Master of Computing and Information Systems

Program Director
Dr. Alina Lazar
307C Meshel Hall
(330) 941-2981
alazar@ysu.edu

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 is designed to serve students with some background in computing (possibly work related) but who need additional deeper, more comprehensive, or more up-to-date knowledge of computing/information systems in order to make career advancements or to better utilize the technology that they are required to use on a daily basis.

Like most applications of information systems, the program is also interdisciplinary in nature to allow students with a background in areas other than information systems to learn how to apply information systems to those areas. A number of interdisciplinary courses are supported, and students may 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:

<table>
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<tr>
<th>COURSE</th>
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<tbody>
<tr>
<td>CSIS 1590</td>
<td>Survey of Computer Science and Information Systems (or equivalent of information systems courses)</td>
<td>3</td>
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<tr>
<td>CSIS 2610</td>
<td>Programming and Problem-Solving (or equivalent of computer programming)</td>
<td>4</td>
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<tr>
<td>CSIS 3700</td>
<td>Data Structures and Objects (or equivalent of computer programming)</td>
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<td>CSIS 3722</td>
<td>Development of Databases (or equivalent of databases courses)</td>
<td>3</td>
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<tr>
<td>CSIS 3723</td>
<td>Networking Concepts and Administration (or equivalent of networking courses)</td>
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<tr>
<td>or CSIS 3782</td>
<td>Cisco Networking Academy 1</td>
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<tr>
<td>INFO 3704</td>
<td>Business Communication (or equivalent of technical communication skills courses)</td>
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Equivalent employment-related experience may be substituted for some of these requirements. The experience must be described in detail and reliably documented (in a letter of recommendation from an employer, for example).

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. The Graduate Record Examination (general test) is also required and students must obtain an acceptable score.

Students not satisfying all admission requirements may be admitted with provisional status subject to the approval of the graduate program director and the graduate dean. Such students will generally be required to take specified undergraduate and/or foundation courses, which will not count toward the master’s degree.

Graduate Faculty
Abdurrahman Arslanyilmaz, Ph.D., Associate Professor
Computer-based learning design; hazard detection in traffic simulation; computer-based and case-based learning

Coskun Bayrak, Ph.D., Professor, Chair
Software engineering, soft computing, Health Informatics

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

Yong Zhang, Ph.D., Associate Professor
Computer vision; image processing; biometrics; object detection and recognition; medical imaging

A minimum of 34 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

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<tr>
<td>CSCI 6901</td>
<td>Principles of Computer Programming</td>
<td>3</td>
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<tr>
<td>CSCI 6920</td>
<td>Theory and Practice of Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 6950</td>
<td>Advanced Database Design and Administration</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 6997</td>
<td>Seminar in Computer and Information Systems (take in the first semester if possible but no later than the second semester)</td>
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<td>Strategic Project and Change Planning</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 6940</td>
<td>Advanced Network Design and Administration</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 6951</td>
<td>Data Warehousing and Data Mining</td>
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Electives
Select a minimum of 15 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.

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<td>CSCI 6999</td>
<td>Thesis</td>
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Total Semester Hours 34

Non-Thesis Option

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Select one of the following: 3
CSCI 6900 Computer Science Project 3 s.h.

Electives
Select a minimum of 18 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.

Capstone Project
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

Total Semester Hours 34

The student's course of study will be determined in conjunction with the student's major advisor and, possibly with an advisor from outside of the department, particularly if the student is interested in applying information systems to some other area. This course of study will be based on the student's area of specialization, background interests, and career interests. It may also include graduate courses from other areas where appropriate. A cohesive individual curriculum program of approved elective courses will be developed in conjunction with the student's major advisor after nine semester hours of core courses have been completed. Prior approval to carry more than 12 credit hours in any one semester must be obtained from the student's major advisor and the Dean of Graduate Studies.

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 area 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.: CSCI 3700 and CSCI 3740.

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.: CSCI 3700 and CSCI 3740.

CSCI 5820 Simulation 3 s.h.
Methods for modeling discrete event systems by algorithmic approaches using simulation languages.
Prereq.: CSCI 3700 and STAT 3743.

CSCI 5822 Database Design and Information Retrieval 3 s.h.
Study of physical database storage, relational and object data modeling, logical database design (normalization process), and structural query languages.
Prereq.: CSCI 3700 and CSCI 3710.

CSCI 5823 Communication Networks 3 s.h.
Study of network structures and topologies, international standards, models, communication media and protocols, hardware and software.
Prereq.: CSCI 3700 and either CSCI 3723 or CSCI 3740.

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.: CSCI 3700 or CSIS 3701.

CSCI 5840 Theory of Finite Automata 3 s.h.
The structural and behavioral aspects of finite automata.
Prereq.: CSCI 3710 and MATH 3720.

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, cryptographic 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 5860 Programming Language Structures 3 s.h.
Systematic approach to the study of the structures of programming languages. Formal descriptions, syntax, semantics and technical characteristics.
Prereq.: CSCI 3701 and CSCI 3710.

CSCI 5870 Data Structures and Algorithms 3 s.h.
Study and application of analysis and design techniques to non-numerical algorithms. Topics selected from algorithms acting on sets, trees, graphs; memory management; notions of complexity and related areas.
Prereq.: CSCI 3700 and CSCI 3710.

CSCI 5881 Microcomputer System Architecture 3 s.h.
State-of-the-art course on microcomputer architecture. Topics include introduction to microcomputer systems, 16 and 32 bit microprocessors, direct memory access and other I/O transfer schemes, architecture of I/O processors, introduction to computer communications.
Prereq.: CSCI 3740 and CSCI 3780.

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.

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CSCI 6900  Computing Information System Workshop  1-3 s.h.
Intensive study and activity in a topic related to computing and information systems. May be repeated. Grading is S/U.
Prereq.: permission of graduate coordinator.

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.
Prereq.: CSCI 6905 or equivalent.

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 6910  Computer Software Systems  3 s.h.
Classes of software systems, system structures, systems operations. Resource management routines. Software design.
Prereq.: CSCI 6905 or equivalent.

CSCI 6915  Computer Organization Architecture  3 s.h.
Organization and architectural design of the subsystems and major functional units of modern digital computers and their interconnections.
Prereq.: CSCI 6905 or equivalent.

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 6921  Strategic Project and Change Planning  3 s.h.
Information technology control, including organizational effects through methods, control techniques, and project tools. Cases provide domestic and international experience via initialization, planning, execution, tracking, and risk assessment. Time, reporting, resources, project relevance, organizational impact, and operational consistency are addressed through anticipatory, reactive, and crisis approaches.
Prereq.: CSCI 6920.

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.: CSCI 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 Warehousing and Data Mining  3 s.h.
Basic methodology for planning, designing, building, using, and managing a data warehouse. Legacy systems, operational data stores, and data marts. Data mining techniques for visualization and deriving information from a data warehouse for strategic decision making.
Prereq.: CSIS 3722.

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.: CSIS 3700 or CSCI 6901.

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 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 CSCI 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 animated characters in 3D computer games. Surface creation and effects; skeletal and facial rigging; motion and animation; basic game physics. Use of 3D animation software and scripting languages for game engine programming.
Prereq.: CSIS 2605 or CSIS 2610 and at least 3 s.h. of upper division CSIS courses, or CSCI 6901.

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.

CSIS 6975  Ethics, Legal Issues, Privacy and Information Security  3 s.h.
A comprehensive study of the principles and practices of computer systems security, information security management, privacy, ethics, legal issues, and compliance. This course covers the foundations for the policy, law, regulatory, and ethical accountability frameworks that information security managers work within.