

# COMPUTER SCIENCE

Molinaro 248 • 262-595-2314 • Keyword: *Computer Science*

**Degrees Offered:**

Bachelor of Science in Computer Science.  
Master of Science in Computer and Information Systems (see graduate section).

**Professors:**

Perdikaris, Ph.D.

**Associate Professors:**

Hansen, Ph.D. (Chair)

**Assistant Professors:**

Lincke, Ph.D.; Quevedo, Ph.D.

**Lecturers:**

Eddy, M.S.; Knautz, M.S.

**Student Organizations/Clubs:**

Computer Science Club

**Career Possibilities:**

Software engineer, systems programmer, applications programmer, network administrator, systems developer, systems analyst, web developer.

## Department Overview

The Computer Science Department offers strong academic programs that prepare students for work and continuing advancement in information technologies. The pervasive influence of computers in our everyday lives and the strategic importance that computing systems have in our economy and government require an increasingly educated and technologically aware citizenry as well as highly skilled and knowledgeable computing professionals who understand, design, implement and manage complex information systems.

The science of computing is relatively new, having emerged only in the 1960s as an academic discipline. The computer science major at UW-Parkside was established in 1979. Since the inception of the major, UW-Parkside's computer science graduates have found highly successful careers in computing and information technology throughout the region and the country.

Computing professionals must have a solid grounding of fundamentals as a basis for adapting to rapid changes in computing theory and practice. They must also have knowledge and experience with current methodologies which they can apply reliably to solve existing problems and to design systems that work. They must be able to work cooperatively with others and to communicate effectively. Combining theory, practice, and collaboration, the computer science major at UW-Parkside prepares students for successful careers in computing and information systems and contributes to their growth as professionals.

Laboratory experiences are integral components of many of the department's computer science courses. The department's computer science laboratory conference area is open to computer science students for study and discussion. Computer science students use the laboratory's high-performance workstations, servers, and printing facilities – all available by card access during building hours – to carry out their programming and laboratory work.

The computer science major includes 63 credits in computer science, mathematics, and the sciences. In addition, students majoring in computer science fulfill a 9-credit computer science breadth requirement that includes courses in significant application domains such as science, mathematics, business and economics.

In collaboration with faculty in management information systems, the Computer Science Department offers a master of science in computer and information systems (MSCIS). See the Graduate Programs section of this catalog for detailed MSCIS degree requirements, admissions information, and courses.

The Computer Science Department and the Mathematics Department jointly offer a double major in computer science and mathematics. The degree requirements for this double major are listed below.

The Computer Science Department also offers a 34-credit computer science minor and a web development minor and certificates in World Wide Web publishing, UNIX system administration, cyber security.

## Preparation for Graduate School

The computer science major is excellent preparation for students seeking to do graduate work in computer science. Such students may wish to supplement the minimum requirements for a computer science major with additional courses in mathematics and the sciences.

## Internships

Many businesses and industrial firms in the area hire UW-Parkside computer science students as part-time employees in computing-related jobs. In addition to facilitating these informal non-credit internships, the Computer Science Department sponsors a formal credit-bearing internship program with selected companies. In a formal internship, the student, the computer science faculty, and the student's company supervisor collectively agree on fixed-term internship objectives; progress toward meeting these objectives is evaluated periodically throughout the term. Students should contact the department chair for more information on formal and informal internships.

## Computer Science Major Requirements for Graduation

In addition to meeting the general university requirements of a UW-Parkside degree, students seeking to graduate with a major in computer science must satisfy the following:

- Completion of computer science major requirements.
- Attainment of a minimum UW-Parkside cumulative GPA of 2.50 in all courses eligible to meet the student's computer science major requirements, including courses that meet the computer science major breadth requirement.

### Computer science (CSCI) major required courses (72-73 credits):

#### Mathematics

|          |  |      |
|----------|--|------|
| MATH 221 | Calculus and Analytic Geometry I . . . . . | 5 cr |
| MATH 309 | Probability and Statistics . . . . .       | 4 cr |

#### Science

|           |                               |      |
|-----------|-------------------------------|------|
| PHYS 201  | General Physics I . . . . .   | 5 cr |
| <b>or</b> |                               |      |
| CHEM 101  | General Chemistry I . . . . . | 5 cr |

#### Computer Science

|          |  |      |
|----------|--|------|
| CSCI 231 | Discrete Math. . . . .   | 3 cr |
| CSCI 241 | Computer Science I . . . . .   | 4 cr |
| CSCI 242 | Computer Science II . . . . .  | 4 cr |
| CSCI 250 | Digital Logic and<br>Computer Organization . . . . .                 | 4 cr |
| CSCI 331 | Computational Models . . . . .                                       | 3 cr |
| CSCI 333 | Programming Languages . . . . .                                      | 3 cr |
| CSCI 340 | Data Structures and Algorithm Design .                               | 3 cr |
| CSCI 355 | Assembly Language Programming<br>and Computer Architecture . . . . . | 4 cr |
| CSCI 370 | Operating Systems . . . . .  | 3 cr |
| CSCI 380 | Files and Databases . . . . .  | 4 cr |
| CSCI 475 | Software Engineering<br>Principles and Practice I . . . . .          | 3 cr |
| CSCI 476 | Software Engineering<br>Principles and Practice II . . . . .         | 3 cr |
| CSCI 495 | Computer Science Seminar . . . . .                                   | 2 cr |

#### Electives (6 or more credits from)

|          |   |      |
|----------|---|------|
| CSCI 405 | Artificial Intelligence . . . . .                       | 3 cr |
| CSCI 409 | Introduction to Human-<br>Computer Interfaces . . . . . | 3 cr |
| CSCI 420 | Computer Graphics . . . . .                             | 3 cr |
| CSCI 440 | Compiler Design and Implementation .                    | 3 cr |
| CSCI 444 | Event-Driven Programming . . . . .                      | 3 cr |
| CSCI 467 | Computability and Automata . . . . .                    | 3 cr |
| CSCI 470 | Operating System Implementation . . .                   | 3 cr |
| CSCI 477 | Computer Communications<br>and Networks . . . . .       | 3 cr |
| CSCI 478 | Introduction to Network<br>Security . . . . .           | 3 cr |
| CSCI 480 | Database Concepts . . . . .                             | 3 cr |

## Computer Science Breadth Requirement

Students must complete a package of 9 or more credits outside of computer science in a coherent collection of courses that are relevant to computer science and that meet the approval of the computer science faculty. Several such packages have been pre-approved, in areas such as mathematics, the sciences, engineering, business and economics. Pre-approved packages include:

- MATH 222 and 301
- MATH 222 and PHYS 202
- CHEM 102 and 215
- Select any 3 courses from: ACCT 201, FIN 330, MGT 349, and MKT 350
- ECON 320 or 321, and two additional 300-level ECON courses
- GEOG 455, 460 and 465
- Art 102, 277 and either 271 or 377

Optionally, a student may submit an individually designed computer science breadth package of 9 or more credits for approval by the computer science faculty. See the department chair for details.

## Computer Science/Mathematics Double Major (89-90 credits)

Students may satisfy graduation requirements for both computer science and mathematics by completing the degree requirements for computer science with PHYS 201 together with the following mathematics courses (which automatically satisfy the computer science breadth requirement):

|          |  |      |
|----------|--|------|
| MATH 222 | Calculus and Analytic Geometry II . . .                    | 5 cr |
| MATH 223 | Calculus and Analytic Geometry III . . .                   | 5 cr |
| MATH 301 | Linear Algebra . . . . .                                   | 4 cr |
| MATH 317 | Differential Equations and<br>their Applications . . . . . | 4 cr |
| MATH 350 | Advanced Calculus . . . . .                                | 4 cr |
| MATH 441 | Abstract Algebra . . . . .                                 | 4 cr |

Students in the computer science/mathematics double major are encouraged to take computer science electives from the following list:

|          |                                      |      |
|----------|--------------------------------------|------|
| CSCI 405 | Artificial Intelligence . . . . .    | 3 cr |
| CSCI 440 | Compiler Design and Implementation . | 4 cr |
| CSCI 467 | Computability and Automata . . . . . | 3 cr |

## Course Restrictions

Computer science courses are generally not available for audit.

## Disruption of Studies

Normally, students must meet the major requirements in effect at the time they declare a major; however, students majoring in computer science who do not attend continuously may be subject to the major requirements in effect upon their return. In particular, students who do not complete (with a passing grade) a computer science course numbered above 241 for four consecutive semesters will be subject to the major requirements in effect upon their next registration for a computer science course.

## Substitutions

Requests for course substitutions to meet the requirements of the computer science major need the approval of the computer science faculty. In the case of the computer science/mathematics double major, substitutions require the approval of both the computer science faculty and the mathematics faculty. In the case of the computer science/computer engineering concentration, substitutions require the approval of both the computer science faculty and the engineering faculty.

## Transfer Credits

In addition to the minimum UW-Parkside cumulative GPA requirement of 2.50 for courses in the major, students with transfer credits applying to the computer science major must also attain a minimum cumulative GPA of 2.50 in all course work required, including transfer credits.

## Part-Time Study

The computer science major is available to both full-time and part-time students. Classes meet throughout the day, including evenings. Evening classes are offered on a restricted rotation basis to permit persons working full time during the day to complete major requirements during off-the-job hours. Contact the Computer Science Department chair for details.

## Minor in Computer Science

The Computer Science Department offers a minor in computer science. It is designed to meet the needs of students who are majoring in another field, but who desire a deeper understanding of computers and software. Students seeking to minor in computer science must attain a minimum UW-Parkside cumulative GPA of 2.50 in all courses eligible to meet the student's computer science minor requirements.

### Computer science minor required courses (25-26 credits):

#### Mathematics

MATH 221 Calculus and Analytic Geometry I . . . . 5 cr

#### Computer Science

CSCI 231 Discrete Mathematics . . . . . 3 cr  
CSCI 241 Computer Science I . . . . . 4 cr  
CSCI 242 Computer Science II. . . . . 4 cr

CSCI 340 Data Structures and Algorithms . . . . . 3 cr  
**or**  
CSCI 380 Files and Databases. . . . . 4 cr

#### Electives

At least 6 credit hours of CSCI courses numbered 331 or above, excluding CSCI 375.

## Minor in Web Development

The Computer Science Department, in collaboration with the Art and Business departments, offers a minor in web development. The minor is designed for students who are seeking an in-depth technical understanding of web site development and administration. Students completing the minor will be well situated to take on jobs as web programmers, web developers and web server administrators.

### Web Development minor required courses (26-28 credits):

ART 102 Intro to 2D Design. . . . . 3 cr  
ART 277 Intro to Web Design. . . . . 3 cr  
ART 377 Web Design for Designers . . . . . 3 cr  
  
CSCI 241 Computer Science I . . . . . 4 cr  
**or**  
MIS 221 Business Programming . . . . . 3 cr  
  
CSCI 220 Web Concepts I . . . . . 3 cr  
CSCI 322 Web Concepts II. . . . . 3 cr  
CSCI 492 Practicum in Web Development\*. . . . . 2 cr  
ENGL 202 Technical Writing . . . . . 3 cr

#### Electives (Choose any one of the following):

MIS 422 Internet Programming . . . . . 3 cr  
MIS 423 Design Tech. for Web-based IS. . . . . 3 cr  
MIS 328 Database Management Sys. . . . . 3 cr  
CSCI 380 Files and Databases. . . . . 4 cr

A pre-approved CSCI 490 or MIS 490 such as  
Web Security or Web Services . . . . . 3 cr

## Certificate in UNIX System Administration

The Computer Science Department offers a certificate in UNIX system administration that provides background and experience for students interested in careers in system administration. This certificate consists of the following courses:

### Certificate in UNIX System Administration required courses (9 credits):

CSCI 241 Computer Science I . . . . . 4 cr  
CSCI 275 UNIX Concepts and Tools . . . . . 2 cr  
CSCI 375 UNIX System Administration . . . . . 3 cr

## Certificate in World Wide Web Publishing

In cooperation with the Art Department, the Computer Science Department offers a certificate in World Wide Web publishing. The certificate serves traditional students who want to augment their major and improve their employability by adding webmaster skills, as well as professionals interested in the essentials of webpage design. Individuals may enter the program at any point, depending on background and experience.

### Certificate in World Wide Web publishing required courses (15 credits):

|           |  |      |
|-----------|--|------|
| ART 102   | Introduction to Two-Dimensional Design . . . . . | 3 cr |
| ART 277   | Introduction to Web Design . . . . .             | 3 cr |
| CSCI 105  | Introduction to Computers . . . . .              | 3 cr |
| CSCI 220  | Web Concepts I . . . . .                         | 3 cr |
| CSCI 322  | Web Concepts II. . . . .                         | 3 cr |
| <b>or</b> |  |      |
| ART 377   | Web Design for Designers . . . . .               | 3 cr |

## Certificate in Cyber Security

The Computer Science Department offers a certificate in cyber security. With the growth of computer networking and the World Wide Web, cyber security has become of increasing importance to all computer users. Our certificate gives students a background in securing desktop computers, servers, and the networks that connect them. The certificate is supported by a dedicated laboratory that is isolated from the rest of the campus network, allowing students to gain practical hands-on knowledge of the tools used to both attack and defend computers.

### Certificate in Cyber Security required courses (9 credits):

|           |   |      |
|-----------|---|------|
| CSCI 477  | Computer Communication and Networks . . . . .             | 3 cr |
| <b>or</b> |   |      |
| MIS 424   | Advanced Business Data Communications . . . . .           | 3 cr |
| CSCI 478  | Introduction to Network Security. . . . .                 | 3 cr |
| CSCI 490  | Web Security . . . . .                                    | 3 cr |
| <b>or</b> |   |      |
|           | Another pre-approved CSCI 490 or MIS 490 course . . . . . | 3 cr |

## Courses in Computer Science (CSCI)

**101 Computer Software Tools** .....1 cr  
*Prereq: ACSK 095 or demonstrated proficiency. Freq: Fall, Spring.*  
 Each section introduces a particular software tool. Commonly offered tools include: word processors, spreadsheets, presentation software and databases. Meets two hours per week for eight weeks. May be repeated for credit with different content.

**105 Introduction to Computers**.....3 cr  
*Prereq: None. Freq: Fall, Spring.*

Computer components and principles of operation; the human-computer interface; basic networking; the Internet and the World Wide Web; elementary programming concepts. Two-hour lecture, two-hour lab.

**106 Computer Productivity Tools** .....3 cr  
*Prereq: None. Freq: Fall, Spring.*

Introduction to computers, document processing, spreadsheets, and database management tools. Two-hour lecture, two-hour lab.

**130 Introduction to Programming**.....1 cr  
*Prereq: MATH 111 or equivalent. Freq: Fall, Spring.*

Fundamentals of a programming language: input/output, variables and assignment, program control and subroutines.

**220 Web Concepts I** .....3 cr  
*Prereq: CSCI 105 or consent of instructor. Freq: Fall.*

Web client programming concepts. web site authoring, dynamic web pages, object usage, events and event driven programming, markup languages, document object model. Two-hour lecture, two-hour lab.

**231 Discrete Mathematics** .....3 cr  
*Prereq: C or better in MATH 221. Freq: Fall, Spring.*

Sets; the number system; Boolean algebra; formal logic and proofs; relations and functions; combinatorics and recurrence relations; graphs and trees. Cross listed as MATH 231.

**241 Computer Science I** .....4 cr  
*Prereq: Exposure to programming; C or better in MATH 112 and 113, or MATH 114. Freq: Fall, Spring.*

Organization and characteristics of computers, algorithms and programs, fundamentals of programming in a high-level language, and introduction to object-oriented programming. Three-hour lecture, two-hour lab.

**242 Computer Science II**.....4 cr  
*Prereq: C or better in CSCI 241. Freq: Fall, Spring.*

Programming style, string manipulation, searching and sorting, data structures, files and records. Three-hour lecture, two-hour lab.

**245 Assembly Language Programming** .....3 cr  
*Prereq: CSCI 241. Freq: Occasionally.*

Organization of computers, digital representation of data, symbolic coding and assembler systems, instructions, addressing modes, program segmentation and linkage, and applications.

**250 Digital Logic and Computer Organization**.....4 cr  
*Prereq: Programming experience; MATH 112 or concurrent registration. Freq: Fall.*

Logical functions and Boolean algebra, analysis and design of combinatorial logic and sequential logic systems, register transfer and datapaths, computer organization and peripheral devices. Computer simulation and laboratory work included. Three-hour lecture, two-hour lab.

- 275 UNIX Concepts and Tools** .....2 cr  
*Prereq: CSCI 241 or equivalent programming experience.*  
*Freq: Fall.*  
 Concepts and tools for UNIX including file system organization, directory and file manipulation, UNIX processes, editors, text formatting software, filters, X11 windows interface, compiler tools, interacting with other users, interacting with Internet hosts, text processing systems, make files, and shell scripting.
- 290 Special Topics in Computer Science** .....1-4 cr  
*Prereq: Consent of instructor. Freq: Occasionally.*  
 Elementary topics in computer science.
- 296 Professional Certification**.....1-6 cr  
*Prereq: Consent of instructor. Freq: Occasionally.*  
 Instruction and laboratory work preparing students to take professional certification examinations. Credits will vary depending on certification program. Special laboratory fees, add/drop deadlines, and fee refund policies may apply.
- 322 Web Concepts II**.....3 cr  
*Prereq: CSCI 220 or consent of instructor. Freq: Spring.*  
 Server-side programming concepts; server architectures; relational databases and database connectivity; dynamic web pages; form processing; web services. Two-hour lecture, two-hour lab.
- 331 Computational Models** .....3 cr  
*Prereq: C or better in CSCI/MATH 231. Freq: Fall.*  
 Regular languages, finite automata, context-free languages and grammars, push-down automata, Turing machines, algorithms and the Church-Turing thesis, and decidability.
- 333 Programming Languages**.....3 cr  
*Prereq: C or better in CSCI/MATH 231 and CSCI 242.*  
*Freq: Spring.*  
 Introduction to the syntax and semantic issues in programming languages and their effect on language implementation. This includes methods to specify languages, data storage, and the sequence of control in programs. Non-procedural languages, including functional and logic languages, will be examined.
- 335 Functional Programming** .....2 cr  
*Prereq: CSCI 333. Freq: Occasionally.*  
 The functional programming paradigm; data structures, primitive functions, functional forms, and evaluation; major functional programming languages (Common LISP, Scheme, etc.); recursion; scope rules; functions as data; storage management; symbol processing; and object-oriented extensions.
- 340 Data Structures and Algorithm Design** .....3 cr  
*Prereq: C or better in CSCI/MATH 231 and CSCI 242.*  
*Freq: Spring.*  
 Study of the design, implementation and analysis of computer algorithms; time and space requirements for sorting, searching, graph theory, mathematics and string processing algorithms.
- 355 Assembly Language Programming and Computer Architecture** .....4 cr  
*Prereq: C or better in CSCI 241 and 250, or consent of instructor.*  
*Freq: Spring.*  
 Organization of computers, the role of performance; processor design and microcode; symbolic coding; assembly systems; assembly language: instructions and addressing modes, instruction set design, traps and interrupts; architecture: performance consideration, pipelining, and memory hierarchies.
- 368 Mathematical Modeling**.....3 cr  
*Prereq: MATH 222; MATH 250 or CSCI 242. Freq: Occasionally.*  
 Survey of mathematical models, models involving differential equations, probabilistic models, Markovian models, simulation, and Monte-Carlo methods. Cross listed as MATH 368.
- 370 Operating Systems** .....3 cr  
*Prereq: C or better in CSCI 242 and 355. Freq: Fall.*  
 Operating system concepts, process definition and implementation, deadlock, memory management and protection, distributed system architecture, and case studies.
- 375 UNIX System Administration**.....3 cr  
*Prereq: CSCI 275. Freq: Spring.*  
 UNIX system administration concepts and techniques including system organization, kernel configuration, device management, system files and runtime maintenance, software configuration and installation, and network configuration; comparison of UNIX with other operating systems. Laboratory work included.
- 380 Files and Databases**.....4 cr  
*Prereq: C or better in CSCI 242. Freq: Fall.*  
 Data storage, file organization, file access techniques including indexing and hashing. Data modeling and relational database concepts.
- 405 Artificial Intelligence (AI)** .....3 cr  
*Prereq: C or better in CSCI 333. Freq: Occasionally.*  
 Background on AI and AI techniques including search, game playing, and knowledge representation. Specific sub-disciplines of AI including natural language processing and robotics. Programming assignments in LISP.
- 409 Introduction to Human-Computer Interfaces**.....3 cr  
*Prereq: C or better in any 300-level CSCI course and MATH 309.*  
*Freq: Occasionally.*  
 An introduction to the field of human-computer interaction including the user interface development process, human memory, perception, and motor abilities as they relate to user interface design. Qualitative overview of descriptive and inferential statistics. Students design a low-tech prototype of a user interface (user and task analysis, design, and evaluation).
- 420 Computer Graphics** .....3 cr  
*Prereq: C or better in CSCI 340. Freq: Occasionally.*  
 Graphics hardware and software, techniques for representation and visualization, two- and three-dimensional transformations, concepts and techniques of visual realism.

- 440 Compiler Design and Implementation** .....3 cr  
*Prereq: CSCI 331 and 333 or concurrent registration.*  
*Freq: Occasionally.*  
 Theory, design and implementation of compilers and other syntax-directed systems. Applies techniques of finite state machines, lexical analysis, symbol tables, parsing, storage allocation and code generation to the development of a compiler. Laboratory work included.
- 444 Event-Driven Programming** .....3 cr  
*Prereq: C or better in CSCI 370. Freq: Occasionally.*  
 Origins of events; the event-driven programming model; interrupt processing as event handling; client-server architectures; windowing environments and GUI programming; development support software; case studies; and student project.
- 467 Computability and Automata** ..... 3 cr  
*Prereq: C or better in CSCI 331 or consent of instructor.*  
*Freq: Occasionally.*  
 Turing machines, recursive functions, Kleene's T Predicate, Ackermann's function, finite automata, grammars and languages. Cross listed as MATH 467.
- 470 Operating System Implementation** .....3 cr  
*Prereq: C or better in CSCI 370. Freq: Occasionally.*  
 Operating system design including memory management, inter-process communication, protection, distributed systems, multiprocessor systems, network services, file systems, exception handling and system configuration.
- 475 Software Engineering Principles and Practice I**.....3 cr  
*Prereq: C or better in CSCI 333, CSCI 340, CSCI 370 or CSCI 380. Freq: Fall.*  
 Software design as an engineering discipline; project management, verification and validation, software engineering models, measurements, cost estimation, and formal methods.
- 476 Software Engineering Principles and Practice II**.....3 cr  
*Prereq: C or better in CSCI 475. Freq: Spring.*  
 Continuation of CSCI 475; further work on a significant team project; includes oral presentations and written documentation.
- 477 Computer Communications and Networks** .....3 cr  
*Prereq: C or better in CSCI 370. Freq: Occasionally.*  
 Transmission protocols, layered network protocols, network topology, message routing, performance analysis, security, and case studies.
- 478 Introduction to Network Security** .....3 cr  
*Prereq: C or better in CSCI 370, CSCI 375 or MIS 327.*  
 Introduction to computer and network security; operating systems, networks and system administration issues; hacking, incident response, firewalls, VPNs, intrusion detection, and auditing. A background in computer networking is helpful.
- 480 Database Concepts**.....3 cr  
*Prereq: C or better in CSCI 380. Freq: Occasionally.*  
 The relational model; database design; SQL; non-relational database models; operational considerations; and distributed and object-oriented databases.
- 490 Special Topics in Computer Science** .....1-4 cr  
*Prereq: Consent of instructor. Freq: Occasionally.*  
 Advanced topics in computer science with applications.
- 492 Practicum in Web Development**.....2 cr  
*Prereq: Consent of instructor. Freq: Fall, Spring.*  
 Independent work in developing a significant web site or on a specific problem in web development under the supervision of faculty.
- 493 Internship in Computer Science** .....1-2 cr  
*Prereq: Consent of instructor and department chair.*  
*Freq: Fall, Spring.*  
 Participation in the technical activities of an ongoing organization under the joint guidance and supervision of a member of the organization and member of the faculty. Grading will be on a credit/no-credit basis. A student may register and receive credit in this course for a maximum of 6 credits.
- 494 Cooperative Education** .....1-2 cr  
*Prereq: Junior standing and consent of instructor. Freq: Occasionally.*  
 Participation in the Cooperative Education Program offered by the division, which provides alternate classroom and field work experience under faculty supervision. Maximum of 2 credits per work period and up to a total of 6 credits.
- 495 Computer Science Seminar** .....2 cr  
*Prereq: Any 300-level CSCI course or consent of instructor.*  
*Freq: Fall, Spring.*  
 Computer ethics, the computing profession, current trends in information technology, career opportunities; oral presentations included.
- 499 Independent Study** .....1-3 cr  
*Prereq: Consent of instructor and department chair.*  
*Freq: Fall, Spring.*  
 Independent work on a specific problem in computer science under the supervision of faculty.