Program in Computing: Requirements

Interdisciplinary

The Program in Computing concentration is an interdisciplinary program in the application of computers to scientific inquiry. A longer title for the program might be "Computing within a Scientific Context."

The concentration focuses on four major areas:

1. Computer program development, including the construction and implementation of data structures and algorithms
2. Mathematical modeling of natural phenomena (including cognitive processes) using quantitative or symbolic computer techniques
3. Analysis and visualization of complex data sets, functions and other relationships using the computer
4. Computer hardware issues, including the integration of computers with other laboratory apparatus for data acquisition

The overall aim is to prepare the student to use computers in a variety of ways for scientific exploration and discovery.

The Curriculum

The program in computing requires a total of six courses of Kenyon coursework. COMP 118 (Introduction to Programming) serves as a foundation course for the program, introducing students to programming and other essential ideas of computer science.

Contributory courses have been identified in the arts and humanities, biology, chemistry, economics, environmental studies, mathematics, political science, physics and statistics. In these courses, computational methods form an essential means for attacking problems of various kinds.

Students in the concentration also take at least one intermediate program in computing course. The main focus of these courses is computational methods, which are developed or investigated extensively.

In addition to regular courses that are identified as contributory or intermediate, particular special-topics courses or individual studies in various departments may qualify in one of these two categories. Students who wish to credit such a course toward the concentration in program in computing should contact the program director at the earliest possible date.

The capstone course of the program is COMP 401 (Advanced Scientific Computing Seminar), a project-oriented, seminar-style course for advanced students.

Requirements for the Concentration

Required Courses

- COMP 118: Introduction to Programming or PHYS 270: Introduction to Computational Physics
- COMP 401: Scientific Computing Seminar

Contributory Courses

- ARTS 191: Creative Coding
- BIOL 109Y–110Y: Introduction to Experimental Biology
- BIOL 328: Global Ecology and Biogeography
- CHEM 126: Introductory Chemistry Laboratory II
- CHEM 336: Quantum Chemistry
- CHEM 341: Instrumental Analysis
- CHEM 370: Advanced Lab: Computational Chemistry
- CHEM 374: Advanced Lab: Spectroscopy
- ECON 205: Introduction to Econometrics
- ECON 337: Portfolio Allocation and Asset Pricing
- ECON 375: Advanced Econometrics
- ENVS 261: Geographic Information Science
- IPHS 200: Programming Humanity
- IPHS 300: AI for the Humanities
- PHYS 140: Classical Physics
- PHYS 141: First-Year Seminar in Physics
- PHYS 146: Introduction to Experimental Physics
- PHYS 240, 241: Fields and Spacetime and Laboratory
- PHYS 345: Astrophysics and Particles
- PHYS 380: Introduction to Electronics
- PHYS 381, 382: Projects in Electronics 1, 2
- PHYS 385, 386, 387: Advanced Experimental Physics 1, 2, 3
- PSCI 280: Political Analysis
- PSYC 410: Research Methods in Human Neuroscience
- STAT 106: Elements of Statistics
- STAT 116: Statistics in Sports
- STAT 206: Data Analysis
- STAT 216: Nonparametric Statistics

Intermediate Courses

- BIOL 230: Computational Genomics

- COMP 218: Data Structures and Program Design
- COMP 318: Software Development
- COMP 348: Software System Design
- COMP 493: Individual Study
- MATH 258: Mathematical Biology
- MATH 291: Special Topic: Computational Neuroscience (spring 2021)
- MATH 328: Coding Theory and Cryptography
- MATH 347: Mathematical Models
- MATH 368: Design and Analysis of Algorithms
- STAT 226: Statistical Computing with R
- STAT 416: Linear Regression Models

Courses in Computing

Introduction to Programming

COMP 118 CREDITS: 0.5 QR
This course presents an introduction to computer programming intended both for those who plan to take further courses in which a strong background in computation is desirable and for those who are interested in learning basic programming principles. The course will expose the student to a variety of applications where an algorithmic approach is natural and will include both numerical and non-numerical computation. The principles of program structure and style will be emphasized. May be paired with COMP 218 or with any mathematics or statistics course to satisfy the natural science diversification requirement. No prerequisite. Offered every semester.

Data Structures and Program Design

COMP 218 CREDITS: 0.5
This course is intended as a second course in programming, as well as an introduction to the concept of computational complexity and the major abstract data structures (such as dynamic arrays, stacks, queues, link lists, graphs and trees), their implementation and application, and the role they play in the design of efficient algorithms. Students will be required to write a number of programs using a high-level language. May be paired with COMP 118 or any mathematics or statistics course to satisfy the natural science diversification requirement. Prerequisite: COMP 118, MATH 138 or PHYS 270. Offered every other spring.

Software Development

COMP 318 CREDITS: 0.5
This course gives students experience designing, implementing, testing and debugging moderately complex systems of software components that collectively form a multilayer application. There will be an emphasis on crafting quality code, designing and implementing

effective user interfaces, and building multicomponent architectures using a mix of off-the-self and custom code. Topics will include inner process and inter-system communication, multi-threading, and the synchronization of shared resources, web interfaces and working with large data sets. Students will primarily use C++, but also will learn Javascript and other languages as needed. This course does not count toward the completion of any diversification requirement. COMP 218 is recommended but not required. Prerequisite: MATH 138, COMP 118 or PHYS 270.

Software and System Design

COMP 348 CREDITS: 0.5
A study of a software design project that requires planning, analysis, design, implementation, testing and maintenance. Different methods of planning, definition, requirements analysis and cost estimation are considered. A central component of the course is a semester-long team project that engages a team of three to five students in the analysis, design, implementation and documentation of a significant applied project. The goal of this team project is for the students to engage with the material as they work to solve a real-world problem. These projects are real needs of organizations in the surrounding community (including Gambier, Knox County and, at times, beyond). This course does not count toward any elective requirement for the math major. Prerequisite: MATH 138, COMP 118, 218 or 318.

Scientific Computing Seminar

COMP 401 CREDITS: 0.5 QR
This capstone course is intended to provide an in-depth experience in computational approaches to an individual topic of choice. Students will also be exposed to a broad range of computational application through presentations and discussion. Each student will give several presentation to the class throughout the semester. This course does not count toward the completion of any diversification requirement. Prerequisite: COMP 118 or PHYS 270, completion of at least 0.5 units of an intermediate course and at least 0.5 units of a contributory course. Permission of the instructor and program director required. Senior standing