http://www.cs.cornell.edu/courses/cs1110/2021sp

Life after CS 1110

CS 1110

Introduction to Computing Using Python

[E. Andersen, A. Bracy, D. Fan, D. Gries, L. Lee,
S. Marschner, C. Van Loan, W. White]

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!

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

Program development: testing and debugging

Algorithms

Object-oriented programming

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

Obvious Next Step: CS 2110

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

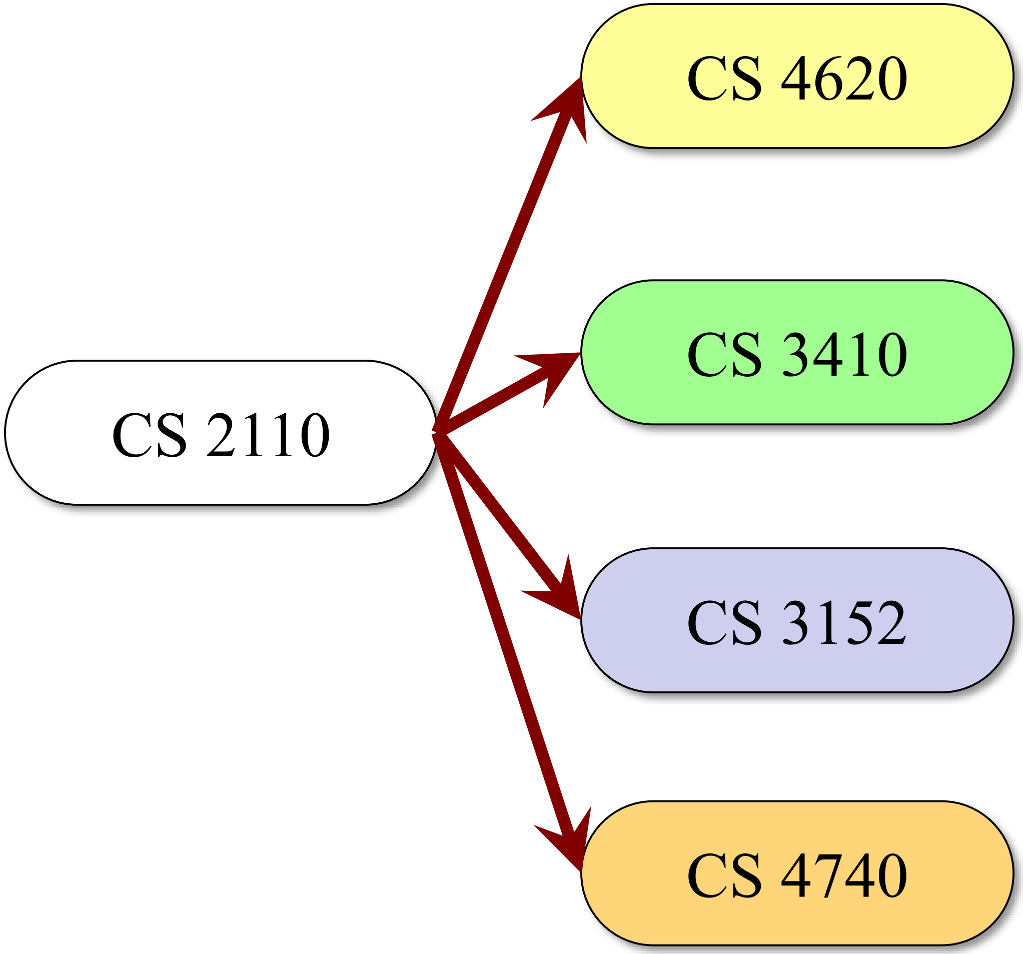
Java Specific

- **OO Theory**
  - More design patterns
  - Interface vs. Implementation
- **Data Structures**
  - Binary Trees
  - Linked Lists
  - Graphs

Major CS Topic

Language Independent

CS 2110 Immediately Opens your Options



CS 2110

CS 4620

Introduction to
Computer Graphics

CS 3410

Computer System
Organization and
Programming

CS 3152

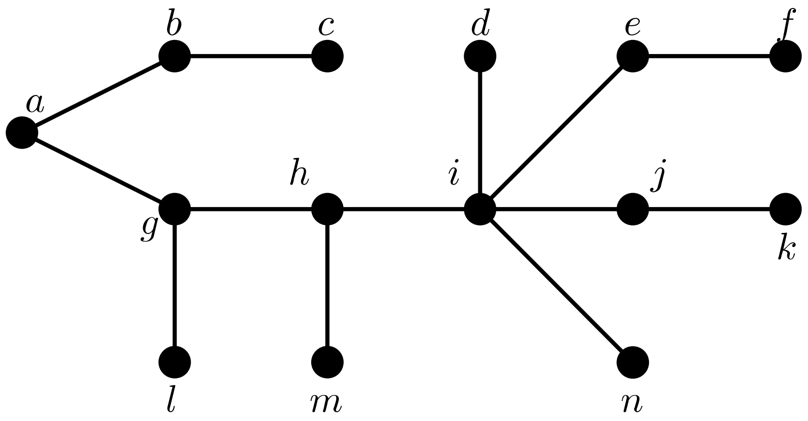
Introduction to
Computer Game
Development

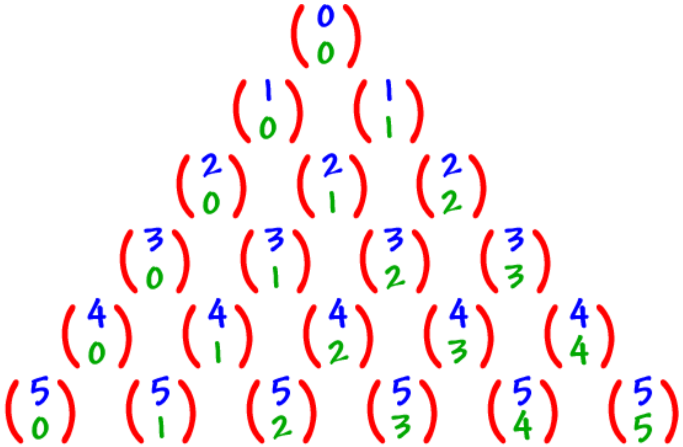
CS 4740

Natural Language
Processing

CS 2800: The Other Important Course

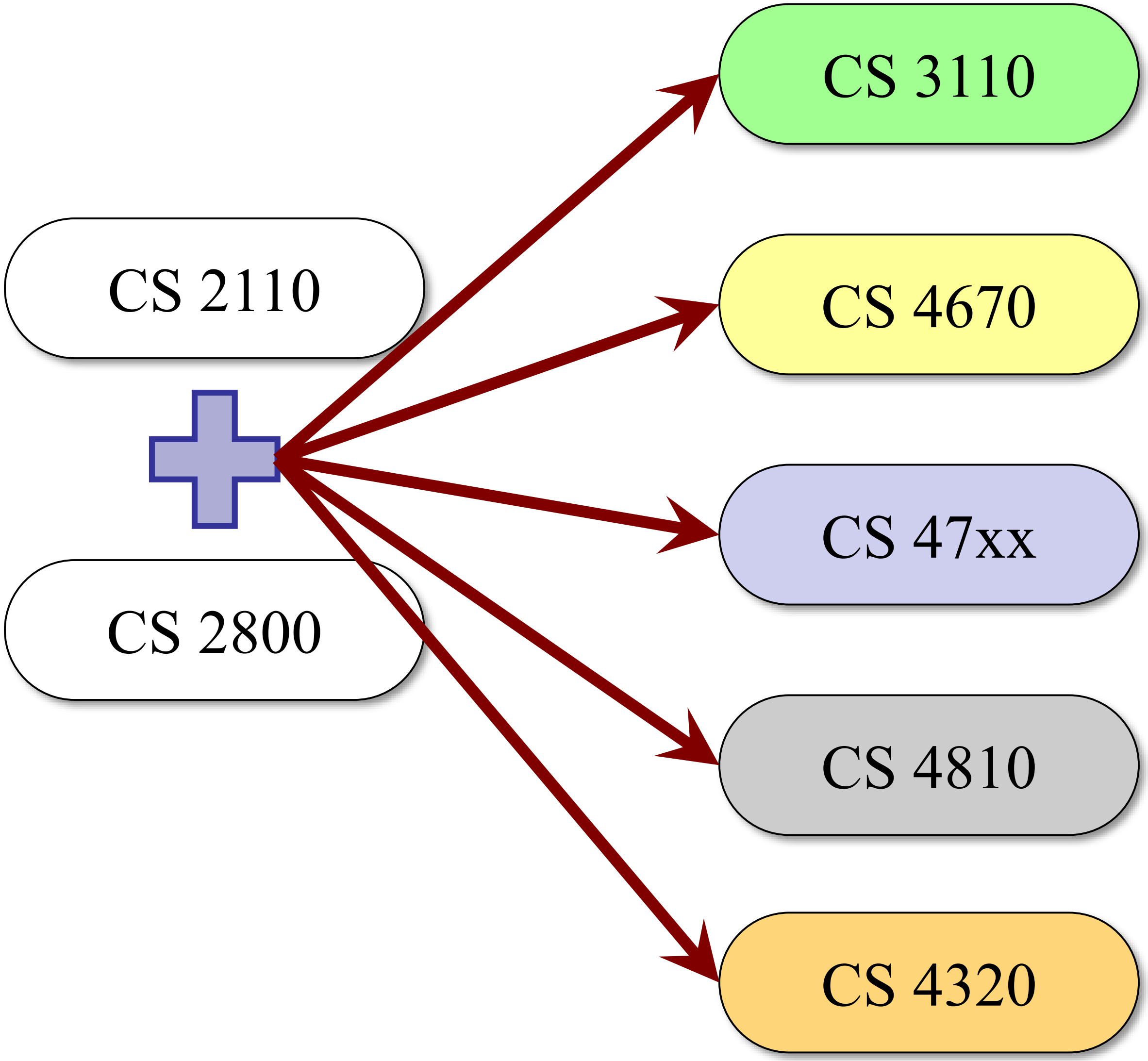
- CS requires a lot of math
  - Analyzing code performance
  - Analyzing data
  - Proving code correctness
- Calculus not the only math
  - Data often not “continuous”
  - Limited to specific uses (e.g. spatial data)
- “Grab-bag” course
  - Math needed for CS
  - Includes writing proofs





$\binom{0}{0}$
$\binom{1}{0}$ $\binom{1}{1}$
$\binom{2}{0}$ $\binom{2}{1}$ $\binom{2}{2}$
$\binom{3}{0}$ $\binom{3}{1}$ $\binom{3}{2}$ $\binom{3}{3}$
$\binom{4}{0}$ $\binom{4}{1}$ $\binom{4}{2}$ $\binom{4}{3}$ $\binom{4}{4}$
$\binom{5}{0}$ $\binom{5}{1}$ $\binom{5}{2}$ $\binom{5}{3}$ $\binom{5}{4}$ $\binom{5}{5}$

CS 2110 + CS 2800 = Even More Options



Data Structures and Functional Programming

Introduction to Computer Vision

Artificial Intelligence, Robotics, Machine Learning (some non-cs pre-reqs)

Introduction to Theory of Computing

Introduction to Database Systems

Computer Science Course Numbers

Programming Languages	x1xx	(e.g. 1110, 2110)
Scientific Computing	x2xx	(e.g. 3220, 4210)
Data Management	x3xx	(e.g. 3300, 4320)
Systems	x4xx	(e.g. 3410, 4410)
Computational Biology	x5xx	(e.g. 5555)
Graphics and Vision	x6xx	(e.g. 4620)
Artificial Intelligence	x7xx	(e.g. 4758, 4700)
Theory	x8xx	(e.g. 4810, 4820)
Research	x9xx	(e.g. 4999)

Level Area

Computer Science Course Numbers

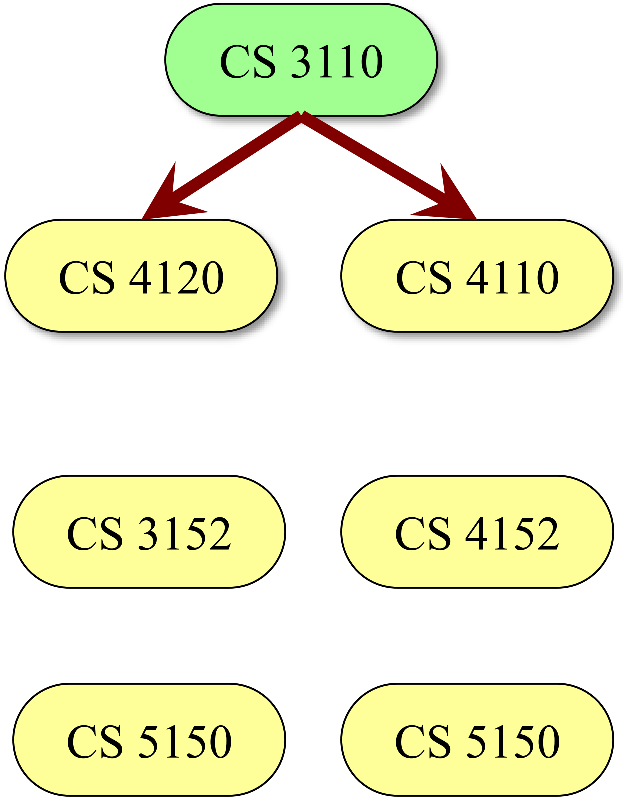
- Programming Languages x1xx (e.g. 1110, 2110)
- Scientific Computing x2xx (e.g. 3220, 4210)
- Data Management x3xx 4320)
- Systems 410)
- Compu)
- Graphic x6xx (e.g. 4620)
- Artificial Intelligence x7xx (e.g. 4758, 4700)
- Theory x8xx (e.g. 4810, 4820)
- Research x9xx (e.g. 4999)

Separation not perfect;
there is a lot of overlap

Level Area

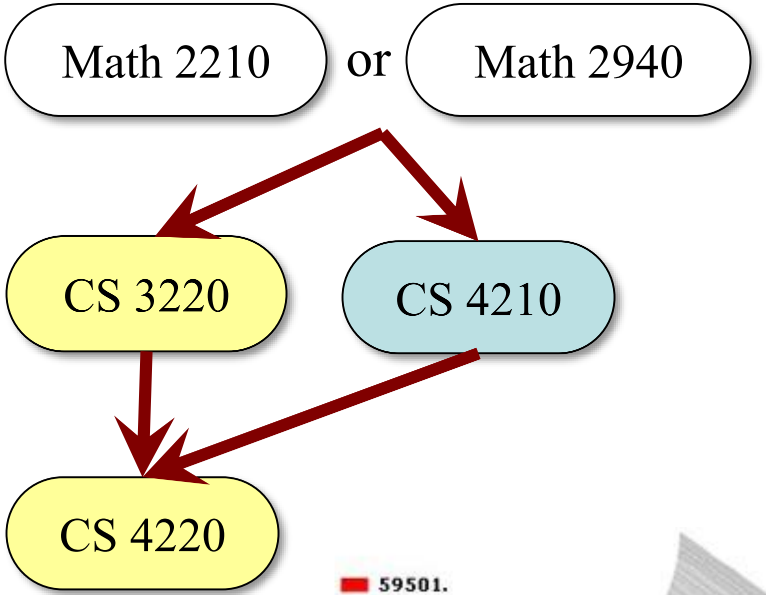
Programming Languages

- **Adv. Language Topics**
  - Functional languages
  - Streaming languages
  - Parallel programming
- **Language Theory**
  - New languages/compilers
  - Software verification
- **Software Engineering**
  - Design patterns
  - Architecture principles



Scientific Computing

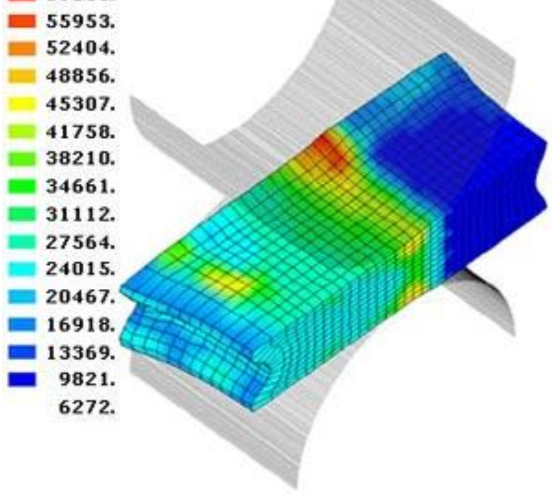
- **Computing + Calculus**
  - Problems from other science domains
  - Process with computer
- **Applications**
  - Complex simulations
  - Physics, computer graphics, robotics
- **Challenge**: Performance
  - Programs can run for days!
  - How do we make faster?


Math 2210 or Math 2940

CS 3220

CS 4210

CS 4220



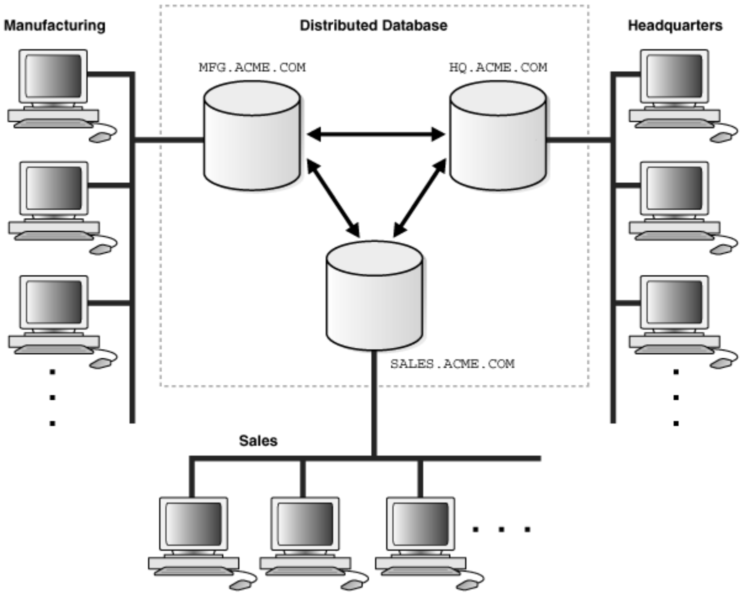
Data Management

- **Modern Web Apps**
  - Storing user/session data
  - Coordinating users
- **Databases**
  - Query languages
  - Database optimization
  - Organizing your data
- **Information Retrieval**
  - Searching
  - Data analysis

CS 4320

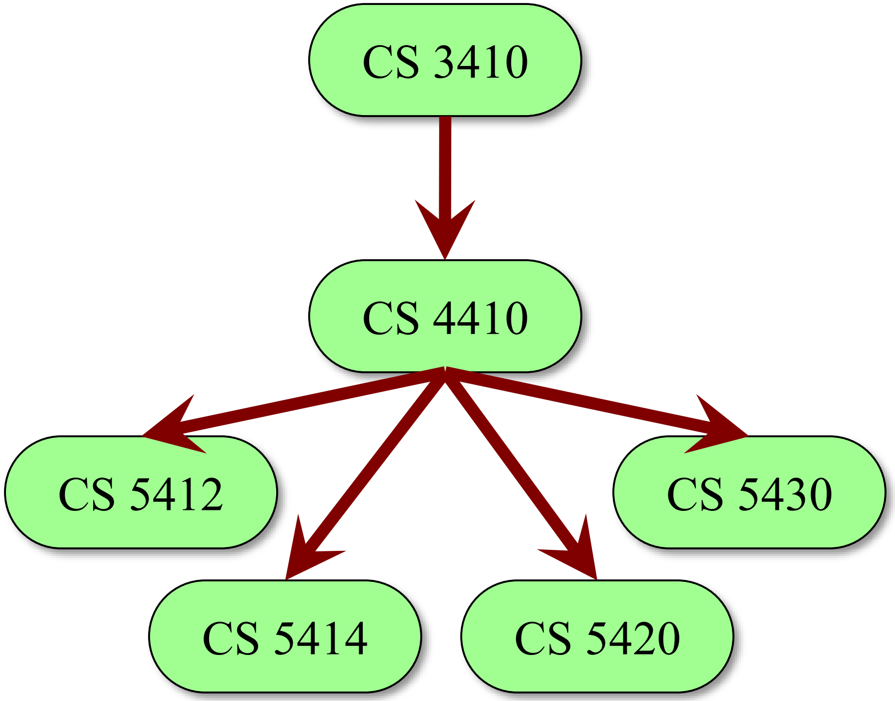
CS 4300

CS 5306



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!



Graphics and Vision

- **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

CS 4620

CS 4670

CS 5625

CS 5650

CS 5678

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

CS 4700

CS 4780

CS 4740

CS 4750

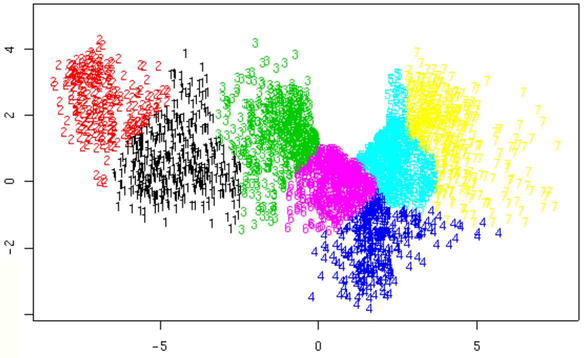
CS 4786

CS 4744

CS 4754

CS 4787

CS 4789



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

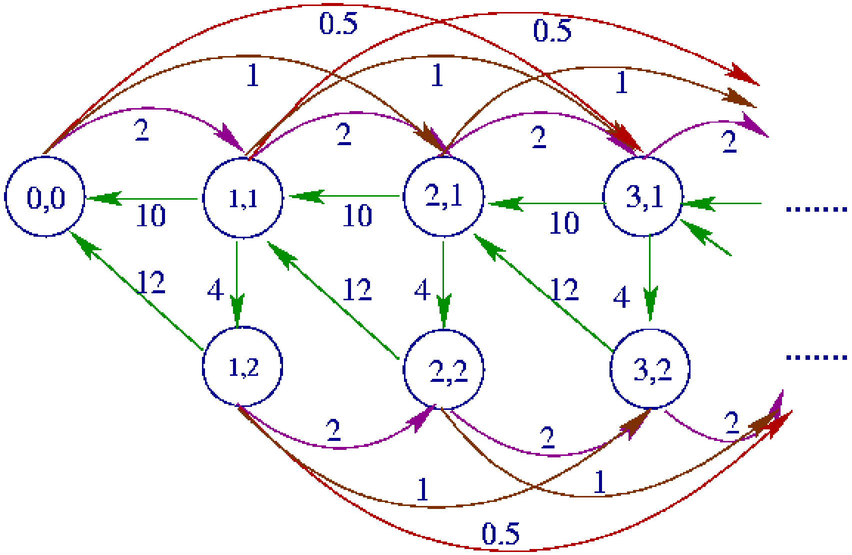
- **Analysis of Algorithms**
  - What is *possible*?
  - What is *feasible*?
- **Analysis of Structures**
  - Social network theory
  - Complex data structures
- **Cryptography**
  - Theory side of security

CS 4810

CS 4830

CS 4860

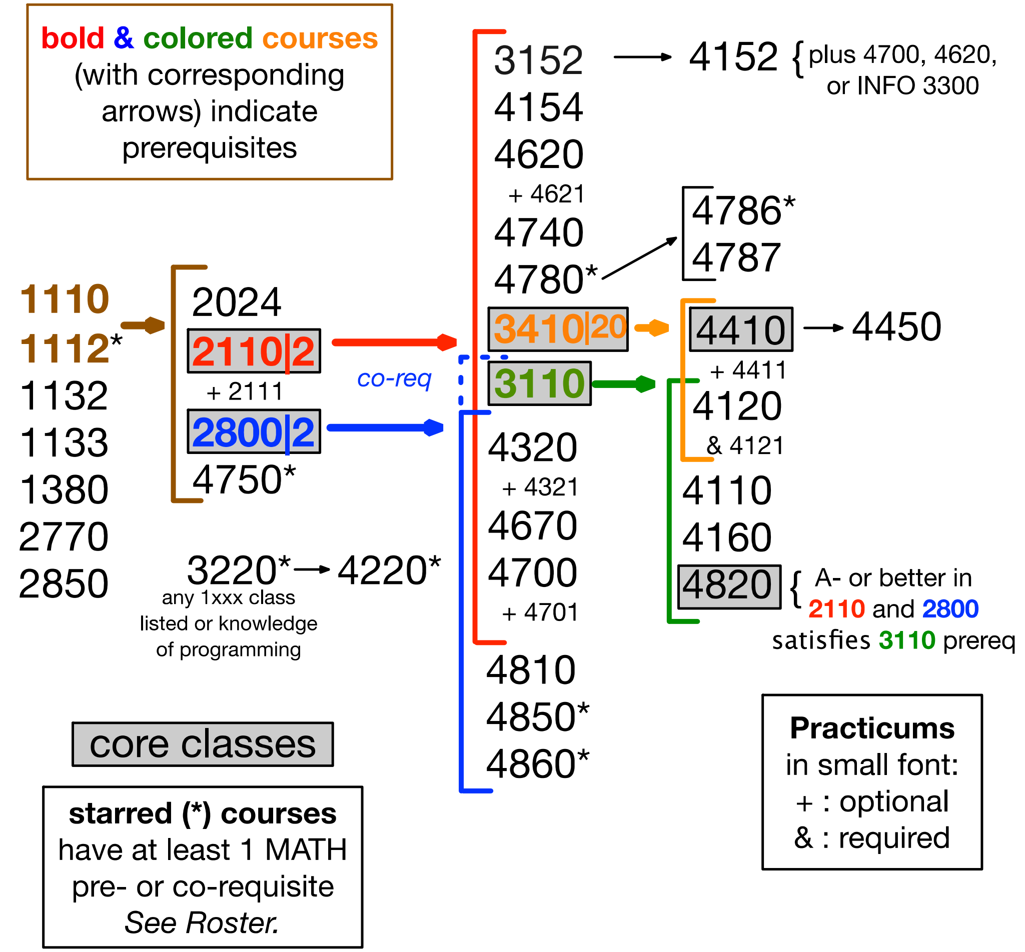
CS 4820



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

1110
1112*
1132
1133
1380
2770
2850

2024
2110|2
+ 2111
2800|2
4750*

co-req

3220* → 4220*
any 1xxx class listed or knowledge of programming

3152 → 4152 { plus 4700, 4620, or INFO 3300
4154
4620
+ 4621
4740
4780* → 4786* 4787

3410|20 → 4410 → 4450
+ 4411
4120
& 4121

3110 →
4110
4160
4820 { A- or better in 2110 and 2800 satisfies 3110 prereq

4320
+ 4321
4670
4700
+ 4701

4810
4850*
4860*

core classes

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

Practicums
in small font:
+ : optional
& : required

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

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

Cornell CIS
Computer Science

Computer Science not your ☕ ?

Try one of our neighbors!

- Information Science
- Statistics and Data Science

Cornell Bowers C·IS
College of Computing
and Information 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!