

Carnegie Mellon
SCHOOL OF COMPUTER SCIENCE

Computation,
Organizations
Society

**Ph.D. Program in Computation, Organizations
and Society (COS)**

**Graduate Student Handbook
2008-2009**

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WELCOME

I am delighted to welcome you to the COS Program. Congratulations - you made the right choice.

Ph.D. Program in the School of Computer Science at Carnegie Mellon University. The Ph.D. program in COS prepares students to be tomorrow's leaders in constructing, evaluating, and reasoning with software that is accountable to society, business, policy, and law. CMU's innovative program integrates disciplines as diverse as organizational behavior, cognitive psychology, biology, privacy, social network analysis, artificial intelligence, game theory, e-business and computation. Combining both empirical and computational approaches, students partner in the creation, evaluation and use of future computational tools, measures, and technologies for meeting diverse needs and increasing the scientific, organizational, business and policy understanding of complex social, corporate, market, legal, national, and international issues. As students work on computational projects, additional constraints from the social, organizational, business, policy and legal realms are identified and incorporated within the original problem definitions of the emerging technologies, and remain in consideration during development, testing, and evaluation. By taking this approach, the resulting technologies are easier to adopt and better meet the needs of the ultimate users and environments in which they operate.

Building on the COS program's world-class interdisciplinary faculty, students are equipped to advance theory and practice as well as to invent, evaluate and understand the policy implications of new technologies. The Ph.D. program in COS exposes students to traditional tenets of computer science interweaved with interdisciplinary coursework, hands-on applications and cutting-edge research. Recent examples include privacy technology, social networks for counter-terrorism and automated trading applications. COS prepares students for academic, research and government careers addressing complex problems at the interface of computation, organizations and society. Consequently, students in the COS Ph.D. program are highly sought after due to the in-depth training not just in computation but also in the fundamental sciences for examining networks of people, organizations, and societies and at the integration of computation into management, law, and policy.

This Graduate Student Handbook is designed to aid you in understanding the academic climate at Carnegie Mellon, and assist you in navigating other areas of interest to graduate students such as housing, financial issues, and campus and local services. In addition it contains policies and material specific to ISR department.

Dr. Kathleen M. Carley

A handwritten signature in black ink, appearing to read 'Kathleen Carley', written in a cursive style.

Director, COS PhD.

CARNEGIE MELLON VISION

VISION

Carnegie Mellon will lead educational institutions by building on its traditions of innovation and transcending disciplinary boundaries to meet the changing needs of society

OUR MISSION

- ❖ To create and disseminate knowledge and art through research and artistic expression, teaching and learning and transfer to society.
- ❖ To serve our students by teaching them leadership and problem-solving skills and our values of quality, ethical behavior, responsibility to society and commitment to our work.
- ❖ To pursue the advantages provided by a diverse community, open to the exchange of ideas, where discovery and artistic creativity can flourish.

OUR VALUES & TRADITIONS

LEADERSHIP

We lead through innovation and excellence; we establish new directions by talent and example, influencing the behavior of other institutions.

INNOVATION

We identify challenges and opportunities presented by evolving human needs, new research methods and technologies and promptly assemble the talent and resources needed to exploit them. Our innovative capability is one of the foundations upon which our leadership capacity is built.

TRANSCENDING DISCIPLINARY BOUNDARIES

We function seamlessly and transcend traditional disciplinary boundaries to our comparative advantage.

RESPONSIBILITY TO SOCIETY

We serve society through transfer of technology, continuing education programs, public service and enrichment of the community through the arts.

LEARNING

We build on our heritage of the Carnegie Plan to become a leading institution that combines first-rate research with outstanding undergraduate education through our focus on learning and problem-solving.

DEDICATION TO OUR WORK

Our students, staff and faculty are committed to our heritage emblazoned on our seal: "My Heart is in the Work."

COMMITMENT TO QUALITY

We focus our energies on understanding the needs of the communities we serve while applying principles of self-evaluation, benchmarking and continuous improvement to fulfill these needs.

GOALS, RIGHTS AND RESPONSIBILITIES AT CARNEGIE MELLON

EDUCATIONAL GOALS

(Originally titled, "Goals, Rights and Responsibilities at Carnegie Mellon," adopted February 15, 1971) Carnegie Mellon is a private university incorporated under the laws of the Commonwealth of Pennsylvania. Its first purpose, as stated in its Articles of Incorporation, is:

"...the establishment and maintenance in the City of Pittsburgh of a coeducational university of higher education, including an institute of technology, emphasizing liberal-professional education and specializing in teaching and research programs in selected areas of importance to the community and to the nation."

Carnegie Mellon seeks to provide education of the highest quality so that all students will be prepared to achieve their potential as professionals and as thoughtful, well-informed individuals. The university encourages and supports scholarship, research and artistic production, both as essential components of its educational program and in fulfillment of the special role of an academic institution as a source of new knowledge and understanding. Through scholarship, research and the men and women it educates, the university contributes to social progress.

As a private university, Carnegie Mellon is free to set its own measures of excellence and to determine its own educational objectives. By carefully exercising the freedom to select limited areas for university effort, it can preserve its ability to be innovative and creative in response to the changing needs of society. It is of the utmost importance that the goals of the university be clear and that the standards and procedures for the conduct of its affairs be well understood by all of its constituents. These appear in detail in the duly promulgated regulations of the university, particularly in the catalogs, the Graduate Student Handbook, The Word and the Faculty Handbook.

ACADEMIC AND INDIVIDUAL FREEDOM

Within the academic community, trustees, administrators, faculty, students and staff share the responsibility for achievement of the goals of the university. Responsibilities specific to various groups are discussed in the sections that follow. Especially important, however, are the responsibilities pertaining to academic and individual freedom. An academic community is uniquely suited to its educational and scholarly purposes primarily because of its firm commitment to intellectual honesty, freedom of inquiry and expression, respect for the dignity of each individual and because of its receptiveness to constructive change.

The commitment to academic and individual freedom carries with it major responsibilities for all members of the university. In exercising their own freedoms, they must respect the rights

of others. In seeking innovation, they must recognize that constructive change can be effected at a university only through orderly and rational processes. Intentional acts threatening personal safety, malicious destruction of property or willful and substantial disruption of university functions have no place in an academic community and will not be tolerated. It is the responsibility of all members of the academic community to maintain an atmosphere in which such violations of rights are unlikely to occur and to develop processes that assure the protection of these rights for all persons.

THE ACADEMIC COMMUNITY

BOARD OF TRUSTEES

The trustees bear ultimate responsibility for the university, its policies, organization, financing and governance. Two direct responsibilities are the supervision of the university's finances and the appointment of the president as chief executive officer. Ordinarily, the trustees do not involve themselves in the everyday affairs of the university. Rather, operating responsibilities and the authority to act are delegated to the president; and it is primarily through the president that the trustees monitor the university's activities.

The trustees have a particular responsibility to mediate between the university community and the larger society the university serves. Thus, the trustees must be alert to the needs of the university and must be willing and able to explain and defend the university's values, goals and procedures.

It is the duty of the trustees to maintain the effectiveness and continuity of the board. In selecting new members, the trustees choose those who have a sincere interest in the university and whose talents and background will contribute to it.

ADMINISTRATION

The administrative officers are formally responsible for supervising the programs and enforcing the policies of the university, for assessing the effects of policy and for recommending improvements or changes where appropriate. The president is the chief executive officer of the university. In the operation of the university, the president delegates responsibility to provost, vice presidents, deans, directors and department heads and to various councils and committees, which may include faculty, students and staff. This delegation may be on a continuing basis or for specified periods and may be withdrawn or reassigned.

It is the duty of the administrative officers of the university to maintain a campus climate that enhances the freedom of the faculty to teach, to engage in research and to take part in other scholarly and artistic activities, and the freedom of the students to learn and grow both inside and outside of the classroom. This means that all policies of the university must be administered effectively and in accordance with the purposes and standards of the university and with due regard to the rights and privileges of all members of the university community. In setting and carrying out the university policies, it is important for administrative officers to maintain a close

exchange of views with faculty and students, both individually and through the formally constituted committees and councils of the university.

Administrative officers share with the trustees the major responsibility for interpreting university policies and actions to the community at large. This responsibility requires that administrative officers interact with representatives of local, state and federal governments, of industry, foundations and many other community groups in both formal and informal ways on the many matters of interest to the university's well-being.

FACULTY

The faculty has the primary responsibility for carrying out the educational and scholarly programs of the university.

All members of the faculty have the duty to conduct their courses in a manner consistent with the highest standards of their profession. Through the presentation of material in the classroom, they should strive to advance the art of teaching. One of the primary goals should be to instill in their students a desire to learn and an enthusiasm for the subject matter at hand. The faculty as a whole also has the major responsibility for establishing and maintaining curricula that meet the standards and fulfill the educational goals of the university.

Members of the faculty may express in the classroom their own opinions on matters relevant to their courses. In doing this, they must always respect the freedom of belief of the student. When dealing with controversial matters, they must take reasonable care in the selection and balanced presentation of material and must try to make clear distinctions between statements of fact and of opinion.

An important responsibility of faculty members is to engage in research, scholarship or artistic production or otherwise to further their professional development. While the particular areas of university or personal commitment may change, continuing professional development should always remain as a distinguishing characteristic of the university and its faculty.

The faculty also has an important role to play in the interaction between the university and the community that it serves. In addition to conducting research and other professional activities, faculty members may participate like other citizens in community affairs. When they engage in non-university activities, faculty members are expected to make clear that they act as individuals and not as spokespersons for the university.

The Faculty Senate is responsible for conducting the affairs of the faculty as a body and for exercising those powers delegated to it by the president. It is the duty of the Senate to be alert and informed concerning matters involving instruction, scholarly or cultural activities or any other matters pertaining to the general welfare of the faculty or of the academic community as a whole. By making known its views and recommendations concerning such matters, the Senate plays an important consultative role in the governance of the university.

STUDENTS

Carnegie Mellon, as a private university, selects from among its applicants those students who have demonstrated the qualifications for achieving professional competence in one of the fields in which the university offers instruction. Any student who meets its standards is welcome to apply for admission and, if admitted, to remain at the university so long as he or she abides by its rules.

Students are encouraged to take advantage of the resources provided by the university to further their academic and personal development. All students are expected to meet the academic requirements of the university and of the college and department in which they study and seek to receive a degree. In turn, all students have the right to expect that the educational resources made available to them are of high quality. They are encouraged to participate constructively with the faculty and administration in many of those processes by which the university community maintains the excellence of its curricula and methods of instruction and the viability of its total educational program.

The university sponsors certain extracurricular programs and makes provisions for various student governing bodies and other groups to sponsor a wide variety of lectures, social events and other activities. Students are encouraged to participate in such activities and have the right to engage in other activities in the community outside the university. Both kinds of activities may complement their academic programs and promote their own personal development. In participating in non-university activities, students are expected to make clear that they act as individuals and not as spokespersons for the university.

The Graduate Student Assembly (GSA) works to represent the ideas and interests of graduate students in the community.

ADVISORY BOARDS

Each academic department and school at Carnegie Mellon, as well as some non-academic units, have an advisory board whose purpose is to assist the department and the university more effectively to carry out their mission. An advisory board may use any appropriate means to achieve this purpose, important among which are evaluating the department's goals and directions and providing information and advice to the president, provost, deans and department heads.

Each advisory board typically will be comprised of two trustees, several alumni and a number of other distinguished experts from outside the university in fields important to the department.

Advisory boards normally meet on the campus one and a half to two days every two and a half years. After meetings with faculty, students, administration and others as necessary, they report their findings and recommendations to the Board of Trustees and to the president, who shares them with all concerned. Responsiveness of the department and the university is vitally important; action on recommendations will be as timely and thorough as circumstances permit.

ABBREVIATIONS AND ACRONYMS

GENERAL: **AAC** Academic Advisory Center (H&SS), **AH** Alumni House, **BH** Baker Hall, **BRH** Bramer House, **DH** Doherty Hall, **CFA** College of Fine Arts, **CMA** Carnegie Mellon Action Project, **CMDS** Carnegie Mellon Dining Service, **MRI** Carnegie Mellon Research Institute, **CYH** Cyert Hall **EDSH** Elliott Dunlap Smith Hall, **FMSB** Facilities Management Services Building, **FMR** Field and Mobile Robotics, **G** Gym, **GSIA** Grad. School of Industrial Administration, **HBH** Hamburg Hall, **HH** Hamerschlag Hall, **HL** Hunt Library, **ICES** Institute for Complex Engineered Systems, **MG** Morewood Gardens, **MI** Mellon Institute, **MMC** Margaret Morrison Carnegie Hall, **MMP** Margaret Morrison Plaza, **NSH** Newell-Simon Hall, **OIE** Office of International Education, **PCA** Purnell Center for the Arts, **PH** Porter Hall, **RB** Planetary Robotics Building, **REH** Roberts Engineering Hall, **RH** Resnik Hall, **ROTC** Reserve Officers Training Corps, **SEI** Software Engineering Institute, **SH** Scaife Hall, **UC** University Center, **WEH** Wean Hall, **WH** Warner Hall, **WHIT** Whitfield Hall, **WW** West Wing.

PEOPLE: **CA** Community Advisor, **CCon** Computer Consultant, **CR** Coordinator of Student Life, **DA** Desk Attendant, **DM** Desk Manager, **OC** Orientation Counselor, **RA** Resident Assistant or Research Assistant, **TA** Teaching Assistant.

MAJORS & COLLEGES: **BA** Business Administration, **BHA** Bachelor of Humanities & Arts, **BHE** Biomedical and Health Engineering, **CHE** Chemical Engineering, **CEE** Civil and Environmental Engineering **CIT** Carnegie Institute of Technology **CFA** College of Fine Arts **CS** Computer Science, **ECO** Economics, **ECE** Electrical & Computer Engineering, **EPP** Engineering & Public Policy, **GSIA** Grad. School of Industrial Admin, **HCI** Human-Computer Interaction, **H&SS** Humanities & Social Sciences, **HEINZ** Heinz School, **IDS** Information & Decision Systems, **INI** Information Networking Institute, **LCS** Literary & Cultural Studies, **LTI** Language Technologies Institute, **MCS** Mellon College of Science, **MEG** Mechanical Engineering, **MSE** Materials Science & Engineering, **PPM** Public Policy & Management, **SCS** School of Computer Science, **SDS** Social & Decision Sciences.

PHRASES & OTHERS: **ASAP** as soon as possible, **Bboard** electronic bulletin board, **BTW** by the way, **CSW** Computing Skills Workshop, **D-list** Email distribution list, **FYI** for your information, **IM** Intramurals (sports), **IMO** in my opinion, **LIS** Library Information System, **PDQ** pretty darn quick, **QPA** Quality Point Average, **SURG** Small Undergrad Research Grant, **TTFN** ta ta for now, **WWW** World Wide Web.

COS MOTIVATION

The past decade has seen a tremendous increase in both the breadth and the complexity of computational systems society has come to rely on. This increase in turn is giving rise to a number of new and challenging societal, management and policy issues, which themselves often

call for new technological innovations. Examples include privacy rights management, data privacy, electronic market mechanisms and automated negotiation, dynamic network modeling, online dispute resolution, etc. Attacking these new problems requires profound understanding of computation and the interplay between the managerial, personal and policy networks in which technology operates. Unfortunately, current degree programs in traditional disciplines (e.g. computer science, policy or management) fail to provide the kind of multi-disciplinary curriculum needed to train tomorrow's leaders in this emerging area. Today's demand for integrated expertise far exceeds supply. As demand for this new breed of researchers continues to grow, it becomes increasingly important to offer a PhD program that fills the void.

There is a general lack of understanding by computer scientists of social, economic and policy issues impacted by computational systems. Yet, increasingly more and more ACM and IEEE computer science conferences and journals, as well as traditional funding sources, focus on work that integrates these disciplines. The Privacy in D.A.T.A. workshop held at Carnegie Mellon University in March 2003 brought together some of the world's leading computer science theorists to examine data privacy problems; the biggest hurdle was helping these computer scientists understand the personal, organizational and policy settings in which well-defined theoretical computer science problems related to data privacy exist. Similarly, multi-agent research has increasingly had to combine methods of social and economic science with computer science, and, conversely, social and economic sciences are increasingly turning to multi-agent modeling for solutions to problems that elude traditional analytical methods. Dynamic network analysis, multi-agent systems, market mechanisms and privacy-preserving data mining, to name just a few, have become major themes at ACM, IEEE, and AAAI conferences. Yet, while computer science researchers are increasingly asked to address or integrate social, economic or legal dimensions into the emerging technologies they develop, traditional doctoral programs continue to emphasize computation as a standalone discipline and ignore its many social, economic and policy ramifications. In contrast, the PhD program in Computation, Organizations and Society (COS) is a computer science based cross-disciplinary program that aims to train computer scientists to understand the bigger picture in which computation operates and to create technology from this broader vantage point.

ADMINISTRATIVE

PEOPLE

Below are faculty and lab groups actively associated with the Ph.D. program in Computation, Organizations and Society (COS).

COS PROGRAM COMMITTEE

- **Director - Kathleen M. Carley**
- **Co-Director – Norman Sadeh**
- **Co-Director - Latanya Sweeney**

CORE COS FACULTY

- **Kathleen M. Carley**
 - computational social and organization theory, dynamic social networks, multi-agent network models, information diffusion, social and organizational policy
- **Lorrie Cranor**
 - privacy enhancing software, policy specification languages, electronic voting, secure systems
- **David Farber**
 - distributed computing, telecommunications and networks, software systems and programming languages, technology policy
- **Bill Hefley**
 - Intelligent user interfaces, IT Services qualification, software industry research
- **Jim Herbsleb**
 - collaboration in software engineering, open source, computer-supported cooperative work, organization design
- **Raj Reddy**
 - digital libraries, sustainable development, technology in emerging environments, human-computer interaction and artificial intelligence
- **Norman Sadeh**
 - pervasive computing, agent technologies, internet-enabled supply chains, automated trading and negotiation, mobile commerce, web security and privacy
- **Michael Shamos**
 - digital libraries, language identification, electronic voting, electronic negotiation, Internet law and policy
- **Latanya Sweeney**
 - data privacy, privacy technology, bioterrorism surveillance, video surveillance, biomedical informatics, intelligent tutoring systems, computer learning
- **Rahul Tongia**
 - Technology leapfrogging, Information and Communications Technology (ICT) for Sustainable Development; Digital Divide; Telecommunications Policy; Smart Metering and Digital Power Grids; Infrastructure (IT, Telecom, Energy, and Power) analysis, options, and regulation

COS PROGRAM MANAGER

- **Connie Herold**

CENTERS AND LABS

- Center for Computational Analysis of Social and Organizational Systems (CASOS)

- CMU Usable Privacy and Security (CUPS)
- Data Privacy Lab
- e-Supply Chain Management Lab
- Mobile Commerce Lab

OVERVIEW OF REQUIREMENTS

The Ph.D. program in Computation, Organizations and Society (COS) augments courses with a computer science main theme to reflect the interdisciplinary nature of studying COS. The curriculum for the Ph.D. program in COS is built on a foundation of five star courses and three electives. Besides its emphasis on research and a set of star courses, it also includes requirements aimed at helping students hone their teaching, writing, speaking and programming skills. Specifically, each student is expected to:

- Complete 102 units of graduate courses (with a B or better in each course). This includes:
 - 5 star courses (60 units) in:
 - Artificial Intelligence
 - Algorithms
 - Probability and Statistics
 - Dynamic Network Analysis
 - Technology Dialectics (Computation, Organizations and Society (COS) Lab)
 - 3 electives (36 units)
- Attend the COS Ph.D. Practicum seminar series each semester while in residence (08-998) and present research regularly in this seminar. Note, this seminar can and should be taken multiple times for credit. (3 Units)
- Serve as a teaching assistant for at least two full-semester courses
- Participate in directed research under the supervision of a research advisor from the first day of enrollment in the program. While they fulfill their course requirements, students are expected to also devote 50% of their time to supervised COS research.
- Write at least one conference quality paper by the end of year 2 – quality here means that the paper has to be both technically sound and well written.
- Demonstrate communication skills by presenting (1) a paper at a national or international conference, and (2) giving regular presentations in the COS Ph.D. Practicum attended by at least two COS faculty.
- Demonstrate programming skills through involvement in a large-scale team project
- Write and defend a thesis describing a significant piece of original research work.

These requirements are further described below at the following sections on course requirements, star courses, constrained electives, electives, and Ph.D. proposal and thesis. A sample plan of study is also provided.

COURSE REQUIREMENTS

In the Ph.D. program in Computation, Organizations and Society (COS), each student must complete 96 University units of graduate courses and get a B or better in each course. Course requirements are intended to ensure that all program graduates have sufficient breadth in COS fundamentals as well as depth in one or more relevant areas of their choice. Requiring all students to complete 60 units in 5 star areas satisfies the breadth requirement. Depth is provided through the remaining 36 units of coursework, which can be fulfilled from a broad selection of relevant electives - as well as research and project work. More information about star courses and electives appear below. *It is recommended that a majority of the star courses are completed before electives are taken.*

UNITS

Ph.D. students should take a minimum of 48 Units during both the Fall and Spring semesters and a maximum of 36 Units during the Summer to be considered a full -time. Students who are off campus on internships are not considered full-time students.

COS PH.D. PRACTICUM

COS Ph.D. Practicum (COS Seminar) 08-998 (3 units). The COS Ph.D. Practicum provides students with practical information on being a researcher, feedback on research, and an opportunity to collaborate with fellow graduate students and faculty. COS Students are required to register for the COS Ph.D. Practicum and give a presentation every semester they are in residence. Students receive 3 units each semester they are in this seminar. Further, students are to present a paper each semester they are enrolled in this seminar.

STAR COURSES

The 5 star courses (60 units) provide, respectively: a survey of artificial intelligence; training in algorithmic thinking realized formally through the study of algorithms, machine learning techniques, or privacy algorithms; a secure foundation in mathematical statistics; a foundation in social network theory and its applications; and active exploration on the integration of computation, organizations and society.

- 15-780 Advanced AI Concepts
- Either: 15-750 Algorithms, 10-701 Machine Learning, Privacy Algorithms
- Either: 10-705 Intermediate Statistics, 10-751 Probability and Statistics for Computer Science, 36-727 Probability and Mathematical Statistics II, 90-905 Statistical Theory for Social Policy
- *There are a wide variety of excellent statistical courses at CMU taught in many departments. In general, the student should consult with his or her advisor to determine whether there is a course that better meets the student's needs than the*

one's listed. If this is the case, the student should petition the COS program committee for a substitution.

- 08-801 Dynamic Network Analysis
- 08-800 Technology Dialectics (Computation, Organizations and Society (COS) Lab) *It is strongly recommended this is taken in the first semester of the program.*

RESEARCH

During the first two years at least 50% of these units should be research units. As the student advances through the program they will be taking more of these courses.

- 17-850 Reading and Research

May be with any faculty member and focuses on an area for which there is not a regularly offered course. This course can be taken multiple times with different faculty.

- 17-999 COS Independent Study (aka Dissertation course)

Must be with the student's COS advisor and is on directed research. This course can be taken multiple times. Advanced students (past thesis proposal) sign up for this course.

- 17-849 COS Practicum (for students that are off campus during the summer)

Note: It is required that during summer students who stay on campus register for 36 units of Research and Reading (17-850). International/ Off campus students should register for Practicum (17-849).

The Technology Dialectics (Computation, Organizations and Society Lab) is a signature course of the Ph.D. program in COS and is co-taught by core COS faculty. It combines faculty lectures and lab work to provide hands-on training in methods for creating technological systems appropriate for organizational, legal and social frameworks.

The Privacy Algorithms course examines privacy algorithms originating from disparate disciplines, including computer security, cryptography, database security, statistical disclosure control, medical informatics, policy rights management, and data privacy. The course examines algorithms and related policies to assess the nature and fitness of the provable guarantees of privacy protection these algorithms provide.

RESEARCH CREDIT

Students should take at least 12 units of Reading and Research 08-997 and 12 units of COS Independent Study 08-996. These units reflect 50% of your overall involvement in research and are designed for in depth study in the area of the student's thesis and with specific attention to project work in the case of the Independent Studies. Note, since all students on campus need to carry a full course load each semester, these courses can, with the student's advisor's approval be used to create a full course load for students who are working on their dissertation.

ELECTIVES

Students select graduate 3 courses, for a total of 36 units of electives. Student are expected to use the electives to gain domain specific knowledge and further depth in particular components related to the students own research interests. Electives are chosen in consultation with the

student's advisor, in order to form a concentration. Additional star courses can also be taken as electives. The following lists contain suggested electives.

Selected electives related to analytical methods:

- 10-661 Probability and AI
- 16-720 Computer Vision
- 21-690 Methods of Optimization
- 21-691 Nonlinear Optimization
- 47-811 or 90-906 Econometrics
- 47-830 Integer Programming
- 47-835 Graph Theory
- 47-836 Networks and Matching
- 47-840 Dynamic Programming
- 47-856 Linear Programming
- 08-810 Computational Modeling of Complex Socio-Technical Systems

Suggested electives related to social and organizational processes:

- 45-899 Knowledge Management & Organizational Learning (6 units)
- 45-890 Seminar in Organizational Theory (6 units)
- 90-903 Social network theory
- 08-810 Computational Modeling of Complex Socio-Technical Systems

Suggested electives related to managerial and business methods:

- 15-892 Foundations of Electronic Marketplaces
- 20-763 Electronic Payment Systems
- 20-863 Mobile Commerce
- 46-866 Supply Chain Management
- 47-801 or 90-908 Micro-Economics
- 08-790 Technology for Developing Communities
- 15-891/16-891 V-Units, independent study units as part of [techbridgeworld](#)
- 08-780 Web Commerce, Security and Privacy
- 08-782 Adaptive Trading Technologies
- 08-781 Mobile & Pervasive Computing Services
- 08-830 Foundations of Electronic MarketPlaces

Suggested electives related to privacy technology:

- 10-711 Privacy and Anonymity in Data
- 15-827 Security and Cryptography
- 15-899 Digital Rights Management – Technology, Policy & Societal Issues
- 08-733/08-533 Privacy, Policy, Law and Technology
- 18-730 Introduction to Computer Security
- 95-751 Organizational Management and Information Security
- 08-780 Web Commerce, Security and Privacy
- 08-731/08-531 Usable Privacy and Security
- 08-200 Computers & Society

- 08-300 Constructing Appropriate Technology

Suggested electives related to policy decision-making:

- 19-701 Theory and Practice of Policy Analysis
- 19-702 Quantitative Methods for Policy Analysis
- 19-712 Telecommunications, Technology Policy & Management
- 47-818 Contract Theory
- 46-830 eCommerce Law and Regulation
- 90-703 Internet and Public Policy
- 90-840 Legislative Policy Making
- 08-732/08-532 Law of Computer Technology

Legend of course numbers:

08-xxx: Computation, Organizations and Society
 10-xxx, 11-xxx, 15-xxx, 16-xxx, 17-xxx: School of Computer Science
 19-xxx: Department of Engineering and Public Policy
 20-xxx: eBusiness Graduate Program
 21-xxx: Department of Mathematics
 45-xxx, 46-xxx, 47-xxx: Tepper (Business School)
 90-xxx, 95-xxx: Heinz School of Public Policy and Management

PH.D. PROPOSAL AND THESIS

A good thesis will be an original and significant work in COS research. While methodologies will likely vary from one dissertation to another, they will typically combine analytical and empirical work and include development of a computational prototype, used as a basis to demonstrate and evaluate concepts introduced in the dissertation. Typically evaluation will not be limited to a computational assessment but will also include proofs of fitness and an analysis and evaluation of relevant human, social, organizational, economic and/or policy ramifications of the proposed solution.

The program is planned to allow a typical student to complete all the required coursework by the end of the third year. By the start of the fourth year a Ph.D. candidate will present a thesis proposal to the COS community. The proposal should include:

- a clear statement of the proposed research problem, including an argument for the significance of the proposed research
- a review of relevant literature relating to the problem
- a review of the candidate's work leading up to the thesis
- a tentative schedule for completing the work.

The dissertation will typically be completed during the student's fifth year. The final defense is a public presentation, in accord with the College and University requirements for the Ph.D. It is the candidate's responsibility to ensure that the College and University's guidelines are followed for publicity of the defense and the availability of the thesis at least one week prior to the defense.

PROPOSAL AND THESIS COMMITTEE

Advising on the thesis proposal, and guiding in the formation of the dissertation committee, is the thesis advisor's responsibility. Normally, the thesis advisor is one of the COS faculty, but this is not mandatory. The thesis committee must be composed of at least four members, one of whom is an external member and at least one of whom is a COS faculty member. The external member may be from another school at Carnegie Mellon, or from outside the University. All thesis committees are subject to approval by the program committee.

THESIS PROPOSAL

Thesis proposals are to be scheduled only during academic periods --not during holidays, weekends, etc., and should be scheduled in normal business hours. Exceptions must be approved by the COS Program Director. Thesis proposals should be announced to the community **at least two weeks** before the presentation. Earlier is even better. To schedule your thesis proposal:

Check with your thesis committee members to determine two or three possible dates.

Check with the Program Manager to make sure the day/time isn't already taken by another thesis proposal or oral thesis defense (no conflicts allowed). She will also help you to find a room.

If it is necessary to arrange for a speaker phone or other AV Equipment send email to av-help@cs.cmu.edu or call x8-5484. Do this well in advance (at least 3-5 days), since you may need to arrange for a special call-out number to be set up. You will need a charge number from your advisor to do this.

The announcement to the community is made by the Program Manager. In order for that to occur in a timely fashion, the following must be done prior to the two week deadline. Once the date/room is scheduled send the following items to the Program Manager so that she can send out the announcement:

- 1) Title
- 2) Date/time/place (for confirmation)
- 3) Abstract
- 4) Thesis Committee names (including external member and affiliation)
- 5) One hard copy of the thesis proposal document
- 6) A picture of yourself for the announcement poster.

Thesis proposals are coherent and direct written documents, typically about 25 pages in length. These documents should contain:

- 1) A clear statement of the proposed research problem, including an argument for the significance of the proposed research. This should discuss the social, scientific or engineering contributions of the work.
- 2) A review of relevant literature relating to the problem.
- 3) A review of the candidate's relevant work leading up to the thesis.

- 4) A tentative list of chapters and short discussion of the content of each chapter
- 5) If the thesis involves empirical data, then a description of that data and a discussion of why it is appropriate needs to be included.
- 6) If the thesis involves methodological analysis, then a high level of what type of analyses will be done and why they are appropriate need to be included.
- 7) A tentative schedule for completing the work.
- 8) Supporting documents, such as a finished chapter or related paper by the student should be available as appendices.

In general, it is strongly recommended that the student propose before doing the bulk of the thesis work.

The proposal can be thought of as a contract. If the student engages in the work agreed to at the time of the proposal then the student should graduate. In looking over the proposal, the committee should be able to assess what the student will do, why, and the likely contributions. It should be clear to the committee as to what are the conditions for “completion” of the work. Thesis proposals are judged on the basis of quality of work proposed, significance of intended contribution, originality, does the student (and committee) have sufficient background to do the proposed work, clear criteria for knowing when the thesis is complete, and that the work represents sufficient effort to constitute a Ph.D. dissertation.

TIMING AND ATTENDANCE

- Faculty should allow 2 hours for the proposal defense and students 1 hour.
- Order
 - Presentation, 40 minutes
 - Q&A, 20 minutes
 - Closed faculty discussion, 1 hour
- Attendance
 - The presentation and Q&A is open to the community.
 - The committee and the proposing student are required to attend. Remote faculty can join by teleconference if arranged in advance. Faculty discussion is open to only research and tenure track faculty and outside committee members. Ultimate decision is made only by the committee.

PH.D. THESIS ORAL DEFENSE

Thesis defenses are to be scheduled only during academic periods --not during holidays, weekends, etc., and should be scheduled in normal business hours. Exceptions must be approved by the COS Program Director. Thesis proposals should be announced to the community **at least one month** before the presentation. Earlier is even better. To schedule your thesis defense:

Steps for Final Oral Defense

Time: Allow 2-2.5 hours for defense:
30 minutes beforehand for set-up

45 minutes for the presentation

45 minutes for Q&A

30 minutes for deliberation by the committee

30 minutes for final debriefing

- The presentation and Q&A is open to the community.
- The committee and the proposing student are required to attend. Remote faculty can join by teleconference if arranged in advance. Faculty discussion is open to only research and tenure track faculty and outside committee members. Ultimate decision is made only by the committee.

I. At least 5 weeks in advance:

1. Confirm the date w/committee. Be sure to check with the Program Manager before finalizing the date, to make sure there are no other orals scheduled at the chosen time. Thesis orals or proposals will not be scheduled to overlap. Once you have settled on a date/time the Program Manager will help you to reserve a room.
2. The room scheduled must be available to the public and must accommodate a reasonably large number of people.
3. Let the Program Manager know whether or not the outside reader will be attending in person or will need to tele-conference in for the defense.
4. Once the date has been confirmed your status in AGOL will be changed to "In Progress". This notifies HUB when you will be graduating.
5. Turn in 4 hard copies of your thesis- one for each committee member and outside reader for final review, changes, etc...
6. Turn in an electronic copy of your thesis. This is used in case any other faculty member wants to read the thesis before the defense.

II. 1 week before your Defense:

Chair confirms with student and Program Manager that it is ok to defend - Final APPROVAL.

ONLY once the final approval is received from Chair, please send to Program Manager:

- **Information Needed for Posting Notice**
 - Date
 - Time
 - Place
 - Title
 - Current list of the thesis committee members, including external member/affiliation.
- **Thesis Abstract - Abstract- 2copies (350 words or less)-1** gets sent to the Hunt Library; 1 Copy goes to Student's File. The library wants a single sided, loose

version of the thesis, since they will actually bind the version you give them themselves (they have a special system in the library).

- **Thesis Summary** - Approximately 15 printed pages in length describing the main results of the thesis. Send a location where this may be viewed on the web (html or pdf). The site will be announced on the web and on physical postings. The summary posting must include:
 1. Your name
 2. Thesis Title
 3. Date/Location of Oral Presentation
 4. Thesis Committee Members
 5. Thesis summary
- **Reconfirm Attendance** - reconfirm with Connie whether or not teleconferencing facilities will be needed.
- **Poster** - 1 color copy goes to Program Manager and 4 around SCS .

Day of Oral Examination:

Pick up your Folder with signature forms from the Program Manager before going to the examination.

- **Graduation Record Card** - to be signed by all members of the thesis committee, once the thesis is considered finished. The thesis advisor should return this form to Connie.
- **Thesis Cover Page Form** -Four copies to be signed by the thesis advisor and committee members, once the final copy of the thesis has been approved by all committee members. The thesis advisor should return these forms to Connie.
- **Teleconference** - Confirm that needed teleconference facilities have been set up. Send any committee member or reader who cannot physically attend a copy of the overhead slides.

Submitting your thesis:

Final 3 hard copies of thesis need to be submitted to the Program Manager for binding and final certification. A final electronic copy of the thesis, including all supporting data and software, needs to be submitted to Connie for archiving.

- **Before you print the final copy:**
 - Get a TR number from Catherine Copetas
 - Check for proper title page format (COS web site)
- **When the FINAL copy is ready:**

- Give Program Manager 3 one-sided hard copies of the thesis (1 copy will be microfiche, bound, and placed in the E&S Library; 1 will remain in the lab and 1 will be send to you). Copies will be bound one-sided. - Note - if there is data or software involved that should be provided on a cd or dvd.
- Give Program Manager an electronic copy of the thesis.
- Talk with Catherine Copetas about making your thesis into an ISR Technical Report by putting it on-line. If you are able to do this successfully, she will not need a hard copy. If not, you will need to provide an extra copy to her for the Tech Report. This copy should be formatted for two-sided copying.
- Print/or pick up from Program Manager the "Survey of Earned Doctorates". Fill out and turn survey in to her. This is requested by NSF and is a requirement of the university for a student to graduate.
- Fill out the University Microfilms Form pages A4 and A5 (you may also pick this up from Program Manager) return to her with thesis. This form is also required by the university in order for you to graduate. If you wish to register your copyright you must attach a check. If you do not wish to register for a copyright, do not fill out this portion of the form.

Before you leave CMU:

- Leave your forwarding address with Program Manager.
- See Program Manager or ISR Business Office Manager to fill out exit forms.
- Turn in office key, laptop and any software/books you have that belong to any Center, Lab, or faculty member.

Final Step: Only after the above requirements are met, your status will be changed to "Certified". Please make arrangements with Program Manager to have your thesis forwarded to your new address.

IMPORTANT DATES:

In order to walk in Commencement ceremony on May 17:

- Student needs to be certified in CMU system by May 8th
- Student needs to finalize the date & send it to the Program Manager at least 4-5 weeks before the defense.
- Student orders cap & gown by April 1st

COMMON QUESTIONS:

- **Who should come to a thesis defense?**
The thesis defense is a public event open to all members of the CMU community. The student's committee (including any readers) should attend in person or, if circumstances prevent that, by phone.

- **What are the outcomes of a defense?**

Common outcomes from a thesis defense are:

- Pass - Thesis is considered complete as is.
- Conditional Pass Level 1 - Changes required and subject only to advisor approval.
- Conditional Pass Level 2 - Changes required and subject to committee approval.
- Required second defense.
- Failure.

- **When do I need to defend in order to walk through the graduation ceremony and hooding ceremony?**

You will need to have all the documentation in place in the first week of March for us to request a diploma.

PETITIONS

All petitions should be sent only to Director Kathleen M. Carley via email, which will then be reviewed by the COS Program committee when the next meeting takes place. Petitions should look like a brief one-page pdf or document with all supporting materials in an appendix. Any deviation from the above guidelines requires a petition.

Note, students are bound by the handbook under which they enter the COS program. That is, later requirements cannot be retroactively applied to the student. Students can, should they choose, petition the COS program committee to be considered under a later handbook.

INCOMING STUDENTS

WELCOME

Welcome to Pittsburgh, and to the COS Program. We are extremely pleased that you have decided to become a member of our Program; we think it's a very special collection of faculty and students, and we hope you will too. If you have any questions please don't hesitate to send me email. We hope you have a good summer, and look forward to having you with us in the fall.

-Connie Herold
Program Manager

THINGS EVERY INCOMING STUDENT NEEDS TO KNOW

IMPORTANT DATES

See the Activities and Dates page on the COS website for:

Orientation Information

- Computation, Organizations and Society (COS) Immigration Course.
- Software Engineering (SE) Immigration Course.
- School of Computer Science (SCS) Immigration Course.
- Campus-wide graduate student orientation.

ACTION ITEMS

1. ARRIVING TO CMU

How to get to Campus: <http://www.cmu.edu/home/visitors/directions.html>

2. SCS COMPUTER ACCOUNT

To apply for your computer account:

- a. Fill out the Graduate Student Data Sheet mentioned previously, indicating three ranked choices for desired user ID, and return to the Program Manager via email. Your userid cannot be more than 8 characters and should not be only your lastname. Additional information is available on the SCS facilities webpages.
- b. The SCS Computer Account application will also be forwarded to you in hard copy. Please fill out, sign, and return to the Program Manager.

Your SCS Account will be set up once the Program Manager receives this information.

3. ANDREW ACCOUNT

You will also need an account on the university Andrew network to view your student account, register for courses, sign up for health insurance, etc. This is automatically assigned when you are entered into the Student Information System. You can find out your Andrew login (it's not the same as your CS account, unfortunately) by fingering yourfirstname.yourlastname@andrew.cmu.edu. The password is the first 8 digits of your US social security number, or your student ID number if you do not have an SSN. (International students should contact me by email to find out your student ID number.)

4. FINANCIAL SUPPORT

Once your Admission Process has been completed, please contact the COS Program Manager (Connie Herold (cherold [at] cs [dot] cmu [dot] edu)) regarding your Monthly Payroll and Visa assistance. She will have the necessary forms ready for you and put you in touch with the ISR Business Office Manager - Helen Higgins.

5. VISA

If you are not a U.S. Citizen you will receive the I-20 Form, which will allow you to obtain the **F-1 student visa**. However, **the I-20 CANNOT BE ISSUED** until we receive a completed **International Student Information Form** from you. Please note that you are not required to provide any proof of financial support unless you have legal dependents (spouse and/or children). In that case you may be required to show that you have additional funds available to support the dependents.

If you are already in the U.S.; you will request a transfer through your Foreign Student Advisor rather than receiving a new I-20 form. For additional information regarding visas you may want to visit the Office of International Education website.

International students will also receive information with your I-20 Form regarding the **International Student Orientation** program sponsored by the Office of International

Education. While this program is not mandatory, it is strongly suggested that you attend, especially if you have not previously resided in the US. If you are not able to attend during this period, you will be required to attend an orientation session before the end of the first week of the semester in order for your enrollment to be complete, and to maintain your valid visa status. An important part of the orientation are instructions of how to obtain a social security number which you will need in order to receive your monthly stipend.

COS Program will allow for a part-time enrollment only for a one year. If you require visa assistance please contact the COS Program Manager (Connie Herold).

6. PARKING

You may apply on-line at <http://www.cmu.edu/parking/permits/index.html> or visit Parking Services office in the University Center.

7. HEALTH INSURANCE

All full-time students are required to carry health insurance and will be assessed a charge for the individual basic mandatory plan offered through the university student health insurance program. The charge will appear on the invoice of the first semester of attendance in the academic cycle. The student is required to take one of the following three actions:

- i. Enroll in the basic plan as charged
- ii. Upgrade the benefit plan by enrolling in the enhanced student health insurance options during the open enrollment period
- iii. Apply for a waiver from the mandatory plan.

Benefits and Enrollment Information are available online

<http://www.studentaffairs.cmu.edu/HealthServices/insurance/index.html>

Carnegie Mellon is pleased to extend the services of Tuition Management Systems (TMS) to help you manage your health insurance costs. The TMS Health Insurance Monthly Payment Option allows you to spread your health insurance premium over nine monthly installments. The installments begin in September and end in May. We are offering this special TMS plan to cover your health insurance costs only. There is no interest, no pre-qualification or credit check for this service.

With this payment option, you have 24-hour access to account information through TMS's web site, toll-free automated account information through Infoline, and personal account service Monday through Saturday.

Students and their families may already be familiar with TMS from the Monthly Payment Option for tuition and fees. If you already use a TMS plan to cover your tuition and fees, you can add your health insurance premiums to that plan.

For more information, visit Tuition Management System's website or call 1-800-722-4867 and speak with an Education Payment Counselor.

If you would like to set this up online, follow these steps:

- Visit www.afford.com
- Select **Students and Families**
- Select **Monthly Payment Plans**
- Select **Enroll in a Payment Plan**
- Select **2005-2006**, then **Pennsylvania**, then **Continue**
- Select **Carnegie Mellon University, Pittsburgh PA**
- Select **Carnegie Mellon -- Health Insurance Payment Plan**, then **Continue**.
- Select **Annual** then **Continue**
- Enter your insurance premium totals (you can include medical, dental and vision premiums here if you like) then **Continue**
- Select **9 Payments** then **Continue**
- Continue through the forms to add your personal information.

Note that payroll deduction can no longer be used to cover your health insurance costs.

If your insurance costs change later in the year, the costs associated with your insurance choices can sometimes change later in the year, depending on your circumstances. If you get married and add a spouse, if you add a child to the policy, or if you leave the university early and receive a prorated refund of the costs you paid, this can alter the amount of the insurance premiums you want to have handled through TMS.

After completing the necessary paperwork (see links below) to make the changes to your insurance enrollments at Student Health, you'll then want to contact TMS again to make sure the amounts you are paying there are also adjusted accordingly.

Requirements for Waiver of University Health Insurance: Application for waiver from the university student health insurance plan must be made to Student Health Services by the last day of the open enrollment period. Students applying for waiver must provide documentation of continuing coverage verifying that they are enrolled as the dependent, partner/spouse or principal in an employer or government-sponsored insurance plan. Additionally, the plan must meet minimum standards for coverage as set forth below:

- b. It must offer at least 75% coverage for in-patient and outpatient medical services in the Pittsburgh area.
- c. It must include mental health benefits.
- d. The deductible must not exceed \$500 per accident or illness.
- e. It must offer medical benefits of at least \$50,000 per accident or illness.
- f. It must cover pre-existing conditions.

8. HOUSING

For more detailed information on housing and related issues, you may want to visit the CMU

Housing Office <http://www.housing.cmu.edu/> (412-268-2139) website, which can be very helpful in locating suitable apartments or houses for new students. They can provide computerized listings of spaces available to match your specific needs. If you will be looking for an apartment before you arrive, the best times are either early May or mid-July. Most leases are for one year, ending in May or August. You can sign a lease any time if the space is available - but people don't always let the landlords know whether they'll be renewing until 30 - 45 days before the end of the lease. There is usually a little overlap in August -- old leases not over until the end of August, but you need a place by mid-August -- but it's often possible to "bunk in" with older students for a few days until your place comes available.

Change of Address: Please notify the COS Program Manager (Connie Herold) of any address changes throughout your time here at Carnegie Mellon. Also update your address in the Student Information System.

9. INFORMATION REGARDING REGISTERING FOR COURSES

For schedule of courses and to register go to <http://www.cmu.edu/hub/>

10. ACADEMIC CALENDAR - <http://www.cmu.edu/hub/calendar.html>

11. OFFICE OF INTERNATIONAL EDUCATION

<http://www.studentaffairs.cmu.edu/oie/> to fill out your I20 form

All International Students must attend the OIE Orientation.