Language Proc</td>
</tr>
<tr>
<td>CS 5999 MEng Project</td>
<td>CS 5999 MEng Project</td>
</tr>
<tr>
<td>CS 7090 CS Colloquium</td>
<td></td>
</tr>
</tbody>
</table>

Note: Courses are not always offered every year and the semester of offering may change. This is a sample schedule not a template schedule. It is intended to show how you might arrange your two semesters.
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<table>
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<th>Spring</th>
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<tbody>
<tr>
<td>CS 5150 Software Engineering</td>
<td>CS 5300 Large Scale Info Systems</td>
</tr>
<tr>
<td>CS 5320 Databases</td>
<td>CS 5430 System Security</td>
</tr>
<tr>
<td>CS 5321 Database practicum</td>
<td>CS 7090 CS Colloquium</td>
</tr>
<tr>
<td>ECE 4450 Networks &amp; Telecom</td>
<td>NBA 6010 E-Commerce</td>
</tr>
<tr>
<td>CS 7090 CS Colloquium</td>
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<td>CS 5999 M.Eng Project</td>
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<table>
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<th>Spring</th>
<th>Fall</th>
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<tbody>
<tr>
<td>CS 5114 - Network Prog Lang</td>
<td>CS 5780 - Machine Learning</td>
</tr>
<tr>
<td>CS 5300 Large-Scale Info Syst</td>
<td>INFO 6210 - Info, Tech, &amp; Soc</td>
</tr>
<tr>
<td>CS 5430 - System Security</td>
<td>CS 7090 CS Colloquium</td>
</tr>
<tr>
<td>STS 4661 - Public Comm of Sci &amp;Tech</td>
<td>CS 5999  MEng Project</td>
</tr>
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Every year we hold a fair during the spring semester to show off independent work by students.

Recruiters come from all over the country.

Consider being a presenter. The theme could be something that you have done earlier or it could be ongoing work related to your MEng-Project.

* CIS = Computing and Information Science
About Academic Integrity…

- Be advised that the penalty for cheating in a course or misrepresenting your contribution to a project is severe.
- Guard against lapses of better judgment that occur towards the end of the semester when you are stressed.
- When in doubt about violations, talk to a TA or a faculty member.
About Academic Integrity...

If you find yourself about to submit work which you realize you ended up working with others in ways that are against that course's academic integrity rules, agree with those you worked with to put a note to that effect in your work.

It's like putting a list of references to your work. You may well get no points for that work, but at least will have avoided an academic integrity hearing.
About Social Integrity…

Everybody in the program is EQUAL regardless of undergraduate background, work experience, ethnicity, citizenship, gender, or sexual orientation.

Zero toleration for any disrespect that targets a student or any member of the staff or faculty.

If you spot problems in this regard then contact Stephanie or myself.