

# MASTER OF COMPUTING AND INFORMATION SYSTEMS

## Program Director

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## Program Description

The Master of Computing and Information Systems is designed to emphasize important applied areas of computing, providing background in the overall structure of information systems, in-depth knowledge in vital areas, such as databases and networking, and opportunities to learn a variety of other important, emergent, and current areas of computing, such as web design, application development, and computer security.

The program serves students with some background in computing (possibly work related) who need additional deeper, more comprehensive, or more up-to-date knowledge of computing and information systems in order to find IT-related jobs, to make career advancements, or to better utilize the knowledge gained in work environment to solve work-related tasks on a daily basis.

The program is interdisciplinary in nature to allow students, with a background in areas other than information systems, to learn how to apply information systems fundamentals to those areas. Therefore, the program also supports a significant number of interdisciplinary courses, which allows students to take elective courses outside of the department.

## Admission Requirements

In addition to the minimum College of Graduate Studies admission requirements, students must also have previous courses in or the equivalent of:

COURSE	TITLE	S.H.
MATH 1571	Calculus 1 (or equivalent calculus courses)	4
CSIS 3722	Development of Databases (or equivalent of databases courses)	3
CSIS 3723	Networking Concepts and Administration (or equivalent of networking courses)	3
or CSIS 3782	Cisco Networking Academy 1	

Equivalent employment-related experience may be substituted for some of these requirements.

Students are also required to submit a résumé, a written statement describing their past experience in computing/information systems (both employment and academic), and their reasons and goals for applying to the program.

## Graduate Faculty

**Abdu Arslanyilmaz**, Ph.D., Professor, Director  
Computer-based learning design; hazard detection in traffic simulation; computer-based and case-based learning

**Alina Lazar**, Ph.D., Professor  
Applied machine learning; database mining; agent-based simulations, and parallel programming

**John R. Sullins**, Ph.D., Associate Professor  
Artificial intelligence; game design; neural networks and expert systems

**Feng Yu**, Ph.D., Associate Professor  
NoSQL databases; big data systems; cloud computing

## Degree Requirements

A minimum of 30 approved semester hours of credit (at least half of which must be at the 6900 level) is required for the Master of Computing and Information Systems.

## Thesis Option

COURSE	TITLE	S.H.
<b>Core</b>		
At least half of the semester hours must be at the 6900 level		
CSCI 6901	Principles of Computer Programming	3
CSCI 6920	Theory and Practice of Information Systems	3
CSCI 6950	Advanced Database Design and Administration	3
CSCI 6997	Seminar in Computer and Information Systems (take in the first semester if possible but no later than the second semester)	1
Select one of the following:		3
CSCI 5801	Software Engineering	
CSIS 5828	Computer Network Security	
CSCI 6951	Data Science and Machine Learning	
<b>Electives</b>		
Select a minimum of 12 s.h. of electives consisting of approved graduate and/or swing courses. Up to 9 s.h. may be taken in departments other than Computer Science and Information Systems.		12
<b>Thesis</b>		
CSCI 6999	Thesis	5
<b>Total Semester Hours</b>		<b>30</b>

## Non-Thesis Option

COURSE	TITLE	S.H.
<b>Core</b>		
At least half of the semester hours must be at the 6900 level		
CSCI 6901	Principles of Computer Programming	3
CSCI 6920	Theory and Practice of Information Systems	3
CSCI 6950	Advanced Database Design and Administration	3
CSCI 6997	Seminar in Computer and Information Systems (take in the first semester if possible but no later than the second semester)	1
CSCI 6993	Computing and Information Systems Graduate Internship	2
Select one of the following:		3
CSCI 5801	Software Engineering	
CSIS 5828	Computer Network Security	
CSCI 6951	Data Science and Machine Learning	
<b>Electives</b>		
Select a minimum of 12 s.h. of electives consisting of approved graduate and/or swing courses. Up to 9 s.h. may be taken in departments other than Computer Science and Information Systems.		12
<b>Capstone Project</b>		
This project is meant to explore and apply some area of computing and information systems and is subject to the approval of the major advisor.		
CSCI 6990	Computer Science Project	3
<b>Total Semester Hours</b>		<b>30</b>

## Learning Outcomes

The Master of Computing and Information systems program provides preparation for students to

- design a large-scale information system to meet the goals of an organization, encompassing software, databases, networks, and people.
- analyze the design, implementation, and maintenance of databases within a large organization.
- compile knowledge in crucial areas of information systems, such as data mining, advanced network design, and project management.
- design components and evaluate decisions related to information systems that interact with the outside world, including networking, security, and client-server web design
- design, and implement a significant component of a large-scale information system

## Graduate Courses

### CSCI 5801 Software Engineering 3 s.h.

Developing and maintaining complex software systems. Process and life-cycle models, and tools for software development (such as CASE). Specification methods, prototyping, validation and verification strategies, and version maintenance. Management of the system development process. A group project is required.

**Prereq.:** CSIS 3701.

### CSCI 5802 Software Tools and Practices 3 s.h.

A course that focuses on the different tools and techniques that software engineers typically use while developing software. Topics include current software engineering tools and practices, software testing, software architecture, version control systems, build and make systems, debuggers, static analysis tools, dynamic analysis tools, and design patterns. Students gain experience in multiple environments (Windows and a UNIX-based environment).

**Prereq.:** Junior standing and CSIS 3700 or CSCI 6901.

### CSCI 5806 Operating Systems 3 s.h.

Study of the various components of operating systems including kernels and monitors, currency and parallel processing, processor management, storage management, device management, I/O processing and file management.

**Prereq.:** CSIS 3700 and CSIS 3740.

### CSCI 5807 Compiler Design 3 s.h.

Study of compiler design and construction, including context-free languages, lexical analysis, parsing, code generation and optimization.

**Prereq.:** CSIS 3700 and CSIS 3740, CSCI 3710.

### CSCI 5814 Computer Architecture 3 s.h.

Study of high-performance sequential computer architecture. Topics include performance evaluation, instruction set design, processor implementation techniques, pipelining, vector processing, memory hierarchy design, and parallel architecture.

**Prereq.:** CSIS 3700 and CSIS 3740.

### CSCI 5820 Simulation 3 s.h.

Methods for modeling discrete event systems by algorithmic approaches using simulation languages.

**Prereq.:** CSIS 3700 and STAT 3743.

### CSCI 5835 Artificial Intelligence 3 s.h.

Study of the theory and applications of intelligent systems. Topics may include general problem-solving techniques, knowledge representation and expert systems, vision and perception, and natural language processing. AI systems and languages.

**Prereq.:** CSIS 3700 or CSIS 3701.

### CSCI 5840 Automata Theory 3 s.h.

Abstract models of computers, and the languages they generate or recognize. Finite state automata and regular expressions; Context-free grammars and pushdown automata; Turing machines. Limits of each model, including decidability and undecidability of computing-related problems. Applications of these models to areas such as input validation, security, language design, and compilers.

**Prereq.:** CSCI 3710.

### CSCI 5849 Computational Methods for problems in the Physical Sciences 3 s.h.

CSCI 5849: Computational Methods for the Physical Sciences 3 s.h. Provides application of the techniques discussed in the class to real world situations. Cross-Listed: MATH 5849 and PHYS 5849.

CSCI 5849: Computational Methods for the Physical Sciences 3 s.h. **Prereq.:** MATH 3705 and PHYS 2610.

### CSCI 5857 Encoding and Encryption 3 s.h.

Securing computer and information systems through encoding and/or encryption. Private and public cryptographic methods, digital certificates and signatures, cryptovvariable techniques, key management, and database security issues.

**Prereq.:** CSIS 2605 or CSIS 2610; MATH 1513 or MATH 1552 or Math Placement Test of 4 or 40 or higher; and at least 3 s.h. of upper-division departmental courses.

### CSCI 5870 Data Structures and Algorithms 3 s.h.

Study and application of analysis and design techniques to nonnumerical algorithms. Topics selected from algorithms acting on sets, trees, graphs; memory management; notions of complexity and related areas.

**Prereq.:** CSIS 3700 and CSCI 3710.

### CSCI 5895 Special Topics 2-4 s.h.

A study of special topics in computer science. Subject matter and credit hours will be announced in advance. May be repeated multiple times if topic is different.

**Prereq.:** At least 3 s.h. of upper-division departmental courses, and permission of chair.

### CSCI 6901 Principles of Computer Programming 3 s.h.

Significant features of several computer programming languages to fit the needs of graduate students with no previous computer science experience. Programming techniques and problem analysis. Students will do programming projects appropriate for their needs.

### CSCI 6905 Information Structures 3 s.h.

Basic concepts of information: modeling structures, machine level implementation, storage management, programming, language implementation, run-time structures, sorting, and searching.

**Prereq.:** CSCI 3710 and CSIS 3740, or permission of chair.

### CSCI 6920 Theory and Practice of Information Systems 3 s.h.

A study of the relationship of information systems to individuals, organizations, and society. A detailed study of the principles, methodologies, and issues associated with designing, implementing, and administering information systems as a resource in a networked, data-driven organization.

**Prereq.:** CSIS 3722 and CSIS 3723.

### CSCI 6930 Formal Languages and Syntactic Analysis 3 s.h.

Study of formal languages, especially context-free languages, and their applications to parsing and syntactic analysis.

**Prereq.:** CSCI 3710 or CSCI 6905.

### CSCI 6940 Advanced Network Design and Administration 3 s.h.

Advanced network design, implementation, and administration. Topics include infrastructure and architecture, VLSM, logical and physical designs, security issues, voice over IP, client/server networks, and VLANs.

**Prereq.:** CSIS 3723 or CSIS 3783.

### CSCI 6950 Advanced Database Design and Administration 3 s.h.

Advanced concepts in database design, development, and administration. Database query languages, transactions, and data warehousing. Relational calculus. System analysis; concurrency; backup and recovery, and security issues; advanced models, including distributed, object-oriented, and online databases.

**Prereq.:** CSIS 3722 or equivalent.

**CSCI 6951 Data Science and Machine Learning 3 s.h.**

Basic methodologies for the data science pipeline: data acquisition and cleaning, handling missing data, exploratory data analysis, visualization, feature engineering, modeling, interpretation, and presentation in the context of real-world datasets. Classical models and techniques for classification, clustering, anomaly detection, deep learning, and collaborative filtering.

**Prereq.:** CSIS 3722 with a grade of C or better.

**Cross-Listed:** CSCI 4851.

**CSCI 6952 Deep Learning 3 s.h.**

Foundations of neural networks and deep learning. Master the practical aspects of implementing deep learning solutions, using a hands-on approach to understanding both theory and practice. Key architectures in deep learning are covered, including feedforward networks, convolution neural networks, recurrent neural networks, long short-term memory networks, autoencoders and generative adversarial networks. Apply deep learning to real world problems.

**Prereq.:** CSIS 3722.

**Cross-Listed:** CSCI 4852.

**CSCI 6961 Client-Side Web Development and Programming 3 s.h.**

Design and development of interactive, multimedia webpages. Effective uses of forms, graphics, and animation. Client-side programming tools, such as dynamic HTML, document object model, and JavaScript for graphics and form validation. Storyboarding techniques and user interface design principles.

**Prereq.:** CSIS 2617 or CSCI 6901.

**CSCI 6962 Server-Side Web Development and Programming 3 s.h.**

Configuration of web server software and the use of server-side programming. Server-side scripting in languages such as PHP and JavaServer Pages. Database access and drivers. Security issues, including access control and secured transmissions.

**Prereq.:** CSIS 3722 and either CSIS 3700 or CSCI 6901.

**CSCI 6970 Biometrics 3 s.h.**

Biometrics is an emerging and fast growing field that has found applications in a wide range of areas. This course will introduce major biometric techniques (face, fingerprint, voice and iris), focusing on the methods that have roots in computer vision, image processing, pattern recognition and machine learning. The course is designed to be project oriented. Student can choose a topic and develop it into a full project. Students who are interested in writing C++ codes and doing tests with OpenCV libraries are particularly encouraged to do so.

**Prereq.:** CSCI 6901 or CSIS 3700 or FSCI 3716/L or permission of instructor.

**CSCI 6971 Cloud Computing and Big Data 3 s.h.**

The objective of this course is to provide an introduction of cloud computing and big data, including the background knowledge and embracing technologies. This course addresses the latest advances in hardware and software, cluster architecture, programming paradigms that emphasize in system performance, scalability, security, and energy efficiency. We also include hands-on experiences for students to practice on building, managing, and programming on contemporary cloud and big data systems. Research directions in cloud and big data will be introduced for graduate level study.

**Prereq.:** CSIS 3700 or CSCI 6901.

**CSCI 6990 Computer Science Project 1-3 s.h.**

Report and discussion of individual topics or research projects in computer science.

**Prereq.:** Nine semester hours of computer science courses numbered above 5000.

**CSCI 6991 Data Engineering Capstone 3 s.h.**

This capstone project is designed so students in the MCIS program get the chance to apply and demonstrate their skills and knowledge in SQL, NoSQL, RDBMS, Bash, Python, ETL, Data Warehousing, Machine and Deep Learning, BI tools, Big Data, Cloud and Distributed Computing, Networking and Security and Software Engineering. To be taken during the last semester of studies.

**Prereq.:** Nine semester hours of computer science courses numbered above 5000.

**CSCI 6993 Computing and Information Systems Graduate Internship 1-3 s.h.**

An industrial/academic experience in information systems/technology. Employment for 15 to 20 hours per week. May be repeated once with the permission of graduate internship supervisor.

**Prereq.:** CSCI 6920 and permission of graduate internship supervisor.

**CSCI 6995 Special Topics in Computer Science 1-4 s.h.**

Special topics in computer science selected by the staff.

**Prereq.:** Permission of chair.

**CSCI 6996 Independent Study 1-4 s.h.**

Study under the supervision of a faculty member.

**Prereq.:** Permission of chair.

**CSCI 6997 Seminar in Computer and Information Systems 1 s.h.**

Overview of research methods and presentation techniques (written and oral) for advanced work in computer science and information systems. Will include presentations of current student/faculty research. Students will be required to deliver at least one conference-style presentation of their own in an area related to their research.

**CSCI 6999 Thesis 3-6 s.h.**

A student may register for six semester hours in one semester or for three semester hours in each of two semesters.

**CSIS 5824 Applied Artificial Intelligence 3 s.h.**

Study of artificial intelligence software related to decision making. Topics may include robotic control, expert systems, automated knowledge acquisition, or logic programming.

**Prereq.:** CSIS 3700 and 3 s.h. of upper-division departmental courses, or CSIS 6901.

**CSIS 5828 Computer Network Security 3 s.h.**

Overview of security issues that arise from computer networks, including the spectrum of security activities, methods, methodologies, and procedures. Intrusion detection, firewalls, threats and vulnerabilities, denial of service attacks, viruses and worms, encryption, and forensics.

**Prereq.:** CSIS 3723 or equivalent.

**CSIS 5837 Artificial Intelligence in Game Design 3 s.h.**

Artificial intelligence techniques for designing and programming intelligent non-player characters for a variety of different types of game genres. Finite and fuzzy state machines, terrain analysis and path planning, board games, language understanding, and learning.

**Prereq.:** CSIS 3700 or CSIS 3701 or CSIS 3726 or CSCI 6901.

**CSIS 5838 Graphics and Animation for Gaming 3 s.h.**

Design and implementation of 3D computer games. Development of 3D characters, including surface creation and effects, skeletal and facial rigging, and motion and animation. Programming those characters in a 3D game engine, including scripting, level and game design, and game physics.

**Prereq.:** CSIS 2605 or CSIS 2610 or CSIS 3737.

**CSIS 5883 Remote Access and Multilayer Switched Networks 4 s.h.**

Advanced WAN connectivity, including Frame Relay, ATM, ISDN, DSL, and modems; IP address scaling techniques; advanced access control; core issues in network design and management, focusing on multilayer switched networks and emerging multi-service networks. Will incorporate CCNP Cisco Academy curriculum. Three hours lecture, three hours lab.

**Prereq.:** CSIS 3783.

**CSIS 5884 Building Scalable Networks and Advanced Internetwork Troubleshooting 4 s.h.**

Designing scalable networks; advanced routing protocols; VLSM and route aggregation; management and diagnostic tools; troubleshooting tools and methodology for TCP/IP, Novell, and AppleTalk connectivity, VLANs, routers, and switches; Frame Relay and ISDN connectivity. Will incorporate CCNP Cisco Academy curriculum. Three hours lecture, three hours lab.

**Prereq.:** CSIS 3783.