The Masters

CS Programs in Ithaca and NYC. Are any of them right for you?

Prof. Charlie Van Loan
CS M.Eng. Program Director
Some Questions to Answer

- Do I need Graduate Work?
- Is Entrepreneurship part of the deal?
- Is the MEng a stepping stone towards a PhD?
- What about the new 4-semester MS in CS?
- What about NYC programs at Cornell Tech?
- How do I put together a strong application?
- Must I be a CS Major?
Ithaca a In a Nutshell...

- There is a 2-semester* CS MEng
- There is a 4-semester CS MS

*OK to take three semesters if you need to.
In a Nutshell at Cornell Tech...

- There is a 2-semester CS MEng.
- There are various 4-semester MS Programs
In this Presentation I will ...

- Focus on the one-year MEng
- Discuss the difference between the Ithaca and NYC programs. (Entrepreneurship)
- Emphasize breadth of education and its importance to career development.

Although CS-driven, what I say is relevant if you are considering ANY Masters Program in Engineering
It's a Crowded Space

The Bachelors

The M.Eng.

The PhD
It’s a Crowded Space

The Bachelors

Go Work

The M.B.A.

The M.Eng.

The PhD
Two Bits of History

- Up until the 1960s, most undergrad degrees in Engineering were 5 years in length.

- Cornell’s first Master’s degree was awarded to David Starr Jordan. He became the first President of Stanford University (1891-1913).
What is an M.Eng. Degree?

An MEng in X is a professional degree program that emphasizes the practical application of ideas from X.
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True but...
- Being professionally strong means more than just being technically strong.
- The MEng is an occasion to refine your communication skills and your ability to work with others.
What is an M.Eng. Degree?

An MEng in X is a professional degree program that emphasizes the practical application of ideas from X.

True but...
- Practical applications sometimes require theoretical foundations.
- Pay attention to your mathematical, statistical, and logical talents.
M.Eng. Mindsets

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
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.
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
M.Eng. Mindsets

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: Laptop-Based Instruction in poverty areas.
The Dropout Mindset is OK Too!
If you are thinking about graduate study in CS, then it makes sense to review all the options.

Let’s contrast the MEng and the PhD:

**Obvious:** One year vs five or more years

**Not Obvious:** Entrepreneurship vs Research
Not polar opposites!

What it takes to apply technology is very similar to what it takes to discover something new.
1. The entrepreneur’s job is to identify a problem worth solving.
Entrepreneurism & Research

1. The entrepreneur’s job is to identify a problem worth solving.

1’. A PhD student’s job is to define a research problem worth solving.
2. Problem complexity is changing faster than technology.
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2’. Research problems are changing faster than field-specific education and can no longer be solved by homogeneous teams of look-alike experts.
3. Great entrepreneurs are able to describe a problem clearly, precisely, and with an economic description that talks about a customer and a price.
3. Great entrepreneurs are able to describe a problem clearly, precisely, and with an economic description that talks about a customer and a price.

3’. Great researchers are able to describe the “nut they cracked” in terms that can be understood by the public.
4. As an entrepreneur you need humility to know what you do not know because customers think differently, often in ways that have nothing to do with science, logic, or evidence.
4. As an entrepreneur you need humility to know what you do not know because customers think differently, often in ways that have nothing to do with science, logic, or evidence.

4'. As a researcher, you need humility to know what you do not know because colleagues outside your area often think in ways that are orthogonal to the traditions of your field.
Entrepreneurism & Research

The Message of Ben Franklin
The Ben Franklin Message

Properly practiced, there is no difference between

“Curiosity-Driven” Research

and

“Product-Driven” Research.
The Ithaca CS M.Eng

Now for a Few Details...
Who is it for?

- CS Majors who are hungry for more.

- Ugrads who major in X and (sort of) minored in CS.
Who is it for?

- **CS Majors** who are hungry for more.  
  Need five years to be fully prepared for the work force.

- **Ugrads** who major in X and (sort of) minored in CS.  
  X + CS is a powerful combination for students interested in a career in X or graduate study in X.
# What a CS Minor Looks Like

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 2800</td>
<td>Discrete Math</td>
</tr>
<tr>
<td>CS 2110</td>
<td>Object-Oriented Prog.</td>
</tr>
<tr>
<td>CS 3410</td>
<td>Computer Systems</td>
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</table>

**Required**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>CS 4220</td>
<td>Scientific Computing</td>
</tr>
<tr>
<td>CS 4320</td>
<td>Databases</td>
</tr>
<tr>
<td>CS 4700</td>
<td>Artificial Intelligence</td>
</tr>
<tr>
<td>CS 4620</td>
<td>Computer Graphics</td>
</tr>
<tr>
<td>CS 4780</td>
<td>Machine learning</td>
</tr>
<tr>
<td>CS 4830</td>
<td>Cryptography</td>
</tr>
</tbody>
</table>

*3 courses of your choosing*

(many more options)
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.

Roughly six courses and a project.

All courses at the 4000-level and 5000-level. No specific course is required.
CS Courses for MEng Students

Parallel Computing
Software Engineering
Large-Scale Information Systems
Scripting Languages
Defending Computer Networks
Open Source Software Engineering
Heuristic Methods for Optimization
Cloud Computing
Computer Security
Physically-Based Animation

Computer Networking
Building Large-Scale Information Systems
Mobile Systems
Signal and Image Processing
Physical Computing
Images and Video
Technology Product Development
Psychological and Social Aspects of Connected Media
Big Data/Complex Event Proc.
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.
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.
Impact of Nearby Degrees

The CS Undergraduate Program

The CS PhD Program

The CS MEng Program

The 5th year idea.
Background building.

Research snapshots.
How research works.
The Cornell Environment

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.
Using Cornell

Can take two courses outside CS to strengthen your skill set

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

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>INFO 4130</td>
<td>Health and Computation</td>
</tr>
<tr>
<td>INFO 4240</td>
<td>Designing Technology for Social Impact</td>
</tr>
<tr>
<td>INFO 4430</td>
<td>Teams and Technology</td>
</tr>
<tr>
<td>INFO 4550</td>
<td>Deception in the Networked Age</td>
</tr>
<tr>
<td>INFO 6230</td>
<td>Games, Economic Behavior, and Internet</td>
</tr>
<tr>
<td>INFO 6260</td>
<td>Networks, Crowds, and Markets</td>
</tr>
<tr>
<td>INFO 6310</td>
<td>Behavior and Information Technology</td>
</tr>
<tr>
<td>INFO 6350</td>
<td>Text Mining History and Literacy</td>
</tr>
<tr>
<td>INFO 6710</td>
<td>Revolutions of the Mind</td>
</tr>
</tbody>
</table>
Johnson School of Management.

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<tr>
<th>Course Code</th>
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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>
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</table>
Science & Technology Studies

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<tbody>
<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>
<tr>
<td>Course Code</td>
<td>Course Title</td>
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<tr>
<td>-------------</td>
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</tr>
<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 Title</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------------</td>
</tr>
<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

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</tr>
</thead>
<tbody>
<tr>
<td>MATH 4240</td>
<td>Wavelets and Fourier Series</td>
</tr>
<tr>
<td>MATH 4330</td>
<td>Honors Linear Algebra</td>
</tr>
<tr>
<td>MATH 4340</td>
<td>Honors Introduction to Algebra</td>
</tr>
<tr>
<td>MATH 4370</td>
<td>Computational Algebra</td>
</tr>
<tr>
<td>MATH 4410</td>
<td>Introduction to Combinatorics I</td>
</tr>
<tr>
<td>MATH 4420</td>
<td>Introduction to Combinatorics II</td>
</tr>
<tr>
<td>MATH 4550</td>
<td>Applicable Geometry</td>
</tr>
</tbody>
</table>
Statistical Science

STSCI 4740  Data Mining and Machine Learning
STSCI 5010 - Applied Statistical Analysis
STSCI 5060 - Database Management and SAS High Performance Computing with DBMS
STSCI 5080 - Probability Models and Inference
The MEng Project

- Typically an application of computer science techniques to practice.
- All projects must be supervised by a Computer Science faculty member or researcher.
- Illustrate the path from theory to practice, from classroom to product, etc.
Some Project Formats

- 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
- Some 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
Some Project Formats

- 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.
The Cornell Tech CS M.Eng.

Same as the Ithaca CS MEng except that the entrepreneurial aspect is very explicit:

• Faculty have entrepreneurial experience.
• Tight coupling to the NYC tech scene.
• Industrial mentors for the project.
• Courses that are interdisciplinary.
• A weekly seminar with outside entrepreneurs
Course selection is limited to what is taught by Cornell Tech faculty. Offerings this semester:

- CS 5091 Conversations in the Studio
- CS 5092 Start-Up Ideas
- CS 5356 Start-Up Systems Design
- CS 5422 Physical Computing
- CS 5435 Security and Privacy Concepts
- CS 5555 Health Tech Data and Systems

Not allowed to take Ithaca classes remotely.
The Cornell Tech CS M.Eng.

Projects

Fall:  
Company projects in collaboration with the NYC high tech scene

Spring:  
Start-up projects, form teams, work with advisors and clients.
Note: Ithaca-Based 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
Building a Strong Application

Transcript

Coursework that is systematic and shows that you can handle the requirements of the grad program to which you are applying.

Admissions is not by formula, but for Cornell undergrad applicants we like to see a 3.4 overall GPA with B’s or better in CS courses.
Two Letters of Recommendation

Should speak to your independence, originality, communication skills, and ability to work with others.

Make the letter-writer's job easier by supplying a brief paragraph that summarizes your plans.
The Statement of Purpose

Show that you understand what the grad program is all about and how it resonates with your ambitions.

Tell a “story” that explains the origins of your ambitions.

Practice good journalism. Be succinct and captivating. Less is often more.
Building a Strong Application

Test Scores

GRE’s Required

Exception: Cornell applicants to Ithaca MEng

The score helps us interpret the other parts of your application. It is not a stand alone make-or-break number.
Relevant Experiences For Cornell Tech

• Been part of a startup.
• Belonged to a student organization/club related to entrepreneurship.
• Made intrapreneurial contributions to some project.
• Would like to apply CS to a real world problem.
• Worked in the non-profit/ gov’t sector and would like to return with a stronger CS background.
Numbers and Deadlines

Ithaca:

Admit about 70 for August start. (Feb 1 Deadline)

Admit about 30 for January start. (Oct 1 Deadline)

Accept applications from Cornell ugrads ANYTIME.

Tuition is at endowed ugrad rate.

About 20 “MEng TA-ships” available. $5400/sem, 8hr/wk or so.
Numbers and Deadlines

Cornell Tech:

Admit about 45 students for Fall start only.

Deadline is March 1*

Tuition is at endowed ugrad rate.

Limited number of Fellowships.

*Early round admissions with Oct 1 and Jan 15 deadlines.
Apply to Both?

Not possible. Different application systems.

Ithaca: College Net
NYC: SalesForce

However, we can provide a “quick read” of your Ithaca application if that helps you decide on the better program. And we will alert NYC if to us you look like a prime candidate for their program.

In the past, the NYC process involves a Skype interview
The (New) 4-Semester MS

Key Attributes....

• 34 credits including thesis research
• Advanced CS Coursework
• Outside Minor
• Serve as TA and receive full tuition and stipend.

Limited size at the start: about 7 students Now.
The MS: Sample Schedules

Sample Schedules....

Term 1: 3 CS                      (4+4+3)
Term 2: 1 CS, 1 nonCS            (4+3)
Term 3: 1 CS, 1 nonCS            (4+3)
Term 4: 1 CS, Thesis Research    (3+6)

Term 1: 2 CS, 1 nonCS            (4+4+3)
Term 2: 1 CS, 1 nonCS            (4+3)
Term 3: 1 CS, Thesis Research    (4+3)
Term 4: Thesis Research          (9)
The MS: Who is it for?

• Students who wish to deepen their knowledge of computer science through advanced coursework, research, writing, and teaching.

• Students who are self-motivated, have expository skills, enjoy the research environment, and like working with undergraduates in introductory courses.

• Students who might like to teach CS at a 4-year college.

• Students who like research but are anxious about the PhD timeline
The MS: Admissions Criteria

• Must have been a CS major or have a CS minor.

• Must have served as ugrad grader/ta.

• 3 letters of recommendation + essay

• Tough numbers. About 250 apps for 3-4 places
Other Cornell Tech Programs

MS* in Health Tech

MS* in Connective Media

MS* in the Built Environment (Planned)

One-Year Tech MBA

* Two year programs through the Jacobs Institute which is part of the Cornell-Technion collaboration.
All of these programs set the stage for greater professional mobility and opportunity.

You have to balance long term job satisfaction against short term costs (e.g., tuition) and long term costs (e.g., student loans).
CS MEng: Cornell Tech vs Ithaca

Cornell Tech offers a highly focused environment where entrepreneurship is front and center at all times.

Ithaca offers the chance for a broader education with an entrepreneurial component that YOU determine through course selection, project design, and outside involvement.
Hope to See You Here
... Or Here!