

Department of Computer Science

Chair: Dr. Patricia Morreale
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The Department of Computer Science prepares students to think critically and creatively; to succeed in challenging careers in computing and information technology, or pursue graduate degrees; to adapt to changing technological and social environments in a global economy.

The department offers three B.S. degree programs:

- Computer Science (accredited by the Computing Accreditation Commission of ABET, www.abet.org [Union campus only])
- Computer Science (Information Systems Option)
- Information Technology

and a graduate program, an M.S. in Computer Information Systems.

These programs prepare technically oriented professionals for leadership and management positions in business, education, and government or graduate studies. Our primary purpose is to provide technology and research related undergraduate and graduate programs to support the career goals of individuals entering and advancing in technical and managerial positions at all levels in the computing and information technology fields.

Computer science faculty are actively engaged in ongoing research activities and undergraduate student researchers are included in this effort. The department recently received highly competitive National Science Foundation (NSF) grants for scholarship and equipment. Additional department research funding has been provided by Google and the Computing Research Association, as well as private industry.

An M.S. degree in Computer Information Systems is available as part of a 5-year B.S. CS/M.S. CIS program. Please see more information at the department website: www.kean.edu/~compsci

For information regarding College/program mission and student learning outcomes please see <http://www.kean.edu/KU/CNAHS-Mission-and-SLOs>

COMPUTER SCIENCE CLASSROOMS

The Department of Computer Science classes have a maximum size of 20 students per class.

Hardware: Over a hundred machines are distributed across five dedicated classrooms. Each classroom is equipped with twenty-one networked computers, an overhead LCD projector, a presentation screen, printing capability, and Internet access as well as local access and whiteboard space for presentations. The primary instructional rooms each have twenty-one Dell Optiplex 790 machines with dual-boot option settings, permitting students to work in either Windows or Linux. An additional dedicated classroom has twenty-one iMac machines [2@24" (2.8 GHz) and 19@20"

(2.66 GHz), running dual-boot option settings, permitting students to work in OS X or Windows] and one Dell workstation, in addition to the technology classroom teaching suite (projector/board/screen). A networked HP Laserjet 84250n printer is in each classroom.

Software: Dual boot Linux and Windows. Microsoft Office 2010, with Access, Excel, Powerpoint, Project Visio, and Word is available. Java, C, C++, and Visual Studio are available, along with other programming packages and utility programs.

COMPUTER SCIENCE RESEARCH LABORATORIES

The Computer Science Department maintains a teaching environment, accessible via login from the classroom and campus laboratories on the following machine:

Dell PowerEdge R710 2 CPUs (2.4 Quad Core Xeon), 24GB RAM 3TB RAID;

Dell PowerEdge 2950: 2 CPUs (2.0GHz Quad Core Xeon), 10GB RAM and 1TB RAID;

Dell PowerEdge 2950: 2 CPUs (2.0GHz Quad Core Xeon), 4GB RAM and 3TB RAID and

The **High-Performance Computing Laboratory** (managed by the Computational Science Group, part of the Department of Computer Science at Kean University) has one large cluster, funded by a NSF MRI grant. The cluster is available for student and faculty researchers and is composed of a 130 node (1040 core) Beowulf Cluster. Hardware: Dual 2.66 GHz Quad Core Xeon CPU, 2GB RAM per core, 3TB HD. Software: Linux, MPICH.

The **Network Laboratory**, utilized by student researchers for hands-on projects associated with human-computer interaction (HCI), multimedia and mobile application development, networking configurations and network programming experience, includes 6 workstations (2@2.66 GHz and 4@3GHz), and a variety of telecommunications equipment and software. A wireless testbed of 10 Oracle Java SPOTs and 6 Crossbow sensors are used for distributed data collection and data mining. Two brain-computer interface (BCI) headsets are available for student research.

The **Virtual Reality Laboratory**, used by student researchers to conduct projects in virtual reality, augmented reality, human-computer interactions maintains two PC workstations (2.8GHz, 4GB RAM, and 500GB HD), two Z800 3D Visor Head-mount displays, two DG5-VHand Data Gloves, one Phantom Omni Haptic Device, one 35" Multitouch Surface + software, and the CAVE Automatic Virtual Environment for 3D immersive visualization environment.

The **Electronics Laboratory** is used by faculty for telecommunications research, circuit design and systems investigation, and support senior research projects. The lab maintains a variety of electronics testing and fabrication equipment, and twenty-one PC workstations running Windows and development software tools.

ADMISSION REQUIREMENTS:

The Department of Computer Science has formally adopted the following standards for admission to all options of the Computer Science major:

1. Minimum cumulative GPA of 2.5 at the time of admission to the major.
2. At least 9 credits of CPS courses with a grade of "C" or better in each and these credits must have been taken at Kean University.

Transfer credit policy: Transfer credit is evaluated during admission, using university standards and www.njtransfer.org. Department evaluation of transfer credit is conducted by the Department Chair or designated representative. Coursework to be transferred to Kean is evaluated as equivalent work based on course numbering, pre-requisites, co-requisites, catalog description, and supporting materials. Any exceptions are documented.

B.S. DEGREE COMPUTER SCIENCE

Computer science students are prepared to think critically and creatively to succeed in challenging careers in computing or pursue graduate degrees by applying knowledge of computing and mathematics to analyze problems for the identification, design, and implementation of computer-based solutions to adapt to the changing technological and social environments in a global economy. The B.S. Computer Science degree is accredited by the Computing Accreditation Commission of ABET, www.abet.org (Union campus only).

GENERAL EDUCATION 36

FOUNDATIONS REQUIREMENTS 13

GE	1000	Transition to Kean ¹	1
OR			
GE	3000	Transfer Transitions ¹	1
ENG	1030	College Composition	3
*MATH	1054	Precalculus #	3
COMM	1402	Speech Communication	3
GE	2024	Research and Technology	3

DISCIPLINARY/INTERDISCIPLINARY DISTRIBUTION REQUIREMENTS

<i>Humanities</i>	6
*ENG 2403 World Literature	3
(Select one course from below)	
Fine Arts or Art History	3
Philosophy or Religion	3
Foreign Languages	3
Music or Theatre	3
Interdisciplinary	3
<i>Social Sciences</i>	6
*HIST 1062 Worlds of History	3
(Select one course from below)	
Psychology	3
Economics or Geography	3
Political Science	3
Sociology or Anthropology	3
Interdisciplinary	3

Science & Mathematics	8
CPS 1231 Fund. of Computer Science**	4
Lab Science I (Bio/Chem/Phy)	4

G.E. AND MAJOR CAPSTONE

CPS 4951 Sr. Project or CPS 4961 Senior Research	3
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ADDITIONAL REQUIREMENTS***32/36

Lab Science II (Bio/Chem/Phy)	4
TECH 2920 Computer Systems	3
ENG 3091 Technical Writing	3
MATH 2110 Discrete Structures	3
MATH 2526 Applied Statistics	3
MATH 2415 Calculus I	4
MATH 2416 Calculus II	4
OR	4
MATH 2995 Matrix & Linear Alg.	3

Select one from MATH 3120, 3155, 3225, 3415, 3455, 3544, 3815, or 3940 3

Select two Math/Science electives: (Math elective 2xxx-4xxx level only)

Math/Science elective	3/4
Math/Science elective	3/4

COMPUTER SCIENCE MAJOR*** 41

MAJOR CORE REQUIREMENTS 14

CPS 2231 Comp Org. and Prog.	4
CPS 2232 Data Structures	4
CPS 2390 Org. & Architecture	3
CPS 3250 Comp Operating Systems	3

MAJOR CONCENTRATION REQUIREMENTS 12

CPS 3440 Analysis of Algorithm or	3
CPS 4501 Formal Lang. & Automata	3
CPS 3962 OO Analysis & Design (WE)	3
CPS 4150 Computer Architecture or	3
CPS 4200 Systems Programming	3
CPS 4222 Principles of Networking	3

MAJOR ELECTIVES 15

15 credits in Computer Science, at the 3000 level or above selected with approval of departmental advisor. CPS 3150 is recommended.

FREE ELECTIVES 11/15

(50% of free electives must be taken at the 3000-4000 level)
(ID 1400 Computing in Modern Society for 3 credits is recommended if Math 1000 is needed)

TOTAL 124

Note on Free Electives

CPS 4999 Cooperative Education may be counted as a free elective (no more than 3 S.H.). There are four prerequisites for CPS 4999 which are listed on the program guidesheet.

¹ University Requirement for Graduation for all undergraduate students that must be satisfied in one of two ways: Complete GE 1000 (all freshmen and transfers entering with 0-29 credits)

OR GE 3000 (transfers entering with 30 credits or more).

Students eligible to take MATH 2415 Calculus based on their placement test may take that course in place of Math 1054. In that case, MATH 2415 will fulfill the Distribution requirement and the student may take an additional three credits in Free Electives to total 124 S.H.

* General Education Required

** Students who have had prior programming experience may enter CPS 2231 directly. In this case, CPS 2231 will be counted as the Distribution requirement and the student may take another 4 credits in Free Electives to total 124 S.H.

***All major courses, additional requirements and concentration courses, including the capstone, require a grade of C or better.

B.S. DEGREE COMPUTER SCIENCE

OPTION: INFORMATION SYSTEMS

This option, with an emphasis on information systems, prepares students to design, develop, and manage systems in large enterprises, including business environments.

GENERAL EDUCATION 35

FOUNDATIONS REQUIREMENTS 13

GE 1000 Transition to Kean ¹	1
OR	
GE 3000 Transfer Transitions ¹	1
ENG 1030 College Composition	3
MATH 1000 Algebra for College Students #	3
COMM 1402 Speech Communications	3
GE 2024 Research and Technology	3

DISCIPLINARY/INTERDISCIPLINARY DISTRIBUTION REQUIREMENTS

Humanities	6
*ENG 2403 World Literature (Select one course from below)	3
Fine Arts or Art History	3
Philosophy or Religion	3
Foreign Languages	3
Music or Theatre	3
Interdisciplinary	3
Social Sciences	6
*HIST 1062 Worlds of History (Select one course from below)	3
Psychology	3
Economics or Geography	3
Political Science	3
Sociology or Anthropology	3
Interdisciplinary	3
Science & Mathematics	7
*MATH 1054 Precalculus ##	3
Lab Science I (Bio/Chem/Phy)	4
*Required Distribution Course	

G.E. AND MAJOR CAPSTONE

CPS 4951 Senior Project or CPS 4961 Senior Research	3
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ADDITIONAL REQUIREMENTS*** 27-28

COMM 2405 Public Speaking	3
ENG 3091 Technical Writing	3
MATH 2110 Discrete Structures	3
MATH 2415 Calculus I or MATH 2400 Cal for Biz	4/3
MATH 2526 Applied Statistics	3
TECH 2925 Web Client-Side Programming or	3
Lab Science II (Bio/Chem/Phy)	4
Select one of the approved 3 course tracks:	9

Accounting & Finance:

ACCT 2200 Accounting I	3
FIN 3310 Mgt. Corp. Finance I	3
ACCT 2210 Accounting II or FIN 3311	3

Quantitative Management:

ACCT 2200 Accounting I	3
MGS 2110 Quantitative Methods	3
MGS 4110 Operations Research	3

Web Systems:

GC 1000 Computer Graphics Design I	3
GC 2000 Computer Graphics Design II	3
TECH 3601 New Media Programming I	3

COMPUTER SCIENCE MAJOR (INFORMATION SYSTEMS OPTION)*** 42

MAJOR CORE REQUIREMENTS 18

CPS 1231 Fund. of Computer Science**	4
CPS 2231 Comp Org. and Prog.	4
CPS 2232 Data Structures	4
CPS 2390 Org. & Architecture	3
CPS 3250 Comp Operating Systems	3

CONCENTRATION REQUIREMENTS 12

CPS 3351 Info. Systems Programming	3
CPS 3740 Database Mgmt Systems	3
CPS 3962 OO Analysis & Design (WE)	3
CPS 4931 Distributed Systems Apps	3

MAJOR ELECTIVES 12

12 credits in Computer Science, at the 3000 level or above selected with approval of departmental advisor.

FREE ELECTIVES 19-20

(50% of free electives must be taken at the 3000-4000 level)
(ID 1400 Computing in Modern Society for 3 credits is recommended if Math 1000 is needed)

TOTAL 124

Note on Free Electives

CPS 4999 Cooperative Education may be counted as a free elective (no more than 3 S.H.). There are four prerequisites for CPS 4999 which are listed on the program guidesheet.

¹ University Requirement for Graduation for all

undergraduate students that must be satisfied in one of two ways: Complete GE 1000 (all freshmen and transfers entering with 0-29 credits) OR GE 3000 (transfers entering with 30 credits or more).

Students eligible to take Math 1054 Precalculus based on their placement test may take that course in place of Math 1000 and take an additional three credits in Free Electives to total 124 S.H.

Students eligible to take Math 2415 Calculus I based on their placement test may take that course in place of Math 1054. In that case, Math 2415 will fulfill the Distribution requirement and the student may take an additional three credits in Free Electives to total 124 S.H.

** Students who have had prior programming experience may enter CPS 2231 directly. In this case, CPS 2231 will be counted as the Distribution requirement and the student may take another 4 credits in Free Electives to total 124 S.H.

***All major courses, additional requirements and concentration courses, including the capstone, require a grade of C or better.

MINOR IN COMPUTER SCIENCE†

TOTAL CREDITS IN COMPUTER SCIENCE 21/20

REQUIRED COURSES 12

CPS 1231	Fund. of Computer Science**	4
CPS 2231	Comp Org. and Prog.	4
CPS 2232	Data Structures OR	4
CPS 2240	IT Data Structures	3

CPS ELECTIVES 9

3 Computer Science courses at the 2000 level or above.

SUPPORTING COURSES 9

*MATH 1000	College Algebra	3
*MATH 1054	Precalculus	3
MATH 2110	Discrete Structures	3

*Waived for students who have completed the equivalent of this course in high school.

†All minor required courses, CPS electives and supporting courses, require a grade of C or better.

COMPUTER SCIENCE COURSES

CPS 1010 Introduction to Computing Systems (1)

An introduction to the computing systems used in Computer Science classes at Kean. System access, file manipulation, program compilation, and features unique to the university systems are presented. Required for Computer Science and Technology majors who have received transfer credit for CPS 1231. Offered only on a Pass/Fail basis. (E)
Prerequisites: CPS 1231 credit or the equivalent.

CPS 1032 Microcomputer Applications (3)
A study of computer literacy concepts, and organization of data in files and databases for information generation. Emphasis is on the proper use of microcomputer application packages to fulfill the information needs of organizations and support professional problem solutions. Students will be introduced to a variety of microcomputer application packages. Not for credit in Computer Science Major. (E)
Prerequisites: ENG 1030 and Math 1000 or Math 1010, 1016, or 1030.

General Education Distribution Course

CPS 1231 Fundamentals of Computer Science (4)

Fundamental computing concepts, components and processes; hardware and software components; communications and information systems; use of systems software; problem solving with application software; introduction to design of algorithms using a high-level programming language. (3 hr. lec./1 hr. lab.) (E)
Prerequisite: MATH 1000. ENG 1030 or equiv.

General Education Distribution Course

CPS 2231 Computer Organization and Programming (4)

Fundamental computing concepts and processes; use, development, analysis and style of algorithms involving a high-level programming language; object-oriented programming concepts. (3 hr. lec./1 hr. lab.) (E)
Prerequisites: CPS 1231 and MATH 1054.

CPS 2232 Data Structures (4)

The theory of Abstract Data Types (ADTs); applications and implementations of the classical ADTs including lists, sets, stacks, queues, hash tables, trees, and graphs; recursion; elementary algorithm analysis. (3 hr. lec./1 hr. lab.) (E)
Prerequisite: CPS 2231
Co-requisite: MATH 2110.

CPS 2240 IT Data Structures and Applied Programming (3)

Applied fundamental data structures and algorithms; user interface design and implementation; human-computer interaction; application programming interfaces involving data structures, graphical user interface, networking, multithreading, and event-driven model; use of integrated development environments, documentation generators, and debugging tools. (FA)
Prerequisite: CPS 2231.

CPS 2310 Topics in Programming Language (1)

An in-depth exploration of a selected programming language not covered in Kean's computing curriculum. Details of the language, syntax, semantics and applications will be discussed. May be taken more than once for credit. Prior programming experience required.
Prerequisites: CPS 2231.

CPS 2390 Organization and Architecture (3)

Fundamental concepts of assembly language programming as a means of introducing computer architecture. Data representation, logic gates, CPU and memory organization, the instruction cycle, addressing modes, high and low level code equivalence from assignments and iteration to subroutine and parameter passing. (E)
Prerequisite: CPS 2231
Co-requisite: MATH 2110.

CPS 3150 Advanced Programming Techniques (3)

Advanced programming concepts and techniques; team-oriented systematic development of large-scale programs; use of integrated development environments, revision control systems; documentation generators, profiling and debugging tools; application programming interfaces involving data structures, graphical user interface, networking, multithreading, and event-driven model. (FE)
Prerequisite: CPS 2232.

CPS 3250 Computer Operating Systems (3)

Historical development of operating systems, types of operating systems, CPU scheduling, memory management, file organization and access, concurrent processes, I/O organization. (E)
Prerequisites: CPS 2232 and CPS 2390.

CPS 3276 Local Area Networks (3)

An introduction to operation and software design for local area networks: ISO/IEEE network standards, survey of network operating systems, setting up a network, LAN programming at the system level, NETBIOS and assembly level network programming.
Prerequisite: CPS Core.

CPS 3310 Programming Languages (3)

A study of the characteristics of programming languages, with an emphasis on the ongoing evolution of programming languages, including the classification and utility assessment of specific programming languages. (FA)
Prerequisite: CPS 2232 or CPS 2240

CPS 3351 Information Systems Programming (3)

Information systems computing concepts and processes using a high level visual programming language; information systems requirements, design, construction and testing. (FA)
Prerequisite: CPS 2232.

CPS 3410 Applied Algorithms and Data Structures (3)

An investigation into the application of algorithms using a high level language. The application of structured programming concepts in a "hands-on" environment. The investigation and development of projects emulating the "real world." (SP)
Prerequisite: CPS 2232.

CPS 3411 Competitive Programming (1)

Competitive programming strategy and tactics. Programming team organization. Use of automatic submission/judging software in programming competitions. Students are expected to participate in the annual ACM Regional Collegiate Programming Contest. Offered in the Fall Semester. May be repeated for up to a total of 3 credits. (FA)
Prerequisite: CPS 3410 or permission of instructor.

CPS 3440 Analysis of Algorithms (3)

Algorithm analysis techniques. Algorithms involving advanced data structures, sorting, trees, and graphs. NP-Completeness. (FA)
Prerequisites: CPS 2232

CPS 3498 Computer Security (3)

Information and coding, measurement and transmission of information, redundancy, noise, data bank security in government and industry, computer network weaknesses, data encryption. (FA)
Prerequisite: CPS 2231.

- CPS 3500 Web Programming (3)**
The Internet and the World Wide Web, Unix essentials, TCP/IP, MIME, browsers, HTML, the Winsock API, Introduction to PERL, CGI, Web server configuration and administration, JavaScript and Java, Client/server computing on the Web. (SP)
Prerequisite: CPS 2232.
- CPS 3740 Database Management Systems (3)**
Fundamental concepts and standards for database management systems; database design; database implementation; storage and performance considerations; transaction processing concepts; application of database management systems. (E)
Prerequisite: CPS 2232.
- CPS 3884 Functional Programming (3)**
Lambda Calculus; recursion; continuations; closures; evaluation; functional programming in COMMON LISP.
Prerequisite: CPS 2232.
- CPS 3962 Object-Oriented Analysis and Design (3)**
Design and analysis of Computer Information Systems. Topics will include Systems Development Life Cycle, Design and Analysis tools, CASE tools, File and Database systems. (SP)
Prerequisites: CPS Core.
Writing Emphasis Course
- CPS 4130 Data Communications (3)**
Data communication terminology and concepts; identification of hardware and software components; networking; survey and usage of protocols; security.
Prerequisite: CPS Core.
- CPS 4150 Computer Architecture (3)**
The fundamental concepts of modern machine organization and the implementation of instructions with emphasis on the major factors determining computer performance. (FA)
Prerequisite: CPS 2390.
- CPS 4200 Systems Programming (3)**
Module development of modern system functions and extensions. Topics include: multi-tasking, windowing, large address spaces, interrupts operating systems such as UNIX and Windows. (SP)
Prerequisite: CPS 3250.
- CPS 4220 Compiler Design (3)**
A practical and theoretical introduction to compilers for high-level programming languages with emphasis is placed on accepted techniques for constructing compilers.
Prerequisite: CPS 3250.
- CPS 4222 Principles of Networking (3)**
Network design, routing, and implementation, including wireless, multimedia, and mobile networks; security in computer networks, and network management. (SP)
Prerequisites: CPS 3250.
- CPS 4301 Software Engineering (3)**
Examination of the software development process. The course includes the organization of software development projects, testing, security and privacy, and the legal aspects of software development. (FA)
Prerequisites: CPS Core.
Writing Emphasis Course
- CPS 4222 Principles of Networking (3)**
Mathematical preliminaries, electromagnetic phenomena, encoding methods, error detection and correction, network topologies, frame formats, routing and the OSI model, LAN, MAN, and WAN characteristics, mathematical modeling of networks. (SP)
Prerequisites: CPS 3250.
- CPS 4301 Software Engineering (3)**
The study of Software Engineering methodologies for the development of quality, cost effective, schedule-meeting software. (FA)
Prerequisites: CPS Core.
Writing Emphasis Course
- CPS 4408 Computer Graphics Algorithms (3)**
Applications of Computer Graphics; Input and Output Devices; Line Drawing Algorithms; Windows; Viewports; Clipping; Two-Dimensional Transformations; Three-Dimensional Transformations; Projections; Animation.
Prerequisites: CPS 2232 and MATH 2526.
- CPS 4410 Systems Simulation (3)**
Simulation as a problem solving technique; modeling; queuing models; random number generators; testing of random number generators; the Monte Carlo technique; generating random varieties; a simulation package. (FE)
Prerequisites: CPS 3250 , MATH 2526
- CPS 4501 Formal Language and Automata Theory (3)**
The study of the concepts and theory of Formal Language and the relationship to automata; types of grammars; Turing machine. (SP)
Prerequisites: CPS 2232.
- CPS 4601 Human Computer Interaction Design (3)**
Knowledge and skills for conceptualizing, designing, implementing, and evaluating software applications and computing technologies for the benefit of the user. Human, technological, and organizational concerns are addressed in project-based learning experiences. (SP)
Prerequisite: CPS 3250 or Tech 2925
- CPS 4801 Artificial Intelligence (3)**
Representation of knowledge; reasoning models; language learning. (SE)
Prerequisites: CPS 3250.
- CPS 4881, 4882 or 4883 Independent Study in Computer Science (3)**
Advanced topics in Computer Science which are not available in courses offered by during the semester. An independent course of study is developed by the student under the direction of a faculty member in the department; an independent study contract is used. May be repeated up to three times; can be used as a major elective. (AN)
Prerequisite: Faculty Permission
- CPS 4893 Senior Seminar in Computer Science (3)**
An in-depth exploration of one or more current issues in Computer Science, involving the application of a variety of concepts taken from throughout the Computer Science curriculum.
Prerequisite: Completion of 30 semester hours in Computer Science at the 2000 level or above.
- CPS 4931 Distributed Systems Applications (3)**
Principles and concepts along with the design and development of distributed systems applications. Concurrent operating systems and database requirements for the development of a transaction processing application in a network environment, using the client/server paradigm. (FA)
Prerequisite: CPS Core and CPS3962.
- CPS 4951 Senior Project (3)**
A software implementation course that integrates theory and practice in design and development of a large computer information system. The student will choose a project, and then research, design, implement, test, document, demonstrate and present results to the class. The instructor must approve the project. (SP)
Prerequisites: Completion of 30 semester hours in Computer Science at the 2000 level or above.
- CPS 4961 Senior Research (3)**
A student(s) will investigate and contribute to a specialization area of the research of a faculty member, taken from any Computer Science specialty. This will give the student real experience in a Computer Science research team.
Prerequisites: Completion of 30 semester hours in Computer Science at the 2000 level or above.
- CPS 4980, 4981, 4982 Special Topics in Computer Science (3)**
Research study of areas in computer science influenced by contemporary developments as well as interests and needs of students majoring in computer science. A maximum of nine semester hours may be taken in this area towards major electives.
Prerequisite: Permission of instructor.
- CPS 4999 Cooperative Education in Computer Science (3)**
Practical field experience providing resources other than those within the college environment. These credits cannot be used towards the 39 credits of course work required for computer science majors. (E)
Prerequisites: Minimum completion of CPS Core; minimum 3.00 GPA in major; minimum 2.75 cumulative GPA; approval of advisory committee.