Program Planning

I. Starting Out Right and Maintaining Acceptable Progress

Graduate students who have half-time jobs (or less) are generally advised to take three courses per regular semester. Note, however, that it is permissible to take four. The beginning graduate student should select 400-, 500- or 700-level courses depending on undergraduate background. Students with little or no programming background are encouraged to acquire programming skills prior to beginning their regular graduate studies. Most graduate courses offered by the Department require at least a minimal level of programming skills. Students who are accepted for admission, but who lack basic computer science prerequisites (CS 354 and CS 367), should contact the Graduate Advising Committee (GAC) well in advance of beginning their first semester.

All entering students should consult with GAC no later than the beginning of registration week to discuss the planning of their schedules. GAC must formally approve all graduate schedules each semester. Students who have completed the master's degree requirements or the qualifying process and who have an official doctoral major professor may have their schedules approved by that professor.

It is important that the student maintain satisfactory academic progress (SAP). Unsatisfactory academic progress (USAP) leads to ineligibility for financial support through teaching assistantships and, if continued for a second semester, results in dismissal from the Department. Initially, failure to complete an adequate course load is the only reason for USAP. Students who are doing badly so that USAP is possible should immediately discuss the problem with a member of GAC.

II. Sources of Advice

1. Members of GAC are available during regular schedule office hours, with special hours during registration periods. They will give advice and must also formally approve proposed courses of study.
2. An informal advising service is run by graduate students during registration periods. This is an excellent source of information about the pros and cons of courses and professors.
3. Particular questions about a course can often best be resolved by contacting the course instructor.
4. The University provides counseling services for help with personal problems. See the handbook *The Wheat and the Chaff.*

III. The Normal Schedule for a Computer Sciences Graduate Student

1. *Master's degree:* Most full-time students obtain this degree in three or four semesters.
2. *Doctoral qualifying examinations:* A student well prepared at time of admission might attempt at least some of these examinations as soon as the second semester after entry, but many students take the qualifying examinations during their fourth through sixth semesters after entry.
   Students should begin preparing for qualifying examinations well in advance. They are stiff examinations which many students fail. Topics lists for the various areas are available in the Department office. These topics lists contain suggestions for background reading. Also, students may find the file of previous examinations, available at Bob's Copy Shop, 1314 W. Johnson St., useful in determining what will be expected of them on the examinations. In general, each qualifying examination (a) requires a broad and unified knowledge of an area, (b) is closed-book, (c) is written under time constraints, and (d) often contains questions that require essay answers. It is a good idea for a student to discuss preparation for the qualifying

examinations with appropriate faculty members once the areas of specialization have been decided.

3. *Doctoral preliminary examination:* This should be taken within two semesters after the qualifying examination deadline has been passed. Before taking it, the student should have satisfied the minor requirement and should have worked on some project for his or her major professor.

4. *Oral defense of Ph.D. dissertation:* In ideal circumstances, the student will be at this final step four years (eight semesters) after entry; the student should certainly be here by the ninth or tenth semester as a graduate student.

Students who do not maintain a schedule reasonably close to these recommendations should not expect continued financial support from the Department.

IV. Scheduling Courses in Particular Areas

1. *Artificial Intelligence*
   The Artificial Intelligence Qualifying Exam for Fall 1992 will cover materials and courses under the current policy. However, this is the last semester during which that policy will be valid. For Spring 1993 and later semesters, the new policy will hold. For the Fall 1992 examination students should use the existing reading lists. For examinations in Spring 1993 and later, extensively revised reading lists will be prepared. The Spring 1993 examination will be considered transitional and will consist of questions and question selection options suitable for students proceeding under either the old or new policies.

   CURRENT POLICY FOR ARTIFICIAL INTELLIGENCE QUALIFYING EXAMINATIONS
   Students should first take 540 if they have not had a comparable course as an undergraduate. 540 and 731 cover the material included in the AI breadth qualifying exam. Advanced work in AI divides into four main fields — computer vision; deductive problem solving, logic programming and expert systems; learning; and natural language processing. Vision is covered in 765 and 766. Problem solving, logic programming and expert systems are covered in 562, 761 and 762. Learning is covered in 760. Natural language processing is covered in 545, 771, 773 and 774. The AI depth exam is in two parts: a set of questions covering 540, 731 and associated readings, and a set of questions covering material in the four advanced fields. Students are allowed to select any combination of questions from the four fields.

   NEW POLICY FOR ARTIFICIAL INTELLIGENCE QUALIFYING EXAMINATIONS
   The Department's standard course offerings in Artificial Intelligence include a senior-level survey of the field, CS 540; a graduate-level survey of the field, CS 731; and a series of 700-level courses each covering one sub-area of the field.

   The sub-areas and the primary courses covering them:
   - Machine learning, CS 760.
   - Deductive problem solving and logic programming, CS 761.
   - Knowledge representation and expert systems, CS 762.
   - Computer vision, CS 766.

   Each of the 700-level courses has CS 540 (or a comparable course, e.g., CS731) as a prerequisite. Staff shortages may make it impossible for the Department to regularly offer CS 731. When it is offered in a semester appropriate for their course scheduling, graduate students should take CS 731 instead of CS 540. If CS 731 is not available to them when they need it, they should take CS 540.

Students taking the AI Breadth Qualifying Examination will be prepared for it if they have mastered the material presented in CS 540 (or 731) and in one of the primary 700-level sub-area courses, and if they have assimilated the publications contained on the AI Breadth Reading List for AI in general and for their chosen sub-area.

The Breadth Examination will consist of three general AI questions (B540/731), two machine learning questions (B760), two deductive problem solving questions (B761), two knowledge representation questions (B762), and two computer vision questions (B766). To pass the examination, students will have to satisfactorily answer two of the three questions in the set B540/731 and both of the questions in one of the sets B760, B761, B762, and B766.

Students taking the AI Depth Qualifying Examination will be prepared for it if they have mastered the material presented in CS 540 (or 731) and in the primary 700-level courses for two or more of the separate sub-areas, and if they have assimilated the publications contained on the AI Breadth Reading List for AI in general and on both the AI Breadth and AI Depth reading lists for their chosen sub-areas, with special concentration in one of them.

The Depth Examination will contain the same B540/731, B760, B761, B762, and B766 question sets as does the Breadth Examination and in addition will contain two advanced questions in each of the sets D760, D761, D762, and D766. To pass the examination, students will have to satisfactorily answer two of the three questions in the set B540/731; both of the questions in one of the B sets (B760, B761, B762, and B766); both of the questions in the D set (D760, D761, D762, or D766) for the same sub-area; and two additional questions from any of the other B or D sets except B540/731. The two additional questions can be but do not have to be from the same set.

2. *Computer Architecture and VLSI*
There are three main courses in computer architecture, one in VLSI design, and one in design tools for VLSI. All are cross-listed as Electrical and Computer Engineering courses with the same number. 552 is the basic course. 752 and 757 cover advanced topics in computer architecture, 755 covers advance topics in VLSI design, and 756 covers design tools for VLSI. 755 and 757 are usually offered in the fall under the auspices of the ECE Department and in the spring under the Computer Sciences Department. 752 is usually offered by the Computer Sciences Department in the fall and by the ECE Department in the spring. 756 is offered in the fall semester alternately by the two departments. Though the same basic course, the emphasis in 755 varies considerably, and CS graduate students who do not have an undergraduate engineering degree usually experience difficulty with the course as offered by ECE. The breadth qualifying exam requires knowledge of material covered in 552 and 752. The depth qualifying exam requires knowledge of material covered in 552 and 752 and some extra readings, most of which are covered in 757.

3. *Database Systems*
At the present time two courses are offered in the area of database systems. Students interested in a general introduction to database systems and their implementation should take 564. Students with an interest in more advanced topics and current research directions in the area, such as students preparing for either of the database qualifying exams, should take 764 after completing 564. Those students who are planning on taking the depth database qualifying exam are expected to complete their preparation for the exam independently. In addition, students interested in pursuing research in the database systems area are advised to consider taking courses in the related areas of operating systems, performance evaluation, and artificial intelligence to prepare for their work in this relatively broad area.

4. *Mathematical Programming*
Students should first take 525 unless they have had a thorough introductory course in linear programming. After completing a good linear programming course, students may take 719 or 720 (which emphasize combinatorial optimization) without further prerequisites, and students with a background in basic mathematical analysis may take 726, 727, or 730 (which emphasize continuous, nonlinear optimization). (Note that 525 is not a prerequisite for 726, 727 or 730.) Some background in probability is recommended for 723, which is not taught every year. All of the 700-level courses may be taken independently of each other. Ph.D. students planning on taking the depth qualifying examination in this area should be familiar with the material in 525 and 719, 720, 726, 727, 730 and optionally 723. For the breadth exam familiarity with the material in 525 and one of the 700-level courses is sufficient. Master's and Ph.D. students minoring in math programming should take 525 and at least one of the 700-level courses in the area.

5. *Modeling and Analysis of Computer Systems*
The various techniques for performance modeling and analysis of computer systems constitute the topics in the MA area. Three courses, CS 547, CS 737, and CS 747 are currently offered in this area. CS 547, which introduces analytic modeling methods and some elementary queueing theory results, is offered in the Fall semester each year. Students enrolling in CS 547 are expected to have some background in operating systems, databases, or computer architecture, which provide some of the systems analysis questions that are used as examples in the course. Students with little or no background in probability theory should audit or enroll in Math 431 prior to or concurrently with CS 547. Both CS 737 and CS 747 are offered in the Spring semester each year. CS 747 covers additional and more advanced analytical modeling methods, while CS 737 covers performance simulation methods. CS 547 is a pre-requisite for CS 737 and CS 747. CS 547 and either CS 737 or CS 747 are required for the MA breadth exam. CS 547 and CS 747, plus additional reading on the Reading List, are required for the MA depth qualifying exam. Whenever possible, a CS 838 seminar is offered which covers papers on the reading list for the depth exam, advanced topics in performance modeling, and provides students with the opportunity to apply modeling and analysis techniques to problems in their field of interest.

6. *Numerical Analysis*
The course sequence 513, 514 provides the basic introduction to numerical analysis and is a prerequisite for the breadth qualifying exam. Students planning to take the depth qualifying exam in numerical analysis should take the course sequence: 717, 712 and 713. This sequence also serves as the starting point for the more advanced courses, 883, 884, 887, 718, 881, 882, and 885. Numerical analysis is a broad field and Ph.D. students usually take several courses in mathematics as well as independent reading courses. Prospective Ph.D. students should consult with numerical analysis faculty about their course of study.

7. *Operating Systems*
Three courses are offered in the area of operating systems. 537 introduces the subject, providing hands-on experience with building parts of operating systems in simple environments. There are several large programming assignments. 736 is an advanced course, often run as a seminar, which discusses a selection of advanced topics. This course often has a large project associated with it. 739 takes up where 736 leaves off. It covers distributed systems in greater depth, studying a wide variety of systems and examining issues such as replication, fault tolerance, load balancing, and security. Both 537 and 736 are needed for the OS breadth qualifying examination. The depth exam covers material in these two courses and advanced material from 739 and 740 (computer networks).

8. *Programming Languages and Compilers*
   After finishing 367, students interested in the area of programming languages should take 536. This course provides an introduction to compilers and to programming-language implementation techniques. The graduate courses in the area are 701/2, 703, and 704. 701 is an extremely time-consuming course, during which each student builds a working compiler for a non-trivial language. Either 701 alone or 701/702 may be taken; the latter is a way to get 3 more credits at the expense of a relatively small amount of extra work. Ph.D. students usually take 701 alone; master's students usually take the combination. 703 covers a selection of advanced topics, such as alternative parsing methods and code optimization. 704 provides an introduction to the theory of programming languages, including the study of functional languages and formal language semantics. Occasionally, a section of 838 deals with issues in programming language design; this course is extremely valuable for students intending to do Ph.D. work in programming languages. For the breadth qualifying exam, 536 and 701 suffice; for the depth qualifying exam, 704 is required and 703 is recommended.

9. *Theory of Computing*
   The breadth exam in theory covers concepts that are introduced in the undergraduate theory courses, 520 and 577. Graduate students who wish to take theory courses in preparation for the breadth exam should take the graduate theory courses 810 and 787, which cover some of the same concepts at a level suitable for graduate students. Students preparing for the depth exam in theory should take 810 and 787, and should cover topics from at least two courses in the following list: 709, 767, 812, 820, 830. Courses 709, 767, 787 and 812 focus on algorithms for specific problems, and courses 810, 820 and 830 study models of computation and complexity classes; students are advised to take both types of courses in their program. All students interested in theory are encouraged to take 880, a special topics course, when offered.

V. Transfer of Credits Toward the Master's Degree

1. *Other UW Departments and UW Special Students*

   Computer Sciences students who were previously special students or students in other departments may apply some or all of their previous courses at the University toward a Computer Sciences Master's degree, subject to the following restrictions:

   (a) A course must either be a Computer Sciences course or it must satisfy the criteria for "approved" courses (see part VII below). In either case, the course must be entered on the student's GAC file, and be initialed as approved by a GAC member.

   (b) At most, one-fourth of the courses applied toward one graduate degree may be applied toward a second graduate degree. Courses applied toward an undergraduate degree may not be applied toward a graduate degree.

2. *Other Universities*

   Courses taken at other universities may not be counted toward the Master's degree.

VI. Maintenance of Student Records

GAC maintains two types of records about each student. These records are available for inspection and verification by the student. At the beginning of each registration week, they are placed in the GAC advising room, and at other times they are in the Department office. It is the responsibility of the student to see that these records are correct and up-to-date.

1. *The Master's Degree/Qualifying Examination Course Plan*

   The course plan must be prepared, in consultation with GAC and the student's personal faculty adviser, during registration week of the student's first semester as a graduate student. The purpose of the course plan is to ensure that the student understands Department regulations and is pursuing a suitable course of study. The course plan may be changed at any time in consultation with GAC and the student's personal faculty adviser. For most students the course plan represents a course of study leading to a master's degree. For graduate students not pursuing a master's degree, the course plan represents a course of study preparing for doctoral qualifying examinations.

2. *The Course History Record*

   The course history record card contains a record of all courses completed or being taken. This record must be brought up to date during each registration week.

In addition to the above records, a student wishing to obtain a master's degree should submit a completed application form, available from the Department office, not less than one month before the end of the semester when the degree is desired.

VII. Approved Courses

Courses taken outside the Department which are to be counted, either toward satisfactory academic progress or toward a master's degree, must be approved by GAC. Approval must be obtained before the course has been taken. Usually approval is given during the registration period, but approval can be requested at an earlier stage if a student wishes to plan ahead.

To be approved, a course must materially contribute to the specific computer science education for which the student is working. For example, a mathematics course in advanced algebra would be approved for a student in hardware and software systems but not for a student in numerical analysis. In doubtful cases, GAC will require a note from a Department faculty member supporting the request for approval.