Computer Science

Associate in Science Degree

The Associate in Science degree in Computer Science prepares students for transfer to a bachelor’s-level degree program in Computer Science. Degree requirements are based on national standards. Core Computer Science knowledge and skills are acquired in the following courses: Computer Science I, II and III (Data Structures and Algorithms), Computer Assembly Language, and Software Engineering.

Today most career opportunities in Computer Science require a minimum of a bachelor’s degree. This is due to not only increased competition for IT jobs on a worldwide basis but also because the demands of an IT position require a solid foundation in several and varied areas of computing, a broad range that simply cannot be completed in two years. The US Bureau of Labor Statistics predicts that computing will have 1,240,100 job openings by 2022 and that the growth rate of job opportunities is much faster than average for all occupations. For example, it projects a 22.8 percent employment growth for software developers between 2012 and 2022. Some examples of positions available to B.S. Computer Science degree graduates include programmer, database manager, game developer, web developer, mobile applications developer, systems engineer, software engineer and systems analyst.

There are numerous opportunities to transfer to a four-year institution and study Computer Science. The following public and private New Jersey colleges and universities offer a bachelor’s-level Computer Science degree: The College of New Jersey, Kean University, Montclair State University, New Jersey City University, Ramapo College, Richard Stockton State College, Rowan University, Thomas Edison State College, William Paterson University, New Jersey Institute of Technology, Rutgers University, Drew University, Fairleigh Dickinson University, Monmouth University, Princeton University, College of Saint Elizabeth, Saint Peter’s College, Seton Hall University and Stevens Institute of Technology.

For more information, visit the Department of Information Technologies (http://www.ccm.edu/academics/divdep/bmet/department-of-information-technologies) website.

Degrees

AS Computer Science
(P2500)

General Education Foundation

<table>
<thead>
<tr>
<th>Category</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Communication</td>
<td>ENG-111</td>
<td>English Composition I</td>
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<tr>
<td>Communication</td>
<td>ENG-112</td>
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<td>Math-Science-Technology</td>
<td>MAT-123</td>
<td>Precalculus</td>
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<tr>
<td>Social Science/Diversity</td>
<td>MAT-131</td>
<td>Analytic Geometry and Calculus I</td>
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<td>MAT-132</td>
<td>Analytic Geometry and Calculus II</td>
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Choose from General Education list (Humanities) 1

<table>
<thead>
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<tr>
<td>Laboratory Science Sequence</td>
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Computer Science Core

<table>
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<tr>
<th>Course Code</th>
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<tr>
<td>CMP-128</td>
<td>Computer Science I</td>
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<tr>
<td>CMP-129</td>
<td>Computer Science II</td>
<td>3</td>
</tr>
<tr>
<td>CMP-230</td>
<td>Computer Architecture and Assembly Language</td>
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</tr>
<tr>
<td>CMP-233</td>
<td>Data Structures and Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CMP-280</td>
<td>Software Engineering</td>
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CIS Electives

<table>
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<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>MAT-225</td>
<td>Discrete Mathematics</td>
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</table>

Total Credits

60

1 Students should consult their academic advisors when selecting these courses.

Faculty

Colleen Bamford
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B.S., Pace University
## Certificates of Achievement

### Information Security

**A Certificate of Achievement within Computer Information Systems**  
(P0354)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CMP-120</td>
<td>Foundations of Information Security</td>
<td>3</td>
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<tr>
<td>CMP-124</td>
<td>Network Security</td>
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<tr>
<td>CMP-125</td>
<td>Information Security Management</td>
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<td>Restricted Electives</td>
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Select two of the following:
- CJS-116 Introduction to Criminology
- CJS-121 Criminal Justice System
- CMP-128 Computer Science I
- CMP-160 Digital Forensics I
- CMP-243 Ethical Hacking and Systems Defense
- CMP-261 Digital Forensics II
- CMP-280 Software Engineering
- CMP-292 Special Topics in Information Technology
- CMP-293 Special Topics in Information Technology II
- PHL-114 Ethics
- TEL-110 Routing I (CISCO)
- TEL-120 Routing II (CISCO)

**Total Credits**: 18

1 Students should consult their academic advisors when selecting these courses.

### Web Development

**A Certificate of Achievement within Computer Information Systems**  
(P0352)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tr>
<td>CMP-239</td>
<td>The Internet and Web Page Design</td>
<td>3</td>
</tr>
<tr>
<td>CMP-244</td>
<td>Web Design II</td>
<td>3</td>
</tr>
<tr>
<td>CMP-245</td>
<td>Web Design Tools</td>
<td>3</td>
</tr>
<tr>
<td>Restricted Electives</td>
<td></td>
<td>6</td>
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</tbody>
</table>

Select two courses from the following list:
- CMP-120 Foundations of Information Security

**Total Credits**: 18

1 Students should consult their academic advisors when selecting these courses.

### Courses

<table>
<thead>
<tr>
<th>Course</th>
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<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMP-000</td>
<td>Technology Literacy Test. 0 Credits.</td>
<td></td>
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</tbody>
</table>

**LECT hrs**: Technology Literacy Test.
Additional Fees: Course fee applies.

CMP-126. Computer Technology and Applications. 4 Credits.
LECT 3 hrs, LAB 2 hrs
This general education course teaches: (1) basic computer-use concepts such as hardware and peripherals, file organization and management, and operating system use; (2) Internet use, browsers and search engines; (3) software applications including word processing, spreadsheet, electronic slideshow presentations, database use and calendaring; (4) netiquette, ethics and copyright policies; (5) downloading and installing software and plug-ins; (6) communications technologies including email, blogs and Web technologies; (7) personal computer and information security; and (8) career exploration, job search strategies and portfolio development. Students are required to complete a series of laboratory assignments that illustrate skills and use technologies in the areas listed including a cross-applications/technologies project. Not for Information Technologies Department majors. Students will not receive credit towards graduation for more than one of the following courses: CMP-126, CMP-135, or BUS-119.
Additional Fees: Course fee applies.

Additional Fees: Course fee applies.

Additional Fees: Course fee applies.

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Additional Fees: Course fee applies.

Additional Fees: Course fee applies.
CMP-135. Computer Concepts With Applications. 3 Credits.
LECT 2 hrs, LAB 2 hrs
This general education course is designed to provide familiarity with current software for word processing, spreadsheet, presentation and database applications. An introduction to web browsers, computer and information security, social impact of computing, concepts in computer hardware, and application and system software is also included. Students are required to complete a series of laboratory assignments that illustrate skills in using the above software applications. Students must allocate time to complete assignments using the same software (available on campus). Not for Computer Information Systems majors. Students will not receive credit towards graduation for more than one of the following courses: CMP-135, CMP-126 or BUS-119.
Additional Fees: Course fee applies.

CMP-149. Critical Game Play. 3 Credits.
LECT 2 hrs, LAB 1 hr
This is an introductory course designed to increase games literacy and foster a shared understanding of the history of games, culturally and aesthetically. A thorough knowledge of the games that have shaped this industry is integral for all students considering entering the field. The class covers a wide spectrum of digital and analogue games. Students will take part in discussions and lectures. They will compose a short analysis of different games and justify their stances in group-wide presentations. The primary activity of the class is critical play - playing games and analyzing them in order to better understand the medium on a personal and professional level.
Additional Fees: Course fee applies.

CMP-150. Game Programming. 3 Credits.
LECT 2 hrs, LAB 2 hrs
This course covers fundamental game programming techniques using an industry-standard scripting language. Students learn how to use a popular game engine to build game programs. Topics include sprites, animation, collisions, timers, game state variables, player input, audio, user interface design and storyboarding. Laboratory work includes several game element programming exercises, leading up to a final game project.
Prerequisites: CMP-128 or equivalent
Additional Fees: Course fee applies.

CMP-160. Digital Forensics I. 3 Credits.
LECT 2 hrs, LAB 2 hrs
This course introduces the student to the fundamental concepts of computer forensics. By conducting a detailed examination of data media for structure, file system type, volumes, lost and hidden areas, the student will develop the ability to collect and analyze computer data for digital evidence. An understanding of specific resources and an exploration of software tools available for data recovery and forensic analysis will be conducted in a laboratory setting. Upon completion of this course, the student will demonstrate various data recovery techniques as the basis for forensic evaluation.
Additional Fees: Course fee applies.

CMP-170. Mobile App Design. 3 Credits.
LECT 2 hrs, LAB 2 hrs
This course introduces students to the design and development of mobile applications. Students will learn how to install and use a leading mobile app software development kit, design the user interfaces using different design patterns, create and edit app resources, and design and develop native source code. Students will strengthen their programming skills in user input, variables, operations, decision control structures, methods, lists and arrays. Audio, images, animation and other application controls will be incorporated into apps. Other topics include testing, deployment and publishing apps.
Prerequisites: CMP-128
Additional Fees: Course fee applies.

CMP-200. Computer Operating Systems and Utilities. 3 Credits.
LECT 3 hrs, LAB 1 hr
This is an introductory course in personal computer operating systems. Topics include the features and characteristics of operating system software; installation and configuration including customization, file organization and management; memory and storage management; control of peripheral devices; troubleshooting; networking wizards; and the use of utilities to monitor system performance, backup data and optimize disks. Laboratory assignments provide hands-on opportunities for students to apply the information related in lectures.
Additional Fees: Course fee applies.

CMP-205. Database Programming (MS Access). 3 Credits.
LECT 3 hrs, LAB 1 hr
It is recommended that students take CMP-207 Electronic Spreadsheets before taking CMP-205. This course is designed to develop skill in the use of a leading database management system. Topics include the design and maintenance of relational databases and their objects (tables, queries, forms and reports). Also covered is the use of macros to implement procedures. The final portion of the course covers automation techniques by introducing the Visual Basic for Applications programming language and the use of this code to create a user-friendly interface.
Additional Fees: Course fee applies.

CMP-207. Electronic Spreadsheets (MS Excel). 3 Credits.
LECT 3 hrs, LAB 1 hr
It is recommended that students take CMP-207 Electronic Spreadsheets before taking CMP-205. This is a course in problem solving using a popular spreadsheet program. Emphasis is on construction of elementary to moderately complex worksheets; charting worksheet data, database definitions and reporting; and using VBA (Visual Basic for Applications) to construct simple macros.
Additional Fees: Course fee applies.

CMP-209. Introduction to UNIX. 3 Credits.
LECT 3 hrs, LAB 1 hr
This course combines lecture with hands-on training in the UNIX Operating System. Upon successful completion of this course, students are proficient in using the UNIX Operating System commands and utilities. Topics include purpose and functions of an operating system, hierarchical file system, the shell, vi editor, file security, process management, sorting, networking theory and communications, redirection, file security, process management, sorting, networking theory and communications, and an introduction to shell scripts.
Prerequisites: CMP-128 or equivalent
Additional Fees: Course fee applies.
CMP-230. Computer Architecture and Assembly Language. 3 Credits.
LECT 3 hrs, LAB 1 hr
This course is an introduction to computer architecture and assembly language programming. Topics covered include digital logic and data representation, computer architecture and organization, interfacing and input/output strategies, memory architecture, functional organization, and multiprocessing. Students are exposed to basic assembly language programming techniques in laboratory assignments.
Prerequisites: CMP-128 or equivalent
Additional Fees: Course fee applies.

CMP-233. Data Structures and Algorithms. 3 Credits.
LECT 3 hrs, LAB 1 hr
The course includes advanced computer science topics dealing with logical structures of data and the design and analysis of computer algorithms operating on these structures. The course concentrates on data structures such as linked lists, trees, queues, stacks, hash tables and graphs. Algorithms covered include stacks, queues, hash tables, trees, graphs, heaps, sorting and searching. Both iterative and recursive algorithms are explored with analysis of their efficiency. Problems and computer exercises implementing the above structures and techniques are assigned.
Prerequisites: CMP-129 or equivalent and MAT-123 or higher
Additional Fees: Course fee applies.

CMP-235. Advanced UNIX. 3 Credits.
LECT 3 hrs, LAB 1 hr
This is a continuation course in UNIX programming with emphasis on building upon the previously developed skills. Topics include an in-depth coverage of shell scripts, system administration, GUIs, differences and similarities between shells, higher-level programming languages in the UNIX environment, the Internet, sorting, and other advanced topics.
Prerequisites: CMP-209
Additional Fees: Course fee applies.

CMP-237. Visual Basic (VB.Net). 3 Credits.
LECT 3 hrs, LAB 1 hr
This is a fundamental course in object-oriented programming in a Windows environment. Topics include form design, managing controls, handling variables and constants, using decision and loop structures to construct efficient code, handling built-in functions, and simple debugging techniques for detecting errors. Basic fundamentals of classes are introduced.
Prerequisites: CMP-128 or equivalent
Additional Fees: Course fee applies.

CMP-239. The Internet and Web Page Design. 3 Credits.
LECT 3 hrs, LAB 1 hr
This course is an in-depth study of the Internet and its various services that allows students to appreciate the impact of the Internet in society. Students create World Wide Web home pages using strict Hypertext Markup Language, Cascading Style Sheets (CSS) and XHTML. Other current specifications also are discussed.
Additional Fees: Course fee applies.

CMP-241. Database Programming (Oracle). 3 Credits.
LECT 3 hrs, LAB 1 hr
This course uses the rules and syntax of an "industrial-strength" database programming language that can be used on all types of computers. Topics include relational database aspects, data input and validation, creation and maintenance of files, query, user control center, and application generator. Emphasis is on development of programs related to business database applications.
Prerequisites: CMP-128 or equivalent or permission of department chair
Additional Fees: Course fee applies.

CMP-243. Ethical Hacking and Systems Defense. 3 Credits.
LECT 2 hrs, LAB 2 hrs
This course combines an ethical methodology with the hands-on application of security tools, techniques, and methodologies in performing computer system and network security vulnerability - risk analyses - to better help students secure and defend their systems. Topics to be covered include internal and external penetration tests, risk analysis methodology, and security audits. Students are introduced to common countermeasures that effectively reduce and/or mitigate attacks. This class is designed to help students prepare for professional careers in the information security field and the Certified Ethical Hacker (CEH) certification exam.
Prerequisites: CMP-124
Additional Fees: Course fee applies.

CMP-244. Web Design II. 3 Credits.
LECT 3 hrs, LAB 1 hr
This course is a continuation of The Internet and Web Page Design with an emphasis on more advanced concepts and techniques. Topics include Cascading Style Sheets, forms, JavaScript and other current scripting languages. Students learn to work with hosting and web server technology. For their final project, students build a website using these techniques.
Prerequisites: CMP-239
Additional Fees: Course fee applies.

CMP-245. Web Design Tools. 3 Credits.
LECT 2 hrs, LAB 3 hrs
Students learn the leading web design and development tools including the Adobe Creative Suite. Instruction and practice in the suite provides seamless integration and a unified user interface across all tools to streamline multimedia and web development. Through hands-on practice, activities and relevant project application, students develop competence in the use of industry-leading development tools.
Prerequisites: CMP-108 or CMP-128 or CMP-239 or MED-110 or GRD-111
Additional Fees: Course fee applies.

CMP-246. Operating Systems. 3 Credits.
LECT 2 hrs, LAB 2 hrs
This course introduces students to operating systems and their uses and design concerns. Covered are the roles and responsibilities of operating systems including scheduling, concurrency and process synchronization, memory management, file organization and management, and control of peripheral devices. Security and protection topics are also addressed. Laboratory assignments provide interactive learning experiences which demonstrate operating system concepts using programming, operating system commands and scripting.
Prerequisites: CMP-129
Additional Fees: Course fee applies.
**CMP-249. Advanced Web Programming. 3 Credits.**
LECT 2 hrs, LAB 2 hrs
This advanced course in Web Development introduces the student to creating interactive and dynamic Web sites using current Web programming. Building on concepts and principles of computer programming and scripting languages, students will interact with Web server technologies and develop front end, advanced professional Web sites with fully functioning back end support.
**Prerequisites:** CMP-128 and CMP-244
**Additional Fees:** Course fee applies.

**CMP-250. Game Production. 3 Credits.**
LECT 2 hrs, LAB 2 hrs
Working in teams, students combine their game design and programming skills to explore the practical challenges of managing the development of games. Industry-standard software and advanced programming are used in this capstone course to develop a functioning game of the highest professional quality. Emphasis is placed on the game design document, storyboarding, the game production process, user interface and game design, interactive storytelling, character development, 3D animation, special effects, audio, the collaborative process, and usability testing.
**Prerequisites:** CMP-150 or MED-220
**Additional Fees:** Course fee applies.

**CMP-255. Linux. 4 Credits.**
LECT 3 hrs, LAB 1 hr
This is a hands-on course in the administration of a Linux Operating System. Students utilize the command line interface to control the operating system and its utilities. Focus is placed on the file system, user system, file security, process and job management, X-Windows, shells and shell scripting. A POSIX-compliant shell, such as ash, dash, bash or ksh, is introduced. Concepts include redirection, piping, and regular expressions. Upon successful completion of this course, students are proficient in using the Linux operating system, with combined lecture and lab exercises focusing on basic/intermediate skills essential to an IT professional.
**Prerequisites:** CMP-128
**Additional Fees:** Course fee applies.

**CMP-261. Digital Forensics II. 3 Credits.**
LECT 2 hrs, LAB 2 hrs
This advanced course in digital forensics will enable the student to understand advanced file system forensics, the theory of forensic procedures, review of identification, imaging, and authentication, review of FAT file system, NTFS and EXT3 file systems, partitioning, Window's logical analysis, email analysis, and web history analysis conducted in a laboratory setting. Upon completion of this course the student will apply investigative methodology as it applies to data artifacts, including where they are found in computer operating systems, and how they are deployed in digital forensics. The student will perform forensic media acquisition and verification.
**Prerequisites:** CMP-160
**Additional Fees:** Course fee applies.

**CMP-263. Web Development Workflow. 4 Credits.**
LECT 3 hrs, LAB 2 hrs
This course provides students with cutting edge Web development skills to create and maintain Web sites that are modern, responsive, and dynamically delivered across a wide range of devices. Students learn leading Web design and development tools including current industry standard Web interactive tools, Git, JQuery Framework, and content management systems. Instruction and practice on available platforms provide seamless integration and unified interface across all tools to streamline Web development from local development to staging to production. Students will develop competence in the use of industry-leading development tools in building a current, engaging, and dynamic Web site.
**Corequisites:** CMP-239 or MED-110 or GRD-108
**Additional Fees:** Course fee applies.

**CMP-271. Mobile App Programming. 3 Credits.**
LECT 2 hrs, LAB 2 hrs
This second course in a series of mobile app development courses covers advanced design elements and programming constructs. Topics include accessing device resources including the camera, accelerometer, and GPS; utilizing local and networked database services; animation and gaming; accessing background services; file management; designing for multiple devices including wearables; and localization/internationalization and accessibility design. Students will create apps individually and as part of a team and their learning will culminate with the development of a final project that will be of industry-level quality.
**Prerequisites:** CMP-170
**Additional Fees:** Course fee applies.

**CMP-280. Software Engineering. 3 Credits.**
LECT 2 hrs, LAB 1 hr
Software engineering practices are examined in the context of the system development life cycle, comparing traditional structured approach and the object-oriented approach, with the main focus on object-oriented approach. Topics include user stories, use cases, object-oriented modeling, comprehensive project management, the Unified Modeling Language (UML) diagrams, Agile techniques, and user-interface design. Class projects provide students with practice in developing soft skills necessary to work as part of a team. Students participate in a semester-long team project to design an application using system analysis and design techniques.
**Prerequisites:** CMP-128 and one of the following: CMP-129, CMP-150, or CMP-237
**Additional Fees:** Course fee applies.

**CMP-290. Independent Study in Information Technology. 3 Credits.**
LECT 3 hrs
Students, in consultation with the department chair, undertake an in-depth analysis of a selected topic, problem or issue related to information technology or pursue additional computer-related work experience. Students are responsible for developing a statement of goals and strategies, maintaining a weekly log, and preparing a written and oral summary report. Computer Information Systems majors only.
**Prerequisites:** Permission of department chair
**Additional Fees:** Course fee applies.
CMP-291. Special Topics in Information Technology. 3 Credits.
LECT 3 hrs, LAB 1 hr
An examination of selected topics or issues in information technologies. Topics may differ each time the course is offered. Students should consult the department chair for additional information. Computer Information Systems majors only.
Prerequisites: Permission of department chair
Additional Fees: Course fee applies.

CMP-292. Special Topics in Information Technology. 3 Credits.
LECT 3 hrs, LAB 1 hr
An examination of selected topics or issues in information technologies. Topics may differ each time the course(s) is offered. Students should consult the department chair for additional information. Computer Information Systems majors only.
Prerequisites: Permission of department chair

CMP-293. Special Topics in Information Technology II. 1 Credit.
LECT 1 hr
An examination of selected topics or issues in information technologies. Topics may differ each time the course is offered. Students should consult the department chair for additional information. Computer Information Systems majors only.
Prerequisites: Permission of department chair
Additional Fees: Course fee applies.

CMP-296. Cooperative Work Experience-Information Technology (135-300 Hours). 3 Credits.
COOP 3 hrs
This course provides students in the Department of Information Technologies programs with job training and practical experience in a work environment prior to permanent employment amounting to between 135 to 300 hours in duration. The course may be taken in fulfillment of a Computer Information System (CIS) elective. Students desiring to participate in this experience should make their intention known to the department at the beginning of their second semester. Computing majors only.
Prerequisites: Permission of department chair.

CMP-297. Cooperative Work Experience-Information Technology (90-200 Hours). 2 Credits.
COOP 2 hrs
This course provides students in the Department of Information Technologies programs with job training and practical experience in a work environment prior to permanent employment amounting to between 90 to 200 hours in duration. The course may be taken in fulfillment of a Computer Information System (CIS) elective. Students desiring to participate in this experience should make their intention known to the department at the beginning of their second semester. Computing majors only.
Prerequisites: Permission of department chair.