ADVICE
to
GRADUATE STUDENTS

Computer and Information Science

2109 Ingersoll Hall
Brooklyn College, City University of New York
Brooklyn NY 11210

(718) 951-5657

http://www.brooklyn.cuny.edu/pub/departments/cis/

cis@sci.brooklyn.cuny.edu

Chairperson:	**Prof. Y. Langsam**	2109N	951-5657
Graduate Deputy Chair	**Prof. P. Whitlock**	1212N	951-5000 x2069
Undergraduate Deputy Chair (CLAS):	**Prof. M. Augenstein**	2122N	951-5000 x2041
Undergraduate Deputy Chair (SGS):	**Prof. J. Thurm**	2109N	951-5657
Graduate Secretary:	**Elena Hintze**	2109N	951-5657

This brochure is intended to be a summary of the rules applicable to graduate study in computer science at Brooklyn College. The Brooklyn College Graduate Bulletin is the official statement of the rules and regulations and should be consulted for final resolution of any questions. Each student should make sure to obtain a copy of the Brooklyn College Graduate Bulletin.

This brochure has been updated to the new course numbers effective September, 2010. For a list matching new course numbers to old course numbers, go to
http://www.brooklyn.cuny.edu/courses/new_crs_num.jsp

Brochure Preparation:
    Jacqueline A. Jones, with assistance from
        Keith Harrow
        Yedidyah Langsam
        Aaron Tenenbaum
        Paula Whitlock

Effective Date:
    September, 2017

TABLE OF CONTENTS

I. DEPARTMENT OF COMPUTER AND INFORMATION SCIENCE

Brooklyn College has a large and distinguished graduate program in computer science. The department, established in 1972, is recognized for excellence. The faculty includes two Distinguished Professors.

An outside evaluation ranked Brooklyn College's Computer and Information Science (CIS) Department as one of the best in the New York metropolitan area. In addition, the faculty is actively engaged in research in which students may become involved.

The department's graduate course offerings cater to a diverse range of interests. The department offers courses in artificial intelligence, database management and information processing, theory of computing, computer architecture, operating systems and compilers, communications, signal processing, object-oriented programming, graphical user interfaces, and many other areas. Specialized topics are offered as interest arises.

The department provides a stimulating environment for those interested in studying computer science. There is enthusiastic interaction among students and faculty, and there are strong research groups. Advanced graduate students have the opportunity of doing research under the guidance of department faculty. The department has significant grant support for research, with faculty supported by such agencies as NIH, NSF, ONR, and NASA.

Graduates of the programs in computer science at Brooklyn College have achieved success in a wide variety of areas. For example, Brooklyn College students have received Ph.D. degrees from such prestigious schools as NYU, Harvard, and Stanford University; some Brooklyn College graduates are teaching at Columbia, Harvard, and Stanford.

Each year the CIS Department awards more than 50 Master's degrees. Some of the graduates continue their studies towards the Ph.D. degree, while most work as professionals in the computer field. Recent Master's recipients are enrolled in doctoral programs at the City University of New York, SUNY at Stony Brook, M.I.T., the University of Delaware, and the University of Maryland. CIS Department Master's graduates are employed at numerous companies in the New York metropolitan area, including AT&T, Bellcore, Bell Labs, Citibank, IBM, Metropolitan Life, Keyspan Energy, Con Edison, the Port Authority, CBS, Chase, and other major corporations. Many international students have returned to their native lands to pursue careers there.

The department's academic goal in the graduate program is to train graduate students for careers in computing research and applications. The two primary graduate programs of the department are a Master of Arts (M.A) degree in Computer Science, oriented toward computer science research and development applications; and a Master of Science (M.S.) degree in Information Systems, oriented towards organizational and administrative uses of computing. Both programs include study of advanced applications and methodology. The M.A. degree also prepares students for Ph.D. study. The department plays a major role in the Ph.D. Program in Computer Science of the City University of New York.

II. GRADUATE PROGRAMS AT BROOKLYN COLLEGE

The CIS Department offers a variety of options leading to the Master's degree and participates in several joint programs with other departments.

Graduate Degree Programs

1. M.A. in Computer Science

2. M.S. in Information Systems

3. M.S. in Health Informatics

4. CUNY Ph.D. in Computer Science

This brochure concentrates on the first three programs. Links to information on the Ph.D. Program in Computer Science are provided later in this brochure.

M.A. in Computer Science

The Master of Arts (M.A.) degree in Computer Science is designed for students interested in computer science research, system development, or advanced applications. This program is focused on teaching the student advanced techniques and methodology, in addition to applying standard computer tools. The program is also recommended for students who wish to pursue doctoral studies in computer science.

> The M.A. program emphasizes all aspects of computer science. The title "Master of Arts" reflects that it is a broader program than the M.S. in Information Systems, not that it is any less scientifically oriented. In fact, the M.A. program is a more mainstream computer science degree than the M.S.

Professor Paula Whitlock is the Graduate Deputy Chair. Students who are entering the M.A. program in Computer Science should meet with Professor Whitlock (whitlock@sci.brooklyn.cuny.edu).

M.S. in Information Systems

The Master of Science (M.S.) degree in Information Systems is designed for students interested in the applications of computer science to the practical information systems needed for business and administration. The theory of computing is presented with an eye towards practical applications. It is for students who wish to understand the use of the computer as a management tool, its place in organizations for both planning and production, and the organization of complex computer systems so that they are most effective and efficient. Advanced computer tools and their usage are also a focus of study.

> The M.S. degree is intended for students who wish to become computer systems managers, directors, and executives in such organizations as banks, insurance companies, universities, brokerage houses, etc., or who wish to manage information systems in other industrial or service organizations.

Current M.S. students are divided into two groups. One group consists of computer professionals already working in industry, and the other group consists of accountants, comptrollers, business executives and administrators who wish to apply computer science to their own fields. Both groups are interested in learning computer science theory and its integration into their own fields.

The Graduate Deputy Chair, Professor Paula Whitlock, is in charge of all Master's Degree programs. Students who are entering any of our graduate programs should meet with Professor Whitlock to discuss their plans.

M.S. in Health Informatics

The Master of Science (M.S.) degree in Health Informatics focuses on the use of technology in a wide range of health care and medical services. It is designed for students interested in applications of computing and research in computer science as it is utilized in the fields of healthcare and other aspects of health science. The program is focused on teaching the student advanced techniques and methodology, in addition to applying standard computer tools. The program is appropriate for both practitioners of health applications using computers and for researchers in new computer-based methods and measures in health-related fields.

> The M.S. degree in Health Informatics is intended for students who wish to become computer systems managers, directors, and executives in hospitals and health-related institutions.

The Graduate Deputy Chair, Professor Paula Whitlock, is in charge of all Master's Degree programs. Students who are entering any of our graduate programs should meet with Professor Whitlock to discuss their plans.

III. ADMISSION REQUIREMENTS AND APPLICATION PROCESS

Applicants for the master's degree programs in Computer Science or Information Systems are expected to have the equivalent of at least 15 credits in computer and information science and related areas, including all of the following: knowledge of a high-level computer language (preferably Java or C++), knowledge of assembly language and computer architecture, a course in discrete structures, a course in data structures, and a course in calculus. Applicants for the M.S. degree in Information Science are expected to have all the courses listed plus a course in probability and statistics.

Students interested in the M.S. degree in Health Informatics must offer at least 18 credits in undergraduate or graduate courses in health and nutrition sciences and/or health-related fields. Applicants are also expected to have the equivalent of at least 12 credits in computer and information science, including all of the following: knowledge of a high-level computer language (preferably Java or C++), a course in discrete structures and a course in data structures.

Students who do not have all of these requirements may be accepted with the condition that they complete these courses at the undergraduate level.

Students who majored in any area as an undergraduate can be accepted as graduate students in computer science. Approximately half of the applicants majored in computer science as undergraduates. Other applicants majored in mathematics, engineering, physical and natural sciences, social sciences, fine arts, education, and so on.

Applications

Students can download an application for admission on the Brooklyn College Web site at http://www.brooklyn.cuny.edu/pub/graduate_students.htm or apply online at https://websql.brooklyn.cuny.edu/admissions/graduate/. As part of their application, students are required to submit transcripts from all colleges that they have attended, two letters of recommendation, and TOEFL scores if appropriate (see below). Brooklyn College uses a self-managed application form for graduate students, in which the student is responsible for collecting all materials required for admission.

TOEFL

Students whose native language is not English are required to take the TOEFL (Test of English as a Foreign Language) examination before applying for admission. Students whose native language is not English but who have lived in the United States for several years may be exempt from these requirements.

Prerequisite Courses

When a student is admitted to a Master's program, the student will receive a letter describing which (if any) prerequisite courses must be completed. If a student believes that there is a mistake in this list, the student should contact the Graduate Deputy Chair as quickly as possible to resolve the problem.

Deadlines for Matriculation

In general, Brooklyn College's deadlines for admission are April 1 for the Fall semester, November 1 for the next Spring semester. If a student misses the deadline, the application can still be considered.

The Master's program accepts students from a wide variety of backgrounds. Each semester more than 100 students, from a multitude of countries around the globe, apply for admission. Many students come from Asia (including China, Korea, Taiwan, India, Pakistan, and Bangladesh). There are a number of students whose home country is in the Middle East (including Egypt, Saudi Arabia, Lebanon, and Israel). Other applicants come from Western or Eastern Europe, including a number from Russia. Still others come from Africa, South America, and Central America. Of course, many of the applicants come from Brooklyn, the entire metropolitan area, and elsewhere in the United States.

Non-Matriculated Students

Students who do not meet the entrance requirements or who miss the application deadline may be admitted with non-matriculated status. A student in non-matriculated status is restricted in many ways; most important, the student may not register after completing 15 credits. After completing six credits with a 3.0 average, a student should apply for matriculated status. 7000-level courses taken as non-matriculated students will count toward the degree once the student has become matriculated.

International students, or students who need to obtain a visa of some type in order to study at Brooklyn College, cannot register as non-matriculated students. Such students must be accepted as matriculated students in order to attend Brooklyn College.

IV. DEGREE REQUIREMENTS

M.A. in Computer Science   (HEGIS code 0701)

All students must take 30 credits of courses numbered 7000 and above and maintain at least a B (3.00) average. In addition, if a student is required to take one or more undergraduate courses, the student should also have a B average in those courses.

M.A. in Computer Science Course Requirements (30 credits)

All students must complete 30 credits in courses numbered 7000 and above. These courses must include at least one course from each of the following five groups:

- (1) **Operating Systems and Compilers**: CISC 7110X, 7120X, 7124X, 7132X, 7310X, 7312X.
- (2) **Analysis of Algorithms**: CISC 7200X, 7212X, 7214X, 7219X.
- (3) **Software**: CISC 7410X, 7412X, 7414X, 7500X, 7510X, 7512X, 7610X, 7620X.
- (4) **Theoretical Computer Science**: CISC 7220X, 7221X, 7224X, 7228X, 7422X.
- (5) **Architecture**: CISC 7302X, 7330X, 7332X, 7334X, 7360X.

In addition, the 30 credits must include **at least three advanced level courses.** For a list of advanced courses, see Section VIII of this brochure or the Graduate Bulletin, where advanced level courses are labeled with an asterisk (*).

Up to 10 credits in courses in other departments may be substituted with the permission of the Graduate Deputy Chair. However, this approval is rare, and students are urged to take all of their graduate courses in computer science.

Graphics/Multimedia Concentration

Students who wish to have a concentration in graphics/multimedia should take any three of the following courses as part of their program in satisfying the degree requirements: CISC 7610X, 7620X, 7622X, 7630X, 7640X, 7642G, 7650X.

M.A. Thesis or Comprehensive Examination

All students must complete one of the following (for more details, see Section VI: Exit Requirements):

(1) Take CISC 7990G and submit a thesis acceptable to the department. No more than 6 credits in thesis research may be counted toward the degree.
(2) Pass a written comprehensive examination.

M.S. in Information Systems   (HEGIS code 0702)

All students must take 36 credits of courses and maintain at least a B (3.00) average. In addition, if a student is required to take one or more undergraduate courses, the student should also have a B average in those courses.

M.S. in Information Science Course Requirements (36 credits)

Students must complete all of the following.

All of the following: CISC 7520X; 7300X or 7310X; 7500X, 7510X, 7530X, and 7540X. (Students who have completed an undergraduate course in the area of one or more of these courses may, with department permission, substitute another 7000-level computer science course for each such course.)

Two courses chosen from the following: CISC 7100X, 7124X, 7132X, 7354X, 7410X, 7412X, 7414X, 7512X, and 7610X. Students who take the thesis option (see below) may, with permission of the department, present a maximum of 3 credits in the courses 7990G, 7992G, and/or 7994G as a substitute for one of these courses.

One of the following: CISC 7330X, 7332X or 7334X

Two courses chosen from the following: CISC 7522X, 7532X, 7534X.

Three additional credits in courses numbered 7000 or above in the department. With the permission of the department chairperson, these credits may be in other departments (e.g., Business, Economics, Mathematics, Psychology). Two recommended courses are BUSN 7230 and BUSN 7276. On the whole, students are urged to take all of their graduate courses in computer science.

M.S. Thesis or Comprehensive Examination

All students must complete <u>one</u> of the following (for more details, see Section VI: Exit Requirements):

(1)   Complete CISC 7990G, Thesis Research (this course may be counted as the additional 3 required credits), and submit a thesis acceptable to the department.

(2)   Pass a written comprehensive examination.

M.S. in Health Informatics (HEGIS code 0799)

All students must take 30 credits of courses and maintain at least a B (3.00) average. In addition, if a student is required to take one or more undergraduate courses, the student should also have a B average in those courses.

M.S. in Health Informatics Course Requirements (30 credits)

Students must complete all of the following.

All of the following: 7500X, 7510X, 7530X and 7450X.

One of the following: CISC 7320X, 7522X, 7532X and 7534X.

One additional CISC course numbered 7000 or above.

Three courses chosen from the following: Health and Nutrition Sciences 7110X, 7120X, 7140X, 7144X and 7150X, and Kinesiology 7000X, 7044X, 7100X and 7342X.

M.S. Thesis

All students must complete <u>one</u> of the following (for more details, see Section VI: Exit Requirements):

(1) Computer and Information Science 7990G and a thesis acceptable to the Department of Computer and Information Science.
(2) Computer and Information Science 7900X and a project acceptable to the Department of Computer and Information Science.
(3) Kinesiology 7990X and a project acceptable to the Department of Kinesiology, with the approval of the Chair or Graduate Deputy of the Department of Kinesiology.
(4) Computer and Information Science 7980X and an internship acceptable to the Department of Computer and Information Science.

CUNY Ph.D. Program

The Ph.D. Program in Computer Science at CUNY is conducted as a consortium of several senior colleges and the Graduate Center, located on 34th St. and 5th Ave. in Manhattan; students enrolled in the program may take courses at any of the locations. Most of the advanced graduate courses and seminars are offered at the Graduate Center, although many are given at Brooklyn College.

All 7000-level courses of the Brooklyn College CIS Department may be credited toward the CUNY doctoral degree with permission of the Executive Officer of the doctoral program. Many members of the CIS department faculty are also members of the doctoral faculty, and students who wish to do supervised research may work with any of those faculty members. About 10-15

> Keep in mind that the Ph.D. in computer science is not necessary for most jobs in the field; it is intended to prepare selected students for careers of leadership in industry, research, and teaching in academia.

Ph.D. students at Brooklyn College are supported, either by a tuition grant, as grad fellows, or through research projects. A number of doctoral students based at Brooklyn College get Ph.D.s each year.

It is possible for a student with an outstanding record to be admitted to the Ph.D. program directly after receiving the Bachelor's degree; however, it is more common to be admitted after receiving a Master's degree. Students who wish to obtain the Ph.D. degree are invited first to complete the Master's degree at Brooklyn College, where their Master's work will count toward the CUNY doctoral degree.

Admissions Requirements

All applicants to the Ph.D. are required to have a minimum average of B in their undergraduate work and to have completed coursework equivalent to an undergraduate major in computer science. Exceptions may be made for students with degrees in related fields or with extensive experience in computer science.

Applicants must take the Graduate Record Exam. It is strongly recommended that the applicant also submit scores for the Computer Science advanced area test.

Students whose first language is not English are required to take the TOEFL. Applicants must also submit two letters of recommendation and an official transcript.

For further information about the CUNY Ph.D. program, consult the Graduate Deputy Chair of the CIS Department or the Executive Officer **of** the Ph.D. program in Computer Science.   For the brochure "Prospectus for the Ph.D. Program in Computer Science," contact the Executive Officer of the Ph.D. Program in Computer Science at the address below.

For applications, contact the Office of Admissions at the address below:
The Graduate Center, CUNY, 365 Fifth Ave., New York NY 10016-4309
(212) 817-8190   compsci@gc.cuny.edu   http://www.gc.cuny.edu/Admissions/index.htm

V. RECOMMENDED SCHEDULES

M.A. in Computer Science

There are a variety of schedules from which students can choose, depending on their level and the number of courses they wish to take. It is advisable to see the Graduate Deputy Chair before planning each semester's program. Students who enter with background in computer science will generally be able to go directly into 7000-level courses. Students without such a background will need to take selected undergraduate courses, described below, before taking any 7000-level courses.

Beginning M.A. Students with Limited Background in Computer Science

A. Students **just beginning to study computer science** must take CISC 1115 (Programming in Java) in their first semester. This course is a prerequisite to all other CIS courses.

B. Students **who know another language** (e.g., C++) and **who have some mathematics background**, may take CISC 2210 (Discrete Structures) at the same time as CISC 1115.

C. Students **who already know Java** may take CISC 2210 and CISC 3115 (Modern Programming Techniques).

D. Students **who have begun their study of computer science in C++** (CISC 1110) may complete the CISC 1110 / 3110 / 3130 sequence, but they must be aware that

CISC 3110 will be offered for the last time in Spring, 2018, and CISC 3130 will be offered in C++ for the last time in Fall, 2018.

E. Students **who have completed CISC 2210** may take CISC 3310 (Principles of Computer Architecture). CISC 3310 can be taken at the same time as CISC 3115 or 3130.

F. Students **who have completed CISC 3115** must continue on to take CISC 3130 (Data Structures), which is a prerequisite for almost all CISC 7000-level courses.

G. Students **must demonstrate knowledge of basic calculus**. If necessary, the student should take the first undergraduate calculus course (MATH 1201).

If the student already knows the material covered in any of these courses, the student may apply for a waiver for that course from the Graduate Deputy Chair. The student must be prepared to demonstrate competence if a waiver is requested.

M.A. Students Who Have Completed All Undergraduate Prerequisite Courses or Who Have an Undergraduate Degree in Computer Science

Students who have completed all undergraduate prerequisite courses (or who were not required to take any of these courses) have a wide variety of 7000-level courses available. Currently, the CIS Department offers about 15 7000-level courses per semester, selected in a rotating fashion from a list of more than 40 such courses. The complete list of all CIS Department graduate courses appears in the Brooklyn College Graduate Bulletin and in Section VIII.

All degree requirements, prerequisites, exclusions, and general Brooklyn College regulations are listed in the Brooklyn College Graduate Bulletin. Students should make sure that they receive a copy of the Graduate Bulletin, since they are responsible for satisfying the various rules and regulations.

First Level and Advanced Level Courses

The 7000-level courses are divided into two basic groups: first level and advanced level courses. In the M.A. program in computer science, students are required to complete three advanced level courses. With a few exceptions, courses that have a graduate-level prerequisite are advanced level, while those without such a prerequisite are not. Advanced level courses are marked with an asterisk in the Graduate Bulletin and in Section VIII.

Prerequisites and Exclusions

Among first level courses, some cover the same material (in somewhat more depth) as advanced undergraduate courses. These graduate courses are not open to students who have already had a corresponding course, whether at Brooklyn College or at another school. For example, the course CISC 7410X (Artificial Intelligence) is not open to a student who has already had a course, graduate or undergraduate, in artificial intelligence. The following CIS courses are in this category: 7310X, 7110X, 7410X, 7510X, and 7360X. Students who have taken the undergraduate course CISC 3220 (Analysis of Algorithms) or its equivalent can take either CISC 7200X or 7214X, but it is recommended that they take CISC 7214X.

On the other hand, a number of first-level courses are open to students even if they have already had an undergraduate course in the area. For example, CISC 7302X (Computer Architecture) is open to students who have had an undergraduate course in architecture.

Counseling

With the aid of the Graduate Deputy Chair, a student should determine exactly which courses are available to him or her, and which are excluded. At that point, the student can select up to four courses to take in a given semester, depending upon the student's job status, time available, and so on.

Students who must maintain full-time status either to satisfy the requirements of their visa or the rules of a loan program or for some other reason should make sure that they take sufficient courses each term to be considered a full-time student.

M.S. in Information Systems

There are a variety of schedules from which students can choose, depending on their level and the number of courses they wish to take. Several of these courses have prerequisites and students are expected to meet these requirements before registering for these courses. It is advisable to see the Program Director or Graduate Counselor before planning each semester's program. Students who enter with background in computer science will generally be able to go directly into 7000-level courses. Students without such a background will need to take selected undergraduate courses, described below, before taking any 7000-level courses.

Beginning M.S. in IS Students with Limited Background in Computer Science

A. Students **just beginning to study computer science** must take CISC 1115 (Programming in Java) in their first semester.

B. Beginning students can also take CISC 1050 (Introduction to Computer Applications). This course covers the fundamentals of Windows, Microsoft Word (word processing), Excel (spreadsheet), and Access (database).

C. Students **who know another language** (e.g., C++) **and who have some mathematics background** may take CISC 2210 (Discrete Structures) at the same time as CISC 1115 and/or CISC 1050.

D. Students **who have begun their study of computer science in C++** (CISC 1110) may complete the CISC 1110 / 3110 / 3130 sequence, but they must be aware that CISC 3110 will be offered for the last time in Spring, 2018, and CISC 3130 will be offered in C++ for the last time in Fall, 2018.

E. Students **who know Java** may take CISC 3115 (Modern Programming Techniques) at the same time as CISC 2210.

F. Students **who have completed CISC 3115** must next take CISC 3130 (Data Structures), which is a prerequisite for almost all 7000-level courses.

G. Students **who have completed CISC 2210** may take CISC 3310 (Principles of Computer Architecture). CISC 3310 can be taken at the same time as CISC 3115 or 3130.

H. Students **must demonstrate knowledge of basic calculus**. If necessary, the student should take the first undergraduate calculus course (MATH 1201).

I. Students **must demonstrate a knowledge of basic probability and statistics**. If necessary, the student should take an undergraduate probability and statistics course (MATH 2501 or a similar course in another department).

M.S. in IS Students Who Have Completed All Undergraduate Prerequisite Courses or Who Have an Undergraduate Degree in Computer Science

Students who have completed all undergraduate prerequisite courses (or who were not required to take any of these courses) have a wide variety of 7000-level courses available. Currently, the CIS Department offers about 15 7000-level courses per semester, selected in a rotating fashion from a list of more than 40 such courses. The complete list of all CIS Department graduate courses appears in the Brooklyn College Graduate Bulletin and in Section VIII of this brochure.

All degree requirements, prerequisites, exclusions, and general Brooklyn College regulations are listed in the Brooklyn College Graduate Bulletin. Students should make sure that they receive a copy of the Graduate Bulletin, since they are responsible for satisfying the various rules and regulations.

Prerequisites and Exclusions

Most of the 7000-level courses have prerequisites and students are expected to meet these prerequisites before registering for these courses. For example, CISC 7330X, 7332X, and 7334X each have a prerequisite of CISC 7310X and 7302X.

A number of 7000-level courses are open to students even if they have already had an undergraduate course in the area. For example, CISC 7302X (Computer Architecture) is open to students who have had an undergraduate course in architecture.

On the other hand, several of the 7000-level courses cover the same material (in somewhat more depth) as advanced undergraduate courses. These graduate courses are **not open** to students who have already had a corresponding course, whether at Brooklyn College or at some other school. For example, CISC 7410X (Artificial Intelligence) is not open to a student who has already had a course, graduate or undergraduate, in this area. The following CIS courses are in this category: 7310X, 7110X, 7410X, 7510X, and 7360X.

If the student already knows the material covered in any of these courses, the student may apply for a waiver for that course from the Graduate Deputy Chair. The student must be prepared to demonstrate competence if a waiver is requested.

Counseling

With the aid of the Graduate Deputy Chair, a student should determine exactly which courses are available to him or her, and which are excluded. At that point, the student can select up to four courses to take in a given semester, depending upon the student's job status, time available, and so on.

Students who must maintain full-time status to satisfy the requirements of their visa or because of the rules of a loan program or for some other reason should make sure that they take sufficient courses each term to be considered a full-time student.

VI. EXIT REQUIREMENTS

As a part of his or her degree requirements, each student in the MA in CS or MS in IS program is required to pass a written comprehensive examination or to write a Master's thesis. Most students take the comprehensive exam, but each semester a few students write a thesis. Students in the MS in HI program <u>must</u> write a thesis. The rules for a thesis are described later in this section.

Master's Comprehensive Examination

It is strongly recommended that a student who intends to take the comprehensive exam should take the exam in the term before he or she plans to graduate. (This allows for the possibility of failing the exam and retaking it the next semester without delaying graduation.) For example, a student who intends to graduate in the Spring semester (June), should take the exam the previous Fall semester. Students must register for the exam within the first month of the semester in which they wish to take the exam; see the Schedule of Classes for the exact date.

Rules for the Exam

The Master's Comprehensive exam has exams in <u>ten</u> areas (the areas tested in each part are listed in the next section). The examination is three and a half hours long. Each part contains approximately one hour's worth of questions. These questions are similar to those that would be asked on a final exam in the appropriate course. Each student must answer <u>three</u> of the ten parts. However, the student does not have to decide in advance which three parts to answer. In the examination room, each student will receive all parts of the exam and can make the decision at that time. Nonetheless, it is strongly suggested that a student plan in advance to answer certain parts, with the option to change his or her mind after seeing all of the parts.

Exam Areas

The Master's comprehensive exam has nine parts (one area has two parts from which the student picks one part). Students must pass three parts. The nine parts are as follows (note that not all parts may be offered every term; when you register for the exam, check which parts are being offered):

1. analysis of algorithms
2. architecture
3. artificial intelligence
4. programming languages
5. databases
6. management information systems
7. networks and communications
8. operating systems
9. theoretical computer science

M.A. students must take the exam in Analysis of Algorithms, plus any two other exams. M.S. in Information Science students must take the exam in Management Information Systems, plus any two other exams.

Reading Lists

A set of reading lists is posted outside the department office. Students who expect to register for the exam can request a copy of the reading list.

Grading

Each part is graded individually. In order to pass the exam, a student must pass all three parts.

If a graduate student completes all three parts of the Comprehensive Exam but passes only one part, the next time the student takes the Comprehensive Exam he or she need take only the two missing parts. The student will be given 2/3 of the total time to complete the missing parts.

If a graduate student completes all three parts of the Comprehensive Exam but passes only two parts, the next time the student takes the Comprehensive Exam he or she needs to take only the one missing part. The student will be given 1/3 of the total time to complete the missing part.

Normally, a student is allowed to take the exam twice, but students can petition to take the exam for a third time.

Students should be aware of the following Brooklyn College regulation (for more details, see the BC Graduate Bulletin):   A student who fails the comprehensive exam cannot then write a thesis; similarly, a student who submits a thesis which is not acceptable may not then choose to take a comprehensive exam.

Thesis

Rules for Submitting a Master's Thesis Proposal

The first step is for the student to select a thesis advisor. Normally this will be a full-time CIS faculty member, although there can be exceptions to this rule. The student submits a thesis proposal to the Graduate Deputy Chair. The proposal is then forwarded to the Graduate Curriculum Committee for its approval.

The thesis proposal should be anywhere from 1-5 pages long. It must state clearly what the student intends to do. If appropriate, a short bibliography should be included as well. The proposal should contain the student's name, social security number, address, phone number, and the name of the thesis advisor. The proposal must be signed by the thesis advisor.

A thesis proposal must be submitted by the following dates: **December 15** in order to register for the Spring semester and **May 15** in order to register for the Summer or Fall semester.

In addition, the student should submit a list of graduate courses completed so far, together with the semester in which each course was taken and its grade. In general, before students start working on a thesis, they will be expected to have completed at least 15 credits with an index of 3.5 or above.

Registering for a Thesis Course

Students who want to register for a thesis course should submit their proposals by the date shown above. If necessary, they can register for their other courses, then register for the thesis course when the proposal is approved.

If the thesis proposal is approved, the student will be notified and given permission to register for the appropriate thesis course: CISC 7990G, 7992G, or 7994G.

Similar rules apply to students who want to do a research project in CISC 7900X.

Students should be aware of the following Brooklyn College regulation (for more details, see the BC Graduate Bulletin): A student who submits a thesis which is not acceptable may not then choose to take a comprehensive exam; similarly, a student who fails the comprehensive exam cannot then write a thesis.

Guidelines for Master's Thesis Proposals

1. The student must have a GPA of 3.5 or above.

2. The student needs to find an advisor who will mentor him or her for the thesis research.

3. With the advisor's help, the student needs to write a research proposal that
      a) includes a statement of the goal of the research,
      b) gives a short background of the research area with citations of relevant research,
      c) describes exactly what the student's contribution will be,
      d) describes the outcomes that are expected,
      e) includes a timeline for accomplishing the research.

4. The student sends the proposal to the Graduate Deputy Chairperson and the proposal is read by a committee of at least three faculty members that has been assembled by the advisor. Members of the thesis committee shall include a member of the Graduate Curriculum Committee and the thesis advisor. Once the proposal is approved, the student will be given permission to register for the thesis research course.

It takes most students at least a year to perform the research and write the thesis.

VII. APPLICATIONS FOR FINANCIAL ASSISTANCE

Applications for financial assistance are encouraged from students with strong undergraduate preparation in computer science, mathematics, or related fields. Financial aid forms are available from the Financial Aid Office, 1507 Plaza.

Keep in mind that there are roughly 150 students in the graduate program, but that only about 5 get assistance each year. Only a few students get assistance in their first semester. Almost no international students receive financial aid from Brooklyn College.

Teaching Fellowships

A student with a teaching fellowship can teach one or two courses as an Adjunct Lecturer. The stipend can vary between $2,000 and $4,000 per semester. Proficiency in the English language is essential for students seeking teaching fellowships.

There are two types of such fellowships:

1. Those provided by the Ph.D. program. For such a fellowship, apply directly to the Ph.D. program of CUNY (see page 12 for contact information).

2. Those provided by Brooklyn College.

A student who wants to apply for such a fellowship should write a letter to the department chair, Prof. Yedidyah Langsam, with a resume. The applicant should get a recommendation from the Graduate Deputy Chair. The Chair and the Graduate Deputy Chair will make assignments for the limited number of positions.

Grant Support

For exceptional students, there is an opportunity to work on research projects with faculty members who have grant support. These students must speak to the individual faculty member involved.

VIII. COURSES OFFERED BY THE CIS DEPARTMENT

Descriptions of courses can be found in the Graduate Bulletin.

All courses, except as noted, are 37½ hours plus conference and independent work; 3 credits. Courses marked with an asterisk are advanced courses and satisfy the M.A requirement of three advanced level courses.

7100X Foundations of System Programming
Prerequisite: a course in data structures**.**

7110X Compiler Construction
Prerequisite: a course in assembly language, and a course in data structures.
Not open to students who have taken an undergraduate course in compilers.

*7120X Programming Languages and Compilers
Prerequisite: CISC 7110X or a course in compilers.

*7122X Programming Language Design
Prerequisite: CISC 7110X or a course in compilers.

*7124X Object-Oriented Programming
Prerequisite: One of the following: CISC 7110X, 7120X, 7122X, 7310X, or 7312X.

7200X Analysis of Algorithms
Prerequisite: a course in data structures and a course in discrete structures.
This course is open to students who have taken an undergraduate course in analysis of algorithms.

*7210X Graph and Network Algorithms
Prerequisite: CISC 7200X.

*7212X Parallel Algorithms
Prerequisite: CISC 7200X or a course in analysis of algorithms.

*7214X Algorithms and Complexity
Prerequisite: CISC 7200X or a course in analysis of algorithms.

7220X Computability and Unsolvability
Prerequisite: CISC 7221X or a course in theoretical computer science.

7221X Theoretical Computer Science
Prerequisite: A course in discrete structures.
Not open to students who have completed a course in theoretical computer science.

7224X Formal Languages and Automata Theory
Prerequisite: CISC 7221X or a course in theoretical computer science.

*7226X Information and Computation
Prerequisite: CISC 7200X or CISC 7214X; and a course in probability.

*7228X Quantum Computing
Prerequisites: CISC 7200 and a course in calculus.

*7230X Cryptosystems
Prerequisite: CISC 7220X or 7224X.

7240X Numerical Methods
Prerequisite: A course in linear algebra and an elementary course in differential equations.

7300X Computer Systems and Architecture
Prerequisite: a course in computer organization or architecture and a course in data structures.
Not open to students who have taken CISC 7310X.

7302X Computer Architecture
Prerequisite: an undergraduate course in computer organization

7310X Operating Systems I
Prerequisite: A course in data structures and a course in computer organization.
Not open to students who have taken CISC 7300X or a course in operating systems.

*7312X Operating Systems II
Prerequisite: CISC 7310X or a course in operating systems.

*7320X Computer Security
Prerequisite: a course in calculus; CISC 7310.

*7330X Teleprocessing Systems
Prerequisite: CISC 7300X or 7310X or a course in operating systems; CISC 7302X or a course in computer organization; and a course in probability and statistics.

*7332X Local Area Networks
Prerequisite: CISC 7300X or 7310X or a course in operating systems; CISC 7302X or a course in computer organization; and a course in probability and statistics.

*7334X Computer Communication Networks
Prerequisite: CISC 7300X or 7310X or a course in operating systems; CISC 7302X or a course in computer organization; and a course in probability and statistics.

*7340X Parallel and Distributed Systems
Prerequisite: CISC 7100X and either 7310X or a course in operating systems.

*7342X Programming Parallel Processors
Prerequisite: CISC 7312X and 7340X.

*7350X Distributed System Administration
Prerequisite: CISC 7310X or a course in operating systems or permission of the chair.

*7352X Performance Evaluation of Computer Systems
Prerequisite: CISC 7310X or a course in operating systems; two terms of calculus; and a course in probability and statistics.

*7354X Topics in Systems Simulation
Prerequisite: a course in data structures; and a course in probability and statistics.

7360X Microprocessors
(24 hours lecture plus conference; 21 hours laboratory plus independent work; 3 credits)
Prerequisite: a course in computer organization.
Not open to students who have taken an undergraduate course in microprocessors.

7362X Advanced Microcomputer Applications
Prerequisite: a course in microcomputer applications.

7400X Foundations of Cognitive Science
Prerequisite: A course in probability and statistics; and knowledge of a high-level programming language such as C, Pascal, PL/I, or LISP.

7410X Artificial Intelligence I
Prerequisite: a course in data structures.
Not open to students who have taken an undergraduate course in artificial intelligence.

*7412X Artificial Intelligence II
Prerequisite: CISC 7410X or a course in artificial intelligence.

*7414X Expert Systems
Prerequisite: CISC 7410X or a course in artificial intelligence.

7420X Logic in Computer Science
Prerequisite: a course in discrete structures and a course in data structures.

7422X Game Theory and Social Choice
The course will concentrate on game theory and the theory of elections.
Prerequisite: a course in discrete structures.

*7430X Natural Language Processing
Prerequisite: a course in data structures.

*7440X Pattern Recognition and Neural Networks
Prerequisite: one year of elementary calculus; a course in probability theory; and CISC 7410X or a course in artificial intelligence.

*7442X Robot Vision
Prerequisite: CISC 7440X or CISC 7650X

7450X Computer Applications in Health Sciences
(45 hours; 3 credits)
Prerequisite: one 7000-level course in health and nutrition sciences and one 7000-level course in computer and information science.

7500X Introduction to Management Information Systems
Prerequisite: a course in advanced programming techniques.

7510X Database Systems
Prerequisite: knowledge of a database management system. Not open to students who have taken an undergraduate course in database systems.

*7512X Advanced Database Systems
Prerequisite: CISC 7510X or its equivalent.

7520X Requirements Modeling for Information Science
Prerequisite: a course in data structures.

7522X Systems Analysis and Design
Prerequisite: a course in data structures.

*7530X IT Project Management
Prerequisite: CISC 7500X.

7532X Information Systems Management
Prerequisite: CISC 7500X.

7534X Information Systems Planning and Policy
Prerequisite: CISC 7500X.

*7540X Software Methodology
Prerequisite: CISC 7510X and two courses chosen from among CISC 7522X, 7532X, and 7534X.

*7610X Multimedia Databases
Prerequisite: CISC 7510X or a course in database systems.

7620X Computer Graphics: Software System Design
Prerequisite: a course in data structures.

*7622X Algorithms for Computer Graphics
Prerequisite: CISC 7620X or a course in computer graphics.

*7630X Multimedia Computer Systems
Prerequisite: One of the following: CISC 7310X, 7302X, 7334X, 7510X, 7620X, 7640X, 7650X.

7640X Multimedia Presentations
Prerequisite: a course in data structures.

7642G Advanced Digital Art
Prerequisite: Matriculation for the M.A. in teaching art or matriculation for the M.F.A., or CISC 7620X or CISC 7640X.

*7650X Digital Signal Processing
Prerequisite: two terms of calculus; and CISC 7200X or a course in analysis of algorithms.

7700G Introduction to Data Science
Prerequisite: CISC 7510X.

7900X, 7902X Research Project I, II
(Minimum of 90 hours of independent work each term; 3 credits each term)
Prerequisite of 7900X: Permission of the graduate deputy chair.
Prerequisite of 7902X: CISC 7900X.

7940X, 7942X Seminar in Computer Science I, II
Prerequisite of 7942X: CISC 7940X.

*7950X, *7952X Advanced Seminar in Computer Science I, II
Prerequisite of 7952X: CISC 7950X

7980G Health Informatics Internship
150 hours conference and independent work; 3 credits
Prerequisite: Completion of at least 21 credits of required graduate courses.

7990G, 7992G, 7994G Thesis Research
(2 credits each term)
Prerequisite: Permission of the graduate deputy chair. For information, see Section VI, part 2: Thesis.

IX. COMPUTER AND LIBRARY FACILITIES

CIS graduate students have access to computer facilities at Brooklyn College and limited access to the computer facilities at the City University Computer Center (CUNY/UCC).

CUNY Computer Facilities

CUNY/UCC serves as the central computer facility for all units of the City University of New York. CUNY/UCC is connected to many university centers around the world via the Internet. CUNY/UCC has several mainframe computers.

Brooklyn College Computer Facilities

Computer Labs

The ITS Public Computing Labs (in the West End Building) now feature 250 new computers—including SUN workstations, PCs, and Apple MACs—in an inviting open work space. Nearby are lounge areas, study rooms, classrooms, tutoring areas, and a videoconference room. Special services include scanning, DVD writing, and express printing. The lab has been specially designed acoustically to make for a quiet facility.

> Computer accounts are automatically assigned to students enrolled in classes which require them. Students who need computer accounts for other purposes should ask at the front desk of the ITS Public Computing Facility.

Other Computer Facilities

The CIS Department maintains an Ethernet-based network of computers for use by its faculty and other researchers. The network is an Internet node. Many departments have computer-based courses. To meet the demand for computers, there are many computer labs distributed around the campus, especially in the library. The Internet Café in Whitehead Hall is open 24 hours per day.

Brooklyn College Library

The Brooklyn College Library has numerous computers, and it also maintains the Internet Café in Whitehead Hall. There is a New Media Center on the second floor. The library has numerous computer science journals available online. See "Quick Tips for Computer and Information Science Research in the Brooklyn College" at this URL:
http://www.brooklyn.cuny.edu/pub/departments/cis/CIS_Research_in_BC_Library.pdf.

Internet Resources

The CIS Department's Web page is http://www.brooklyn.cuny.edu/pub/departments/cis/. Information about department programs is available at this site, as are links to the Web pages of various CIS faculty members.

The CIStalk List

There is a CIS email list, called **CIStalk**. The purpose of this list   is to provide a way for CIS faculty to send to students and other faculty information on jobs, internships, and other articles of interest, Messages sent to the list are distributed via email to all subscribers to the list. The list is free, and all CIS students are encouraged to subscribe. Students may not post to the list due to abuses of the list in the past.

To subscribe to the list, unsubscribe from the list, or to access an archive of past postings to the list, go to this page:

http://www.sci.brooklyn.cuny.edu/cistalk/

X. FACULTY MEMBERS AND THEIR AREAS OF RESERCH

FULL-TIME FACULTY

David Arnow

Distributed programming;
simulation of physical systems;
computer science education.

arnow@sci.brooklyn.cuny.edu
1216N 951-5000 x2040

Moshe Augenstein

Data structures; program efficiency;
software engineering;
microcomputers.

augenstein@sci.brooklyn.cuny.edu
2122aN 951-5000 x2041

Amotz Bar-Noy

Design and analysis of algorithms;
theoretical aspects of communication
networks.

amotz@sci.brooklyn.cuny.edu
2112aN 951-5000 x2042

Hui Chen

Mobile wireless networks, wireless
sensor networks, system and network
security, software engineering,
probabilistic modeling and simulation.

chen@sci.brooklyn.cuny.edu
1432N 951-2055

Eva Cogan

Intelligent agents; logic; multiagent systems.

cogan@sci.brooklyn.cuny.edu
2112bN 951-5000 x2046

James Cox

Sensory-based robotics; medical imaging;combinatorial algorithms and computational complexity theory.

cox@sci.brooklyn.cuny.edu
2112cN 951-5000 x2047

Scott Dexter

Network security; formal methods.

dexter@sci.brooklyn.cuny.edu
0113N 951-5000 x2048

Tzipora Halevi

Security, privacy, human-computer interaction, embedded systems, Internet of things, signal processing.

halevi@sci.brooklyn.cuny.edu
2156aN   951-1517

Jacqueline Jones

Operating systems; hardware; programming languages, music and computers.

jones@sci.brooklyn.cuny.edu
2218N 951-5000 x2054

Devorah Kletenik

Algorithms; Boolean functions; machine learning/computational earning theory.

kletenik@sci.brooklyn.cuny.edu
5316N 951-5000 x1502

Yedidyah Langsam

Multimedia; medical informatics; data structures; personal computing and the Internet.

langsam@sci.brooklyn.cuny.edu
2109N 951-5657

Rivka Levitan

Natural language processing; spoken language processing; dialogue systems; prosody and discourse.

levitan@sci.brooklyn.cuny.edu
3114N 951-5000 x3997

Michael Mandel

Signal processing; machine learning; audio processing; noise robust automatic speech recognition; psychoacoustics.

mim@sci.brooklyn.cuny.edu
2232N 951-5000 x2053

Rohit Parikh

Applications of logic to AI; logic and semantics of programs; formal languages; proof theory.

rparikh@gc.cuny.edu
1161N 951-5000 x2058

Theodore Raphan

Modeling and simulation of eye movement control orientation; data acquisition and analysis; mechanisms; models of spatial pattern recognition and computer vision; neural networks; artificial intelligence.

raphan@nsi.brooklyn.cuny.edu
541NE 951-4193

Ira Rudowsky

Database design, analysis and implementation; multimedia databases intelligent agents.

rudowsky@brooklyn.cuny.edu
1417N 951-5000 x2062

Charles Schnabolk

Formal development of programs; programming languages.

CSchnabo@brooklyn.cuny.edu
2118N 951-5000 x 2064

Dina Sokol

Algorithm design and analysis; pattern matching algorithms; computational biology; data compression.

sokol@sci.brooklyn.cuny.edu
3209dN 951-5000 x2065

Aaron Tenenbaum

Data structures and algorithms; programming languages and compilers.

tbaum@sci.brooklyn.cuny.edu
2122bN 951-5000 x2066

Joseph Thurm

Database management practical uses of computers in business.

thurm@sci.brooklyn.cuny.edu
2109N 951-5657

Gerald Weiss

Object-oriented software development and patterns; programming languages and compilers; operating systems and constraint solving and programming; distributed programming.

weiss@sci.brooklyn.cuny.edu
143NE 951-5000 x2664

Paula Whitlock

Programming languages and compilers. Computer simulations, especially Monte Carlo methods; development of random number generators, especially or parallel computing systems.

whitlock@sci.brooklyn.cuny.edu
1212N 951-5000 x2069

Noson Yanofsky

Category theory. Complexity theory. Higher-dimensional algebra.

yanofsky@sci.brooklyn.cuny.edu
1430N 951-5000 x2070

Gavriel Yarmish

Distributed and parallel optimization methods; optimization of large linear optimization programs.

yarmish@sci.brooklyn.cuny.edu
1214N 951-5000 x2071

Neng-Fa Zhou

Programming languages abstract
machines and compilers constraint
solving and programming Web
publishing.
zhou@sci.brooklyn.cuny.edu
1161N 951-5000 x2073

Chaim Ziegler

No photo available

Multimedia systems; computer
networks; queueing theory; computer
and Internet telephony systems.

ziegler@sci.brooklyn.cuny.edu
1233N 951-5000 x2074

Department Staff

Johnathan Dixon	jdixon@sci.brooklyn.cuny.edu	951-5000 x1538
Lawrence Goetz, Network Administrator	goetz@sci.brooklyn.cuny.edu	951-5000 x2050
Elena Hintze	EHintze@brooklyn.cuny.edu	951-5657
Camille Martin	Cmartin@brooklyn.cuny.edu	951-5000 x2057
Bridget Sheridan	BSheridan@brooklyn.cuny.edu	951-5657