The Master of Engineering Program
In
Computer Science

Charlie Van Loan
Director
Administration
When are regular “walk-in” office hours?

CVL: Visit http://www.cs.cornell/cv
SAM: If the door is open!
Administration

Charles Van Loan  Stephanie A. Meik
Director          Assistant Director
423 Gates        110D Gates
cv@cs.cornell.edu meik@cs.cornell.edu
255-5418          255-8720

Special CVL MEng-Only Office Hours:

Tomorrow:  1:00-2:30PM
<table>
<thead>
<tr>
<th>Charles Van Loan</th>
<th>Stephanie A. Meik</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director</td>
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</tr>
<tr>
<td>423 Gates</td>
<td>110D Gates</td>
</tr>
<tr>
<td><a href="mailto:cv@cs.cornell.edu">cv@cs.cornell.edu</a></td>
<td><a href="mailto:meik@cs.cornell.edu">meik@cs.cornell.edu</a></td>
</tr>
<tr>
<td>255-5418</td>
<td>255-8720</td>
</tr>
</tbody>
</table>

**Why use regular “walk-in” office hours?**

Course selection, course issues, project issues, career issues, workload issues.
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Why set up special appointments?

Cannot make regular hours, emergencies, matters that require confidentiality etc.
The Environment
The Cornell Environment

The University is particularly famous for

1. The way it respects breadth of education.
2. The way it promotes interdisciplinary research.

These can be attributes of YOUR MEng experience IF you choose.
The CS Environment

The CS Undergraduate Program

The 5th year idea.
Background-building

The CS MEng Program

Take what you need from the local environment.

The CS PhD Program

Cutting-edge snapshots
How research works
You
Things for you to Think About...

- How to set the stage for the career I want
- How to take full advantage of Cornell
- How to fulfill program requirements
- How to choose the right courses
- How to design an interesting project
- How to navigate “the system”
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.

From the job point of view, there is a WORLD shortage of computer scientists WHO CAN DO ONE OTHER THING
Create Your Own NYC
Aspiring Mindsets

1. 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
Aspiring Mindsets

2. The Algorithmic Mindset...

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

Think: Being the CS person in a lab.
Aspiring Mindsets

3. 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
Aspiring Mindsets

4. 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.
Interested in Entrepreneurship?

Some organizations...

Software Entrepreneurship & StartUp Engineering
cornellsense.com

The Cornell Entrepreneur Network
cen.cornell.edu

The Entrepreneurship and Innovation Institute
johnson.cornell.edu/entrepreneurship-and-innovation-institute

Entrepreneurship @Cornell
eship.cornell.edu
Take Charge of Your Career

- Go to talks,
- Go to the Job Fair
- Go to the Career Center

Hang Out and Tout Your CS Skills
The Program
The 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.
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.
2. At least two of the CS courses must be at the 5000-level or higher.
3. CS seminars and CS 5999 do not qualify as “CS courses”.
4. NonCS courses must be technical* and approved.**
5. At least 28 credit hours must be for a letter grade.
6. For a course to count, the grade earned must be C- or higher.
7. For the project to count, the project grade must be B or better.
8. Overall grade point must be 2.5 or higher.

* Some nontechnical business courses and S&TS courses are OK.
** A list of pre-approved nonCS courses is on the MEng website.
Not on list? Send me 'n Stephanie an email with course description.
The Key Attribute: Flexibility

You have the freedom to structure your course selection and project so that what you learn resonates with your career aspirations.
Practicalities: Your Schedule
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.
- Use courses and labs to develop both your writing and your presentation skills.
Thinking about Courses

If there are \( m \) courses that interest you and you aim to take \( n \) courses and \( m > n \), then shop around. That means sit in during the first week or two and then make an informed decision.

Note: Formal enrollment in some courses is not routine due to oversubscription. Attend such courses for details on enrollment protocols.
Course Numbering

- **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.

* this means A-level work in an elementary version of the course
Online Cornell Course Info

For 1-paragraph course descriptions, Google “Cornell Courses of Study”

For time/place information, Google “Cornell Course and Time Roster”
Two-Semester Balance

• Aim for 14-18 hours in first semester
• Nice load: 2 heavy courses + 1 light course + project
• Nice load: 3 heavy courses + 1 light course
• Plan ahead

The definition of “light” and “heavy” depends as much on your background as it does on the actual course content and the “volume” of work required.
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 (made possible by AP credits & summer coursework)
Practicalities: CS Courses
### Spring Line Up

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 5120(1)</td>
<td>Compilers*</td>
</tr>
<tr>
<td>CS 5152</td>
<td>Open Source Software Engineering</td>
</tr>
<tr>
<td>CS 5223</td>
<td>Matrix Comp &amp; Numerical Optimization</td>
</tr>
<tr>
<td>CS 5300</td>
<td>Large Scale Information Systems</td>
</tr>
<tr>
<td>CS 5306</td>
<td>Crowdsourcing and Human Computation</td>
</tr>
<tr>
<td>CS 5320(1)</td>
<td>Databases*</td>
</tr>
<tr>
<td>CS 5412</td>
<td>Cloud Computing</td>
</tr>
<tr>
<td>CS 5430</td>
<td>System Security</td>
</tr>
<tr>
<td>CS 5625</td>
<td>Interactive Computer Graphics</td>
</tr>
<tr>
<td>CS 5786</td>
<td>Machine Learning for Data Science</td>
</tr>
</tbody>
</table>

* The practicums are 2-credit companions to the corresponding lecture
## Spring Line Up

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 4512</td>
<td>Advance Computer Game Architecture</td>
</tr>
<tr>
<td>CS 4410(1)</td>
<td>Operating Systems*</td>
</tr>
<tr>
<td>CS 4300</td>
<td>Language and Information</td>
</tr>
<tr>
<td>CS 4654</td>
<td>Virtual Reality Design</td>
</tr>
<tr>
<td>CS 4754</td>
<td>Human-Robot Interaction</td>
</tr>
<tr>
<td>CS 4810</td>
<td>Theory of Computing</td>
</tr>
<tr>
<td>CS 4820</td>
<td>Algorithms</td>
</tr>
<tr>
<td>CS 4850</td>
<td>Math Foundations of the Information Age</td>
</tr>
</tbody>
</table>

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## CS Courses: Cornell Tech

These are not open to Ithaca campus students:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 5091</td>
<td>Conversations in the Studio</td>
</tr>
<tr>
<td>CS 5093</td>
<td>Product Management</td>
</tr>
<tr>
<td>CS 5304</td>
<td>Data Science in the Wild</td>
</tr>
<tr>
<td>CS 5438</td>
<td>Security and Privacy Concepts</td>
</tr>
<tr>
<td>CS 5460</td>
<td>Parallel and Distributed Computing</td>
</tr>
<tr>
<td>CS 5682</td>
<td>User Interfaces</td>
</tr>
<tr>
<td>CS 5740</td>
<td>Natural Language Processing</td>
</tr>
<tr>
<td>CS 5830</td>
<td>Cryptography</td>
</tr>
</tbody>
</table>
Typical Fall Course Line-Up:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 5150</td>
<td>Software Engineering</td>
</tr>
<tr>
<td>CS 5220</td>
<td>Applications of Parallel Computers</td>
</tr>
<tr>
<td>CS 5320(1)</td>
<td>Databases*</td>
</tr>
<tr>
<td>CS 5420</td>
<td>Advanced Architecture Computing</td>
</tr>
<tr>
<td>CS 5434</td>
<td>Defending Computer Networks</td>
</tr>
<tr>
<td>CS 5620(1)</td>
<td>Computer Graphics*</td>
</tr>
<tr>
<td>CS 5740</td>
<td>Intro to Natural Language Processing</td>
</tr>
<tr>
<td>CS 5752</td>
<td>Robotic Manipulation</td>
</tr>
<tr>
<td>CS 5780</td>
<td>Machine Learning</td>
</tr>
</tbody>
</table>

* The practicums are 1-credit companions to the corresponding lecture
## Typical Fall Course Line-Up

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 4154</td>
<td>Analytics-Driven Game Design</td>
</tr>
<tr>
<td>CS 4210</td>
<td>Numerical Solution Differential Equations</td>
</tr>
<tr>
<td>CS 4300</td>
<td>Information Retrieval</td>
</tr>
<tr>
<td>CS 4320(1)</td>
<td>Databases (Practicum)*</td>
</tr>
<tr>
<td>CS 4410(1)</td>
<td>Operating Systems (Practicum)*</td>
</tr>
<tr>
<td>CS 4420</td>
<td>Computer Architecture</td>
</tr>
<tr>
<td>CS 4700(1)</td>
<td>Artificial Intelligence (Practicum)*</td>
</tr>
</tbody>
</table>

* The practicums are 1-credit companions to the corresponding lecture.
**Typical Fall Course Line-Up**

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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>CS 4744</td>
<td>Computational Linguistics</td>
</tr>
<tr>
<td>CS 4775</td>
<td>Computational Genetics and Genomics</td>
</tr>
<tr>
<td>CS 4814</td>
<td>Intro Computational Complexity</td>
</tr>
<tr>
<td>CS 4830</td>
<td>Intro Cryptography</td>
</tr>
<tr>
<td>CS 4860</td>
<td>Applied Logic</td>
</tr>
</tbody>
</table>
CS 7090 - Computer Science colloquium.

This can be taken each semester for 1 credit hour.

Time: Thursday 4:15-5:15

Preceded by an atrium reception.
Weekly Research Seminars

CS 7190 - Seminar in Programming Languages
CS 7290 - Seminar on Scientific Computing and Numerics
CS 7390 - Database Seminar
CS 7490 - Systems Research Seminar
CS 7670 - Special Topics in Computer Vision
CS 7690 - Computer Graphics Seminar
CS 7790 - Seminar in Artificial Intelligence
CS 7794 - Seminar in Natural Language Understanding
CS 7800 - Topics in Theory of Computing
CS 7890 - Seminar in Theory of Algorithms and Computing

Semester-long participation in the (white) lunch seminars is recommended. Usually no credit unless you give a talk.
The CS colloquium is preceded by a reception with food. It is not OK to attend the reception without going to the talk.

Regular attendance/participation at a research seminar is fine subject to the approval of the faculty in charge. Sporadic attendance is discouraged.

These guidelines are designed to promote a vibrant research environment.
Practicalities: The Project
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 CS faculty member or researcher.
- A 2-page final report or poster is required.
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 (Cont’d)

- 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: 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 second semester MEng students, about projects.

- If you enjoy a course project, you can often find ways to grow it into a more ambitious MEng project.
Practicalities: Non-CS Courses
Use the Cornell Environment

Can take 2-3 courses in nearby areas, e.g.,

- Information Science
- Electrical and Computer Engineering
- Operations Research
- Mathematics
- Statistical Science
- Johnson Graduate School of Management

Some typical courses follow...
Information Science

INFO 4130  Health and Computation
INFO 4240  Designing Technology for Social Impact
INFO 4430  Teams and Technology
INFO 4550  Deception in the Networked Age
INFO 6230  Games, Economic Behavior, and Internet
INFO 6260  Networks, Crowds, and Markets
INFO 6310  Behavior and Information Technology
INFO 6350  Text Mining History and Literacy
INFO 6710  Revolutions of the Mind
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>ECE 5470</td>
<td>Computer Vision</td>
</tr>
<tr>
<td>ECE 5630</td>
<td>Fundamentals of Information Transmission</td>
</tr>
<tr>
<td>ECE 5650</td>
<td>Statistical Signal Processing and Learning</td>
</tr>
<tr>
<td>ECE 5775</td>
<td>High-Level Digital Design Automation</td>
</tr>
</tbody>
</table>
### Operations Research

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR&amp;IE 4152</td>
<td>Entrepreneurship for Engineers</td>
</tr>
<tr>
<td>OR&amp;IE 4350</td>
<td>Introduction to Game Theory</td>
</tr>
<tr>
<td>OR&amp;IE 4600</td>
<td>Introduction to Financial Engineering</td>
</tr>
<tr>
<td>OR&amp;IE 5580</td>
<td>Simulation Modeling and Analysis</td>
</tr>
</tbody>
</table>
## Mathematics

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<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>MATH 4330</td>
<td>Linear Algebra</td>
</tr>
<tr>
<td>MATH 4410</td>
<td>Introduction to Combinatorics I</td>
</tr>
</tbody>
</table>
## Statistical Science

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>STSCI 4030</td>
<td>Linear Models and Matrices</td>
</tr>
<tr>
<td>STSCI 4090</td>
<td>Theory of Statistics</td>
</tr>
<tr>
<td>STSCI 4740</td>
<td>Data Mining and Machine Learning</td>
</tr>
<tr>
<td>STSCI 5080</td>
<td>Probability Models and Inference</td>
</tr>
<tr>
<td>STSCI 5110</td>
<td>Stat Methods for the Social Sciences</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
</tr>
<tr>
<td>-------------</td>
<td>------------------------------------------------------------</td>
</tr>
<tr>
<td>NCC 5500</td>
<td>Financial Accounting</td>
</tr>
<tr>
<td>NCC 5530</td>
<td>Marketing Management</td>
</tr>
<tr>
<td>NCC 5540</td>
<td>Managing and Leading in Organizations</td>
</tr>
<tr>
<td>NBA 5070</td>
<td>Entrepreneurship for Scientists &amp; Engineers</td>
</tr>
<tr>
<td>NBA 5640</td>
<td>Entrepreneurship and Business Ownership</td>
</tr>
</tbody>
</table>
Integrity
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.
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 CVL or the Department Chair.
In Conclusion
The CS MEng is a professional degree program that emphasizes the practical application of CS ideas.
What Is It All About?

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.
Be Adventurous!

- 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 a ugrad.
Be Creative and Independent!

The project is your place to do something original and exciting.

The project is your place to exercise a measure of independence.

The project is your place to challenge to apply classroom knowledge.
Thanks
And
Let’s Go!