

COMPUTER SCIENCE (CS)

Undergraduate students may choose from one of three degree options: the B.S. in computer science, which is intended for students interested in the design and implementation of software systems, the B.S. in information technology, which focuses on the application of existing computing technologies to meet the information needs of organizations and individual computer users, or the B.S. in and analytics and data science. Students may choose between two options within the B.S. in analytics and data science major. The analytics option, which emphasizes the application of data science in business and industry or the data science option, which focuses on the theoretical and computational underpinnings of modern data science.

<https://ceps.unh.edu/computer-science/>

Programs

- [Analytics and Data Science Major: Analytics Option \(B.S.\)](#)
- [Analytics and Data Science Major: Data Science Option \(B.S.\)](#)
- [Analytics Minor](#)
- [Computer Programming Cognate](#)
- [Computer Science Major \(B.S.\)](#)
- [Computer Science Major: Algorithms Option \(B.A.\)](#)
- [Computer Science Major: Cybersecurity Option \(B.A.\)](#)
- [Computer Science Major: Systems Option \(B.A.\)](#)
- [Computer Science Minor](#)
- [Data Science Minor](#)
- [Information Technology Cognate](#)
- [Information Technology Major \(B.S.\)](#)
- [Information Technology Minor](#)
- [Skills and Perspectives for the Digital World Cognate \(CEPS\)](#)

Courses

Analytics (DATA)

DATA 557 - Introduction to Data Science and Analytics

Credits: 4

An introduction to data science and analytics. The landscape of analytics, including an overview of industries and sectors using analytics or expected to use analytics in the near future. Data generation, data management, data cleaning, and data preparation. Ethical use of data. Focus on visual and exploratory analysis. Project-based, with an emphasis on collaborative, experiential learning. Programming and statistical software will be used, but previous experience is not required.

Attributes: Environment, TechSociety(Disc)

DATA 674 - Predictive and Prescriptive Analytics I

Credits: 4

A first course in predictive and prescriptive analytics. Supervised learning models including linear models and CART models. Model assessment and scoring methods, including cross-validation. Regularization and model tuning. Unsupervised learning models including k-means clustering. Project-based, with an emphasis on collaborative, experiential learning. Statistical software will be used and programming required. Prereq: MATH 425, COMP 570, DATA 557.

DATA 675 - Predictive and Prescriptive Analytics II

Credits: 4

A second course in predictive and prescriptive analytics. Time series analysis and model ensembles. Bootstrapping, simulation, optimization. Monte Carlo methods. Project-based, with an emphasis on collaborative experiential learning. Statistical software will be used and programming required. Prereq: DATA 674.

DATA 690 - Internship Experience

Credits: 4

A field-based learning experience via placement in a business, non-profit, or government organization using analytics. Under the guidance of a faculty advisor and workplace supervisor, students gain practical experience solving problems and improving operational processes using analytics. May be repeated but no more than 4 credits may fill major requirements. Prereq: UMST 582.

Repeat Rule: May be repeated for a maximum of 8 credits.

DATA 750 - Neural Networks

Credits: 4

Artificial neural networks power the recent advances in computer vision, speech recognition, and machine translation. This is a first course on neural networks with a focus on applications in computer vision and natural language processing. Topics will include generic feedforward neural networks, convolutional neural networks for computer vision tasks, and recurrent neural networks with application to natural language processing, with other topics to be selected based on the interests of the instructor and the class. Prereq: Senior status.

Equivalent(s): COMP 750

DATA 757 - Big Data

Credits: 4

A first course in large-scale analytics and data science. Characteristics of big data and the emerging software stack for working with massive datasets, including Hadoop and MapReduce. Algorithms for extracting information from massive datasets. A first course in linear algebra is not a prerequisite, but is recommended. Prereq: MATH 425, DATA 557, or instructor permission.

DATA 790 - Capstone Project

Credits: 4

Under direction of a faculty mentor, students work in teams to find solutions to complex real-world problems using analytics. Projects may come from internal or external sources. Students define the problem, obtain the necessary data, develop suitable models and solutions, and present their results. Prereq: Senior status.

Computer Science (CS)

CS 400 - Introduction to Computing

Credits: 1

Initial exploration of computing, including comparison of the various subfields. A wide range of issues, including fundamental concepts, selected current topics and the role of both computing and computing professionals in organizations and in society are also discussed. Cr/F.

CS 401 - Computers and Their Applications**Credits:** 4

Use of computers to manage and analyze information across a variety of settings and disciplines. Introduces major categories of computer software, including word processing, spreadsheets and database systems. Covers basic computer concepts and the computer's role in today's society. Significant hands-on work required outside of the class. Not open to CS majors. CEPS students should check with their major department for approval.

Attributes: Environment,TechSociety(Disc)**Equivalent(s):** CIE 530, CS 401H, CS 495, DCE 491, DCE 492, INCO 495**CS #404 - Do-It-Yourself Internet****Credits:** 4

The objective of this course is to demystify the design process that leads to the evolution of the Internet. In doing so, we investigate the ways that technology changes to meet the needs of society, how society changes in response to these new technologies and how these societal changes create pressures that produce needs for new technologies.

Attributes: Environment,TechSociety(Disc)**CS 405 - Introduction to Applications Programming****Credits:** 4

Introduces the concepts and techniques of computer programming. Particular emphasis on computer programming as a problem-solving technique for business applications. The basic software development process (modeling, algorithm design, programming, testing and debugging) is illustrated. CEPS students should check with their major department for approval. Not open to CS and IT majors.

CS 408 - Living in a Networked World: The Good, the Bad, and the Ugly**Credits:** 4

The objective of this course is to explore the implications of living in a networked world. The course surveys the fundamental technologies and practices that make up the Internet and then ask the student to examine the ramifications of using the technologies. Users of the technologies should understand the technology in order to make educated decisions about how to use it safely and effectively. Students have the opportunity to self-publish by using various current technologies including blogs, discussion boards, email and creating web pages using xhtml.

Attributes: Environment,TechSociety(Disc)**CS 410C - Introduction to Scientific Programming/C****Credits:** 0 or 4

Introduces the concepts and techniques of computer programming. Particular emphasis on computer programming as a problem-solving technique in science and engineering applications. Good programming style is stressed. Significant out-of-class programming required.

Equivalent(s): CS 410**Mutual Exclusion:** No credit for students who have taken CS 415.**CS 410P - Introduction to Scientific Programming/Python****Credits:** 0 or 4

Introduces the concepts and techniques of computer programming. Particular emphasis on computer programming as a problem-solving technique in science and engineering applications. Good programming style is stressed. Significant out-of-class programming required. Not open to students who have completed CS 415 or the equivalent.

Equivalent(s): CS 410, CS 415**CS 414 - From Problems to Algorithms to Programs****Credits:** 4

This course is an introduction to the design and implementation of computer programs. The basic software development process (modeling, algorithm design, programming, testing and debugging) is illustrated through problem examples. Programming techniques are introduced to allow students to implement and evaluate solutions as programs.

Attributes: Quantitative Reasoning(Disc)**CS 415 - Introduction to Computer Science I****Credits:** 0 or 4

Theory and practice of computer science. Algorithm development and analysis; data abstraction techniques; elementary data structures; dynamic memory manipulation; debugging; and program design issues. Computer systems and applications. Intended for CS majors.

Mutual Exclusion: No credit for students who have taken CS 410C.**CS 416 - Introduction to Computer Science II****Credits:** 0 or 4

Theory and practice of computer science. Algorithm development and analysis; data abstraction techniques; elementary data structures; dynamic memory manipulation; debugging; and program design issues. Computer systems and applications. Intended for CS majors. Prereq:

CS 415.

CS 417 - From Programs to Computer Science**Credits:** 0 or 4

Accelerated coverage of programming techniques for students with experience equivalent to CS410 or CS 414. Covers basic algorithm analysis. Topics include basics of classes, inheritance, and data abstraction; linear data structures (vectors, lists, stacks and queues); trees and simple graphs; hash tables; sorting and searching; recursion; and basic graph traversal algorithms. Numerous labs and programming assignments build skills in planning, problem solving, and debugging: this is a hands on course. Prereq: CS 410 or CS 414 or equivalent.

CS 457 - Introduction to Data Science and Analytics**Credits:** 4

An introduction to data science and analytics. Overview of the use of analytics by industry, government, and nongovernmental organizations. Impact of analytics on society, ethical use of analytics. Methods of data generation, data management, data cleaning, and data preparation, with a focus on visual and exploratory analysis. Project-based, with an emphasis on collaborative, experiential learning. Design and implementation of programs, use of statistical software. Not open to CS and IT majors.

Attributes: Environment,TechSociety(Disc)**Equivalent(s):** DATA 557**CS 501 - Professional Ethics and Communication in Technology-related Fields****Credits:** 4

A mixed lecture/seminar course intended to improve both reasoning and ability to communicate effectively in front of an audience. Students learn basic forms of ethical argument, they read about ethical situations in which technology and technology professions play a key role, and they participate in student-led discussions about the reading. Students also make oral presentations about both ethical and technical topics, and evaluate each other's presentations in order to improve their sense for what makes a good presentation. Prereq: ENGL 401.

Attributes: Environment,TechSociety(Disc); Inquiry (Discovery)

CS 515 - Data Structures and Introduction to Algorithms**Credits:** 0 or 4

Reviews basic data structures; advanced data structures such as graphs, B-trees, and AVL trees; abstract data structure design and programming techniques; use of data abstraction language. Introduction to algorithm analysis. Prereq: CS 416 or CS 417.

CS 518 - Introduction to Software Engineering**Credits:** 4

Study of software development practices and processes in the following areas: software life cycle; system validation and verification; development pipeline; cloud infrastructures; virtual machines, and containers; logging, instrumentation, and performance; fundamental security concepts. Experience working in groups. Restricted to students not in Senior Standing. Prereq: CS 416 or CS 417 or equivalent.

CS 520 - Assembly Language Programming and Machine Organization**Credits:** 0 or 4

Assembly language programming and machine organization: program and data representation; registers, instructions, and addressing modes; assemblers and linkers. Impact of hardware on software and software on hardware. Prereq: CS 416 or CS 417.

Equivalent(s): CS 611**CS 580 - Introduction to Topics in Computing****Credits:** 1-2

Introductory material not normally covered in regular course offerings, but of value to students prior to internships or senior-level courses.

Repeat Rule: May be repeated for a maximum of 6 credits.**CS 619 - Introduction to Object-Oriented Design and Development****Credits:** 0 or 4

Principles of problem analysis and software design applied to the development cycle of a software system (i.e. from system requirements specification to design, implementation, and system test). Design and implementation using object-oriented principles, patterns, and tools. Experience in understanding and debugging software systems. Experience in working in groups. Prereq: CS 515.

Equivalent(s): CS 516**CS 620 - Operating System Fundamentals****Credits:** 4

Introduces operating system concepts and design. Process and memory management; scheduling; file systems; storage devices; inter-process communication. Prereq: CS 520.

Equivalent(s): CS 610**CS 659 - Introduction to the Theory of Computation****Credits:** 4

Review of sets, relations, and languages. Induction and diagonalization. Finite automata, context-free languages, pushdown automata. Basic complexity theory. Prereq: MATH 531.

CS 671 - Programming Language Concepts and Features**Credits:** 4

Explores the main features of modern, high-level, general purpose programming languages from the user (programmer) point of view. Provides students with an opportunity to use non-imperative programming paradigms, such as object-oriented, functional, and logical, and to learn how specific features of such languages can be used efficiently in solving programming problems. Prereq: CS 520.

CS 696 - Independent Study**Credits:** 1-6

Individual projects developed and conducted under the supervision of a faculty member. Prereq: permission of faculty supervisor and department chairperson. May be repeated for credit.

Equivalent(s): CS 696W**CS 696W - Independent Study****Credits:** 1-6

Individual projects developed and conducted under the supervision of a faculty member. Prereq: permission of faculty supervisor and department chairperson.

Attributes: Writing Intensive Course**Repeat Rule:** May be repeated for a maximum of 8 credits. May be repeated up to 1 time.**Equivalent(s):** CS 696**CS 699 - Internship****Credits:** 1

Provides the opportunity to apply academic experience in settings associated with future professional employment. A written proposal for the internship must be approved by the instructor. The proposal must specify what the student will learn from the internship, why the student is properly prepared for the internship and what supervision is available during the internship. A mid-semester report and final report are required. Prereq: permission. Only open to Computer Science majors. Cr/F.

Repeat Rule: May be repeated for a maximum of 4 credits. May be repeated up to 3 times.**Equivalent(s):** CS 600**CS 712 - Compiler Design****Credits:** 4

Formal languages and formal techniques for syntax analysis and parsing; organization of the compiler and its data structures; code generation. LL and LR parsing; automatic generation of scanners and parsers from high level descriptions. Implementation of features from imperative and object-oriented languages. Students required to design and implement a compiler for a simple language. Prereq: CS 520.

CS 720 - Systems Programming**Credits:** 4

Study and simulation of various types of systems that include assemblers, linkers, memory management, concurrency and other resource management techniques. Prereq: CS 520.

Prerequisite(s): CS 610.**CS 723 - Performance Evaluation of Computer Systems****Credits:** 4

Introduces the main concepts, techniques, and tools needed to evaluate the performance of computer systems under various configurations and workloads. The techniques allow one to perform capacity planning based on quality of service requirements of users and workload characteristics. Course is mainly based on the use of analytic queuing network models of computers systems. The performance techniques are applied to study the performance of centralized, distributed, parallel, and client/server systems. The course also discusses performance measuring tools for operating systems such as Unix and Windows NT. Prereq: CS 620 and (MATH 539 or MATH 644).

CS 725 - Computer Networks**Credits:** 4

Introduction to fundamental concepts of computer networks and exploration of widely-used networking technologies. Topics include principles of congestion and error control; network routing; local, wireless and access networks; application protocol design; and network programming. In-depth discussion of the Internet suite of protocols.

Prereq: CS 520.

Equivalent(s): IT 725**CS 727 - Computer Security****Credits:** 4

Introductory course in the mechanism and implementation of techniques in computer security. Various fundamental security topics include cryptography, passwords, access control, protocols, software vulnerabilities and malware detection. Prereq: CS 520.

CS 730 - Introduction to Artificial Intelligence**Credits:** 4

In-depth introduction to artificial intelligence, concentrating on aspects of intelligent problem-solving. Topics include situated agents, advanced search techniques, knowledge representation, logical reasoning techniques, reasoning under uncertainty, advanced planning and control, and learning. Prereq: CS 515.

CS 733 - Mobile Robotics**Credits:** 4

An introduction to the foundational theory and practices in mobile robotics. Topics include Kinematics of wheeled mobile robots, Sensors for mobile robots, Robot navigation and perception, Robot vision, Localization and mapping of mobile robots. Hands-on experience directed towards implementation with a real robot. Prereq: Programming course of Permission of instructor.

CS 735 - Introduction to Parallel and Distributed Programming**Credits:** 4

Programming with multiple processes and threads on distributed and parallel computer systems. Introduces programming tools and techniques for building applications on such platforms. Course requirements consist primarily of programming assignments. Prereq: CS 520.

Equivalent(s): CS 735W**CS 745 - Formal Specifications and Verification of Software Systems****Credits:** 4

Course focuses on the formal specification and verification of reactive systems, most notably concurrent and distributed systems. Topics relevant to these systems, such as non-determinism, safety and liveness properties, asynchronous communication or compositional reasoning, as discussed. We rely on a notation (TLA+, the Temporal Logic of Actions) and a support tool (TLC, the TLA+ Model Checker). Prereq: CS 520 and CS 659.

CS 750 - Machine Learning**Credits:** 4

An introduction to fundamental concepts and common methods in machine learning. In addition to theoretical topics, the course involves hands-on experience in making predictions using synthetic and real-world datasets. Prereq: MATH 539 or MATH 644, and Programming course or Permission of instructor.

Mutual Exclusion: No credit for students who have taken IT 630, MATH 738.**CS 753 - Information Retrieval****Credits:** 4

Fundamental algorithms and techniques for text processing and text-based information retrieval systems. Topics include how to build an end-to-end information retrieval system, such as a Web search engine. Prereq: CS 515.

CS 757 - Mathematical Optimization for Applications**Credits:** 4

This course introduces the foundations of mathematical optimization and reinforces them via applications. The content includes convex optimization, first and second-order methods, constrained problems, duality, linear and quadratic programming, as well as discrete and non-convex optimization. Applications will focus on machine learning methods but also include problems from engineering and operations research. Prereq: MATH 426; Programming proficiency in MATLAB, R, Java, C, Python, or equivalent.

Equivalent(s): MATH 757**CS 758 - Algorithms****Credits:** 4

An introduction to important concepts in the design and analysis of algorithms and data structures, including implementation, complexity analysis, and proofs of correctness. Prereq: CS 515 and CS 659.

CS 760 - Introduction to Human-Computer Interaction**Credits:** 4

Human-computer interaction is a discipline concerned with the design, evaluation, and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them. Prereq: CS 619.

Equivalent(s): CS 760W**CS 770 - Computer Graphics****Credits:** 4

Input-output and representation of pictures from hardware and software points of view; interactive techniques and their applications; three-dimensional image synthesis techniques and their applications. Prereq: CS 671.

Equivalent(s): CS 770W**CS 771 - Web Programming Paradigms****Credits:** 4

In this course you will learn languages to program the Web. Languages integrated into browsers, like JavaScript, and languages invoked on the server, like Ruby. You will also learn about frameworks, like Rails, and various techniques used to support the programming process. In addition, you will learn languages you will need to create, modify, and process Web documents. Although we will learn how to read and write in these languages, our primary goal will be an understanding of how the design of these multi-paradigm dynamic languages support the process of developing Web applications. Prereq: CS 671.

Equivalent(s): IT 771**CS 775 - Database Systems****Credits:** 4

Introduction to database management systems — design, implementation, and usage — with focus on the relational model. Data description, manipulation, and query language in the context of MySQL. Schema design and normalization; indexes, transaction processing. Web access of databases (PHP); overview of XML and noSQL systems. Prereq: CS 515.

Mutual Exclusion: No credit for students who have taken IT 775.

CS 780 - Topics**Credits:** 1-4

Material not normally covered in regular course offerings. May be repeated for credit.

CS 791 - Senior Project I**Credits:** 2

First semester of the capstone design experience. Modern software engineering practices and tools are surveyed and applied in team projects. Students begin development on software projects proposed by faculty or external sponsors, including initial stages of design, implementation, and documentation, with an interim presentation of progress expected toward the end of the semester. Principles of security, testability, and maintainability are stressed. Prerequisite: BS CS: CS 520, CS 619, 1 additional 600 level course; BA CS Algorithms & Systems Options: CS 520, CS 619, 1 additional 600 level course; BA CS Cybersecurity Option: CS 620 and (CS 727 or IT 666); BS ADS: DATA 674 or MATH 738 or CS 750.

CS 792 - Senior Project II**Credits:** 2

Continuation of CS 791: Senior Project I. Students complete the project by implementing their design. Students work in teams. Successful completion of this course fulfills the Capstone Experience requirement for Computer Science majors. Prereq: CS 791. Writing intensive.

Attributes: Writing Intensive Course**CS 799 - Thesis****Credits:** 1-5

Students work under the direction of a faculty sponsor to plan and carry out independent research resulting in a written thesis. Required for honors-in-major. Prereq: CS 520, CS 619, CS 600 level course, GPA >3.4, permission. A minimum of 4.0 credits is required for the completion of the course.

Attributes: Writing Intensive Course**Repeat Rule:** May be repeated for a maximum of 8 credits.

Information Technology (IT)

IT 403 - Introduction to Internet Technologies**Credits:** 4

Introductory course exploring the fundamentals of Internet communications with an emphasis on the World Wide Web. Students develop an understanding of the Internet's underlying technologies and learn how to utilize them as contributing members of the Web community. Students become proficient with creating and publishing Web pages using HTML and CSS. No prior knowledge or experience is assumed. No credit if credit earned for CIS 405. (Note CIS 405 is offered at UNH Manchester, and is not related to CS 405 at UNH Durham.)

Equivalent(s): CIS 405, CIS 410F, CIS 495, CS 403**IT 502 - Intermediate Web Design****Credits:** 4

An intermediate level exploration of the theory and practice of Web design. Students learn the fundamentals of design theory applicable to the World Wide Web and examine tools and techniques for applying that knowledge to their projects. Additional topics include information architecture, usability, accessibility, optimization, typography, and market visibility. Working knowledge of XHTML and CSS required. Prereq: CS 403.

Equivalent(s): CS 502**IT 505 - Database Programming****Credits:** 0 or 4

Introduces database programming in the microcomputer environment. Students use a procedural programming language such as Visual Basic to manipulate data managed by a database management system. Emphasis is on the relational database model. Topics include connections, queries (including use of SQL), relations, constraints, transaction processing, concurrency issues, exception handling, and report generation. Prereq: a programming course. Computer Science majors not allowed.

IT 520 - Computer Architecture**Credits:** 4

Fundamentals of computer organization, including binary systems, data representation (and compression), machine language, program execution, memory and process issues. Operating systems and networking basics. Not open to CS majors. Prereq: a programming course.

IT 604 - Server-side Web Development**Credits:** 4

An intermediate-level examination of the theory and practice of developing server-side applications for the World Wide Web. Students will learn practical techniques for designing and implementing data-driven Web sites through the use of server-side processing. Working knowledge of HTML, CSS, and some programming language is required. Prereq: IT 403 and a programming course.

Equivalent(s): CS 504**IT 605 - Client-side Web Development****Credits:** 4

An intermediate-level examination of the theory and practice of developing client-side applications for the World Wide Web. Students will learn practical techniques for designing and implementing dynamic Web sites through the use of client-side processing. Working knowledge of HTML, CSS, and some programming language is required. Prereq: IT 403 and a programming course.

IT 609 - Network/Systems Administration**Credits:** 4

Introduces the central issues in administration of a networked computer system. Topics include the client-server model (including support of mail, FTP, Telnet, the Web), disk and file systems, backup and recovery, and security. Privacy and other legal/social issues will be discussed. Prereq: IT 520 and a programming course, or permission of the instructor.

Equivalent(s): CS 509**IT 612 - Scripting Languages****Credits:** 4

This course is a study of the class of programming languages and tools known as scripting languages. Topics include: a general discussion of language design and its relationship to the intended computing environment, introduction to the command-line environment, the role of scripts in controlling and connecting other programs and components, basic functionality of at least two scripting languages, and the syntax use of regular expressions. Programming projects in multiple languages will be required. Prereq: IT 505 or CS 515.

IT 630 - Data Science and Analytics**Credits:** 4

An introduction to various disciplines that contribute to what is commonly known as Data Science. Students will learn how to gather, analyze, classify data utilizing various techniques. Study of tools and programming techniques to analyze data. Pre-requisite: CS 416 or CS 417 or Permission of Instructor.

Mutual Exclusion: No credit for students who have taken CS 750, MATH 738.

IT 666 - Computer Security**Credits:** 4

Provides students with the skills required to recognize and diagnose potential security issues in computer and network systems. Through readings, case studies, exercises, research papers, exams and personal experience, students will discuss and debate security policies and legislation, system procedures, security tools and techniques and the patterns that attackers use to foil security systems. Other topics include types of attacks, viruses, intrusion detection and tracking, firewalls, trust relationships and authentication, secure connections, and cryptography. At the conclusion of the course, student will have a heightened sense of security in the actions they take when using and maintaining computer systems. Prereq: IT 520 or permission of the instructor. No credit if credit earned for CIS 615.

Equivalent(s): CIS 615

IT 696 - Independent Study**Credits:** 1-6

Individual projects developed and conducted under the supervision of a faculty member. Prereq: permission of faculty supervisor and department chairperson. Only open to Information Technology majors.

Repeat Rule: May be repeated for a maximum of 8 credits.

IT 699 - Internship**Credits:** 1

Provides the opportunity to apply academic experience in settings associated with future professional employment. A written proposal for the internship must be approved by the instructor. The proposal must specify what the student will learn from the internship, why the student is properly prepared for the internship and what supervision is available during the internship. A mid-semester report and final report are required. Students may receive compensation for their internship work. Prereq: permission. Information Technology majors only. Cr/F.

Repeat Rule: May be repeated for a maximum of 4 credits. May be repeated up to 3 times.

Equivalent(s): IT 600

IT 704 - Advanced Web Development**Credits:** 4

An advanced exploration of various topics in Web development. Topics covered each semester will be chosen to reflect the current state of stable and accepted Web technologies, with a decided emphasis on open-source solutions. Both client-side and server-side technologies are likely to be included, with particular attention given to concepts and techniques used to facilitate efficient Web development. Prereq: IT 604.

IT 705 - Project Management for Information Technology**Credits:** 4

This course focuses on a core set of project management essentials that can affect the bottom line of project technical and business performance. These are termed "best practices," and those addressed are: formal risk management, agreement on interfaces, metrics based scheduling/tracking, frequent binary completion milestones, incremental development, people aware management style, and change management. The emphasis is on information technology projects; however, the basic principles are pertinent to a wider class of project domains. Prereq: Senior standing in IT or permission.

Attributes: Writing Intensive Course

IT 725 - Network Technology**Credits:** 4

Introduction to fundamental concepts of computer networks and exploration of widely-used networking technologies. Topics include principles of congestion and error control; network routing; local, wireless and access networks; application protocol design; and network programming. In-depth discussion of the Internet suite of protocols. Prereq: IT 520.

Equivalent(s): CS 725

IT 775 - Database Technology**Credits:** 4

Topics include database architecture, schema design and definition, entity-relationship diagrams, data retrieval and update, and indexing performance. Architectures for single-user, multi-user, client-server, and web access are introduced. The relational data model is emphasized but alternative database models, such as semi-structured and object models, are introduced. Database administration topics include examination of metadata information, data integrity, and management of users and privileges, performance tuning, transactions, isolation levels, and security. Ethics of data protection are introduced. Students develop skill in SQL. Not open to CS majors. Prereq: IT 505.

Mutual Exclusion: No credit for students who have taken CS 775.

IT 780 - Topics in Information Technology**Credits:** 4

Material not normally covered in course offerings.

Repeat Rule: May be repeated for a maximum of 8 credits.

IT 791 - Senior Project I**Credits:** 2

First semester of the capstone design experience. Industry best practices and tools are surveyed and applied in team projects. Students begin development on software projects proposed by faculty or external sponsors, including initial stages of design, implementation, and documentation, with an interim presentation of progress expected toward the end of the semester. Principles of security, testability, and maintainability are stressed. Pre- or Coreq: IT 705. Information Technology majors only.

IT 792 - Senior Project II**Credits:** 2

Continuation of IT 791: Senior Project I. Students complete the project, a final presentation of results is expected toward the end of the semester. Successful completion of this course fulfills the Capstone Experience requirement for Information Technology majors. Prereq: IT 791.

Attributes: Writing Intensive Course

Equivalent(s): IT 710

Faculty

<https://ceps.unh.edu/directory/all>