The Plan

- basics
- the electives spectrum
- sample schedule
So You Think You Want A CS Degree

- available through both schools
- six required CS classes
  - +2 for engineers
- 3-5 electives
Programming Basics

- 11 - intro to programming topics and C++
- 15 - do interesting things with your data
- 40 - where are your bits, what are you doing with them
Computer Science Basics

- 105 - do beautiful things with your code
- 160 - know how fast you get stuff done
- 170 - what are our problems and how hard are they, really?
Math

- discrete math - logic, proofs, sets, and counting
- calc 2 - dem integrals
Electives & the Future

- two main directions for post-grad
- electives can reflect that (kind of)
Industry vs Academia

- industry - build products for people
- academia - create knowledge
Four Broad Categories

industry

Directly applicable
Highly relevant
Applied research
Theoretical research

academia
Directly Applicable

- 23 - game development
- 20/120 - web programming
- 116 - security
- 150 - music apps for the iPad
Highly Relevant

- 111 - operating systems
- 150 - internet-scale distributed systems
- 135 - machine learning
- 50 - concurrency
- 115 - database systems
- 86 - OO programming for GUIs
Applied Research

- 175 - computer graphics
- 171 - human-computer interaction
- 165 - cryptography
- 131 - artificial intelligence
- 167 - computational biology
Theoretical Research

- 163 - computational geometry
- 136 - statistical pattern recognition
- 150 - graph theory
- 126 - numerical analysis
Sample Schedule

- CS/math through engineering
- 7 APs (sorry)
## Freshman

| COMP 11: Intro to CS | COMP 15: Data Structures |
| Music & Art in Engineering | COMP 61: Discrete Math |
| MATH 13: Calc III | MATH 46: Linear Algebra |
| CAD | Ethics |
| Physics 11 | Physics 12 |
**Sophomore**

<table>
<thead>
<tr>
<th>Course 1</th>
<th>Course 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMP 40: Machine Structure &amp; Assembly Level Programming</td>
<td>COMP 105: Programming Languages</td>
</tr>
<tr>
<td>COMP 165: Cryptography</td>
<td>COMP 167: Computational Biology</td>
</tr>
<tr>
<td>MATH 135: Real Analysis I</td>
<td>MATH 136: Real Analysis II</td>
</tr>
<tr>
<td>ES 3</td>
<td>Chem 1</td>
</tr>
<tr>
<td></td>
<td>Calligraphy</td>
</tr>
<tr>
<td>COMP 160: Algorithms</td>
<td>COMP 170: Computational Theory</td>
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</tr>
<tr>
<td>COMP 150: Advanced Functional Programming</td>
<td>COMP 175: Computer Graphics</td>
</tr>
<tr>
<td>MATH 161: Probability</td>
<td>MATH 162: Statistics</td>
</tr>
<tr>
<td>Watercolor</td>
<td>ES 4</td>
</tr>
<tr>
<td><strong>Yoga / Choir</strong></td>
<td></td>
</tr>
</tbody>
</table>
### Senior

<table>
<thead>
<tr>
<th>Course</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMP 97: Senior Capstone</td>
<td>COMP 98: Senior Capstone</td>
</tr>
<tr>
<td>COMP 136: Statistical Pattern Recognition</td>
<td>COMP ??</td>
</tr>
<tr>
<td>MATH 145: Abstract Algebra I</td>
<td>MATH 146: Abstract Algebra II</td>
</tr>
<tr>
<td>Drawing</td>
<td>Breadth Elective</td>
</tr>
</tbody>
</table>
General Advice

- 40 and 105 are the ‘prereqs’
- flat hierarchy
- Make CS friends
What is CompE?

- Hardware vs. Software
- Operating System and Down
- Where Electrical Engineering meets Computer Science
Fields

- Chip Design
- Embedded Systems
- Low Level Programming
- Computer Architecture
- Computer Networks
- Controls and Robotics
- EE or CS
Shared General Ed Courses

- Calculus I, II, and III
- Differential Equations
- Physics 11 and 12
- Chemistry I
- ES2, ES93
- Probability and Statistics - ES56 or EE104
Shared ECE Courses

- Introduction to Electrical Engineering - ES3
- Microelectronics I - EE21
- Linear Systems - EE23
- Electromagnetism - EE18
- Junior Design - EE31
- Senior Design - EE97 and 98
Shared CS Courses

- Introduction to Computer Science - Comp11
- Data Structures - Comp15
- Operating Systems - EE128
Microprocessor Architecture

Operating Systems

Intro to Digital Logic

Digital Logic Systems

Computer Engineering

Comp Sci

application (e.g., Facebook)

operating system (e.g., Windows)

compiler

assembler

software

hardware processor memory input/output system

data path and control
digital design
circuit design
transistors

increasing level of abstraction
CompE Courses

- Digital Logic - ES4
- Microprocessor Architecture - EE14
- Digital Logic and Systems - EE26
- Operating Systems - EE128
- Computer Engineering - EE126
- VLSI Design - EE103
Digital Logic - ES4

- Implementing Logic via circuits
- The basics of computer components

Microprocessor Architecture - EE14

- Assembly Language and Some C
- Embedded Systems
- Hardware version of Comp40
Digital Logic and Systems - EE26

- Higher Level Logic
- Manipulating individual numbers

VLSI Design - EE103

- How transistors process logic
  - Making them fast
  - Fitting 100 million on the head of a pin (22 nanometers/1 transistor)
Computer Engineering - EE126

- High Level Computer Hardware
- How a Computer processes instructions
  - (and how it does it fast)

Operating Systems - EE128

- Low Level C Programming
- How to make the OS fast
- How to make the OS do what you want
# Freshman Schedule

<table>
<thead>
<tr>
<th>Fall 2011</th>
<th>Spring 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculus III</td>
<td>Differential Equations</td>
</tr>
<tr>
<td>Introduction to Psychology</td>
<td>Chemistry I</td>
</tr>
<tr>
<td>Physics: Electricity and Magnetism</td>
<td>Introduction to Environmental Geology</td>
</tr>
<tr>
<td>EN2 - Intro to CAD</td>
<td>Introduction to Engineering Programming</td>
</tr>
<tr>
<td>ES93</td>
<td></td>
</tr>
</tbody>
</table>
## Sophomore Schedule

<table>
<thead>
<tr>
<th>Fall 2012</th>
<th>Spring 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Accounting</td>
<td>Intro to Digital Logic - ES4</td>
</tr>
<tr>
<td>Public Speaking</td>
<td>Microelectronics I - EE21</td>
</tr>
<tr>
<td>Discrete Mathematics - Comp61</td>
<td>Data Structures - Comp15</td>
</tr>
<tr>
<td>Intro to Electrical Engineering - ES3</td>
<td>Linear Algebra</td>
</tr>
<tr>
<td>Intro to CompSci - Comp11</td>
<td>Intro to Business Planning</td>
</tr>
</tbody>
</table>
### Junior Schedule

<table>
<thead>
<tr>
<th>Fall 2013</th>
<th>Spring 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microprocessor Architecture - EE14</td>
<td>Computer Engineering - EE126</td>
</tr>
<tr>
<td>Linear Systems - EE23</td>
<td>Intro to Electromagnetism - EE18</td>
</tr>
<tr>
<td>Microelectronics II - EE22</td>
<td>Intro to Buddhism</td>
</tr>
<tr>
<td></td>
<td>Hong Kong Studies</td>
</tr>
</tbody>
</table>
# Senior Schedule

<table>
<thead>
<tr>
<th>Fall 2014</th>
<th>Spring 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Systems - EE128</td>
<td>Computer Networks</td>
</tr>
<tr>
<td>VLSI Design - EE103</td>
<td>Digital Logic Systems - EE26</td>
</tr>
<tr>
<td>Mobile Medical Devices - EE93</td>
<td>Junior Design - EE31</td>
</tr>
<tr>
<td>Prob and Stats for Engineers - ES56</td>
<td>Senior Design - EE98</td>
</tr>
<tr>
<td>Senior Design - EE97</td>
<td></td>
</tr>
</tbody>
</table>
General Advice

- If you can’t decide, go with CompE
- Waiting is hard, but worth it
- Don’t worry about finding your passion immediately
Electrical Engineering
Will Lenk
### Not Just Circuits
(But almost always some circuits)

#### Analog Design
- Amplifiers
- Filters
- Sensor Arrays
- Signal Converters
- Power Management
- Biomedical Devices

#### Signal Processing
- Image Processing
- Sampling Theory
- Machine Learning
- Statistical Signal Processing
- Biomedical Signal Processing
- Estimation Theory

#### Systems
- Embedded Systems
- Controls Systems
- Communications Systems
- Robotics
- Power Systems

#### More
- Semiconductors
- Solar Cells
- Microwaves
- Plasma Engineering
- Flexible & Organic Electronics
- Lasers & Optics
Math Requirements

Calc III (Multivariable)
Relatively important for electromagnetism (EE18) and Probability (EE104)

Differential Equations
Very important for everything, (just baseline knowledge needed, not entirety of course material)

ELECTRICAL ENGINEERING = MATH
GO TO CLASS. KEEP YOUR NOTES
ES3 – Intro to Circuits

Crucial. Will be utilized for any circuits class, namely EE21 and EE22 (Electronics I and II)

It takes a while to catch on. Don’t worry if you’re lost. Trust Lasser

Comp11 – Intro to Comp

Very important. All employers want basic coding ability.

Will come back into play for microcontrollers like Arduino, which are used in EE31 (Junior Design)
Sophomore Spring Reqs

**ES4 (Digital Circuits)**
Relatively Important
Final project is lengthy, difficult, but very helpful (and pretty cool)

**EE21 (Electronics I)**
Crucial for EE22, EE31, and any other course involving analog circuits
Fundamental knowledge for any electrical engineer.
Junior Fall Reqs

**EE14 (Microprocessors)**
Relatively Important for an EE for familiarity with microcontrollers

**EE22 (Electronics II)**
Very Important. More in depth look at fundamental analog design.
Introduction of BJT transistor. Design and analysis of amplifiers, oscillators.

**EE23 (Linear Systems)**
Crucial. You had no idea about this...
Fourier Transforms. Frequency Analysis. Sampling Theory. **Fundamental for EVERYTHING that is signal processing**
Where math really steps up in difficulty
Junior Spring Reqs

EE18 (Electromagnetics)
Relatively Important.
Very difficult both conceptually and mathematically.
Electrostatics, dynamics. Magnetostatics, dynamics. Transmission Lines, Optics

EE31 (Junior Design)
Crucial. Your first design experience combining all your knowledge
Great resume / interview material. Easy to fall behind, don’t do it!!!
Build an autonomous robot
Senior Fall Reqs

**EE105 (Feedback Controls)**

*Very important.* Controls systems are ubiquitous in electronic systems.

Deep mathematical understanding of principles of feedback.

**EE107 (Communications)**

*Very important.* Communications systems are fundamental applications of electrical engineering.

**EE97 (Senior Design)**

*Crucial. Equivalent of your thesis.*

Choose your team wisely. Choose a project you are interested in. **START EARLY** (you’re already behind...)
Senior Fall Electives

Digital Signal Processing
Related: EE23, EE107

Microwaves
Related: EE18

Physics of solar cells
Related: EE18, EE21

Music Recording
Related: ?

Mobile Medical Devices
ES3, EE21, EE31, Comp 15, Comp20, EE125
Top 3 Non-Required Courses for Electrical Engineers

1) Math 70 (Linear Algebra)

2) Comp 15 (Data Structures)

3) EE104 (Probabilistic Systems Analysis)
# My Schedule

<table>
<thead>
<tr>
<th>Freshman Fall</th>
<th>Freshman Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phys 11: General Physics I</td>
<td>Phys 12: General Physics II</td>
</tr>
<tr>
<td>Mus 41: History of Blues</td>
<td>Mus 10: Intro to music theory</td>
</tr>
<tr>
<td>Math 42: Calc III</td>
<td>ES2: Computing in Engineering</td>
</tr>
<tr>
<td>EN2: CAD</td>
<td>Math 70: Linear Algebra</td>
</tr>
<tr>
<td>ES 93-05: Music and the art of engineering</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sophomore Fall</th>
<th>Sophomore Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES3: Intro to Electronics</td>
<td>ES4: Digital Circuits</td>
</tr>
<tr>
<td>Math 51: Differential Equations</td>
<td>Phil 06: Critical Thinking and Reasoning</td>
</tr>
<tr>
<td>Comp 11: Intro to Comp Sci</td>
<td>EE21: Electronics I</td>
</tr>
<tr>
<td>Chem 1: Chem Fundamentals</td>
<td>Comp 15: Data Structures</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Junior Fall</th>
<th>Junior Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE22: Electronics II</td>
<td>EE18: Electromagnetic Fields &amp; Waves</td>
</tr>
<tr>
<td>EE14: Microprocessor Architecture</td>
<td>EE94: Undergraduate Research Study</td>
</tr>
<tr>
<td>EE23: Linear Systems</td>
<td>Comp / Math 51: Discrete Mathematics</td>
</tr>
<tr>
<td>EE104: Probabilistic Systems</td>
<td>EE31: Junior Design</td>
</tr>
<tr>
<td>Phil 01: Intro to Philosophy</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Senior Fall</th>
<th>Senior Spring</th>
</tr>
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<tbody>
<tr>
<td>EE1105: Feedback Controls Systems</td>
<td>EE58: Senior Design (Spring)</td>
</tr>
<tr>
<td>EE107: Communications Systems</td>
<td>Concentration Elective (EE..??)</td>
</tr>
<tr>
<td>EE125: Digital Signal Processing</td>
<td>Natural Science (Astronomy, Geology??)</td>
</tr>
<tr>
<td>EE93 / Comp 50: Mobile Medical Devices</td>
<td>Free Elective (Yoga, Pilates??)</td>
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(But almost always some circuits)

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**More**
- Semiconductors
- Solar Cells
- Microwaves
- Plasma Engineering
- Flexible & Organic Electronics
- Lasers & Optics
- Analog Design
- Power Management
- Biomedical Devices
QUESTIONS?
Additional Resources

- Tufts CSX
  fb.com/tuftsCSX
- Tufts IEEE
  fb.com/tuftsieee
- Engineering Mentors
  tuftsengineeringmentors.com
- Course Selection Night Presentation Slides
  ieee.ece.tufts.edu/resources.html