

**THE MASTER of SCIENCE
in
COMPUTER SCIENCE
GRADUATE PROGRAM BROCHURE**

--

**UNIVERSITY OF MINNESOTA DULUTH
DULUTH, MINNESOTA 55812**

2021-2022

The information in this brochure and other University catalogs, publications, or announcements is subject to change without notice. University offices can provide current information about possible changes.

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

In adhering to this policy, the University abides by the Minnesota Human Rights Act, Minnesota Statute Ch. 363, by the Federal Civil Rights Act, 420 S.C. 2000E; by the requirements of Title IX of the Education Amendments of 1972; by Sections 503 and 504 of the Rehabilitation Act of 1973; by Executive Order 11246, as amended; 38 U.S. 2012, the Vietnam Era Veterans Readjustment Assistance Act of 1972, as amended; and by other applicable statutes and regulations relating to equality of opportunity.

University of Minnesota Graduate School Commitment to Diversity

The Graduate School embraces the University of Minnesota's position that promoting and supporting diversity among the student body is central to the academic mission of the University. We define diversity to encompass many characteristics including economic disadvantage, special talents, evidence of leadership qualities, race or ethnicity, a strong work record, and disability. A diverse student body enriches graduate education by providing a multiplicity of views and perspectives that enhance research, teaching, and the development of new knowledge. A diverse mix of students promotes respect for, and opportunities to learn from, others with the broad range of backgrounds and experiences that constitute modern society. Higher education trains the next generation of leaders of academia and society in general, and such opportunities for leadership should be accessible to all members of society. The Graduate School and its constituent graduate programs are therefore committed to providing equal access to educational opportunities through recruitment, admission, and support programs that promote diversity, foster successful academic experiences, and cultivate the leaders of the next generation.

TABLE OF CONTENTS

1. THE DEPARTMENT OF COMPUTER SCIENCE	4
1.1 Computing Facilities	5
1.2 The Faculty	7
2. ADMISSION INFORMATION	9
2.1 Departmental Information	10
2.2 Application Deadlines	11
2.3 Entrance Requirements	12
2.4 Ethical Considerations	13
3. FINANCIAL AID	13
3.1 Financial Aid Application	14
3.2 Costs	15
4. REQUIREMENTS FOR A M.S. DEGREE IN COMPUTER SCIENCE	15
4.1 Residency	15
4.2 Performance	16
4.3 Courses	17
4.4 Additional Requirements for Plan A (Thesis Option)	18
4.5 Additional Requirements for Plan B (Project Option)	18
4.6 Departmental Progress Milestones (Plan A and Plan B)	18
4.7 Degree Papers and the Thesis/Project Proposal	20
4.8 Colloquium and Oral Exam	21
4.9 Records and Departmental Policies	21
4.10 Career Fair and Other External Off-Campus Attendance Policy	22
4.11 2018-19 Schedule with Important Dates	22
4.12 Graduate Student Deadline Checklist	24
5. SELECTED COURSE DESCRIPTIONS	25
6. GRADUATES	29
7. RELATED POLICIES AND INFORMATION	47
7.1 Mutual Responsibilities in Graduate Education at the University of Minnesota	47
7.2 Resolution of the Council of Graduate Schools in the United States	49
7.3 Other University Documents	50

1. THE DEPARTMENT OF COMPUTER SCIENCE

Computer Science is a discipline that requires understanding the design of computers and computational processes. The discipline ranges from the theoretical study of algorithms to the design and implementation of software at the systems and applications levels. The Department of Computer Science offers programs leading to both the B.S. and M.S. degrees in Computer Science. The M.S. is a two-year program that depends upon a solid foundation in mathematics and statistics, computational problem solving, software design and analysis, programming languages, algorithms, data structures, and computer organization and architecture. The Master's program builds upon this foundation to provide depth in specified areas of computer science, with a focus on research and research methods. It provides the necessary foundational studies for graduates planning to pursue either a Ph.D. in computer science or a career as a computer scientist in business or industry.

Graduates from our M.S. program complete a wide range of research in computer science. Students and their thesis or project titles is provided on this web page:

<https://scse.d.umn.edu/about/departments-and-programs/computer-science-department/computer-science-research/research>

The department currently consists of eleven full-time faculty members with Ph.D.s in computer science or a closely related field. On an annual basis, the department confers approximately fifty to sixty bachelor's degrees. The Master's program, begun in 1987, serves a student body of approximately twenty students per year.

The Computer Science Department is part of the Swenson College of Science and Engineering at the University of Minnesota Duluth, a campus of the University of Minnesota system. The University provides a comprehensive set of high quality programs in the areas of undergraduate, graduate and professional education to a population of some 10,000 students. Duluth is located on the shores of Lake Superior in one of the most beautiful areas of the country with numerous opportunities for outdoor activities. The metropolitan area, with a population of approximately 100,000, offers many cultural events and excellent educational, recreational, and medical facilities.

The faculty is committed to excellence in both teaching and research. Research is focused in the following areas:

Computer Security	Artificial Intelligence
Parallel/Distributed Computing	Human Computer Interaction
Natural Language Processing	Machine Learning
Environment Simulation	Energy Efficiency
Sensors and IoT	Health informatics
Cloud Computing	Data Mining
Operating Systems	Computer Networks
Network Traffic/Performance/Quality	Reinforcement Learning

Virtual Environments
Applied Perception in Graphics

Real-time Systems
Knowledge Representation
Computational Linguistics

1.1 Computing Facilities

UMD students have access to a variety of computing facilities.

Computer Science Computing Facilities.

Each Research and Teaching Assistant affiliated with the department is provided with a workstation for his/her own use. Each workstation is on the UMD network and has access to a printer.

The Department maintains six departmental laboratories, described below. Along with its description is included the primary use of the lab, its location, and, where applicable, the faculty member who maintains it.

1. The CS Software Development Lab. 17 Alienware X51 workstations. 2 Dell Precision T5500 w/ NVIDIA Tesla cards. 3 iMacs. 1 HP All-in-one for windows consulting. [Heller Hall 314].
2. The CS Networking and Hardware Lab. 22 Dell workstations with removable hard drives. This lab has magnetic keycard access and is available to students registered in networking and system-related classes 24 hours a day. The lab also contains dedicated network switches and routers to provide a network testbed for exploration and investigation of network connectivity and communication protocols. [Marshall W. Alworth Hall (MWAH)187]
3. LARS Lab - The Laboratory for Advanced Research in Systems (LARS) is a lab dedicated to cutting-edge research into the security and efficiency of modern devices and their operating systems. Founded in 2015, the lab is currently under construction, but will feature a publicly-available testbed for hardware and software testing and energy measurement. The testbed will provide full hardware access and energy measurement for a variety of device types to researchers at UMD and beyond. LARS will also have a workstation for building devices and adding energy measurement instrumentation to existing hardware, such as smart phones, laptops and tablets. LARS has a strong commitment to education and outreach; in addition to hosting UMD's Ubuntu Linux mirror and developing security exercises for university students, we will be hosting a competitive cyber-tank programming league for regional high school students. [334 Heller Hall; Peterson]
4. Research at Distributed Systems and Networking Lab (DSNL) in UMD concentrates on designing highly scalable and efficient networking

infrastructures, by combining optimization, economics, and computer science. Besides network optimization, projects at DSNL also address application specific issues in cloud computing, peer-to-peer (P2P) and multimedia systems. For example, our study on cloud computing aims to mitigate the performance as well as the energy issues in the existing visualization environments. Our students will be able to test and explore different real-world cloud systems (e.g., cloud gaming/synchronization apps) in our lab. [MWAH 187; Wang]

5. Simulation and Interaction in Virtual Environments (SIVE) Lab. The SIVE Lab specializes in interactive simulations that use GPU-based resources, or benefit from interactive, immersive visualization capabilities. The lab consists of a 21ft x 33ft space containing a OptiTrack Motion Tracker system. The tracker system is primarily used to track the movements of users potentially wearing head-mounted displays (such as the NVIS nVisor SX Head Mounted Display or several Oculus Rift displays). The lab also contains a specialized L-shaped stereo projection display system. The L-shaped display is part of a haptic terrain system that allows users to feel what they virtually step on through the use of a special, robotic Smart-shoe. Two projectors provide forward and floor stereo projection for the user. This equipment allows us to provide an interactive, immersive experience in which people are able to walk around using their own locomotive abilities in a simulated 3D space. The lab also contains several Linux and Mac workstations to support the computation associated with visualization and interaction in these virtual environments. The lab is used for research, as well as teaching classes on human-centered computing (HCC) in virtual environments. Both undergraduates and graduate students work in the lab on a regular basis. Access to the lab is scheduled by the instructor. [Marshall W. Alworth Hall (MWAH) 143; Willemsen]

6. Motion and Media Across Disciplines (MMAD) Lab. The MMAD lab is supported by an interdisciplinary group of researchers (Morris Levy, Biomechanics-HPER; Joellyn Rock, Art + Design; Thomas Isbell, Theater; Robert Feyen, Mechanical and Industrial Engineering; Peter Willemsen, Computer Science, with assistance from Lisa Fitzpatrick). The lab is funded through an Infrastructure Investment Initiative (I3) award from the University of Minnesota.

The MMAD Lab is a 3D motion capture and high definition video production studio. It is equipped with a multiple camera shooting space, cyclorama and backdrops, studio lighting and sound booth, and a Vicon motion tracking system. The high definition video production and motion capture studio fosters faculty collaboration and research in biomechanics, ergonomics, animation, performing arts and computer generated virtual environments research. Access to the lab is scheduled by the instructor. [Bohannon Hall 24a; Willemsen]

In addition to these resources, the Computer Science Department maintains two compute servers. The Dell PowerEdge R820 has 10 8-core processors and 512GB of

memory. The Dell PowerEdge R815 compute server has 4 8-Core processors and 192 GB of memory. Both run Ubuntu Linux. These computers are often used in advanced classes for extremely large jobs and for undergraduate research. The Department also maintains a file server. This file server is a virtual computer running on ITSS's servers, and has about 5TB of storage for people in Computer Science.

U.M.D. Computing Facilities

UMD's Information Technology Systems and Services (ITSS) provides a wide range of computing services including networking, computing labs (using a variety of hardware/software platforms) and a wide range of application software. To learn more about the resources available to students, visit the [ITSS website](#).

1.2 The Faculty

A listing of departmental graduate faculty, along with a brief description of teaching and research interests and a recent publication, follows:

Arshia Khan, Ph.D., Professor of Computer Science

Teaching and Research Interests: ***Humanoid Therapeutic Robotics and Wearable Sensors***: My research interests span the robotics, medical informatics, and biomedical engineering requiring interdisciplinary collaborations with experts such as cardiothoracic surgeon, neuropsychologists, roboticist, psychologist, physical therapist, dietician, nurse and occupational therapist. Given my engineering background and interest in medicine, my research has evolved into various segments of biomedical engineering such as robotic assistive technology, sensor based assistive mobile technology, and personalized medicine.

Publication:

Khan, A., Bahra, R. Bipolar Depression Druid: Wireless Technology Framework to Predict Bipolar Depression. Proceedings of the International Conference on Health Informatics and Medical Systems, Las Vegas, 2016; http://worldcomp-proceedings.com/proc/p2016/HIMS16_Contents.html; ISBN: 1-60132-437-5, CSREA Press

Khan, A., Reuter, M., Phung, N. (2016) "Wireless Solution to Prevent Decubitus Ulcers: Preventive Weight Shifting Guide, Monitor, and Tracker App for Wheel Chair Users with Spinal Cord Injuries (Phase II), Proceedings of the e-Health Networking, Applications and Services (Healthcom), 2016 IEEE 18th International Conference on (pp. 1-6). IEEE.

Khan, A. Imtiaz, D., Seelye, A. (2017). Happy Times: A Mobile Multimedia Reminiscence Therapy Application to Reduce Behavioral and Psychological Symptoms in Persons with Alzheimer's -Phase 1. Journal of Healthcare Engineering

Khan, A. Hassan, A., Seelye, A. (2017). Framework to Predict, Identify, and Track Wandering behavior in Individuals with Alzheimer's Dementia using Various Physiological and Other Sensors, and Kinects. EURASIP Journal on Advances in Signal Processing.

Research Description: My research sits under the umbrella of biomedical and health informatics where wireless sensor based mobile assistive technology and robotics are used to enhance the delivery of care. In the recent months, my research interests have evolved into robotic assistive technology where we are employing new and innovative assistive robotic technologies to help patients recover after open heart surgery. In addition, we are also exploring the use of robots in identifying and predicting wandering behavior among individuals with dementia. I am fortunate to be able to contribute to the growth of this new and emerging field of medical and health informatics. In this interdisciplinary work, I am collaborating with experts such as cardiothoracic surgeon from St. Luke's, neuropsychologists from the VA, roboticist from University of Minnesota TC campus, psychologist from Cadence Hospital, physical therapist and Essentia Health systems, dietician, nurse and occupational therapist.

Assistive technology plays an important role in offering individuals opportunities to track and monitor any personal health problems. There is a big need for tools that can increase individual access to applications that can be used to their benefit. In particular, mobile and robotic assistive technology has been recognized to have a great potential in advancing the delivery of care in chronically ill individuals.

Wireless sensors integrated with mobile platforms offer cost efficient solutions that have the potential to address, track and monitor chronic illnesses in real time by remote monitoring, patient data tracking, increased accessibility to patient clinical data and wellness apps.

In the area of sensor based mobile technology my projects utilize sensors for tracking heart rate, blood pressure, body surface temperature, oxygen saturation, accelerometer, and pressure sensors to monitor and track various physiological conditions that play a role in prevention of pressure ulcers, tracking, monitoring and management of bipolar disorder, and detection of wandering in patients affected with dementia.

Sophia Knight, Ph.D., Assistant Professor of Computer Science

Publication: Sophia Knight, Bastien Maubert, François Schwarzenruber: Reasoning about knowledge and messages in asynchronous multi-agent systems. *Mathematical Structures in Computer Science* 29(1): 127-168 (2019)

Research Description: I research the relationship between knowledge, communication, information flow, and interaction in dynamic multi-agent systems, using tools from concurrency theory and epistemic logic. I apply these ideas to problems in social

networks and other multi-user online systems with personal data, as well as to security problems. I have studied these problems from several perspectives: various modal logics with an epistemic focus, process algebra, games, and topological models. I am currently working on a logic for analyzing the effects of asynchronous communication on knowledge as well as an epistemic version of strategy logic for modelling agents' abilities and knowledge under uncertainty. I am also developing a constraint programming language with modal information, in order to reason about knowledge and information flow among agents in a distributed system.

Eleazar Leal, Ph.D., Assistant Professor of Computer Science

Teaching and research interests: Database Management, Data Mining/Machine Learning, Parallel Algorithms for GPUs and Multicore CPUs.

Publication: Eleazar Leal, Le Gruenwald, Jianting Zhang, Simin You. Parallel Processing of Top-K Trajectory Similarity Queries with GPGPUs. *International Journal of Big Data*, Vol. 3, Issue 2, 2017.

Research Description: My research interests lie in the intersection of data mining/machine learning, database management, and parallel algorithms. My research goal consists in designing parallel algorithms for GPUs and multicore CPUs that: use data mining to solve database management problems, or that use database management techniques to solve data mining challenges. Some more concrete areas where I have worked are: spatial databases, data stream management, and spatio-temporal mining.

Richard Maclin, Ph.D., Professor of Computer Science

Teaching and research interests: data mining, machine learning, bioinformatics, database management systems, artificial intelligence, robotic learning.

Publication: Advice Refinement for Knowledge-Based Support Vector Machines. *Proceedings of the Twenty-Fifth Conference on Neural Information Processing Systems (NIPS 2011)* (with G. Kunapuli and J. Shavlik)

Ted Pedersen, Ph.D., Professor of Computer Science

Teaching and research interests: natural language processing, computational linguistics.

Publication: Offspring from Reproduction Problems: What Replication Failure Teaches Us. *Proceedings of the 51st Annual Meeting of the Association for Computational Linguistics, August 4-9, 2013, pp. 1691-1701, Sofia, Bulgaria.* (Fokkens, van Erp, Postma, Pedersen, Vossen, and Freire)

Research Description: I develop methods that enable computers to understand and use human language. I am especially interested in automatically organizing words and concepts based on their meaning since this is often at the core of solving a wide range of problems in human language. I'm a great believer in open science, and put a high priority on making software and data freely available so that experimental results can be easily reproduced by other researchers.

Peter Peterson, Ph.D., Assistant Professor of Computer Science

Teaching and research interests: Computer Security, Operating Systems, Energy Efficiency, CS Education

Publication: Datacomp: Locally Independent Adaptive Compression for Real-World Systems. Peter A. H. Peterson and Peter L. Reiher. In the Proceedings of the International Conference on Distributed Computing Systems (ICDCS), 2016.

Research Description: My primary research focuses on computer security and efficiency -- and on the intersection of the two. Security generally costs more resources than insecurity, and efficiency efforts can hurt security. I look at how to improve security while reducing the efficiency impact, or how to improve efficiency without meaningfully harming security. I also perform research and development in the area of computer security education.

Jomara Sandbulte, Ph.D., Assistant Professor of Computer Science

Research Description:

Focused on how to help people develop software that is effective and inclusive, and how technology can be used to support individuals to share and collaborate, to learn, and to manage their lives. The people she is trying to help range from developers to end users who interact with systems and services. In particular, main research has focused on Health Informatics, a topic that is broadly concerned with using information technology to improve healthcare outcomes. Work has explored how technology can be used to support individuals' health and wellbeing by evaluating existing systems (e.g., wearables trackers) or building alternative applications (e.g., mobile apps). In addition, Has interest in expanding her research scope to propose projects focused on accessibility, user diversity, and software development (e.g., mobile development). Uses an interdisciplinary approach in conducting research where the users are in the center of the development process. To achieve that, combines qualitative methods such as interviews and design thinking techniques such as prototyping software to create systems aiming for a great user experience.

Publications:

Sandbulte, J., Tsai, C. H., & Carroll, J. M. Family's health: Opportunities for non-located intergenerational families collaboration on healthy living. International Journal of Human-Computer Studies, 146, 102559.

10:13

Sandbulte, J., Beck, J., Choe, E. K., & Carroll, J. M. (2020). Inciting Incidents: How Can We Motivate Family Conversations about Health?. *International Journal of Human-Computer Interaction*, 1-14.

10:15

One more article (PS. Binda is my maiden name): de Oliveira, E, Bindá, J, Valle, E, Lopes, R. Paperclickers: Affordable solution for classroom response systems. *Comput Appl Eng Educ.* 2020; 28: 1520– 1535. <https://doi.org/10.1002/cae.22323>

Andrew Sutton, Ph.D., Assistant Professor of Computer Science

Teaching and research interests: theory of randomized search heuristics, theory of evolutionary computation, parameterized complexity, randomized algorithms.

Publication: B. Doerr, F. Neumann, and A. M. Sutton. Time Complexity Analysis of Evolutionary Algorithms on Random Satisfiable k-CNF Formulas. *Algorithmica*, 78:2 (2017), pp. 561-586. [\[Article Link\]](#)

Research Description: My research takes an algorithmic approach to studying search and optimization heuristics that come from the domain of artificial intelligence. These techniques are sometimes inspired by natural processes and are popular because they are easy to deploy in situations where problem-specific knowledge is incomplete due to domain complexity or resource scarcity. Despite their industrial use and practical success, the development and application of these approaches is still very much an art, often driven by trial and error. The broad goal of my research is to develop a sound and mathematically rigorous understanding of the influence of problem structure on the behavior of these kinds of search and optimization algorithms.

Haiyang (Henry) Wang, Ph.D., Associate Professor of Computer Science

Teaching and research interests: computer networking, in particular, cloud computing, social networking, peer-to-peer networking, multimedia communications, IP routing and QoS

Publication: H. Wang, F. Wang, J. Liu, D. Wang and J. Groen, Enabling Customer-Provided Resources for Cloud Computing: Potentials, Challenges, and Implementation, *IEEE Transactions on Parallel and Distributed Systems (TPDS)*, 2014.

Research Description: Dr. Wang's research concentrates on designing highly scalable and efficient networking infrastructures, by combining optimization, economics, and computer science. For example, his research on cloud computing aims to mitigate the performance as well as the energy issues in such existing virtualization environments as Xen and KVM.

Peter Willemsen, Ph.D., Professor of Computer Science

Teaching and Research Interests: computer graphics, perception in graphics, simulation and human-centered computing in immersive virtual environments.

Publication: A Rapid and Scalable Radiation Transfer Model for Complex Urban Domains, *Urban Climate*, vol 15, pp. 25-44 (2015) Elsevier (with M. Overby, B. Bailey, S. Halverson, and E.R. Pardyjak)

Retired Graduate Emeritus Faculty

Douglas Dunham, Ph.D., Professor of Computer Science

Teaching and research interests: computer graphics, visualization, 3D rendering, hyperbolic geometry, user interface design.

Publication: Creating Regular Repeating Hyperbolic Patterns, *5th Mathematics & Design International Conference Proceedings* (2007).

2. ADMISSION INFORMATION

All applications to the Computer Science Graduate Program are now handled electronically through <https://choose.umn.edu/apply/>. General information on the application process is found on the UMD Graduate School Office web page at <http://www.d.umn.edu/grad/> along with access to the automated application interface.

Applicants are encouraged to submit applications early in the year, which allows time to resubmit material that may be missing and enables the department to consider requests for financial aid in a timely fashion. See Section 2.2 (below) for deadlines.

The Computer Science Department requires as a part of the application packet an official report of the scores received by the applicant on the Graduate Record Examination (GRE) General Test. Specify university code 6873 for UMD so that your official score may be retrieved from ETS.

2.1 Departmental Information

Some applicants may be interested in the following information:

The GRE Subject Test:

The Department does not require that applicants take the GRE Subject Test in Computer Science. However, an applicant seeking to support his/her application may

wish to submit an official report of his/her scores, especially if the undergraduate degree is in a related field.

If your native language is not English:

Each applicant whose native language is not English must submit a record of the scores received on either the TOEFL (Test of English as a Foreign Language) or IELTS (International English Language Testing System).

For TOEFL: Specify the University of Minnesota Duluth, code number 6873, for reporting purposes. The Graduate School requires a score of 550 on the written test, 213 on the computer-based test and 79 or above with the Internet-based test. The department gives preference for financial support to those with minimum scores of 650 (written test), 280 (computer-based) and 110 (Internet-based). Additionally, TOEFL sub-scores in the Speaking Proficiency

For IELTS: The Graduate School will accept scores from the IELTS in lieu of the TOEFL. See www.d.umn.edu/grad/ or <http://www.deii.org> for details. The minimum acceptable score on the IELTS is 6.5. Individual IELTS scores must also be at the 6.5 level or above.

Foreign Applicants:

Each foreign applicant must submit an International Financial Certification Statement before a visa will be issued. See the UMD Graduate School Office web page for information.

Financial Aid:

Any applicant seeking financial aid should supply additional information as indicated in Section 3. The Application for Graduate Assistantship is available at <https://scse.d.umn.edu/sites/scse.d.umn.edu/files/application-graduate-assistantship.pdf>. The Application for Assistantship form and the required recommendations should be submitted with online application.

Fall Admissions Policy:

Under normal circumstances, the Computer Science Graduate Program restricts its admissions to once a year. All applicants are evaluated in the spring for admission the following fall semester.

2.2 Application Deadlines

The department processes applications as they are received. Thus it is in the applicant's best interests to submit his/her application early in the cycle (i.e., by **January 15th** if possible). Early application enhances the opportunity for financial aid.

February 1- March 15 -- Initial Round of Financial Aid Decisions

The decisions on admissions and financial aid for the next academic year are made during this period. To be considered in the first round, an applicant must have submitted an admissions application by March 15.

March 15 - April 15 -- Notification of Financial Aid

The department makes its offers of financial aid as early as possible in the spring of the year. Although we attempt to make all offers by April 15th, for various reasons during a particular year this may not be possible. In this case, offers may be made as late as April 30th. If you are awarded financial aid, you will be notified by email no later than April 30th.

Due to the large number of applications received, the department is unable to inform you personally if you have not been awarded aid. However, funding may become available later in the year, so if you are interested in this possibility, please notify the department via email and your name will be kept on file. You will then be considered for any financial aid that subsequently becomes available for the next academic year.

April 15 -- Council of Graduate Schools Deadline

Note that the University of Minnesota Duluth subscribes to the Resolution of the Council of Graduate Schools in the United States, and every offer of financial aid in the form of a Teaching or Research Assistantship is subject to this Resolution as a term of employment (see Section 7.2). This resolution specifies that acceptance of an offer of financial aid is an agreement that both student and graduate school are expected to honor. To quote:

“Acceptance of an offer of financial support (such as a graduate scholarship, fellowship, traineeship, or assistantship) for the next academic year by a prospective or enrolled graduate student completes an agreement that both student and graduate school expect to honor. In that context, the conditions affecting such offers and their acceptance must be defined carefully and understood by all parties.

Students are under no obligation to respond to offers of financial support prior to April 15; earlier deadlines for acceptance of such offers violate the intent of this Resolution. In those instances in which a student accepts an offer before April 15, and subsequently desires to withdraw that acceptance, the student may submit in writing a resignation of the appointment at any time through April 15. However, an acceptance given or left in force after April 15 commits the student not to accept another offer without first obtaining a written release from the institution to which a commitment has been made. Similarly, an offer by an institution after April 15 is conditional on presentation by the student of

the written release from any previously accepted offer. It is further agreed by the institutions and organizations subscribing to the above Resolution that a copy of this Resolution or a link to the URL should accompany every scholarship, fellowship, traineeship, and assistantship offer.”

This Resolution was renewed October 2009.

Please note that any student who accepts a Teaching or Research Assistantship from the department, fails to submit a written resignation prior to April 15, and enters the country on our form I-20 will be strictly held to the conditions of employment to which s/he has agreed. Under no circumstances will such a student be given a written release since at this point it is then too late to fill the position.

The department regrets that it is unable to answer email or telephone inquiries about the status of an application. However, email inquiries may be directed to the department at cs@d.umn.edu and we will reply as time permits.

July 15 -- Deadline for Fall Admission

2.3 Entrance Requirements

The program is designed for those with undergraduate degrees in Computer Science. These students should be able to enroll immediately in 5000-level computer science courses at UMD. All such students should have completed the following courses or their equivalents: CS 3512 (Computer Science Theory), CS 5621 (Architecture) or CS 5651 (Computer Networks), and CS 5631 (Operating Systems) prior to enrollment.

Students with other backgrounds may be considered if they have completed the following courses or their equivalents: CS 1511 and 1521 (Computer Science I and II), CS 2511 (Software Analysis and Design), CS 2521 (Computer Organization), CS 3512 (Computer Science Theory) or both CS 5511 (Theory of Computation) and CS 5521 (Advanced Data Structures), CS 5621 (Computer Architecture) or CS 5651 (Computer Networks), and CS 5631 (Operating Systems). The appropriate math prerequisites, namely, Math 1296 and 1297 (Calculus I and II), and Statistics 3611 (Probability and Statistics) are also required. Students who lack only a small subset of these required courses may be admitted at the discretion of the DGS based on the recommendation of the Graduate Committee. The GRE General Test is required of all applicants; the TOEFL (or IELTS) is also required of international students.

2.4 Ethical Considerations

The Department of Computer Science adheres to the tenets of the ACM Code of Ethics and Professional Conduct. Any student found to be in violation of this code or the UMD Code of Student Conduct will be subject to immediate dismissal. Such violations

include plagiarism and the inappropriate access of computing resources (e.g., attempts to violate system security, access files belonging to others, forge/falsify email, download inappropriate or copyrighted files, etc. using university equipment). See Section 7.3, Policy on the Appropriate Use of Information Technology for details.

3. FINANCIAL AID

Half-time Teaching and Research Assistantships are available to qualified students. These currently pay \$15,834 per academic year. Research assistantships funded by the National Science Foundation or other agencies may be available. All half-time (50%) assistantships and fellowships carry a tuition waiver. Applicants for Teaching Assistantships are expected to know C, C++, Java, and Visual Basic.

Financial aid in the form of teaching assistantships is available through the department. The number of assistantships available is limited, however, and once a student has committed him/herself to accept an assistantship, any subsequent failure to meet that commitment seriously and negatively impacts the department and its operation. Namely, (1) the department is left shorthanded in meeting the demand for its services during the next academic year, and (2) another deserving applicant is unable to attend graduate school because it is too late to offer the support to another student. ***With this in mind, we ask that you carefully evaluate your position before accepting a teaching assistantship with us. Should you for some reason be unable to fulfill the stipulations set forth in the offer letter, please notify the department at once so that another student may be offered the funding.***

When applying for financial aid please specify a **fax number, telephone number,** and an **email address** where you may be reached **at any time** during the year (**including summer**).

Summer support may be available from one's advisor through research funding. If the advisor is unable to provide it, support may be available for summer research from the DGS through the Summer Fellowship funding. These funds, when available, are targeted primarily at Plan A students, namely, second year students who are completing their theses and first year students working with their advisors on continuing research initiatives. Additionally, to qualify for these funds, students must have satisfied and adhered to the department's Progress Milestones.

Should you accept financial support from the department in the form of a Teaching or Research Assistantship, please note that additional information is due in our office by these deadlines:

June 15: Verification of Visa

A copy of the official verification from the consulate that you have been granted a visa to enter the U.S., i.e., a copy of the page in your passport with the sticker applied by the U.S. consulate. Fax this copy to us at 218-726-8240 or email to llucia@d.umn.edu

August 1: Verification of Travel Arrangements

Your travel arrangements (i.e., flight numbers and dates, including date of arrival) must be emailed to Ms. Lucia in our office by this date. Arrangements will be made for someone affiliated with the department to meet you when you arrive.

3.1 Financial Aid Application

When applying for a departmental teaching or research assistantship, each applicant must complete a financial aid application (see below), which is separate from the admission application.

The deadline for initial consideration for financial aid is March 15. Later applications will be considered until all appointments are filled. The following materials are required to process an application for financial aid:

1. An application for financial assistance which may be found at <https://scse.d.umn.edu/sites/scse.d.umn.edu/files/application-graduate-assistantship.pdf>
2. The completed application, sent by the applicant to the Graduate School using <https://choose.umn.edu/apply/>.
3. Three letters of recommendation, submitted through the online application. These letters should address in particular any teaching experience you have had and how successful it was, along with direct comments on your ability to understand, write and speak English. (The department reserves the right to process, at its discretion, applications with fewer than three letters of recommendation.)
4. Any additional material that the applicant believes may enhance his/her application for financial aid (such as an official report of the scores received on the GRE Subject Test in Computer Science).

3.2 Costs

Tuition information is kept up-to-date on the UMD OneStop site:

<https://onestop.d.umn.edu/finances/tuition>

There are several fees that you will be responsible for paying. The fees assessed by the University are detailed at the following site:

<https://onestop.d.umn.edu/finances/fees>

and are charged to all full-time students. Some additional fees are incurred based on the courses you take and if you are an international student. We suggest you check for the fees you will be expected to pay.

A student with a half-time assistantship receives a tuition waiver equivalent to \$8,532.00 each semester; federal income tax is payable on the value of the tuition benefit. Any student fees, tuition costs over 14 credits and/or late fees are the responsibility of the student.

No one is allowed to register without proof of hospitalization insurance. Any student who registers for at least 6 credits and is without medical insurance is offered an inexpensive student-only policy. More information about Student Health Benefits can be found here:

<https://shb.umn.edu/students-and-scholars/shbp-waiver>

If you have questions regarding health insurance, the UMD Graduate School office and the Student Health Benefits office can be of assistance.

Housing in Duluth can be relatively inexpensive compared to many parts of the country. The department does not make housing arrangements for incoming students. The University residence hall information can be obtained by emailing housing@d.umn.edu or by writing UMD Housing Office, 149 Lake Superior Hall, 10 University Drive, Duluth, MN 55812-2496, phone 218-726-8178. Most graduate students live off campus. One of the resources for International students is Anna Gilmore (anaug0026@d.umn.edu) in the International Student Adviser office. Another resource is Laura Young (lyoung@d.umn.edu) in the Kirby Student Center. This office lists off-campus housing available in the Duluth area.

4. REQUIREMENTS FOR A M.S. DEGREE IN COMPUTER SCIENCE

The Master of Science in Computer Science is offered under two plans. Most students will undertake Plan A, which involves writing a thesis. Plan B involves additional course work and a project in lieu of the thesis.

The requirements for the completion of the M.S. in Computer Science are listed below.

4.1 Residency

The normal time frame for completion of the coursework and research required for a Master's degree in Computer Science is four semesters. (This timeline may be adjusted for part-time students.) All students who receive financial aid in the form of a Teaching Assistantship should understand that such assistantships are given only for a full, one-year period (two semesters) and are renewed (subject to satisfactory

performance and progress toward the degree during the first year) for a second year. Students accepting Teaching Assistantships should plan to spend two years in residence. Support beyond the normal two-year period is not available from the department.

4.2 Performance

Satisfactory performance is judged on the basis of one's academic progress and ability to carry out departmental responsibilities in the areas of teaching (for TAs) and research (all graduate students). Satisfactory performance for a teaching assistant is also based on his/her ability to communicate effectively in English, both on an individual basis and in a classroom environment. Should a teaching assistant fail to meet this requirement during his/her first year, the assistantship will not be renewed for a second year. In addition, each graduate student must progress satisfactorily in his/her own research program. This requires each student to (1) complete the three departmental Milestones for Degree Completion, and (2) maintain active student status by following registration guidelines for fall and spring semesters. A minimum GPA of 3.000 is required for graduation by the Department of Computer Science. The department does not count S/N credits toward graduation.

The Graduate School Constitution requires a written annual progress evaluation for all Masters students. The review annotates the student's progress toward his/her research goals during the semester and concludes with a finding of either satisfactory or unsatisfactory progress. The review is shared with the student and becomes part of his/her permanent file. Any finding of unsatisfactory progress must be discussed by the advisor with both the student and the DGS prior to the beginning of the next semester. The student may request a subsequent discussion with the DGS if desired.

Satisfactory progress toward the degree, maintained on a semester basis, is required in order for a graduate student to receive or retain financial assistance from the department. *Satisfactory progress* entails (1) maintaining a minimal grade point average of 3.00, and (2) completion of the required coursework for the semester (i.e., a minimum of 8 graduate credits, including one 8000-level CS course, Graduate Seminar, and one additional course of 3 or more credits during the first semester; a minimum of 7 graduate credits, including one 8000-level CS course and one additional course of 3 or more credits during the second semester; one 8000-level CS course plus thesis credits or additional coursework as required by the Plan A during the third semester; and one 8000-level CS course plus thesis credits or additional coursework as required by the Plan A during the fourth semester. Any graduate student currently receiving financial aid who fails to meet these standards will not have his/her aid renewed.

The successful completion of a research program requires an ability to express one's thoughts and work in written form. The Graduate Program in Computer Science expects each of its students to produce a written document (e.g., thesis or project

report) detailing his/her research project in accepted manuscript style (i.e., CBE). Students showing deficits in this area may be asked to take remedial work.

The Graduate School has established a five-year time limit for completing master's degrees, but provides a process for requesting individual extensions. Virtually all Computer Science graduate students finish within two years.

4.3 Courses

On the semester system, a minimum of 30 (Thesis) or 32 (Project) credits is required (based on University of Minnesota Graduate School Policy, no graduate Plan A and Plan B program can require more than 36 credits):

All graduate students must complete a minimum of 20 graduate level course credits. Because these are common to both degree plans (Thesis or Project), we suggest you focus on satisfying some of these credits in your first and second semesters.

- 18 course credits from 5000-level or above graduate courses at UMD
 - 12 credits of these credits must come from CS 5000 or higher courses
 - 6 additional credits should be selected in consultation with your advisor from any 5000 or higher course at UMD
- 2 credits of CS 8993 Graduate Seminar (1 credit taken during first semester, 1 credit taken during third semester).
- Plus Plan A or Plan B requirements (below)

Master's Thesis (Plan A) : 30 total credits

Plan A degrees: 10 master's thesis credits (CS 8777) and a minimum of 20 graduate-level course credits (previously defined):

- 10 credits of CS 8777 (Thesis). You can register for this course in each of your semesters, adding 2 or 3 thesis credits as appropriate to reach a total of 10 in your last semester.
- Departmental or college colloquium session, during which the student presents his/her research results. The satisfactory completion of an oral examination focusing on the thesis and supporting area(s).

Master's Project (Plan B): 32 total credits

Project (Plan B) Master's degree programs substitute *additional* coursework and special projects for the thesis efforts.

Plan B Project Credits: Credits taken by the students in relation to their Plan B project as part of the degree requirements. Plan B degrees: a minimum of 30 graduate-level

course credits, including Plan B Project credits as defined by each program and approved by the college.

1. 8 additional credits from courses in Computer Science at the 5000 level or above.
2. 4 credits of CS 8794 (Project) - completion of an approved Plan B project (a significant programming project that extends a project within a 5000-level or higher course). This course can be registered for in your 2nd year.
3. A departmental or college colloquium based on the project, presenting the results of that work. The successful completion of an oral examination covering the project, supporting area(s), and graduate-level computer science courses.

Graduate students may take additional courses either from within the department or outside it. The Graduate Program does not allow the use of S/N credits for courses contributing toward the degree, unless waived by extenuating circumstances. Up to 12 credits of graduate coursework may be transferred as part of a student's degree program, subject to the discretion of the DGS. Transfer credits do not reduce the departmental requirements. University guidelines impose a 5-year limit on the completion of requirements for the Master's degree.

The department reserves the right to determine which option (thesis or project) is taken by the student. In particular, we expect that all students with strong computer science backgrounds (i.e., those with undergraduate degrees in Computer Science or a closely related field such as Computer Engineering) will take the thesis option. Some students with undergraduate degrees in other disciplines may be allowed to choose the project option.

4.6 Departmental Progress Milestones (Plan A and Plan B)

The department tracks thesis (and project) progress through a series of milestones. These milestones represent the department's minimum level of expectation for progress. The milestones are meant to promote consistent and successful progress on thesis work for degree completion.

1. Milestone 1: Draft of Background/Related Work Chapter + Abstract

During the first semester, students will be assigned an advisor. Through working with the advisor, students will work to understand their thesis research question by reading several research papers in their thesis area. Students will then assemble a draft of their thesis abstract along with an initial pass at the background/related work chapter of their thesis document. Students will work with the DGS in the Graduate Seminar (CS 8993) to understand the components of thesis documents and how to write them. Student writing will be evaluated at the end of the 1st semester and remedial work may be required to improve writing skills.

DUE Date: End of 1st Semester

2. Milestone 2: Continued Drafting of Background/Related Work Chapter + Implementation Chapter Draft + Refined Abstract

The second milestone is aimed at helping students better understand what they will be doing for their thesis work. At the end of the second semester, students are expected to turn in to both the DGS and their advisor a refined Abstract, a refined and lengthened Background/Related Work Chapter, and a first pass at the Implementation Chapter.

DUE Date: End of 2nd Semester

3. Milestone 3: Poster presentation of Thesis Work, Improved Thesis Draft

The third milestone will be a Departmental/College-wide Research Poster session or colloquium. By the end of the 3rd semester, students should be able to maintain a conversation about their research work and be able to describe their work to others, namely (1) the problem they are investigating, (2) why it is worth investigating, (3) how they are going about doing it, and (4) what they currently expect of their results. Graduate students will be required to create a poster of their thesis research and present it at the end of semester colloquium.

DUE Date: End of 3rd Semester

4. Milestone 4: Full Thesis Draft

The fourth milestone is a draft of the entire thesis. By the end of their 4th semester, students will have progressed through nearly all of their thesis work. It is expected that a draft of all the components of the thesis will be completed by the end of this last semester. Students may still need to complete some results, but overall, much of the writing and implementation will be completed by this phase of the thesis or project tracks.

DUE Date: End of 4th Semester

Failure to Complete Milestones

Failure to complete any of the milestones will result in both first and second year students being ineligible from receiving summer research funding through our Quality Metrics Allocation funds. Moreover, faculty advisors will not sign OPT forms until the 3rd Milestone is met because OPT requires sufficient progress to completion; completion of Milestone 3 indicates the student is making sufficient progress. The graduate students will be responsible for completing these milestones. Graduate

faculty advisors will be responsible for working with their students and helping them through these milestones.

If Milestone 1 and 2 are not met at the end of their respective semesters, students can still make up for these missed deadlines by completing these milestones later in order to qualify for summer funding opportunities. However, failure to meet the poster session in Milestone 3 could result in a failure of Milestone 3 and thus, students would lose out on funding later in the fourth semester. If students do not complete the poster session, they can make it up later by presenting a 30 minute colloquium to the department on their research, covering the same content as the poster session.

Milestones and Eligibility for Summer Funding Opportunities

Students who complete all Milestones (1-4) will receive higher priority for receiving summer fellowship funds at the end of their second year. Students who have only completed Milestones 1-3 can still qualify for summer funding but will receive lower priority in the award process.

4.7 Degree Papers and the Thesis/Project Proposal

Degree Papers: All graduate students in the Computer Science Department are assigned an advisor when they arrive on campus and are required to complete either a thesis or project under direction of the advisor. After completing a specified number of hours of graduate work, the student is required by the Graduate School to complete his/her *degree papers* (otherwise a *hold* is placed on the student's record preventing registration for the next semester). Degree papers include (1) the graduate degree plan listing the courses the student will take to complete the graduate program; (2) the committee request form (submitted electronically), which specifies the student's committee (requesting a member of the computer science faculty, and a faculty member from the student's related field), the Executive Secretary will submit your adviser information electronically to the graduate school prior to your requesting your other committee members. You can find the forms and additional information at: <http://www.d.umn.edu/grad/current-students-forms-documents.php>. The student's advisor must sign item 1 above. It is the advisor's responsibility to verify, prior to the student's exam and colloquium, that the student's transcript is in agreement with his/her degree program form. All paperwork is examined for compliance by the Graduate School prior to the student's exam and colloquium using their degree clearance procedures.

A change of advisor may be occasioned by the dissatisfaction of advisee and/or advisor with either one's work or the advisor/advisee relationship. The DGS will work with all parties to reach a satisfactory resolution of the problem in the best interests of the student and department.

Thesis Proposal: The thesis/project proposal is represented by Milestone 1 (described previously). It represents the student's initial work towards their thesis/project. The advisor and student indicate their agreement (with respect to the thesis/project tasks to be done and the dates by which each task is to be accomplished) by signing the Milestone completion sheet.

Milestones completion sheets will be submitted at the end of each semester upon successful completion of each Milestone. These forms need to be signed by the student and the advisor and submitted to the DGS, or executive secretary.

Once approved by the DGS, these documents are maintained in the student's file.

4.8 Colloquium and Oral Exam

The colloquium is a one-hour presentation by the student of his/her research. It is immediately followed by a one-hour oral exam, which is directed by the advisor with input from the other members of the student's committee. The colloquium has a specific format: (1) introduction (statement of the problem); (2) background; (3) description of the research itself; (4) the results of this research; and (5) conclusions and suggestions for future work. In no case should items (1) and (2) consume more than 20 minutes of the presentation.

4.9 Records and Departmental Policies

Each graduate student has a graduate academic record file that is kept in the department. This file contains the student's application to the Computer Science Graduate Program, transcript(s), immigration documents, social security information, semester-based progress reports from the advisor, verification of required inoculations (i.e., TB), and any record of disciplinary action associated with the student. Faculty and staff have access to this file on a need-to-know basis as per FERPA regulations. The student may have access, per written request to the DGS, to any information in the file to which s/he has not waived viewing rights.

The Department Chair is the chief administrative officer of the department. The Chair is responsible for making TA assignments, handling disciplinary matters relating to work issues, and determining whether TA (work) performance meets the qualifications for continued funding. The Director of Graduate Studies is the advisor of record for all graduate students. S/he directs the program and advises graduate students on all matters which do not directly relate to the student's research topic. The DGS, working with the Graduate Committee, evaluates applicants and hires RAs and TAs. S/he monitors the progress of students, works with students and faculty to resolve any problems which arise, supervises the evaluation of thesis proposals, and communicates regularly with students on matters which affect them. The department's executive secretary provides much needed support with respect to employment contracts and related issues, budgetary matters, and maintenance of records.

Each UM student has an email account which serves as the University's official method of communication. Graduate students have access to telephones for local calls. Each graduate student employed by the university has his/her own mailbox in the department to facilitate communication with faculty, staff, and other students. TAs and RAs may also utilize copy machines in the department as directed by office staff.

Travel funds are available to graduate students from various sources. These may include the student's advisor, the offices of the collegiate and/or graduate Dean, and particular funds designated for this purpose by the University of Minnesota Graduate School. Partial funding is available from the offices of both the Graduate and CSE Deans for students presenting papers at conferences. Other funding may be available; it is the student's responsibility to investigate and identify potential funding sources.

4.10 Career Fair and Other External Off-Campus Attendance Policy

There will be many opportunities for career fairs and other job searching activities. When you are able, we do encourage students to attend these events. However, Teaching Assistants (TA) are all employed by the University and the Department with important jobs for helping students during office hours, grading, proctoring exams, or teaching labs. As such, the following policy is in place to maintain normal operations in the department during the semester.

Policy for TAs asking to be excused from office hours or lab to attend a career fair

- 1) If you can find a substitute TA who is currently a TA for the course in question, you may attend the career fair. You **MUST** advise the instructor beforehand, and ideally a week before if possible but no later than 2-3 days before the event.
- 2) If you can find a substitute TA who is not currently teaching the course in question, you must secure instructor approval **BEFORE** the career fair. You **MUST** alert the instructor about this 1 week prior to attending the career fair to allow the instructor time to prepare the alternate TA.
- 3) If you cannot find a replacement through (1) and (2) above, you cannot attend the career fair.
- 4) Requests from second-year TAs will be considered before requests from first-year TAs.

4.11 Schedule and Important Dates

Work Schedule: All Graduate Assistants are employed by the department and hence subject to the university calendar. Official university holidays are specified in the calendar; these are the dates on which the university will be closed and UMD

employees may legitimately be absent from campus. Graduate Assistants are paid 39 weeks during the academic year and must be on campus during this time, except for *official university holidays*. This work period *includes the week preceding the start of classes and the week of and immediately following final exams*. The official university holidays are Labor Day and Thanksgiving (for Fall semester), Christmas, New Year's holiday and Martin Luther King Day (during Semester Break).

At the end of classes each semester, Graduate Teaching Assistants are expected to be available to assist the faculty in grading student work and determining grades. Also, during the work period between fall and spring semesters, teaching assistants are expected to assist the faculty in preparing handouts and materials for the next semester. Assistants should not plan on being absent from the campus between semesters except for the official school holidays. Similar work rules apply to Graduate Research Assistants: GRAs are expected to be present to conduct research and to work with their faculty supervisors during any regularly scheduled workday. *The only periods during which a Graduate Teaching or Research Assistant may be absent from campus without the explicit permission of the department head is during an official university holiday (as listed above).*

To reiterate: **Graduate Assistants are to be present on campus for the entire academic year—from the fall starting date to the spring terminal date of employment—except for official university holidays.**

NOTE: Graduate Assistants who are absent from campus in violation of the stated policy are subject to the following penalties: deduction from paycheck in the amount of time missed; loss of tuition benefit covering time in question (the student must then pay this amount from his/her own funds); and a written reprimand inserted in his/her file. Any recommendations made by the faculty with respect to the student in question may be affected as a result.

4.12 Graduate Student Deadline Checklist

For All First Year Students: Additional Dates of Importance

1. **Milestone 1 Deadline:** The thesis/project proposal, or Milestone 1, signed by both advisor and student, must be completed by the end of the first semester. Follow the guidelines provided in the Graduate Brochure (see Section 4.6).
2. **Registration for the Next Academic Year:** All first year graduate students must complete their registrations for the upcoming Fall semester by May 1, 2020. This registration must agree with the courses listed on the Degree Program. All TA assignments for the next academic year are made based on this registration.
3. **Milestone 2 Deadline:** Students must complete Milestone 2 (as described in Section 4.6) and submit the Milestone completion form signed by both the student and the advisor.

For All Second Year Students: Additional Dates of Importance

1. **Milestone 3 Deadline:** Students must complete Milestone 3 which includes a poster colloquium presentation at the end of the 3rd semester.
2. **Degree Program:** The deadline for completion of the Degree Program is the 4th of January, 2020. Graduate School approval of program must be granted by the 12th of February. See the [Degree Application](#)¹ at the Grad School web page for more information.
3. **Application for Degree:** Information regarding the graduation process and requirements can be found at the Graduate Schools [Grad Packet](#) webpage.²
4. **Milestone 4 Deadline:** Completion of Milestone 4 will ensure students receive higher priority for summer funding opportunities. Milestone 4 should be submitted with the application for summer funding that is due near the end of the last semester.
5. **Commencement Ceremony:** The department requires that all of its graduating (i.e., second year) students participate in the Graduate Commencement Ceremony. This is a reflection of the contribution of the Computer Science Graduate Program to the University and of the research and professional accomplishments of its students and faculty. The Spring 2020 commencement will be held Saturday, May 9, 2020.

¹ <http://www.grad.umn.edu/current-students-graduate-student-services-progress/application-degree>

² www.d.umn.edu/grad/current-students-gradpacket.php

5. SELECTED COURSE DESCRIPTIONS

Only credits from courses numbered 5000 and above can be applied toward a master's degree in computer science. The following represent some selected course descriptions. All courses currently available can be located in the online catalog.

Note: students who need undergraduate courses to satisfy the prerequisites of our 5000-level courses are encouraged to complete course equivalents before coming to UMD.

CS 8777. THESIS CREDITS. MASTERS (1.0-24.0 cr. [max 50.0 cr.]; prereq Max 18 cr per semester or summer; 10 cr total required (Plan A only)

Thesis research and development.

CS 8993. SEMINAR (1.0 cr. [max 3.0 cr.]; prereq CS GRAD or #)

Presentation and discussion of basic ethical theories, case studies dealing with ethical issues facing the computing professional in his/her life as a practitioner, and the development of research proposal which meets the requirements and standards of the department and serves as the foundation of and guideline for the development of the graduate research project (i.e., thesis).

7. RELATED POLICIES AND INFORMATION

7.1 Mutual Responsibilities in Graduate Education at the University of Minnesota

Preamble

A major purpose of graduate education at the University of Minnesota is to instill in each student an understanding of and capacity for scholarship, independent judgment, academic rigor, and intellectual honesty. Graduate education is an opportunity for the student to develop into a professional scholar. Graduate research and teaching assistantships offer an "apprenticeship" experience in the academic profession as well as financial support. It is the joint responsibility of faculty and graduate students to work together to foster these ends through relationships that encourage freedom of inquiry, demonstrate personal and professional integrity, and foster mutual respect. This shared responsibility with faculty extends to all of the endeavors of graduate students, as students, employee, and members of the larger academic community.

High quality graduate education depends on the professional and ethical conduct of the participants. Faculty and graduate students have complementary responsibilities in the maintenance of academic standards and the creation of high quality graduate programs. Excellence in graduate education is achieved when both faculty and students are highly motivated, possess the academic and professional backgrounds necessary to perform at the highest level, and are sincere in their desire to see each other succeed.

The following principles illustrate what students should expect from their programs and what programs should expect from their students, to help achieve this excellence.

Principle 1: Information about Policies and Procedures.

The Graduate School and graduate programs are responsible for providing students and prospective student with access to information about their graduate program, areas of specialization, degree requirements, and average time to completion of degrees. Graduate programs are responsible for providing access to information about graduate student financial support in the program, such as the prospects for fellowships, assistantships or other financial support and the proportion of students receiving financial support. In addition, graduate programs should provide students and applicants with information about career experiences of graduates of the program. All such information should be presented in a format that does not violate the privacy of individual students. Programs are encouraged to provide relevant information in their handbooks, websites or other readily accessible formats.

Students are responsible for keeping themselves informed about current policies of their program and the Graduate School that affect graduate students. Students and

alumni also have a responsibility to respond to program inquiries about their career development.

Principle 2: Communication about Academic Status

The Graduate School and graduate programs are responsible for providing students with information about their individual academic status: who in the Graduate School and in their graduate program is responsible for communicating to them about admission issues and progress through the degree program, how the communication will take place, and the possibility for appeal to a third party for assistance in solving disputed issues.

Students are responsible for communicating with the Graduate School and their graduate program about changes in their circumstances that affect their status and progress toward the degree.

Principle 3: Research Contributions

Individual faculty as research directors are responsible for providing students with appropriate recognition for their contributions at conferences, in professional publications, or in applications for patents. It is the faculty member's responsibility to clarify the principles for determining authorship and recognition at the beginning of any project.

Students are responsible for discussing their expectations regarding acknowledgment of research contributions or intellectual property rights with the appropriate person(s) in the research team, preferably early in the project.

Principle 4: University Governance

Departments and graduate programs are responsible for defining specific opportunities for student participation on committees as they deem appropriate. The University recognizes that graduate students make important contributions to governance and decision making at the program, department, college, Graduate School and University level; specific roles for participation are defined at each level by the relevant governing bodies. For example, University Senate policy requires student membership on faculty search committees.

Students are responsible for participating in University governance and decision making that enriches the campus community.

Principle 5: Respectful Employment Conditions

University faculty and staff are responsible for assuring that graduate students are able to conduct their work, as students or students/employees, in a manner consistent with

professional conduct and integrity, free of intimidation or coercion. Students who are employees also have the protection of all University employment policies and laws. Graduate programs are responsible for providing clear communication to students about the possibility for appeal to a third party for assistance in resolving disputed issues.

Students are responsible for reporting unprofessional conduct to the appropriate body or person, as defined in the academic or employment grievance policy; they should be able to do so without fear of reprisal. Students are responsible for acting in a respectful and fair manner toward other students, faculty, or staff in the conduct of their academic work or work they may do in connection with an assistantship.

Principle 6: Conditions of Employment

The University (through its departments, research projects or other employing units) is responsible for providing to prospective graduate assistants a written offer of financial support before a response to the offer is required. Such communication must indicate their salary and the terms and conditions of their appointment, including the general nature of the work they will be performing, duration of employment, and whether and how this employment is tied to their academic progress. The details of specific teaching or research assignments may need to await later written clarification.

Students are responsible for accepting the conditions of employment only if they believe they are qualified and able to complete the tasks assigned. Students have a responsibility for communicating in writing any changes in their circumstances that affect their ability to fulfill the terms and conditions of their employment.

Principle 7: Safe Working Environment

Supervisors are responsible for providing a safe working environment for graduate students, and for developing and publicizing safety policies and training programs to achieve that goal.

Graduate students are responsible for helping to maintain a safe working environment, for adhering to safety policies, for participating in training programs and for reporting safety violations to the proper authority.

7.2 Resolution of the Council of Graduate Schools in the United States

Acceptance of an offer of financial support *(such as a graduate scholarship, fellowship, traineeship, or assistantship) for the next academic year by a prospective or enrolled graduate student completes an agreement that both student and graduate school expect to honor. In that context, the conditions affecting such offers and their acceptance must be defined carefully and understood by all parties.

Students are under no obligation to respond to offers of financial support prior to April 15; earlier deadlines for acceptance of such offers violate the intent of this Resolution. In those instances in which a student accepts an offer before April 15, and subsequently desires to withdraw that acceptance, the student may submit in writing a resignation of the appointment at any time through April 15. However, an acceptance given or left in force after April 15 commits the student not to accept another offer without first obtaining a written release from the institution to which a commitment has been made. Similarly, an offer by an institution after April 15 is conditional on presentation by the student of the written release from any previously accepted offer. It is further agreed by the institutions and organizations subscribing to the above Resolution that a copy of this Resolution or a link to the URL should accompany every scholarship, fellowship, traineeship, and assistantship offer.

This Resolution was renewed October 2009.

7.3 Other University Documents may provide information and guidance relevant to the graduate education experience:

- * Board of Regents, Code of Conduct, adopted 7/12/96
[www.regents.umn.edu/policies/academic/Conduct.pdf]
- * Board of Regents, Academic Freedom and Responsibility, adopted 9/8/95
[www.regents.umn.edu/policies/academic/AcademicFreedom.pdf]
- * Graduate Assistant Office, Handbook for Graduate Assistants
[www.umn.edu/OHR/GAO/]
- * Policy on the Appropriate Use of Information Technology
(www.d.umn.edu/itss/policies/appuse.html)
- * University Senate, minutes, April 19, 1990, Student Conduct Code
[Gopher: U of M Campus Information/ Information for Students/Student Conduct Code]
- * Standards of Student Conduct Enforceable by University Agencies
[www.sja.umn.edu/conduct.html]
- * Expectations of Graduate Students in Research, Scholarship, and Professional Education
[www.grad.umn.edu/Ethics/ethics_brochure.html]
- * Research Involving Human Subjects
[www.research.umn.edu/subjects]
- * Research Involving Animal Subjects
[www.reseach.umn.edu/subjects]
- * Work-Related Policies (inquires directed to Graduate Assistantship Office and/or Human Resources)
[www1.umn.edu/ohr/gao]