

— processor and disk scheduling. Security and protection mechanisms. (3 lecture, 2 lab hours)

CSCI 146. Systems Architecture (3)

Prerequisites: CSCI 113, 144. An in-depth analysis of one or more operating systems — system data structures, hardware architecture, shell and kernel functions, I/O routines, interrupt handling. Other topics may include parallel hardware architectures, performance analysis.

CSCI 148. Systems Programming (3)

Prerequisites: CSCI 113, 144. Topics include implementation of operating system components and modification of existing systems. Device drivers, memory management, communication networks, and file systems will be examined. Projects will be emphasized.

CSCI 150. Introduction to Software Engineering (3)

Prerequisite: CSCI 41. History, goals, and motivation of software engineering. Study and use of software engineering methods. Requirements, specification, design, implementation, testing, verification, and maintenance of software systems. Team programming. (2 lecture, 3 lab hours)

CSCI 152. Software Engineering (3)

Prerequisite: CSCI 150. In-depth examination of techniques for specification, design, implementation, testing, and verification of software. Human-computer interfaces. Formal methods of software development. Use of software engineering tools for the development of substantial software projects. (2 lecture, 2 lab hours)

CSCI 154. Simulation (3)

Prerequisites: CSCI 41, 60; MATH 75. Simulation as a tool for the study of complex systems in computer science, statistics and operations research. Generating random variables. Review of principles behind and examples of simulation languages.

CSCI 156. Internetworking Systems and Protocols (3)

Prerequisite: CSCI 144 or permission of instructor. Review of underlying network technologies. Application-level interconnections, network architectures, addressing, mapping abstract addresses to physical addresses, routing datagrams, error and control messages, protocol layering, gateways, subnets. Client-server interactions. Upper layers of protocol stacks. (3 lecture hours)

CSCI 164. Artificial Intelligence Programming (3)

Prerequisite: CSCI 117. Introduction to problem-solving methods from artificial intelligence. Production systems. Knowledge-based systems. Machine learning. Topics chosen from fuzzy logic, neural network models, genetic algorithms. Verification, validation, testing.

CSCI 166. Principles of Artificial Intelligence (3)

Prerequisite: CSCI 164. Analysis of knowledge-based and neural models, including self-organization, sequential learning models, neurally inspired models of reasoning and perception. Integration of different paradigms.

CSCI 172. Computer Graphics (3)

Prerequisites: MATH 76, CSCI 41, and (CSCI 112 or ECE 118). Hardware devices, raster graphics, device independence, graphic data structure and representations, interactive techniques, and algorithms for the display of two- and three-dimensional objects, graphic transformations, graphics standards, modeling, animation, VRML, and scientific visualization. (3 lecture hours)

CSCI 173. Advanced Computer Graphics (3)

Prerequisite: CSCI 172. Visible surface algorithms, lighting and shading, textures, curves and surfaces, computer-aided design, advanced modeling techniques, solid modeling, advanced raster graphics architecture, advanced geometric and raster algorithms, user interface, ray tracing, animation techniques, and fractals. (2 lecture, 2 lab hours)

CSCI 174. Design and Analysis of Algorithms (3)

Prerequisites: CSCI 115, 119. Models of computation and measures of complexity, algorithms for sorting and searching, set representation and manipulation, branch and bound, integer and polynomial arithmetic, pattern-matching algorithms, parsing algorithms, graph algorithms, NP-complete problems.

CSCI 176. Parallel Processing (3)

Prerequisites: CSCI 113, 144. Characteristics, and classification of computer systems. Notion and realization of parallelism. Pipeline design techniques. Vector processing. Array processing. Multiprocessing. Multiprocessing vs. multicomputers. Shared memory vs. message-passing, problem solving, and parallel programming. Architectural trends.

CSCI 177. Distributed Computer Systems (3)

Prerequisites: CSCI 113, 144. Characteristics and design of distributed systems. Application and network interconnectivity. Enterprise computing. Distributed data and transaction management. Distributed operating systems. Distributed problem solving and programming.

CSCI 186. Formal Languages and Automata (3)

Prerequisite: CSCI 119. Introduction to formal language theory. Context-free grammars, context-sensitive grammars, unrestricted grammars, graph grammars, and rewriting systems; properties of context-free languages, push-down automata.

CSCI 188. Introduction to Computability (3)

Prerequisite: CSCI 119. Introduction to computability and complexity. Turing machines, recursive functions, reduction, undecidability, classes P and NP, and intractable problems.

CSCI 190. Independent Study (1-3; max total 6)

See *Academic Placement — Independent Study*. Approved for *RP* grading.

CSCI 191T. Proseminar (1-3; max total 15)

Prerequisite: permission of instructor. Presentation of selected topics in computer science.

CSCI 194. Cooperative Education (1-4; max total 8)

Prerequisites: courses appropriate to the work experience; approval by major department cooperative education coordinator. Integration of work experience with academic program, individually planned through coordinator. *CR/NC* grading only.

CSCI 198. Project (3)

Prerequisite: senior standing in computer science or permission of instructor and approved subject. See *Criteria for Thesis and Project*. Study of a problem under the supervision of a faculty member. Presentation by the student in a seminar setting and a final report are required. Satisfies the senior major requirement for the B.S. in Computer Science. Approved for *RP* grading.