UNIVERSITY OF WASHINGTON
COMPUTER SCIENCE GROUP

THE GRADUATE DEGREE PROGRAM IN COMPUTER SCIENCE

The field of Computer Science has recently emerged as a separate discipline, evolving from such disciplines as Mathematics and Engineering, which gave Computer Science much of its early impetus. The use and utility of electronic digital computers is well established and well known; it needs no further elaboration. However, Computer Science is much more than the design and programming of computers for their use in certain tasks; it involves the general concept of information and studies the transformation of information in much the same sense as Physics studies the transformation of energy.

Computer Science is devoted to the representation, storage, manipulation and presentation of information in an environment permitting automatic information systems. The computer scientist is interested in discovering the means by which information can be transformed in order to model and analyze the information transformations in the real world. This interest leads to inquiry into both the theory and the application of (1) effective ways to represent information of all forms, (2) effective algorithms to transform information, (3) effective languages with which to express algorithms, (4) effective means to monitor the process and display the transformed information, and (5) economic ways to accomplish (1)-(4).

Both Mathematics and Engineering have contributed greatly to the development of electronic computing and information transformation devices: the former principally through the development of computational algorithms (largely in numerical analysis) and the theories of computability, recursive functions and automata; the latter primarily through the design of computing devices and the development of the theory of digital circuits. In recent years, many other disciplines have taken a very active interest in Computer Science and contributed greatly to the development of this discipline. Linguistics plays an increasing role in the development of computer languages and the problem of machine translation of natural languages; Librarianship , or Library Science, is vitally interested in the efficient storage and retrieval of information; Business Administration has a stake in the processing and the modeling and simulation of complex systems and in the display of business information; Psychology is contributing greatly to the development of learning or self-improving automata; Biology and Medicine provide a substantial amount of background for the modeling of human and animal information processing. This brief list mentions only the principal contributors to the field of Computer Science; the use of computing machines has, of course, invaded practically all fields.

Computer Science includes research in many areas. The following list is indicative of the scope of the field:

Theory and Design of Digital Computers
Theory and Development of Computer Languages and their Processors

Automata Theory
Artificial Intelligence
Numerical Analysis
Information Display Systems
Systems Simulation and Operations Research
Command and Control Systems
Real Time and On-Line Information Processing

The Computer Science Group offers a program leading to the degrees of Master of Science and Doctor of Philosophy.

Admission

In order to be admitted to the graduate program in Computer Science, a student must satisfy the admissions criteria outlined in the Graduate Study section of the University of Washington catalog. In addition, the student must make an application to the Computer Science Group, showing that he has background in the following areas:

(a) Basic knowledge of programming with a procedure-oriented language (e.g., FORTRAN, ALGOL, COBOL), including the development of programming algorithms.

(b) Basic knowledge of computer organization and arithmetic and assembly language programming (e.g., FAP, MAP, Autocoder).

(c) Mathematics through differential and integral calculus, elementary differential equations, algebra of matrices, introductory modern algebra, and fundamentals of mathematical logic. Knowledge of numerical analysis is desirable but not required.

A student with subject area deficiencies may occasionally be admitted. Courses taken to remove such deficiencies will not be counted toward any degree requirement.

The Computer Science Group may restrict admission to the program due to limited facilities. In order to be considered for admission to the program, applicants should observe the following target dates for their applications:

Application for Autumn Quarter: February 1

Application for Winter Quarter October 1

Application for Spring Quarter: January 1

Applications by Foreign Students may be made only for Autumn Quarter and must be submitted by January 1.

Applicants requesting financial aid in the form of scholarships or assistantships will be considered only for Autumn Quarter admission and applications for financial aid must be filed by February 1.

Computer Science and financial aid application forms may be obtained directly from the Computer Science Group. For further information contact:

Professor David Dekker
Graduate Program Adviser
Computer Science Group
University of Washington
Seattle, Washington 98105

Programs of Study

Each student will be assigned a faculty adviser and should plan his program of study with him.

Master of Science

Two options leading to the Master of Science in Computer Science are offered. Individual programs should be designed to provide considerable breadth of knowledge as well as depth in some area of specialization. In addition to the degree requirements outlined in the Graduate Study section of the University catalog, the student must satisfy the following requirements:

1. Non-Thesis Option

   (a) Completion of 40 credits of course work. At least one-half of the credits must be in courses numbered 500 or above.

   (b) At least 30 credits must be in courses chosen from the Computer Science course list. The program must include three quarters registration and participation in Computer Science 520.

   (c) The remaining course work should be in one or more supporting fields, e.g., Engineering, Mathematics, Natural Sciences, Business Administration, Linguistics, Philosophy, Psychology, or Medicine.

   (d) A certificate of proficiency in a foreign language.

   (e) Passing satisfactorily an oral examination in one area of specialization.

2. Thesis Option

   (a) Completion of 31 credits of course work. At least one-half of the credits must be in courses numbered 500 or above.

   (b) At least 24 credits of course work must be in courses chosen from the Computer Science course list. The program must include three quarters registration and participation in Computer Science 520.

   (c) See item (c) under Non-Thesis option.

(d) See item (d) under Non-Thesis option.

(e) Preparation of a thesis, acceptable to a Computer Science Supervisory Committee. Students must register for at least 9 credits of Computer Science 700, in addition to the 31 credits of course work.

(f) Pass satisfactorily an oral examination on his thesis work.

Examples of programs providing appropriate depth are:

(a) A program in programming languages and systems

Computer Science 478, 510, 531
Electrical Engineering 501, 502
Mathematics 405, 519

(b) A program in design of computers

Computer Science 478, 531
Electrical Engineering 501, 576, 588, 589
Mathematics 405

(c) A program in abstract theory for students with a strong algebra background

Computer Science 478, 531
Electrical Engineering 501
Mathematics 405, 504, 505, 506

(d) A program in numerical analysis

Computer Science 478
Electrical Engineering 501
Mathematics 464, 465, 466 and/or 557, 558, 559

Doctor of Philosophy

Each individual Ph.D. program must be approved by the Supervisory Committee, appointed by the Dean of the Graduate School. The following requirements supplement those outlined in the Graduate Study section of the University catalog.

(a) Passing satisfactorily a Ph.D. Qualifying Examination administered by the Computer Science Group. This examination is normally taken after completion of one year of graduate study. The examination will cover breadth of knowledge in Computer Science, as can be obtained by taking the basic Computer Science courses. A detailed prospectus will be issued well in advance of the examination.

(b) Passing satisfactorily the General Examination specified in the Graduate Study section of the University catalog. In this examination the student

must demonstrate depth of knowledge in the area of Programming Languages and in one of a number of special areas acceptable to his Ph.D. Supervisory Committee. Examples of such areas are:

Numerical Analysis
Computer Design
Theoretical Foundations of Computer Science
(includes Automata Theory, Mathematical Logic and Modern Algebra)

(c) Completion of about 60 credits of course work, at least 40 of which are to be in courses numbered 500 or above, and about 45 credits should be in courses chosen from the Computer Science course list. The program must include 3 quarters registration and participation in Computer Science 520. Course work taken toward the M.S. degree will be applicable toward the Ph.D.

(d) Preparation of a dissertation which must be acceptable to the Supervisory Committee. Students must register for at least 27 credits of Computer Science 700, Thesis.

Faculty

Associate Professor John G. Cramer, Physics
Associate Professor David B. Dekker, Mathematics
Associate Professor Hellmut Golde, Electrical Engineering and Computer Science
Professor Allan A. Goldstein, Mathematics
Assistant Professor Alistair D. C. Holden, Electrical Engineering and Computer Science
Professor Edgar Horwood, Civil Engineering
Professor Earl B. Hunt, Psychology and Computer Science
Professor David L. Johnson, Electrical Engineering and Computer Science
Assistant Professor Theodore H. Kehl, Physiology and Biophysics and Computer Science
Professor Laurel J. Lewis, Electrical Engineering
Professor Jerre D. Noe, Electrical Engineering and Computer Science, Chairman, Computer Science Group
Professor Ronald Pyke, Mathematics
Associate Professor Robert W. Ritchie, Mathematics
Associate Professor Ralph T. Rockafellar, Mathematics

Course List (Revision Autumn Quarter 1968)

The following courses are acceptable toward the requirements for Computer Science degrees. Courses may be added to or deleted from this list from time to time. A, W, Sp, and Su refer to Autumn, Winter, Spring, and Summer quarters, respectively. The number of credits is given in parentheses, with an asterisk denoting "by arrangement".

Electives may be chosen from other courses in the University catalog with the approval of the student's adviser.

CSci 478 Computer Organization and Machine Language Programming (4) A, Sp
Differences and similarities in computer structure. Flow of control. Instruction codes and their execution for arithmatic, logical, character manipulation and input-output operations. Indexing and indirect addressing; subroutine linkage. Study of information representations and their relationship to processing techniques.
Prerequisite: Fundamental knowledge of FORTRAN and assembly language.

CSci 510 List Processing and String Manipulation (3) Sp
Structure of information sets which reflect the syntactic or semantic relationships in the information. The generation and processing of structures such as lists and trees. Generalized information systems. Pattern recognition and manipulation of symbolic strings. Markov algorithms. Algebraic symbol-manipulation processes. Syntax, semantics, and use of recent versions of languages such as LISP, FORMULA-ALGOL, SNOBOL, and FORMAC.
Prerequisite: EE501 or permission

CSci 520 Computer Science Seminar (1, max 3) A, W, Sp
Weekly discussion by students and faculty or visitors on current topics of interest. Must be taken by all graduate students for three quarters.

CSci 531 Automata Theory I (3) W
Finite, probablistic, growing and reproducing automata. Representation of automata by state graphs, regular expressions, logical nets, recursive functions, Turing machines.
Prerequisite: Math 305

CSci 573 Artificial Intelligence (4) A
Introduction to problem solving. Survey of theorem proving, symbol manipulating, pattern recognition, and inductive problem-solving techniques. Computer models of human thought.
Prerequisite: CSci 478

CSci 590 Special Topics in Computer Science (*)
Lectures and discussions of topics of current interest in Computer Science. May not be offered every quarter; content may vary from one offering to another. May be repeated for credit.
Prerequisite: permission

CSci 600 Research (*) A, W, Sp, Su
Prerequisite: permission

CSci 700 Thesis (*) A, W, Sp, Su
Prerequisite: permission

EE 501 Computer Languages (3) W
Discussion of computer languages: machine language, assembly language, problem-oriented languages. Manipulation of symbols and strings. Formal definition of computer languages.
Prerequisite: CSci 478

EE 502 Programming Systems (3) Sp
Basic concepts and design of interpreters, assemblers, compilers, and operating systems for digital computers.
Prerequisite: EE 501

EE 576 Communication Theory I (3) W
Mathematical theory of communication. Information theory for discrete and continuous systems. Channel capacity and coding,
Prerequisite: EE 505 or permission

EE 577 Communication Theory II (3) Sp
Communication in the presence of noise. Analysis of systems with random inputs. Optimum linear systems, statistical detection of signals, decision theory. Statistical analysis of nonlinear system.
Prerequisite: EE 576

EE 588 Logical Design of Digital Computers I (3) Sp
Number systems, error detect-correct, Boolean algebra. Optimization of logical systems under various criteria. Topological methods of optimization and synthesis. Sequential logic, memory input, and application equations. Application of logical techniques to digital systems.
Prerequisite: graduate standing

EE 589 Logical Design of Digital Computers II (3) A
Analysis and synthesis of digital systems from logical models. Time-independent and sequential logic, multi-function logic. Boolean matrix synthesis, partitioning, weighting, cellular implementation. Threshold logic, theory. Evaluation of various analysis and synthesis methods in logical systems.
Prerequisite: EE 588

EE 590 Advanced Topics in Digital Computers (2-5, max 15)
Lectures or discussions of topics of current interest in the field of digital computers. Subject matter may vary from year to year.
Prerequisite: permission

Math 403, 404 Introduction to Modern Algebra (3, 3) W, Sp
Algebraic systems; elementary theory of groups, rings, and fields; polynomials; topics in linear algebra; reductions of forms.
Prerequisites: 402 for 403; 403 for 404

Math 405 Introduction to Metamathematics (3) Sp
Formal systems; propositional calculus and predicate calculus of first order. The concepts of consistency, completeness, and decidability are introduced and applied to those systems.
Prerequisite: Math 305 or equivalent

Math 407, 408 Mathematical Optimization Theory (3, 3) W, Sp
Mathematical approach to game theory and linear programming with applications to economics and operations research.
Prerequisite: Math 302 or equivalent

Math 464 Numerical Analysis I (3) A
Basic principles of numerical analysis, classical interpolation and approximation formulas, finite differences and difference equations.
Prerequisite: Math 238

Math 465 Numerical Analysis II (5) W
Numerical methods in algebra. Systems of linear equations, matrix inversion, successive approximations, iterative and relaxation methods.
Prerequisites: Math 305, Math 464, and programming knowledge in FORTRAN and ALCOL

Math 466 Numerical Analysis III (5) Sp
Numerical differentiation and integration. Solution of differential equations and systems of such equations.
Prerequisite: Math 465

Math 501, 2, 3 Mathematical Logic (3,3,3) A, W, Sp
Theory of formal systems. Formal development of number theory. Completeness and incompleteness, decidability and undecidability. The theorems of Gödel, Henkin, Church, Rosser, and Tarski. Selected topics from axiomatic set theory, recursive function theory, theory of models, or advanced theory of formal systems.
Prerequisites: Math 405 or equivalent for 501, 501 for 502, 502 for 503.

Math 504, 5, 6 Modern Algebra (3,3,3) A, W, Sp
Theory of groups, rings, integral domains, and fields, polynomials, vector spaces, Galois theory, and theory of ideals.
Prerequisite: Math 404 or equivalent for 504, 504 for 505, 505 for 506

Math 519 Mathematical Models of Grammar (3) W
A study of some mathematical models of language recognition, emphasizing context-free and context-sensitive grammars.
Prerequisite: graduate standing

Math 557, 8, 9 Special Topics in Numerical Analysis (3, max 9; 3, max 9; 3, max 9) A, W, Sp
Each may be taken three times for credit. Such topics as linear systems, approximation theory, or the numerical solution of differential equations will be covered.

UNIVERSITY OF WASHINGTON
COMPUTER SCIENCE GROUP

APPLICATION FOR ADMISSION TO THE GRADUATE DEGREE PROGRAM IN COMPUTER SCIENCE

Name _____

Mailing Address _____

Telephone _____ Date of Application _____

Degree(s) Desired (MS-Thesis, MS-nonthesis, Ph.D.) _____

Do you intend to pursue graduate work full time? _____

If you are currently enrolled in the UW Graduate School, state Department.

_____

Previous degrees (School, Year, Major, Title of Thesis) _____

_____

Do you require financial support? _____

INFORMATION ON COMPUTER SCIENCE PREREQUISITES

List by course number, title and text (or experience) how you have satisfied the following Computer Science prerequisites.

(a) Programming with a procedure-oriented language (specify language): _____

_____

(b) Basic knowledge of computer organization and assembly language (specify machine(s) and language(s):

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(c) Differential equations: _____

_____

(d) Matrix algebra: _____

_____

(e) Introductory modern algebra: _____

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(f) Elements of mathematical logic: _____

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(g) Other experience in Computer Science. List by course number, title and text any other courses which might be considered toward partial fulfillment of the Computer Science advanced degree requirements. Include courses in fields such as Automata Theory, Linguistics, Numerical Analysis, Computer Languages, Optimization Theory, Etc.) _____

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