COMMUNITY HEALTH MS

College of Allied Health and Nursing
Department of Health Science
213 Highland Center N • 507-389-1527

See **HEALTH SCIENCE**

COMPUTER SCIENCE MS

College of Science, Engineering & Technology
Department of Computer and Information Sciences
273 Wissink Hall • 507-389-2968

Chair: Colin Wightman, Ph.D.
Graduate Coordinator: Christophe Veltsos, Ph.D.

Gregg Asher, Ph.D.; Cyrus Azarbod, Ph.D.; David Haglin, Ph.D.; Dean Kelly, Ph.D.; Ann Quade, Ph.D.; Richard Roiger, Ph.D.; Hamed Sallam, Ph.D.; Julio Sanchez, Ph.D.; Susan Schilling, MA; James Slack, Ph.D.; Mahbubur Rahman Syed, Ph.D.; Leon Tietz, Ph.D.; Christophe Veltsos, Ph.D.; Michael Wells, Ph.D.

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 preservice 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 graduate 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. To expand the functional role of the Department of Computer and Information Sciences in service to the Mankato area and the state of Minnesota.
4. 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 various administrative offices. Deadlines are March 1 for fall and October 1 for spring.

COMPUTER SCIENCE MS
(Thesis Plan - 30 credits)
(Alternate Plan Paper - 34 credits)

Required Core (13 credits)
COMS 600 Research Methods (3)
COMS 602 Research Seminar (1)
COMS 631 Knowledge-Based Systems (3)
COMS 640 Advanced Database Systems (3)
COMS 680 Software Engineering Project (3)

Required 600 level Computer Science Electives (6 credits)
Choose at least 6 credits from the following
COMS 601 Research Topics (3)
COMS 610 Algorithm Analysis (3)
COMS 611 Theory of Computation (3)
COMS 630 Advanced Artificial Intelligence (3)
COMS 641 Distributed Database Systems (3)

Required Computer Science Electives (4-12 credits)
Choose any 5/600 level elective courses from the Department of CIS.
The following courses cannot be used as electives: COMS 591, 691.

Required Non-departmental Electives (3-6 credits)
Choose any 5/600 non-departmental elective courses selected in consultation with an advisor

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

*Before registering for COMS 694 or COMS 699, the student must satisfy the comprehensive examination requirement and must have successfully completed the core courses.

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.

COURSE DESCRIPTIONS

COMS 510 (4) Abstract Machines & Grammars
Study of a variety of computational models including finite state machines, regular expressions, context-free grammars, and Turing machines. For each model, we develop, study, and apply techniques for determining those languages which are computable using a particular model, as well as properties of those languages. Prerequisite: 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. Prerequisite: COMS 210, 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 pipeling and analysis and optimization of storage systems and networks, multiprocessor challenges and trends. Prerequisite: COMS 320

COMS 530 (4) Artificial Intelligence
Artificil 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.
Prerequisite: COMS 230

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, and subsumption architecture.
Prerequisite: COMS 260 or 320, MATH 247

COMS 540 (4) Database Management Systems II
Extensive coverage of query processing and optimization; also concurrence control and recovery and security and integrity in centralized/distributed environments. Team-oriented projects in heterogeneous client server environment.
Prerequisite: 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 and contiuous simulations, and simulation languages and packages.
Prerequisite: COMS 350 and either STAT 352 or 354

COMS 560 (4) Operating Systems
This course covers 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, and privacy and distributed systems.
Prerequisite: COMS 320

COMS 562 (4) Communication Protocols
An introduction to the foundations of computer networking. The course encompasses telecommunications, local area networks, wide-area networks, and wireless communications. Topics covered include the OSI model, TCP/IP, network topologies and associated hardware, error detection and correction, and protocols and security. Prerequisite: COMS 112

COMS 563 (4) Client/Server and Web Applications
This course concentrates on providing administration and client/server development experience. It uses the client/server networking lab to provide exposure to Netware, Windows NT and UNIX network operating systems, as well as client/server applications development. Prerequisite: COMS 562

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.

COMS 565 (4) Parallel & Distributed Processing
Practical parallel programming experiences. Parallel programming languages, parallel algorithm design and analysis, and parallel architectures.
Prerequisite: COMS 210

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.
Prerequisite: COMS 370

COMS 580 (4) Software Engineering
The software life cycle from specification and design phases through construction and maintenance. Object-oriented design and analysis techniques. Software testing, reliability assessment. Software modularity, portability, reusability. Project management.
Prerequisite: COMS 280 and 340

COMS 581 (4) Rapid Application Development
In-depth understanding of low and high CASE tools and rapid development. CASE tools will range from traditional software development life cycle to object-oriented client/server environments. Extensive team-oriented applications will be developed using tools such as SYNON, OBSYDIAN, Power Builder, and MS-SQL server.
Prerequisite: COMS 280

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-compleleness, Co-NP, P parallel-complexity theory, their relationships, counting classes, and the polynomial time hierarchy are discussed.
Prerequisite: COMS 510

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 540

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.). Prerequisite: 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