

COMPUTER SCIENCE MS

College of Science, Engineering & Technology
 Department of Computer and Information Sciences
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The Master of Science degree in Computer Science program of study prepares the student for a career as a computer professional, yet offers enough flexibility to allow a student to design a course of study suitable for preparation for doctoral work in computer science. The program is designed to offer graduate level educational opportunities with an applied science perspective. It addresses the pre-service as well as occupational and career advancement needs of baccalaureate prepared computer scientists. The program objectives are:

1. To address the needs of Minnesota's public and private enterprises by providing opportunities within the state of Minnesota for graduate study in applied computer science.
2. To provide a graduated degree program for practicing computer scientists who have clearly defined academic needs related to professional advancement and/or specialization.
3. To offer a graduate program for baccalaureate students who want to continue their education and gain specialized knowledge and skills in computer science.
4. To expand the functional role of the Department of Computer and Information Sciences in service to the Mankato area and the state of Minnesota.

These objectives are met by a curriculum with core studies in software and knowledge engineering and research methods. The core studies provide the foundation upon which students develop an academic program appropriate to their interests, culminating in a research experience.

Admission. In addition to meeting the general admission requirements of the College of Graduate Studies and Research, successful applicants must meet the following requirements for admission:

1. The Graduate Record Examination (GRE) is required (contact department for specific requirements).
2. Applicants must have an undergraduate degree in computer science, computer information systems, management information systems or a related field. Students with other backgrounds will be granted provisional admission and required to complete undergraduate courses in core areas of computer science.

Financial Assistance. Teaching, Lab Project and Research Assistantships requiring professional computer knowledge are available in the CIS department and from various other departments and administrative offices. Applications are posted on the school's Academic and Administrative Job Postings web page.

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 (Thesis Plan - 32 credits)
 (Alternate Plan Paper - 34 credits)

Required Core (13 credits) from the following:

COMS 600 Research Methods (3)
 COMS 602 Research Seminar (1)
 COMS 610 Algorithm Analysis (3)
 COMS 620 Advanced Computer Organization (3)
 COMS 631 Knowledge-Based Systems (3)
 COMS 640 Advanced Database Systems (3)
 COMS 660 Operating Systems Theory and Design (3)
 COMS 662 Data Communications and Networking (3)
 COMS 680 Software Engineering Project (3)

Required Electives (9 - 15 credits)

Choose any 6 credits using additional core courses, any 500-level COMS course

(excluding COMS 591, 592, and 593) or any of the following elective courses. At most, one 500-level course may be used for elective credits. Up to 4 credits of 5/600 non-departmental elective courses may be selected in consultation with an advisor.

CMOS 601 Research Topics (3)
 COMS 611 Theory of Computation (3)
 COMS 630 Advanced Artificial Intelligence (3)
 COMS 641 Distributed Database Systems (3)
 COMS 677 Individual Study (1-4)

Required Capstone Experience

COMS 699 Thesis (3-6)
 COMS 694 Alternate Plan Paper (1-2)

Students must be registered for a minimum of one credit of Thesis/APP for every semester that they are working on their paper.

Comprehensive Examination Requirement

The comprehensive examination will contain questions from the computer science core except for COMS 602. The comprehensive examination will be waived if the student obtains a 3.5 GPA in the core courses or achieves 60% or better on the subject GRE in computer science.

GRADUATE CERTIFICATE IN DATABASE TECHNOLOGIES

This program provides the basic concepts, skills, and values for pursuing a career in computer and information science, emphasizing design and implementation of sophisticated database systems and related software.

COMS 540 Database Management Systems II (4)
 COMS 640 Advanced Database Systems (3)
 COMS 641 Distributed Database Processing (3)

COURSE DESCRIPTIONS

COMS 510 (4) Abstract Machines & Grammars

This course studies the computational ability of a variety of computational models including finite state machines, regular expressions, context-free grammars, and Turing machines. For each model, the student will develop, study and apply techniques for determining those languages which are computable using the particular model. Pre: MATH 375

COMS 512 (4) Graphics

Concepts and algorithms used in computer graphics, including polygonal and curved images in both 2 and 3 dimensions, representation of solid objects, and color and illumination models. Pre: COMS 310, MATH 247

COMS 520 (4) Advanced Computer Organization

Advanced topics in computer architecture including a major emphasis on measuring and improving computer performance. Topics include advances in pipelining and analysis and optimization of storage systems and networks, multiprocessor challenges and trends. Pre: COMS 320

COMS 530 (4) Artificial Intelligence

Artificial intelligence problem solving techniques including predicate logic and the resolution principle, artificial intelligence programming languages, machine learning, neural network models and object oriented methods are discussed. Pre: COMS 230 or COMS 212

COMS 532 (4) Robotics

Current practice and future directions in robotics including robot anatomy, kinematics, sensors, sensor interfacing and fusion, mobile robotics, real-time programming, vision and image processing algorithms, subsumption architecture. Pre: COMS 320

COMS 540 (4) Database Management Systems II

Extensive coverage of query processing and optimization; concurrency control and recovery, and security and integrity in centralized/distributed environments. Team-oriented projects in a heterogeneous client server environment. Pre: COMS 340

COMS 550 (4) Operations Research II

A second course in operations research for majors and non-majors. Topics include computer simulation, game theory, stochastic processes, queuing theory, Markov processes, and reliability. Simulation topics include Monte Carlo methods, discrete

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and continuous simulations, simulation languages and packages. Prerequisite: COMS 350 and STAT 354

COMS 560 (4) Operating Systems

This course covers basic operating systems concepts including processes, interprocess communication, interprocess synchronization, deadlock, memory allocation, segmentation, paging, resource allocation, scheduling, performance evaluation, file systems, storage, devices, protection, security, privacy and distributed systems. Pre: COMS 320

COMS 562 (4) Communication Protocols

Advanced coverage of data communication and networking protocols with an emphasis on protocol design and implementation. Topics addressed will include data transmission methods, error detection and recovery, flow control, routing, data throughput, and performance analysis of existing and emerging Internet protocols. Pre: COMS 362

COMS 563 (4) Client/Server and Web Applications

Introduction to distributed and client/server systems. Network operating systems to support C/S. Database servers. Client server and the Internet. Distributed objects. Web-based application development on PC and UNIX platforms. The principal functions of web servers and how they handle clients. CGI, ASP, JSP, JDBC, JavaBeans, Active-X, Servlets. Pre: COMS 362

COMS 564 (4) Mobile Applications and Networks

This course provides an understanding of existing and emerging mobile and wireless data networks, with an emphasis on digital data communications. Students will gain an understanding of the unique considerations that must be given to network protocols for wireless and mobile communication as well as their applications. Pre: COMS 362, COMS 310

COMS 565 (4) Parallel & Distributed Processing

This course offers an introduction to technical issues related to parallel and distributed systems. Topics addressed include parallel and distributed programming languages, parallel algorithm design and analysis, and parallel and distributed architectures. The course includes practical parallel programming experiences. Pre: COMS 362

COMS 570 (4) Compiler Construction

Principles and techniques of compiler construction. Development of efficient parsers and scanners; manual and automatic approaches. Optimization techniques and code generation. Pre: COMS 370

COMS 580 (4) Software Engineering

This is a course in software engineering that introduces the student to all important aspects of the discipline. The main purpose of this course is to simulate the engineering of a software product, from gathering requirements through implementation and maintenance. The course emphasizes a traditional development methodology. Students will be introduced to Visual Basic and Microsoft Project, but the emphasis of the course will be on principles of software engineering including project planning, requirements gathering, size and cost estimation, analysis, design, coding, testing, and implementation. Pre: COMS 380

COMS 581 (4) Rapid Application Development

In-depth understanding of low and high CASE tools and rapid application development. CASE tools will range from the traditional software development life cycle to object-oriented client/server environments. Extensive team-oriented applications will be developed using tools such as SYNON, OBSDIAN, Power Builder, and MSSQL server. Pre: COMS 340

COMS 591 (1-6) In-Service in Computer Science

This course is designed to meet the needs of kindergarten through twelfth grade practicing teaching majors who wish to enhance their technology-related skills and knowledge. Both lab and lecture activities are used to provide participants guided experiences with current applications of technology. Prerequisite: consent

COMS 592 (3) Computers in the Classroom

Using both a lecture and lab format, this course provides students with a foundation for developing computer-delivered instruction within the classroom by examining the hardware and software which are part of emerging technologies, and the research issues associated with developing effective instruction using the computer.

COMS 593 (3) Computer-Based Instructional Systems

This course provides participants with opportunities to develop, implement, and assess formative and summative evaluation instruments; identify researchable issues in computer-delivered instruction; develop computer-delivered instruction using a sophisticated authoring tool.

COMS 595 (1) Seminar in Computer Science

Through reading, small group discussion, and presentations, explores the topics not normally covered in the curriculum. Prerequisite: consent

COMS 596 (1-4) Selected Topics in Computer Science

Special topics not covered in other courses. May be repeated for credit on each new topic. Prerequisite: consent

COMS 597 (1-12) Internship

This course is designed to provide students with an opportunity to utilize their training in a real-world business environment. Participants are placed and supervised in selected locations by the internship coordinator for a minimum period of one semester while working under the guidance and direction of a full-time staff member. Prerequisite: Completion of computer science core and consent

COMS 599 (1-2) Individual Study

Problems on an individual basis. Prerequisite: consent

COMS 600 (3) Research Methods

Research methodology in general and in computer science. Data and research sources. Analysis of existing research. Preliminary planning and proposals. Conceptualization, design, and interpretation of research. Good reporting. Prerequisite: an elementary statistics course

COMS 601 (3) Research Topics

Special topics in computer science research not covered in other courses. May be repeated for credit on each new topic.

COMS 602 (1) Research Seminar

Students attend seminar presentations and present a research topic at one of the seminars. Prerequisite: consent

COMS 610 (3) Algorithm Analysis

Brings together fundamental methods in order to provide access to the best method(s) for algorithm usage and analysis. Prerequisite: COMS 510

COMS 611 (3) Theory of Computation

Computation using Turing machines, logic, oracles, alternating Turing machines, and interactive proof systems. Various aspects of computational complexity including NP-completeness, Co-NP, P, parallel-complexity theory, their relationships, counting classes, and the polynomial time hierarchy are discussed. Prerequisite: COMS 510

COMS 620 (3) Advanced Computer Organization

This course will cover concepts and techniques used in modern processor architectures such as pipelining, superscalar execution, branch system and application software such as compilers, operating system, database management systems, and network communication. Prerequisite: COMS 520

COMS 630 (3) Advanced Artificial Intelligence Systems

This course is a continuation of Artificial Intelligence (COMS 530). Emphasis is placed on advanced topics and the major areas of current research within the field. Theoretical and practical issues involved with developing large-scale systems are covered. Prerequisite: COMS 530

COMS 631 (3) Knowledge-Based Systems

The design of large-scale, knowledge-based systems. Emphasis on both theoretical and practical issues. Examination of alternative knowledge representation techniques and problem-solving methods used to design knowledge-based systems. Prerequisite: COMS 530

COMS 640 (3) Advanced Database Systems

In-depth study of advanced topics such as object-oriented databases, intelligent database systems, parallel databases, database mining and warehousing, distributed database design and query processing, multi-database integration and interoperability, and multilevel secure systems. Prerequisite: COMS 540

COMS 641 (3) Distributed Database Processing

Introduction to distributed database systems, resource allocation, homogenous vs. heterogeneous databases, schema integration, distributed concurrency control and recovery, and other topics dealing with distributed database processing. Prerequisite: COMS 560

COMS 660 (3) Operating Systems Theory and Design

This course will focus on advanced uniprocessor and distributed operating systems. Topics covered will include operating system organization, including monolithic, microkernel, and exokernel; communications, including secure communications protocols, naming, and remote procedure call; file systems, including RAID and journaling; and memory management, including distributed shared memory. Prerequisite: COMS 540

COMS 662 (3) Data Communications and Networking

This course will focus on research, design, and analysis of computer networks and data communications systems. The course will also entail detailed examination of modern communication standards, protocols, systems and their implementation. Additional topics may include transmission technology, packet switching, routing, flow control, and protocols. Prerequisite: COMS 562 or 564

COMS 677 (1-4) Individual Study

Problems on an individual basis. Prerequisite: consent

COMS 680 (3) Software Engineering Project

Advanced software design, analysis, and development techniques under realistic time and budget constraints. Hands-on project management techniques. Emphasis of concepts through immersion in a team project of significant size. Prerequisite: COMS 580

COMS 690 (3) Statistical Inference Packages

Statistical package programs used in data collection, transformation, organization, summarization, interpretation and reporting. Statistical description and hypothesis testing with statistical inference. Interpreting outputs. Chi-square, correlation, regression, analysis of variance, nonparametrics, and other designs. Accessing and using large files (U.S. Census data, National Health Survey, etc.) Pre: a statistics course

COMS 691 (1-6) In-Service in Computer Science

A course designed to upgrade the qualifications of persons on-the-job. Prerequisite: consent

COMS 694 (1-2) Alternate Plan Paper

Preparation of a master's degree alternate plan paper under the direction of the student's graduate advisor. Prerequisite: consent

COMS 699 (1-6) Thesis

Preparation of a master's degree thesis under the direction of the student's graduate advisor. Prerequisite: consent
