Life after CS 1110

CS 1110
Introduction to Computing Using Python

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Announcements

• Deadline to request alternate exam arrangement on CMS extended to tonight. Do not assume we’ll be able to grant such requests. Decisions on all pending requests are being deferred to Friday pending University guidance.

• A6 due Friday

• Final exam study guide by Friday

• Final exam is scheduled for May 21st 1:30-4pm

• There’re changes to office hours next week. Profs will have open office hours. See the office hours calendar on course website for updates.
You’ve Learned Lots in CS1110!

- Learn more through practice and using the Python API
- Learn another language?
- Take more courses?

Modular programming using **functions**

Control flow statements: **if**-statement, **for**-loop, **while**-loop

Types and data structures (list, dictionary, tuple)

Operational model of function calls

Recursion

Object-oriented programming

Program development: testing and debugging

Algorithms
Obvious Next Step: CS 2110

- **Programming in Java**
  - Basic Java syntax
  - Static vs. Dynamic Types
  - Adv. Java Topics (e.g. Threads)

- **OO Theory**
  - More design patterns
  - Interface vs. Implementation

- **Data Structures**
  - Binary Trees
  - Linked Lists
  - Graphs

Java Specific

Language Independent

Major CS Topic
CS 2110 Immediately Opens your Options

- CS 4620: Introduction to Computer Graphics
- CS 3410: Computer System Organization and Programming
- CS 3152: Introduction to Computer Game Development
- CS 4740: Natural Language Processing
CS 2800: The Other Important Course

• CS requires a lot of math
  ▪ Analyzing code performance
  ▪ Analyzing data
  ▪ Proving code correctness

• Calculus not the only math
  ▪ Data often not “continuous”
  ▪ Limited to specific uses (e.g. spatial data)

• “Grab-bag” course
  ▪ Math needed for CS
  ▪ Includes writing proofs
CS 2110 + CS 2800 = Even More Options

- CS 3110: Data Structures and Functional Programming
- CS 4670: Introduction to Computer Vision
- CS 47xx: Artificial Intelligence, Robotics, Machine Learning (some non-cs pre-reqs)
- CS 4810: Introduction to Theory of Computing
- CS 4320: Introduction to Database Systems
Computer Science Course Numbers

- Programming Languages  \( x_{1xx} \) (e.g. 1110, 2110)
- Scientific Computing   \( x_{2xx} \) (e.g. 3220, 4210)
- Data Management       \( x_{3xx} \) (e.g. 3300, 4320)
- Systems               \( x_{4xx} \) (e.g. 3410, 4410)
- Computational Biology \( x_{5xx} \) (e.g. 5555)
- Graphics and Vision   \( x_{6xx} \) (e.g. 4620)
- Artificial Intelligence \( x_{7xx} \) (e.g. 4758, 4700)
- Theory                \( x_{8xx} \) (e.g. 4810, 4820)
- Research             \( x_{9xx} \) (e.g. 4999)

Level  Area
Computer Science Course Numbers

<table>
<thead>
<tr>
<th>Level</th>
<th>Area</th>
<th>Course Numbers</th>
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<tbody>
<tr>
<td>1</td>
<td>Programming Languages</td>
<td>x1xx (e.g. 1110, 2110)</td>
</tr>
<tr>
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<td>4</td>
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Separation not perfect; there is a lot of overlap
Programming Languages

- **Adv. Language Topics**
  - Functional languages
  - Streaming languages
  - Parallel programming

- **Language Theory**
  - New languages/compilers
  - Software verification

- **Software Engineering**
  - Design patterns
  - Architecture principles
Scientific Computing

- **Computing + Calculus**
  - Problems from other science domains
  - Process with computer

- **Applications**
  - Complex simulations
  - Physics, computer graphics, robotics

- **Challenge: Performance**
  - Programs can run for days!
  - How do we make faster?

Diagram:
- Math 2210 or Math 2940
- CS 3220
- CS 4210
- CS 4220

Courses:
- CS 4210
- CS 4220
- Math 2210
- Math 2940
- CS 3220
Data Management

• Modern Web Apps
  ▪ Storing user/session data
  ▪ Coordinating users

• Databases
  ▪ Query languages
  ▪ Database optimization
  ▪ Organizing your data

• Information Retrieval
  ▪ Searching
  ▪ Data analysis
Systems

- **Building BIG software**
  - Operating systems
  - Distributed applications (e.g. online, networked)
  - Cloud computing
- **Also System Security**
  - Though that is spread about
- **Senior/masters level classes**
  - Bulk of the 5xxx courses
  - But great project courses!
• **Not** modeling/art!

• **Rendering & Animation**
  - Illumination/reflection
  - Cloth/hair simulation
  - Water and fluids

• **Processing Images**
  - Recognizing shapes
  - Assembling 3D models from 2D pictures
  - Smart cameras
Artificial Intelligence

- **Not** sentient computers
- **Machine learning**
  - Discovering patterns
  - Making predictions
- **Natural Language Proc.**
  - Automatic translation
  - Searching text/books
  - Sentiment analysis
  - Voice-control interfaces
- **Robotics**
  - Autonomous control
Machine Learning

- Also in other departments as undergrad courses
  - ORIE
  - ECE

- Many grad classes
  - ASTRO
  - BME
  - MATH
  - NBA
  - SYSEN
  - and more …

Tailored to the specific areas
Robotics

• Many classes in MAE
  ▪ MAE 3780
  ▪ MAE 4710
  ▪ MAE 4780
  ▪ MAE 67xx

• CS focus on algorithms
  ▪ Planning/perception
  ▪ Robot-Human interaction

There is a robotics minor!
• Take courses in MAE, CS, ECE, INFO
• Administered by MAE
Theory

- **Analysis of Algorithms**
  - What is possible?
  - What is feasible?

- **Analysis of Structures**
  - Social network theory
  - Complex data structures

- **Cryptography**
  - Theory side of security
What About Games?

• CS 3152, Spring only
  ▪ **Prereq:** CS 2110
  ▪ But CS 3110 a big help
• Build game from scratch
  ▪ Want it to be innovative
  ▪ You own the IP
• Interdisciplinary teams
  ▪ 5 to 6 people on a team
  ▪ With artists/designers
• **Final:** public showcase
CS Undergraduate Prerequisite Structure

**bold & colored courses**
(with corresponding arrows) indicate prerequisites

**starred (*) courses**
have at least 1 MATH pre- or co-requisite
See Roster.

**core classes**

1110: Introduction to Computing Using Python
1112: Introduction to Computing Using MATLAB
1132: Short Course in MATLAB
1133: Short Course in Python
1380: Data Science for All
2024: C++ Programming

2110: Object-Oriented Programming and Data Structures
2112: Object-Oriented Design and Data Structures - Honors
2770: Excursions in Computational Sustainability
2800: Discrete Structures
2802: Discrete Structures - Honors
2850: Networks

3110: Data Structures and Functional Programming
3152: Introduction to Computer Game Architecture
3220: Introduction to Scientific Computation
3410: Computer System Organization and Programming
3420: Embedded Systems (prereq: ENGRD 2300, not shown)
4110: Programming Languages and Logics
4120: Introduction to Compilers
4152: Advanced Topics in Computer Game Architecture
4154: Analytics-driven Game Design
4160: Formal Verification
4220: Numerical Analysis: Linear and Nonlinear Problems
4320: Introduction to Database Systems
4410: Operating Systems
4450: Introduction to Computer Networks
4620: Introduction to Computer Graphics
4670: Introduction to Computer Vision
4700: Foundations of Artificial Intelligence
4740: Natural Language Processing
4750: Foundations of Robotics
4780: Machine Learning for Intelligent Systems
4786: Machine Learning for Data Science
4787: Principles of Large-Scale Machine Learning
4810: Introduction to Theory of Computing
4820: Introduction to Analysis of Algorithms
4850: Mathematical Foundations for the Information Age
4860: Applied Logic
Computer Science not your thing? Try one of our neighbors!

- Information Science
- Statistics and Data Science
- Operations Research & Information Engineering
- Electrical and Computer Engineering
  - ECE 2400 (instead of CS 2110) is a good next step
It's been a challenging semester given the state of the world and everyone’s individual situation.

Thank you for persevering!!!!

Hope you’ve found some parts of CS1110 interesting and will find some parts useful in the future!