

## CONCENTRATIONS COURSE LISTINGS

### Computer Systems Concentration

You must complete four of the following courses:

- CS 345 Programming Languages
- CS 350C Advanced Architecture
- CS 356 Computer Networks
- CS 356R Introduction to Wireless Networks
- CS 360V Virtualization
- CS 361S (378H) Network Security & Privacy: (Honors)
- CS 371D Distributed Computing
- CS 375 Compilers
- CS 378 Cloud Computing
- CS 378(H) Concurrency: (Honors)
- CS 378 Multicore Operating Systems

### Cybersecurity Concentration

#### Foundation Courses

To earn the Cybersecurity Concentration, you will need to complete the following courses:

- CS 346 Cryptography
- CS 361S Network Security and Privacy or CS 378H Network Security and Privacy: Honors

#### Electives

You will also need to take any two of the following elective classes:

- CS 349 Contemporary Issues in Computer Science
- CS 378 Ethical Hacking

Maximum of one advanced systems course from this list:

- CS 350C Advanced Architecture
- CS 360V Virtualization
- CS 375 Compilers
- CS 378 Multicore Operating Systems Implementation
- CS 378(H) Concurrency

*In some cases, the graduate course CS395T: Cybersecurity and Law may be substituted for an elective. Please note that undergraduates must be approved to register for graduate classes, and that they may only do so the day before classes start. For more information on that process, please consult your advisor.*

## Game Development Concentration

### Foundation Courses

To earn the Game Development Concentration, you will need to complete the following courses:

- CS 354: Computer Graphics
- CS 354R: Game Technology
- CS 354P: Game Programming Paradigms

Before entering this program, you must take CS 371P: Object-Oriented Programming, CS 378 Generic Programming, or CS 105 C++.

### Capstones

The Game Development Capstone courses — 2D Game Development and 3D Game Development studio — synthesize the expertise that students acquire during the Concentration by enabling them to design, develop, and evaluate computer games.

Students must choose one of these capstones to complete the Game Development Concentration. If both capstone courses are taken, the second may count as an elective.

To enroll in the 2D Game Development course, students must first complete CS 354 Computer Graphics. For the 3D Game Development capstone, students must first complete CS 354R Game Technology or submit an application showing your game-related work.

These courses may change and additional courses may be added in the future.

## Machine Learning and Artificial Intelligence Concentration

### Foundation Courses

To earn the Machine Learning and Artificial Intelligence Concentration, you will need to complete one of the following courses:

- CS 343(H) Artificial Intelligence (Honors)
- CS 363M (378H) Introduction to Machine Learning (Honors)

*If both CS 343(H) Artificial Intelligence (Honors) and CS 363M (378H) Introduction to Machine Learning (Honors) are taken, one may count as an elective.*

## Electives

You will also need to take three of the following elective classes:

- CS 342 Neural Networks
- CS 376 Computer Vision
- CS 371N Natural Language Processing
- CS 378 Practical Applications of Natural Language Processing
- CS 344M Autonomous Multiagent Systems
- CS 344R Robotics
- CS 371R Information Retrieval and Web Search

## Mobile Computing Concentration

### Foundation Courses

You must complete two core classes:

- CS 356R Introduction to Wireless Networking\*
- CS 371M Mobile Computing OR CS 371L iOS Mobile Computing\*

\* One of the following may count as a substitute for CS 356R, but CANNOT double-count as an elective: CS 356 Computer Networks, CS 378 Modern Web Apps, or CS 361S Network Security and Privacy.

*\* If both CS 371M Mobile Computing and CS 371L iOS Mobile Computing are taken, one may count as an elective.*

### Electives

You will also need to take two of the following elective classes:

- CS 356 Computer Networks
- CS 361S Network Security and Privacy
- CS 371D Distributed Computing
- CS 378 Modern Web Applications