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1. Introduction

1.1 Purpose of this Guide

This guide is designed to help graduate students in the Computer Science and Systems Analysis Department (CSA) plan and complete successfully a program of study leading to a Master's Degree in Computer Science. Other information that is important for graduate students is found in the publication *A Handbook for Graduate Students and Faculty*, available from the Graduate School.

1.2 The Computer Science & Systems Analysis Graduate Programs

The Department of Computer Science and Systems Analysis at Miami University offers two graduate programs:

- Master of Computer Science
- Certificate in Software Development

The Master of Computer Science is a research-oriented master's degree for students who hold a bachelor's degree in computer science or a closely related field. It requires a thesis which gives each student the opportunity to work closely with the faculty. The objectives of the master's program are to prepare students to:

- Conduct research in computer science with advanced training in selected areas.
- Enter the computing profession as computer scientists, software engineers, systems analysts, or other similar professions.
- Pursue additional postgraduate study in the computing discipline.

The Certificate in Software Development is designed for students who hold a bachelor's degree in a field other than computing and wish to obtain foundational computing knowledge and skills. The certificate program also serves graduate students in other majors at Miami University and may serve to prepare students for further graduate study in computer science with the possibility of admission into the department's master's program. The objectives of the certificate program are:

- To prepare students for employment in the computing field by providing foundational computing knowledge and skills.
- To provide graduate students in non-computing programs with an opportunity to learn to use computers more effectively as a problem solving tool in their discipline.
- To prepare graduates of non-computing programs for entry in further study in computing.

1.3 Applying for Admission

Residents of the United States apply for admission through the Miami University Graduate School. Application forms should be obtained from the Graduate School, completed, and returned to the Graduate School, Miami University, Oxford, OH 45056. Applications are available online via the university's web portal, <http://www.miami.muohio.edu/graduate/>.

Inquiries concerning international student admission should be directed to the Office of International Education Services, Langstroth House, Miami University, Oxford, OH 45056.

Admission is granted for study beginning in the fall semester of each academic year. Please note that applications must be received by the February 1st deadline.

1.4 Prerequisites and Types of Admission

Before entering the program, all students are required to possess a baccalaureate degree (either a B.A. or B.S.) from a four-year degree program and must meet all of the requirements of the Graduate School.

In addition, the Master's program requires a 3.0 (out of 4.0) undergraduate grade point average, the **general** GRE exam scores (must be taken in the last two years and have the following minimal values: verbal 400, quantitative 650, and analytical 3.5), and that applicants demonstrate proficiency in all of the following subjects as shown on their academic record:

- differential and integral calculus
- discrete mathematics
- probability and statistics
- linear algebra
- substantial computer programming in at least one high-level general-purpose programming language (at least 3 semesters which includes data structures)
- computer organization/architecture
- operating systems
- design and analysis of algorithms
- oral and written communications (minimum TOEFL scores of 230 or 500 (paper-based))

Students whose grade point average is under 3.0 may be admitted on Conditional Status. These students must achieve a 3.0 average during their first 12 hours of graduate work in order to remain in the program.

Entry into the certificate program requires admission for graduate study by the Miami Graduate School, either in another graduate program of study or under Continuing Graduate Non-Degree Status (CGS status).

1.5 Assistantships

1.5.1 Applying for Graduate Assistantships and Grants

Graduate assistantships are awards given to students who are working toward a master's degree that provide for tuition waiver as well as a stipend. In return for this financial assistance, graduate assistants work for the Department or the University for 20 hours per week.

When a student applies to the Graduate School, they should state their desire to be considered for an assistantship. Students are advised to have their application into the Graduate School and the Department by February 1 prior to the academic year in which they desire to enroll.

Other forms of financial aid, such as summer scholarships for graduate assistants and grants-in-aid are available from the Graduate School.

1.5.2 Awarding of Assistantships

Awards are made on a competitive basis based upon the following criteria:

- Intellectual ability and past academic performance
- Promise of future academic performance, as shown by recommendations and GRE scores
- Proficiency in communication skills
- Maturity and motivation
- Preparedness, including mastery of prerequisites
- Fit to the needs of the Department
- First graduate degree

Most, if not all, assistantships are awarded in the first semester (fall) of the academic year for a period of one year. Decision for awards is typically made in May of that year. Thus, students wishing to be considered for an assistantship should apply by February 1 of the year.

1.6 Responsibilities of Graduate Assistants

Students work for 20 hours per week for the Department or the University. Duties can include teaching and/or research responsibilities.

1.7 Term and Renewal of Assistantships

Assistantships are granted for one year and are not automatically renewed. Renewal is predicated upon adequate performance during the initial year of support. You are not required to submit an application to be considered for renewal. The performance of graduate students will be monitored and assessed by a faculty or staff advisor. Assistantships are granted for a maximum of two years.

2. Requirements for the Master's Degree

2.1 Course Requirements

The Master of Computer Science curriculum requires 33 semester hours of course work. An individual plan of study must be designed for each student, depending on the individual's background. Figure 1 illustrates the standard curriculum, which is divided into required and elective courses. The electives listed below may not all be available during your program. In addition, the master's program requires a thesis. See Section 5 for more information on the thesis.

Required Courses (12 credit hours)

- CSA 572 Software Engineering
- CSA 586 Artificial Intelligence
- CSA 615 Mathematical Modeling
- CSA 617 Advanced Networks

Additional Requirements

- CSA 610 Research Seminar (3 hours required)
- CSA 700 Thesis Research (6 hours required)
- CSA 381 Operating Systems*
- CSA 385 Database*
- MTH 231 Discrete Mathematics*

Elective Courses (12 credit hours; maximum of 2 courses at the 500 level)

- CSA 564 Algorithms*
- CSA 565 Comparative Programming Languages
- CSA 571 Simulation Modeling
- CSA 573 Automata, Formal Languages, & Computability
- CSA 574 Compiler Design
- CSA 618 Graphics for Simulation and Virtual Environments
- CSA 620 Special Topics
- CSA 621 Advanced Software Engineering
- CSA 622 Advanced Database Systems
- CSA 624 Expert Systems
- CSA 626 Information Retrieval Systems
- CSA 627 Machine Learning
- CSA 628 Advanced Simulation
- CSA 690 Graduate Research

* Required if not part of the student's undergraduate degree program.

Figure 1. Master's Program Requirements

2.2 Sample Plan of Study

Table 1 shows a sample two-year plan of study for the master's program. This plan would require modification for students whose undergraduate study duplicates substantially a required course or if they have not completed a course in Analysis of Algorithms, in which case CSA 564 is required.

Fall	Spring	Summer – Optional	Fall	Spring (if needed)
CSA 615 CSA 617 CSA 586 CSA 610	CSA 572 Elective CSA 700 (Elective) CSA 610	Elective CSA 700	Elective Elective CSA 700 CSA 610	Elective CSA 700

Table 1. Sample Plan of Study.

2.3 CSA Classes Taken Before Entering the Program and Courses from Other Departments

If a graduate student of another department takes CSA graduate courses and later applies to the CSA graduate program, at most three of the previously taken CSA courses will be counted towards the student's CSA master degree.

Credits earned toward another master's degree or from another school may be applied toward the degree. Consult the publication *A Handbook for Graduate Students and Faculty* for additional information regarding transfer credits and discuss possible transfer of credits with the Director of the Graduate Program. All transfer credits must be approved by the Computer Science and Systems Analysis Graduate Committee.

2.4 Grades and Credit/No Credit Courses

All CSA courses other than CSA 600, CSA 610 and CSA 700 must be taken for a grade if they will be used to satisfy the degree requirements. CSA 600 (Independent Study) and CSA 610 (Research Seminar) are offered for credit/no credit only.

2.5 Minimum GPA Requirement

The minimum grade point average (GPA) required by the Graduate School for an advanced degree is 3.0 in both your major field and your total grade point average. The computation of the GPA includes all graduate and undergraduate courses.

3. Requirements for the Certificate Program

3.1 Course Requirements

The Certificate program requires 20 semester hours of course work. Table 2 illustrates the required courses.

Fall	Spring
CSA 603	CSA 606
CSA 604	CSA 385 or CSA 381
MTH 231	CSA 608

Table 2. Sample Plan of Study.

Students who plan to enter the workforce after completing the certificate program are advised to take CSA 385 (Database Systems). Students who plan to continue their education in computing are advised to take CSA 381 (Operating Systems) and then CSA 385 (Database Systems) during the subsequent summer. If CSA 385 is not offered in the summer, then CSA 381 must be taken during the student's MCS program. CSA 606 requires CSA 603 with at least a grade of B.

3.2 Minimum Requirements

A student must maintain a minimum 3.0 GPA in required courses for the certificate. A student may petition the graduated committee to transfer a maximum of 3 courses.

4. Advising

4.1 New Students

Entering students must meet with the Director of the CSA Graduate Program for initial advising and determination of a Plan of Study the week prior to the start of the fall semester. Students who are supported by assistantship are required to attend an orientation session prior to the start of the semester. Failure to do so may result in forfeiture of the assistantship.

4.2 First-Semester Advisor

The Director of the CSA Graduate Program is the advisor for all first-semester students; however, after their first semester in the program students should seek a thesis adviser. Students should customize the electives in the Plan of Study (the form is appended to this guide) in consultation with their thesis advisor. The purpose of the plan is to identify all requirements for graduation and can be used as an aid in planning. The plan can be updated in consultation with the Graduate Director.

4.3 Thesis Advisor

Students should try to become familiar with the faculty of the department and begin thinking about a thesis topic and a potential faculty member to act as a permanent advisor. One way to do this is by selecting CSA 610s (Research Seminar) that highlight a faculty member's research interests. It is the student's responsibility to approach one or more faculty members and ask whether they are available to supervise the student's graduate research and also act as a permanent academic advisor. A faculty member may advise as many as two or three graduate students at a time, so the student's first choice of an advisor may not be able to accommodate them.

You are not required to choose a thesis advisor who is a member of the CSA department. If you choose a non-CSA thesis advisor, they will carry the designation of thesis co-advisor and another thesis co-advisor must be chosen who is a member of the CSA department.

Faculty members supervise research in an area of their own interest. A student may have to select a topic that is not the one that he or she originally planned. It is the student's responsibility to identify a faculty advisor during the second semester of their first year in the MCS program.

5. Thesis Requirement

5.1 Course Requirements and Distinction Between CSA 690 and CSA 700

Students are required to complete at least 33 semester hours of work, of which six hours are in CSA 700. The rules for CSA 700 are as follows:

- A minimum of two semesters of enrollment in CSA 700 is required,
- Enrollment in the first semester of CSA 700 is by permission of the student's thesis advisor,
- Enrollment in the first semester of CSA 700 is limited to 5 credit hours and 2 credit hours are recommended,
- Enrollment in the second semester of CSA 700 requires presentation and approval of your thesis proposal by your thesis committee,
- Topics studied in CSA 690 may not duplicate the topic of your thesis research (CSA700). A master's degree candidate may earn a maximum of three credits of Graduate Research (CSA690) to count toward fulfillment of degree requirements. If a topic studied in Graduate Research turns into a Thesis topic, then the credit earned in Graduate Research (690) is to be substituted for three hours of Thesis Research (700).

5.2 Graduate Research: The Thesis

Graduate research is made up of two phases, which take a minimum of two semesters to complete. These phases are:

- Proposal Phase
- Research Execution Phase

These two phases are described below:

In the Proposal Phase, the student may register for the first semester of CSA 700 (Thesis Research). The number of CSA 700 credit hours is limited to 5 and 2 is recommended. Figure 2 shows the steps to be carried out in the Proposal Phase:

- a) Choose a faculty advisor
- b) Customize the electives of the Plan of Study with the advisor
- c) Choose a research topic
- d) Choose a Thesis Committee with the advisor
- e) Prepare a research proposal
- f) Present the proposal to your committee and the public
- g) Obtain approval of your proposal from your committee. An approval form is appended to this guide.

Figure 2. Research Proposal Phase.

In the Proposal Phase the student will prepare a research proposal under the supervision of a faculty member. The proposal will include:

- a description of the research problem;
- research objectives;
- significance and background of the problem;
- the approach and methodology to be used;
- expectations from the study.

Prior to beginning the Research Execution Phase, the student **must** have the proposal approved by his or her Committee. Then the student may register for a second semester of CSA 700 and commence the Execution Phase, as shown in Figure 3.

<p>a) Conduct the research b) Prepare the thesis c) Defend the thesis before the Thesis Committee and the public d) Make the final copies of the thesis and submit it for binding</p>
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Figure 3. Research Execution Phase.

In this phase, the student must successfully present and defend the results of his or her work to the public. This presentation and its evaluation constitute the final examination. The thesis must be read before the date of the examination by the members of the examination committee. (The time required for this is detailed below.) Thus, one must have completed the thesis early enough in the semester in which one intends to be examined so that the committee members have adequate time to read the thesis.

The usual format for the defense begins with a 30 to 40 minute oral presentation, accompanied by audio/visual materials (overhead transparencies, presentation software, etc.), to his or her examining committee and the public. The student should review his or her presentation with their advisor prior to giving the presentation.

Following the presentations, members of the committee or the public may question the student. The entire presentation and question period typically lasts about one hour.

Lastly, the public is excused and the examining committee determines whether the student has passed the examination.

5.3 Suggested Time Line

Table 3 summarizes important milestones for a graduate student following the Thesis Option.

Semester	Faculty Milestone	Thesis Milestone
1	Become familiar with the CSA faculty – take Research Seminar (CSA 610)	Consider topics of interest in the field and identify research interest
2	Approach faculty members about being the advisor, identify a thesis committee, begin and potentially complete proposal.	Begin and potentially complete proposal
Summer		Complete proposal and obtain approval
3	Conduct research	Begin writing thesis

4	Present and defend thesis	Complete thesis research and defend the thesis
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Table 3. Important Milestones.

For students who are able to complete the program in less than four semesters, the time line in Table 3 will be compressed, and the student must initiate each milestone earlier than shown in the table. Also, the student should remember that at least two semesters of CSA 700 are required.

5.4 Organization of the Proposal

The purpose of the proposal is to:

- state your thesis topic; i.e., a description of the research problem
- state the context of your study, usually as a literature survey, and research objectives
- state your research methodology and expectations
- gain suggestions from your committee, the faculty, and other students.

Accordingly, the proposal should present the above information and should include a supporting reference list.

5.5 Organization of the Thesis

5.5.1 Style

The results of the research must be reported in the form of a thesis, following the Graduate School's guidelines, as specified in *The Guidelines for Writing a Thesis or Dissertation*, available at the Graduate School. This section is intended to provide a suggested structure for the thesis.

5.5.2 Chapters

A research study should contain a statement of the question to be investigated or goals of the study, a review of relevant literature, a description of how one analyzed, extended, or applied what was learned, results or issues that have been identified in the study, and finally some conclusions that can be drawn and suggestions for future work. The thesis might contain the following sections:

1. Introduction (including goals or thesis question and the significance of the problem to be studied)
2. Literature Survey (background and related work)
3. Analysis Method
4. Results
5. Summary and Conclusions
6. Bibliography

All theses from former students are housed in the library and are available for review as examples of prior work.

5.5.3 Help with Writing

Miami University's Office of Learning Assistance has a Writing Center that offers help with writing. Contact that office (529-8741) if you need help with writing.

5.6 Submission of Final Copies

The student is responsible for copying the thesis and submission of it to the library for binding, or in electronic form as specified by current Miami Graduate School guidelines. Follow the guidelines as provided by the Graduate School as described above in the “Style” section. Take a copy to the Graduate School (or the library) before printing the final copy. The Graduate School is serious about things like margins, page numbers, etc. Do not make final copies of the thesis until the Graduate School approves.

5.7 Housekeeping Tasks

Missing any of the deadlines listed below could delay graduation to a later semester.

5.7.1 Proposal

The proposal must be presented to the public. Student responsibilities include the following:

- Students must schedule a date, time and location to present their proposal with one of the secretaries at least one week (five working days) prior to the intended date of the proposal presentation. The student must provide the title of their proposal, brief abstract, and list of their committee members at the time of scheduling. The secretary will prepare, post, and distribute the proposal announcement to the appropriate individuals.
- If the student has scheduled 223 or 105 Kreger Hall for their proposal presentation, they must schedule an appointment with the SEAS IT support group (529-1930) a week (five working days) in advance to be trained on the computer equipment in the room. If needed, students will also have to reserve equipment such as a laptop computer with SEAS IT a week (five working days) in advance.

5.7.2 Thesis

The thesis is also presented to the public. Student responsibilities include the following:

- Students must apply to the university for graduation and pay the graduation fee.
- Adequate time must be provided for the examining committee to read the thesis prior to the defense. The student should copy and deliver a version of the thesis that has been approved by the advisor to members of the examining committee at least two weeks (ten working days) prior to the defense date.
- The defense must be completed at least two weeks (ten working days) prior to the date on which the student intends to graduate.
- Students follow the steps defined in Section 5.2.

6. Resources

6.1 Kreger Hall

Entrance to Kreger Hall requires the insertion of a Miami ID on the card swipe the outside of the doors facing Irving. If your ID does not unlock the doors, please report this malfunction to the CSA office (230 Kreger).

6.2 Graduate Study Room

The graduate study room is located in room 122 Kreger Hall. Entrance requires a key, which may be obtained from the CSA office (230 Kreger). A refundable deposit of \$10 is required for each key. Each student is required to keep their key secure, not lend it, and return it prior to graduation. Please report lost keys to the CSA office.

A refrigerator and microwave oven are provided in the study room for lunch and snacks. Please do not use the faculty lounge.

6.3 Teaching Assistant Offices

Students who are assigned teaching or research responsibilities may be assigned an office when space is available. Otherwise, individual office space is typically not assigned to graduate students. Office keys are available from the CSA office, 230 Kreger.

6.4 Mailboxes

Mailboxes in the CSA Office are provided (on a shared basis) to students holding graduate assistantships. A common mailbox is also provided for all other graduate students. Students should check their mailboxes at least once per week.

6.5 Computing Accounts

6.5.1 School of Engineering and Applied Science Local Area Network

Personal computers in the Applied Science labs are networked using an Ethernet local area network (LAN) to a central file server that is running Novell Netware. A suite of Windows-compatible software is available for use on these machines. Graduate students will be assigned individual Netware login ids and file space on the server. This LAN is interconnected to the Miami University campus network (Munet).

6.5.2 School of Engineering and Applied Science Unix Systems

The School of Applied Science maintains a number of multi-user or server computers running versions of Linux. Accounts are assigned upon request or for certain classes. To obtain a personal account, see the Applied Science Microcomputer Lab Manager, SEAS IT, room 204 Kreger.

6.5.3 Information Technology Services (IT Services)

Information Technology Services (IT Services) maintains a Unix system (Unixgen). These systems are connected to the internet and can be used for email. Every student is assigned an account on both of these machines -- the login id is based on the university standard that is up to six characters from the last (surname) and the first two initials. Conflicts are resolved by appending an integer. The password is MMDDSSSS where MM is your birth month, DD is your birth year and SSSS is the last 4 digits of either your social security or student ID number. Students can verify their login ID by using the ph program (on-line phone directory) that is available on SEAS Lab PCs. These machines can be used for email access.

6.5.4 MUNet

IT Services also supports the Miami University Data and Video Network. This network will interconnect all Miami offices, classrooms, and residence halls to the campus network and to the Internet, thus supplying email and World Wide Web access. Off campus students can connect using dial-in and the Point-to-Point Protocol (PPP) or using RoadRunner via cable modem. You

can obtain the necessary software to connect to the network from the Bookstore, from a residence hall RA, or for downloading in the IT Services Learning Technologies Centers in MacCracken and Reid Hall. For more details, see the IT Services booklet “IT Services Guide to MUNet.”

6.6 Library

The science library is Brill and is located in Hughes Hall.

6.7 Web Pages of Interest

Several web pages should be of special interest to you. These are:

http://www.muohio.edu/	Miami’s home page
http://www.eas.muohio.edu/	Engineering & Applied Science home page
http://www.lib.muohio.edu/	Miami libraries
http://www.eas.muohio.edu/csa	Computer Science & Systems Analysis home page

7. Administration of the Graduate Program

7.1 Administration

The graduate program is administered by the Graduate Director and the Departmental Graduate Committee.

7.1.1 Graduate Director

The Graduate Director is Dr. Ann E.K. Sobel, room 230J Kreger Hall, voice phone (513) 529-7541, fax (513) 529 1524, email sobelae@muohio.edu.

7.1.2 Graduate Committee

A committee of graduate faculty recommends policy and procedures to the faculty as a whole. The Graduate Committee also considers student plans of study, petitions and requests for exceptions to the requirements for the program, and any other issues of importance for the operation of the program.

7.2 Student Advisory Committee

A committee of graduate students may be appointed by the Graduate Director to act in an advisory capacity and help to facilitate communication between the faculty and the graduate student community.

8. Faculty

The CSA faculty has been partitioned into the following general CS research areas. The details of each faculty member's research can be found on their respective web page at <http://www.eas.muohio.edu/csa/facultystaff.html>.

Virtual Environments

Eric Bachmann

Optimization & Simulation

Donald Byrkett and Mufit Ozden

Network Security

Scott Campbell and Lukasz Opyrchal

Information Retrieval & Databases

William Brinkman, Valerie Cross, Fazli Can and Yuksel Uckan

Artificial Intelligence

Pedrito Maynard-Zhang and Michael Zmuda

Software Engineering

Ann Sobel, Douglas Troy, James Kiper and Alton Sanders

9. Course Descriptions:

All electronic syllabi can be found at <http://www.eas.muohio.edu/course.html>.

10. Approval Forms

Samples of the Plan of Study Form and Thesis Proposal Approval Form are attached.

Plan of Study for Master's Degree Program

Name _____ Year of Enrollment: 20_____

Prior Study: CS degree Certificate Combined CE degree

Undergraduate Deficiencies: Algorithms Data Base Operating Systems Discrete Math

Required Courses (12 credit hours required)

Course	Satisfied?
572 Software Engineering	
586 Artificial Intelligence	
615 Mathematical Modeling	
617 Advanced Networks and Distributed Processing	

Elective Courses (maximum of two at 500 level; 12 credit hours required)

Course	Eligible?	Required?
564 Analysis of Algorithms		
565 Comparative Programming Languages		
571 Simulation Modeling		
573 Automata, Formal Languages and Computability		
574 Compiler Design		
583 Statistical Forecasting		
585 Advanced Database		
618 Graphics for Simulation and Virtual Environments		
620 Special Topics		
• Computer Systems Security		
• Requirements Engineering		
• Networked Virtual Environments		
• Operations Research Models and Techniques		
621 Advanced Software Engineering		
624 Expert Systems		
626 Information Retrieval Systems		
627 Machine Learning		
628 Advanced Simulation		
690 Graduate Research		

610 Research Seminar (3 credit hours)

700 Thesis Research (maximum of 5 hours in first semester; 6 credit hours required)

COMPUTER SCIENCE & SYSTEMS ANALYSIS DEPARTMENT

THESIS PROPOSAL

PRESENTED BY: _____

TITLE: _____

DATE: _____

COMMITTEE RECOMMENDATION:

Approved as submitted

Conditionally approved subject to revisions:

Rejected - Recommended Action:

Revise as follows and resubmit

Proposal not acceptable for thesis study

COMMITTEE MEMBERS:

_____ (advisor) Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

Abstract (single paragraph, 100 word maximum):

Attach a two-page research abstract with contents outlined in the Graduate Handbook