2006 Computer Science Department Self Study

Computer Science Department
Personnel and Budget Committee

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Introduction

This self-study is being undertaken during a period of active ferment that places our discipline in the center of the global shift to the information age and all that this shift implies for institutions of higher education. As liberal arts institutions such as Queens College adapt their curricula to the still-emerging nature of digital information technology in the lives and careers of our students, computer science plays a core, arguably unique, role in the evolution of these curricular shifts.

We begin by placing our department's context within the gamut of fields that currently fall under the "computer" rubric. Our presentation here is based on the structures presented in a report called *Computing Curricula 2005* [ACM 2005], which was produced jointly by three professional organizations: the Association for Computing Machinery (ACM), the Association for Information Systems (AIS), and the Computer Society of the Institute of Electrical and Electronics Engineers (IEEE-CS).

When our department was founded in 1971, and for another two decades or so after that, "computing" was taught in one of three distinct flavors: electrical engineering dealt with hardware, computer science dealt with software, and information systems dealt with automated business practices. But these fields have matured and expanded to the point that there are now five identifiable categories of undergraduate computer-related degree programs:

1. Computer Engineering
2. Computer Science
3. Information Systems
4. Information Technology
5. Software Engineering

Each of these five categories has its own particular focus, although they overlap to various extents in the particular topics they deal with. Broadly speaking, Computer Engineering emphasizes hardware design and implementation, Software Engineering emphasizes software design and implementation, Information Systems deals with the information processing and communication needs of businesses and other organizations, and Information Technology deals with the implementation and maintenance of organizations' networking and computing infrastructure. We'll discuss Computer Science in a moment.

> To make the above distinctions more concrete, consider Queens College as an organization conducting its "business" of providing education to our students. The Office of Converging Technologies (OCT) relies on the Information Technology skills of its employees. They provide and maintain the networking, communication, and computing backbone for the campus at large. Next, the College has a number of offices that rely heavily on the Information Systems skills of their employees: the Registrar's office and the Bursar's office to name just two. The College also deploys software in a wide variety of contexts, from professors' individual course web pages to online registration to library services. All this software, whether developed informally by individuals or purchased from commercial software producers, depends on the skill sets that fall under the rubric of Software Engineering for the appropriateness of their designs and the robustness of their implementations. Finally, the computers and other hardware devices used in the College were designed by computer engineers.

As we mentioned above, the topics dealt with by the various disciplines overlap significantly. Computer engineers need to understand software in order to develop the hardware platforms that will support software systems; information technologists need to understand networking hardware as well as the software that controls it; information systems designers need to understand networking, computing devices, and software system capabilities to be effective.

Programs of study in the various disciplines are typically offered by different types of higher education institutions. The distinctions are not hard and fast, but at least two of the cases are rather easy to identify: computer engineering is found in institutions with other engineering programs, and information systems programs are offered by institutions with business-oriented programs. For example, within the City

University, City College and Baruch College fall into these two categories respectively. The other two disciplines discussed so far have less clear cut "home bases." Information technology can be thought of as an outgrowth of applied programs that have heretofore drawn on the skill sets provided by two year programs such as the Electrical Technology program at Queensboro Community College. As the field has matured, four year programs in this field are emerging to address the expanding skill set demands of the area.

Software engineering covers perhaps the broadest range of computing topics of any of the five discipline areas identified by the Overview Report. Because it deals with software, this discipline must make contact with hardware in one direction. Furthermore, because software engineering deals with issues regarding the management of large software projects, it also extends to the areas of "business practices" in the other direction.

So, where does this leave the computer science discipline, and why is computer science the most appropriate one of these five disciplines for a liberal arts college such as Queens College?

The four disciplines discussed so far all focus closely on practical aspects of computing: the design of computing equipment, the design of software systems, the design of computer-based business systems, and the deployment of computer and communication infrastructures. What distinguishes a computer science curriculum from these others is the attention it gives to the theoretical underpinnings of computational processes. That is, the emphasis is more on the principles of computing than on its practice. Principles and practice are not mutually exclusive, and one of the goals of our department is in fact to graduate students who are well-qualified to work in technical positions. But by emphasizing principles in our course work, we aim to do far more than just train students for their first job. Our goal is to provide students with a solid basis for dealing with and adapting to the particular forms computing-related technology takes over the graduate's career span. We don't know the exact form these technological advances will take over the years and decades ahead, but we do know that the principles of information encoding, algorithmic analysis, and computational structures (both hardware and software) that we teach will continue to provide the basis for emerging digital technologies for the foreseeable future.

The traditional goal of a liberal arts college has been to expose students to the key elements of the humanities, social sciences, and natural sciences in order to develop their skills as critical thinkers. By developing these skills, the liberal arts graduate can not only participate productively in the work force, but also handle leadership positions in their areas of interest as well. With the transition to an economic base that depends at least as much on services and information management as it does on production and delivery of hard goods and services, the traditional liberal arts education must expand to include technological literacy and competence as a core element. We submit that as the College continues the process of reviewing its core curriculum structure, it might well also consider revising its ten-year old mission statement to say " ...to prepare students to become leading citizens of an increasingly global and technology-driven society ... ."

With their emphasis on the *principles of digital technology,* computer science departments nationwide are squarely at the center of the expanding definition of a liberal arts education. The role of the Computer Science Department is central to the core mission of Queens College.

Mission Statement

With the foregoing in mind, our department's mission can be stated as follows:

The mission of the Computer Science Department is, primarily, to provide instruction and to conduct research in the core areas of computer science: software design, theoretical foundations, and hardware systems. Regarding instruction, our courses for computer science majors are designed (a) to provide knowledge and skills that will enable our graduates to immediately enter the workforce as productive employees in the technology sector of the economy, and (b) to provide an understanding of the basic principles of computer science that will serve as a strong foundation for expanding and evolving their knowledge and skills as their careers progress.

Another aspect of our mission is to teach computing-related courses that serve as important components of the liberal arts curriculum of the College. In this regard, we are actively involved in cooperative programs with other departments, and provide service courses and minors for students who need instruction in various areas of applied computing, such as information technology and information systems.

The Department also offers a master's degree program which serves computing professionals and others with bachelor's degrees who wish to extend their knowledge of computer science. Additionally, the Department is involved in preparing the next generation of computer science researchers by participating in the CUNY Ph.D. Program in Computer Science, which is housed at the Graduate Center.

Resources

Current State: Department

Human

In addition to the faculty, the department has a staff of five full-time employees:

- One Higher Education Associate. Network administrator and lead member of the technical support team.
- One Higher Education Assistant.
- One College Assistant
- Two CUNY Office Assistant L-2

Physical

Site Summary: The department is centered in the "A" wing of the Science Building. The department office is on the second floor, along with the chair's office, six faculty offices, an office for the HEA/HEa, an office for shared use by adjuncts, an office used by PhD graduate students, three student labs, a conference room, a networking closet, a storage room, and three mixed/shared-use faculty labs. Eight faculty offices are located on the first floor, and four more are located on the third floor.

The department is also the primary user of a computer-equipped classroom in SB B-131, and is currently completing the installation of an additional student networking lab in A-103.

Laboratories: The department maintains specialized instructional labs for Hardware Design, Computer Graphics, Operating Systems, and Networking. The equipment in the Hardware Design Lab was purchased using funds from an NSF grant in 2003, and consists of eighteen high-end PCs with specialized software for logic circuit design, and a similar number of FPGA (Field Programmable Gate Array) prototyping systems. The other labs have been equipped primarily using funds from the University's Technology Fee charged to all students each semester.

The department is in the process of converting a classroom into an instructional lab for web design using Tech Fee funds, and maintains mixed instructional/research labs in the areas of bioinformatics, genetic algorithms, information retrieval, mobile communications, and wireless technologies.

Computer and Networking Infrastructure: The network is the lifeblood of the department, and we are fortunate to have the technical staff capable of designing, installing, maintaining, and managing this vital resource.

The network connects over 100 computers in the department office, faculty offices, and student and research laboratories. Computers and software cover a wide variety of systems, from PCs running Windows or OS-X to workstations running Solaris or Linux. It has been designed to isolate student-accessible computers from faculty and staff machines, while providing all systems with access to the Internet through a firewalled link to the campus network. The network supports a mix of Gigabit, 100 Megabit, and some legacy 10 Megabit connections.

The department maintains a variety of network services for instructional, research, and professional purposes. These include networked file systems and printers, as well as servers for standard Internet protocols such as HTTP, SSH, and SMTP.

Fiscal

The department receives funding from the following sources:

- Tax-Levy Funds

  OTPS/TS (Other Than Personnel Services / Temporary Services)

  Our OTPS budget for 2006-06 was $20,688, which includes $10,000 for an office assistant, $2,400 in PSC travel funds, temporary service money for tutors, and the remainder for equipment, supplies, and Xeroxing. In addition, two new hires (Reddy and Zheng) received start-up funds of $85,000 and $70,000 respectively.

  Released Time Account

  The department has an account with a current balance of approximately $48,000 to cover certain summer salaries and teaching shortfalls due to released time taken by regular faculty. This account is funded from both internal grants such as PSC-CUNY awards and from external grants.

  Maintenance

  The Sun workstations in the department cost $12,614 to maintain annually. This cost is covered by funds provided by the dean of the division.

  Graduate Assistants

  The College provides the department with funds to hire one Graduate Assistant A to teach eight credits a semester and the CUNY Graduate Center provides one Graduate Assistant C to teach six credits a semester. The number of and funding source for Grad A and Grad C lines can vary from year to year. In Fall 2006 the department will also receive two Graduate Teaching Fellows from the CUNY Graduate Center who will be teaching 6 hours per semester. These graduate students have full responsibility for the courses they teach. There is no funding for traditional teaching assistants (TAs) in the department.

- Non-Tax-Levy Funds

  Grant Overhead

  The department has about $3,400 a year available from overhead recoveries associated with the department's grants and contracts.

  Tech Fee

  The University collects a Technology Fee in the amount of $75 per full-time student per semester. Although the College's share of the fees collected is large, none of it is explicitly allocated to the department. Rather, the department, like all other academic departments and administrative units, applies for funding of "projects" each year.

  Queens College Foundation

  The department is able to draw about $3,000 a year from this account, which is funded primarily by alumni donations.

  Computer Associates Adjunct Assistant Professor

  The department offers one course a semester that is taught by an Adjunct Assistant Professor who is employed by Computer Associates, Inc. His teaching salary is paid directly to him by CA. The nominal value of this service is approximately $6,000 per year.

Current State: College and CUNY

Library

Despite its close physical proximity to the Benjamin Rosenthal Library (BRL), the main library at the College, the department relies very little on the bricks and mortar facilities provided by that facility. Rather, the department relies primarily on access to on-line information resources for its research and instructional information access. The campus library provides the department with valuable access to online technical books through a subscription to the Safari Bookshelf. The College and University provide access to the

online versions of many journals and monographs, including the Association for Computing Machinery's "Digital Library." However, neither the College nor the University provides access to the IEEE's Electronic Library (IEL), nor even the IEEE's Computer Science Electronic Library (CSLSP-e). The IEL is a resource that would be extremely valuable to our faculty.

Laboratories and Computers

The Computer Science Department is, of course, totally dependent on computing resources in virtually every aspect of its instructional and operational existence. While the department manages its own computers for faculty and specialized laboratories, it relies on the College for general computing resources for student use; our students make heavy demands on campus "computer labs" such as those in the Library, in the I Building, and on the first floor of the Science Building. (There are no college computer labs outside the department that are specifically designated for use by our students.)

With the price of a good desktop computer from brand-name manufacturers now less than $300 (probably less than the price of a semester's textbooks for a full-time student), we now assume students have access to their own computing equipment off campus. But not all students have laptops that they can or want to bring to the campus, so the college-supplied computers on campus remain important.

The Computer Science laboratories have benefited tremendously from Technology Fee money, which provides funds for upgrading department labs every three years. Software and licenses are also available for teaching purposes. In addition, funds have been allocated for a new lab and "smart classroom" focusing on web development and computer security. Renovation of classroom SB A103, which will house this lab, is scheduled to begin in Summer 2006.

Research laboratory space in the department is at a premium. There are three main laboratory spaces (Rooms 207 A, B, and C) intended for research, but in fact they are used both as laboratories and to house shared resources like network printers and servers.

Networking Infrastructure

The College provides wired and wireless networking for the campus through the Office of Converging Technologies (OCT). As mentioned previously, the department maintains its own internal network infrastructure, but relies on the campus network for its access to the Internet at large. The College recently upgraded the Department's link to the campus backbone as well as some of its internal switches to Gigabit Ethernet, making a great improvement in our local area network speed. In addition, the College has just completed wiring a dedicated T1 line for the department, allowing us to access this resource for teaching and research purposes where the College firewall might prevent research in certain risky areas, such as computer security and data integrity.

Wireless access on campus is quite good, but many of the classrooms used for our classes lack both wired and wireless access. This is a particularly painful situation for our courses in networking and web design, but should be remedied soon as Technology Fee funds will be used to upgrade all classrooms on campus to "smart classrooms" and the College adds wireless access points to the Science Building.

In 2004, the College ranked 13th nationally in Intel's first annual "Most Unwired College Campuses" survey. However the College's rank dropped to 45 in the current survey. As Intel notes:

> While last year many campuses had minimal wireless network deployment, this year's survey reveals that students are more likely to be enjoying the benefits of campus life, unwired. On average, 98 percent of the top 50 campuses are covered by a wireless network, up from 64 percent in 2004, with 74 percent having 100 percent wireless network coverage on campus, up from just 14 percent last year.

Intel, of course, is promulgating its products with these surveys, and there is no evidence we know of that correlates a college's wireless ranking with its academic standing. But our own networking infrastructure

must integrate closely with the College's in order to provide Internet access to and from the department. OCT and the department must inter-operate smoothly for the department's network to operate effectively.

The College and University provide email accounts for faculty and students. These accounts are in the process of transitioning to a centralized LDAP system based on IBM's Lotus technology.

Effects of Current Resources

Our discussion at this point does not include issues related to faculty staffing levels and workloads. But the resource constraints mentioned above do affect both our teaching and research productivity negatively. Until classrooms are upgraded with appropriate technologies (networking, media projectors, and the other accouterments of smart classrooms), until faculty are supported in their teaching by traditional TAs, and until the library provides us with online access to missing resources like IEL, the department remains at a competitive disadvantage in terms of both productivity and our ability to attract high-caliber students.

While we stress the fundamental principles underlying technology in our courses, we constantly update existing courses and revise our curriculum to make sure the technologies we use as our examples are current. Current funding levels and the uncertainty of Technology Fee funding make it difficult for us to keep our course offerings in sync with our curricular changes.

Fortunately the cost of new technology tends to improve over time, although some of this may be an artifact of the recent era of low interest rate economics. As a result, we have been generally successful in funding and maintaining our instructional and research laboratory equipment. However, we are totally dependent on our own small technical staff for our very survival. We have learned that OCT is spread too thin to provide timely and effective support for our department's networking, computer, and software needs.

A significant gap in current library facilities, which negatively impacts our research productivity, is the lack of electronic access to key publications of the IEEE.

Current amounts of laboratory and office space are constraining the department. New hires are being forced to use offices that have no windows. Instructional labs serve double duty as part-time research labs, and we are unable to accommodate legitimate requests for secure research space by new hires because there is not enough such space available to the department.

Needed Changes in Resources

The department desperately needs access to classrooms with projectors and Internet connectivity. The College has made efforts to provide all faculty members with laptops or tablet PCs for lesson preparation and classroom presentations, but these computers need to be updated regularly. While the need for an improved educational technology infrastructure holds throughout the College, it is particularly critical for our department, which teaches *about* technology as well as *using* technology. Faculty working with obsolete equipment (often purchased with personal funding) is not satisfactory.

The Technology Fee is not handled well from our department's perspective. We understand that much of the difficulty arises from constraints that are outside the College's control, and we are aware that there are efforts underway to address some of them. But we mention here that: (1) The annual-proposal model for tech fee projects makes it difficult for us to plan intelligently. We don't know whether we will be funded for a project next year, and we certainly are unable to construct plans that carry us forward for the longer term. (2) The current guidelines prohibit funding for projects that teach about technology as opposed to projects that expand the use of technology for large populations of the student body. Not only does this policy lead to lowest-common-denominator projects that provide generic resources that don't address the needs of *any* particular discipline, it has a particularly negative effect on our department where, truly, "the medium (the technology) is the message!"

We need a budget for maintaining our research infrastructure. We have recently hired a number of talented young researchers, and it is unrealistic to expect them to be able to get outside funding for shared resources that the College should be providing. Network upgrades, servers, and even big-ticket research equipment for such things as image and video capture need to be acquired on an ongoing basis.

Full-Time Faculty

Number

The department currently has 21 full-time faculty members, including two new hires who started in the Fall 2005 semester. Sixteen of these 21 faculty members also hold positions as members of the CUNY Ph.D. Program in Computer Science. We are currently searching for a new assistant professor, and there is also one deferred replacement line.

Ranks, tenure, and ages are distributed as shown in Table 1.

Rank	Number	Tenured		Avg Age
Full Professor	11	11	100%	54
Associate Professor	3	3	100%	47
Assistant Professor	5	1	20%	38
Lecturer	2	2	100%	44
Totals	21	17	81%	49

Table 1. Distribution by rank of full-time faculty in the Computer Science Department.

Specializations

The subdisciplines of computer science have traditionally been classified into the areas of theory, software, hardware, and methodology. An important emerging area is bioinformatics, the application of computational principles to various aspects of biological research including genome, protein, and taxonomic analyses. Table 2 lists the self-reported areas of interest, both for teaching and for research, for all the faculty in the department. Figure 1 summarizes the data. Perhaps not unexpectedly, the department's main areas of interest and expertise lie in the traditional computer science areas of software and theory.

Name	Research	Teaching
Boklan	T (Cryptography)	T (Cryptography), O (History of Science)
Brown	M (Queuing Theory)	
Chen	S (Web Programming), M (Data Mining)	S (Web Information Processing)
Fluture	B (Pattern Recognition in 3D MRI)	S (Operating Systems, Distributed Systems), T (Discrete Structures)
Ghozati	H (Networks, Parallel Processing)	H (Computer Architecture, Networking)
Goldberg	B (Biomedical Imaging), S T (Algorithms)	M (Computer Vision), T (Genetic Algorithms, Discrete Structures)
Gross	M (Computer Vision), T (Compression, Digital Geometry)	S T (Algorithms), T (Computability), O (Research Practicum)
Kong	T (Digital Topology)	S (Programming Languages, Compilers), T (Discrete Structures)
Kwok	M (Information Retrieval, Statistical Language Processing)	M (Information Retrieval, Statistical Language Processing)
Lord		S (Web and Database Programming, Assembly Language, Data Structures)
Obrenić	T (Algorithms, Graph Embeddings)	T (Discrete Structures, Theory of Computation), S (Databases)
Phillips	S T (Software Engineering, Algorithms)	M (Image Processing, Document Understanding)
Reddy	B (Protein Analysis)	B (Research Practicum)
Ryba	T (Computational Group Theory)	S (Programming), T (Discrete Structures, Computability), O (Math courses in Math Dept., Ed Dept.)
Sy	M (Bayesian Probability, Inference), H S (Wireless)	M (Data Mining), H S (VoIP)
Vickery	S (Web Design Standards), H (Logic Design Technologies)	S (Systems Programming, Web Programming, Software Design), H (Hardware, Architecture and Logic Design)
Waxman	T (Graph Algorithms), O (Computer Science Education)	S (Programming, Data Structures), S T (Algorithms)
Whitehead	T (Continuous Computational Complexity)	S (Operating Systems, Distributed Systems), T (Theory of Computation)
Xiang	M (Graphics, Image Processing)	S (Data Structures, Assembly Language), H (Computer Organization), M (Graphics)
Yukawa	S (Object Oriented Databases)	S (Object Oriented Databases, Programming Languages)
Zheng	H (Wireless and Mobile Computing, Reconfigurable Systems), M (Video compression)	H (Hardware Organization)

Table 2. Individual Faculty Members' Research and Teaching Areas of Expertise. The letters B, H, M, S, T, and O indicate the areas of Bioinformatics, Hardware, Software, Methodology, Theory, and Other.

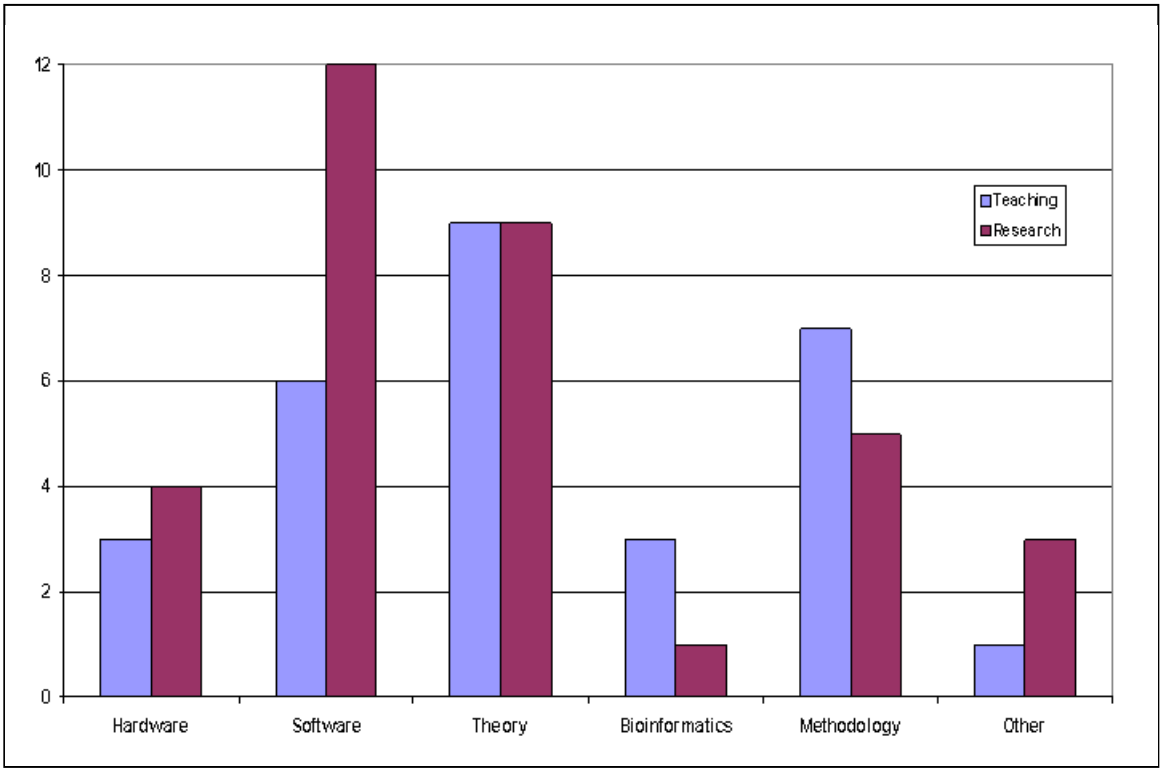

Figure 1. Total number of faculty listing teaching and research interests in the areas of Hardware, Software, Theory, Bioinformatics, Methodology, and Other areas of the Computer Science discipline spectrum.

Scholarship and Creative Activity

The department can boast of researchers who are top-ranked world-wide in the areas of group theory, digital topology, cryptanalysis, and text retrieval. Other faculty are actively productive in the areas of wireless security, vision systems, and algorithm design. We have several recent new hires who are demonstrating strong presence in several areas of research, including bioinformatics, web technology, software engineering, embedded systems, and computer architecture. Table 3 gives the number of publications in various categories for each full-time faculty member in the department, along with their internal (PSC-CUNY) and external grant activity for the past five years.

Our faculty have published in dozens of different journals (over sixty), including publications of the ACM (*Journal of the ACM, Computing Reviews*, and *Transactions on Graphics*) and the IEEE (*Transactions on Computer Vision, Transactions on Pattern Analysis, Transactions on Parallel and Distributed Systems, Transactions on Software Engineering, Transactions on Systems, Man, and Cybernetics, Computer*, and *Graphics and Applications*). Other journals include, among others: *Cryptologia, SIAM Journal of Discrete Mathematics, SIAM Journal on Computing, Mathematical Modeling and Scientific Computing*. Also, the Journals of: *Algebra, Algorithms, Complexity, Computer and Information Technology, Computer Research and Development, Computer Vision and Image Understanding, Group Theory, Interconnection Networks, Logic Programming, Symbolic Programming*,and *the American Society for Information science*, among others.

Conferences at which our faculty have presented papers in the last several years include: *ACM SIGIR Conference on Research and Development, ACM Symposium on Parallel Computation, American Mathematical Society Conference, Expert Systems In Government Symposium, IEEE International Conference on Systems, Man & Cybernetics, IEEE-CS Workshop on Computer Vision, IEEE Symposium on Parallel Computation, INFORMS, International Conference on Combinatorics, Graph Theory and Computing, International Conference on Data Analysis, International Conference on Document Analysis*

and Recognition, NADA, NADE, SIAM, SPIE, Workshop on Computer Architecture Education, and *Workshop on Reconfigurable Computing Education*.

The vibrancy and productivity of the department also manifests itself in the activities of our faculty that fall outside the usual measures of research productivity. While the fundamental principles of computing don't change any more rapidly than the core areas of other disciplines, computing's manifestations in the real world outside of academia are evolving at an extremely rapid pace. For our department, this means that courses, even our core courses, go "stale" distressingly soon after their introduction and need constant revision on a minor or major scale in order to track the current state of the art. Much of the department's strength lies in the time and energy our faculty put into keeping their courses up to date on an ongoing basis.

Name	In Preparation	Books	Book Chapters	Journal Articles	Conference Proceedings	Other	PSC-CUNY Awards	No. External Grants	External Grant Amounts
Boklan	0	0	0	4	0	0	0	1	$50,000
Brown	0	0	0	0	0	0	0	0	$0
Chen	0	0	0	0	8	0	0	0	$0
Fluture	1	0	0	2	2	1	0	0	$0
Ghozati	0	0	0	0	0	0	0	0	$0
Goldberg	5	1	1	10	6	4	0	0	$0
Gross	0	1	0	0	1	0	0	0	$0
Kong	0	0	1	4	5	3	0	1	$100,000
Kwok	0	0	0	0	14	1	1	4	$1,200,000
Lord	0	0	0	0	0	0	0	0	$0
Obrenić	0	1	0	2	0	0	0	0	$0
Phillips	0	0	1	3	8	0	3	1	$64,000
Reddy									
Ryba	4	1	0	5	0	0	1	0	$0
Sy	0	0	3	3	5	3	0	0	$0
Vickery	0	0	0	0	2	3	4	0	$0
Waxman	2	0	0	2	3	2	0	0	$0
Whitehead	2	0	0	1	0	0	4	0	$0
Xiang	1	1	1	0	3	0	0	0	$0
Yukawa	0	0	0	0	0	0	0	0	$0
Zheng									
Sum	15	4	6	36	57	19	13	7	$1,364,000

Table 3. Number of publications, PSC-CUNY grants, and external grants for current full-time faculty for the past five years. Missing data are for new hires.

Teaching Outside Department

College

The School of Education at the College offers a program called *Time 2000* for Secondary Education Mathematics students. A. Ryba of our department teaches two courses in the Time 2000 program. One is a mathematics course, and the other is a specialized version of our introductory course geared to preparing high school teachers who will teach Advanced Placement courses in computer science.

Graduate School

One member of our department, Prof. T. Brown, is the executive officer of the Ph.D. Program in Computer Science at the CUNY Graduate Center. Prof. Brown is also the director of the CUNY Institute for Software Design and Development at the Graduate Center; he teaches one course a year at the Graduate Center, but has no teaching responsibilities within the department at this time.

Various members of the faculty teach courses at the Graduate Center, but not on a regular basis. Recent offerings by our faculty have included courses on cryptanalysis during the spring terms of 2005 and 2006 by K. Boklan, a course on Web Information Retrieval by J. Chen, and a course in Statistical Data Mining by B. Sy.

In addition, six of our faculty have mentored or are mentoring a total of nine Ph.D. students through the graduate center over the past five years. Current faculty and the number of students mentored are:

Kong:	1
Chen:	2
Goldberg:	2
Xiang:	1

Analysis

Breadth of Preparation

As indicated previously, faculty interests cover the spectrum of hardware, software, theory, bioinformatics, and a variety of applied areas that we call “methodology.” Individuals’ interests typically shift over time as technologies change. While some researchers do maintain continuing interest in their research areas over many years, a large portion of our faculty are constantly re-educating themselves in order to keep abreast of the times. For many, the specifics of one’s preparation, except for the fundamental principles of science and technology learned, are soon nearly irrelevant because of this constant need to keep up to date.

Table 5 lists the institutions from which faculty earned their doctorate degrees, the discipline in which the degree was awarded, and the year. The department can boast that fifteen distinct and distinguished universities around the world have educated our faculty.

Name	Institution	Discipline	Year
Boklan	University of Michigan	Mathematics	1992
Brown	New York University	Operations Research	1971
Chen	Technical University of Munich	Engineering	1999
Fluture	City University of New York	Computer Science	2004
Ghozati	Columbia University	Electrical Engineering	1976
Goldberg	New York University (CIMS)	Computer Science	1989
Gross	Columbia University	Computer Science	1992
Kong	Oxford University	Computer Science	1986
Kwok	University of Manchester	Physics	1965
Lord	City University of New York	Computer Science	1995
Obrenić	University of Massachusetts at Amherst	Computer Science	1993
Phillips	University of Maryland	Computer Science	1984
Reddy	University of Hyderabad	Life Sciences	1988
Ryba	University of Cambridge	Mathematics	1985

Vickery	City University of New York	Experimental Psychology	1971
Waxman	New York University	Computer Science	1973
Whitehead	University of Warwick	Mathematics	1975
Xiang	University of Buffalo	Computer Science	1988
Yukawa	Waterloo University	Computer Science	1987
Zheng	University of Nevada	Computer Engineering	2005

Table 5. Institutions from which full-time faculty received their doctoral degrees, plus the disciplines and years in which they were awarded.

Affirmative Action Goals

The faculty ethnic distribution is 55% white and 45% Asian. There are no Blacks, Hispanics, or Native Americans represented on the faculty.

Only 20% of our full-time faculty members are female, but this low proportion is in fact considerably higher than the national average for computer science programs. According to current data from the Computing Research Association, women accounted for 18% of newly hired, tenure-track lines, 16% of assistant professors, 12% of associate professors, and just 10% of full professors for the 2004-05 academic year.

While the department has no obvious biases in the makeup of its faculty, especially given the ethnic and gender mix of our students, we actively look for opportunities to increase our diversity while working within the equal opportunity guidelines of the College.

Age Distribution

As Table 1 shows, the average faculty age for the department is 49, with the expected increase in average age with increasing tenure-track ranks. There seems to be no issue of concern with regard to age.

The percentage of our faculty with tenure (80%) is higher than the College at large (75% according to the College's web site) and is very high compared to the national average for public research and doctoral institutions (about 45% in 1998-99 according to the NEA Research Center. The department is "top heavy" partly because we we unable to hire any new faculty members during the period from 1994 to 1998.

College Service

The department is particularly well-represented on the various committees of the Academic Senate. Dr. K. Lord is chair of the Undergraduate Curriculum Committee and serves as Assistant to the Provost for Instructional Technology; in this latter position, Dr. Lord also serves as an ex-officio member of the Technology and Library Committee. Prof. C. Vickery is chair of the Nominating Committee and is a member of the Technology and Library Committee. Prof. Z. Xiang is a member of the Graduate Scholastic Standards Committee.

Recent Recruitment

We have hired four new faculty in the past three years. Each of them brings an exciting dimension to the department in his own way. J. Chen has a strong background in web technologies (with experience at Microsoft and elsewhere) as well as embedded systems design. K. Boklan, with experience at the NSA, is an international authority on cryptanalysis. Our newest hires, B. Reddy and J. Zheng, are extremely strong in the areas of bioinformatics and embedded systems design.

Altogether there have been eight new-hires since 1994. However, five faculty positions in our department have been vacated during the same period, and one member of our faculty, Prof. Brown, is now based at the Graduate Center (he is the Executive Officer of the Ph.D. Program in Computer Science). So the effective size of our faculty is still much the same today as it was 12 years ago.

Search Process

Once the department has been authorized to search for a new hire, the department's Personnel and Budget Committee follows the standard college procedures required by the College's Affirmative Action Officer. We advertise the position and the areas of expertise in which we are interested in appropriate online venues (such as the ACM web site), we receive resumes and letters of recommendations, we draw up a matrix of candidates and their qualifications, and place candidates into an unranked top tier, a rank-ordered list of other qualified candidates, and an unranked set of unqualified candidates. Once the Affirmative Action Officer has certified that our candidates have been categorized objectively, we invite all candidates from the top tier in for interviews and presentations of their research. After these interviews we decide which of the top-tier candidates we would like to hire and make offers to them one at a time until we either get an acceptance or receive rejections from all top-tier candidates in whom we are interested. If we exhaust our top-tier pool, we invite candidates in from the second-tier one at a time until we either make a successful offer or declare the search a failure.

Selection Criteria

The notion of "selection criteria" for our searches is deeply colored by the salary scale we are able to offer prospective candidates. The Computer Research Association publishes an annual survey of faculty salaries in Computer Science, called the "Taulbee Survey" in honor of the man who first conducted the survey in the 1970's and 80's.

The Taulbee Survey differentiates among institutions by the "academic ranking" of their computer science departments. The main research institutions like Stanford and MIT are in the first rank (top 12 institutions). Columbia and NYU are in the second rank (next 12), SUNY Stony Brook is in the third rank, and the CUNY Graduate Center is included in the set of unranked (below 36) respondents to the survey. As one might expect, salaries at higher ranked institutions are greater than salaries at lesser-ranked institutions. That is, CUNY salaries are not competitive with highly-ranked schools within the New York Metropolitan region such as NYU and Columbia, and they are not even comparable to other public institutions in the area such as Stony Brook and Rutgers, which are in the third tier.

So, how do CUNY salaries compare to salaries at other schools that are ranked below 36 or are unranked? Well, the *maximum* CUNY Assistant Professor's salary is $65,388. And the average *minimum* computer science assistant professor's salary among institutions that are ranked below 36 or are unranked, according to the most recent Taulbee Survey [Zweben 2005], is $72,691. That's an 11% salary disadvantage to start with. When this salary disadvantage is coupled with the high cost of living in New York City and the relatively heavy teaching load required of CUNY faculty, we consider ourselves very fortunate to have attracted the dedicated and highly-qualified group of faculty we do have. But the fact remains that those people with the best research potential, even those who want to be in the New York area, will typically look elsewhere before coming to CUNY.

The department has been able to recruit highly-qualified faculty despite our poor competitive position. In part this is because recent declines in CS enrollments nationally have made jobs scarce at a time when we have been fortunate enough to be hiring. However, this situation is only temporary, and we anticipate greater and greater difficulties in attracting good people into our program as the economy's tech sector rebounds.

Evaluation

Scholarly and Creative Activity

One way to improve levels of scholarly activity is to reduce teaching loads so that people have time to do research. To this end, it is encouraging that we have been able to offer our most recent hires startup packages that give them the chance to establish levels of outside funding that might allow them to "buy out" some of their teaching responsibilities. The flaw in this scheme, however, is that the department does not have a body of senior faculty with research programs in place that could provide the necessary support system for helping

these junior faculty get established before their startup benefits give way to the teaching load grind imposed on the rest of the members of the department, college, and university.

One way this situation can be turned around is for the department to hire senior people with established research programs. Given proper funding incentives, the department should be able to recruit good people who are keenly interested in relocating to the New York metropolitan region. We regularly receive applications from such people when we advertise our searches, but we have not been authorized to hire such much-needed talent in the past. Without infusion at the top, the department will remain primarily a teaching body rather than a strong center of scholarship.

Teaching

Teaching is our strength but, as indicated above, it drains our scholarly resources. Table 6 shows the teaching loads for each department in the Division of Mathematics and Natural Sciences. As the columns labeled "Load" indicate, our department has the highest teaching load in the division at the undergraduate level.

Department	Undergraduate					Master's					Doctoral	
	Number of FTE Faculty	Load (hrs/wk)	FT Hrs	PT Hrs	% PT	Number of FTE Faculty	Load (hrs/wk)	FT Hrs	PT Hrs	% PT	Number of FTE Faculty	Load (hrs/wk)
Biology	19.4	10.8	108.0	127.3	54.1	4.1	8.2	26.9	11.0	29.0	1.7	6.0
Chemistry	18.5	8.6	42.8	183.1	81.1	1.7	10.5	18.2	0.0	0.0	1.4	9.0
Computer Science	**20.8**	**11.4**	**126.0**	**131.5**	**51.1**	**8.7**	**8.6**	**67.2**	**12.0**	**15.2**	**1.7**	**5.6**
EES	9.7	9.4	62.3	38.0	37.9	4.9	5.1	22.9	6.0	20.8	0.6	8.6
Mathematics	37.1	9.0	208.4	185.5	47.1	4.9	7.6	37.0	0.0	0.0	2.1	1.7
FNES	26.2	8.5	74.0	230.6	75.7	6.3	9.3	45.6	19.0	29.4		
Physics	15.4	7.5	57.6	97.0	62.7	0.9	9.4	3.0	8.0	72.7	0.4	5.9
Psychology	23.6	10.4	144.9	129.0	47.1	6.3	10.6	61.3	3.0	4.7	6.5	9.5
Division Average	**21.3**	**9.5**	**103.0**	**140.3**	**57.7**	**4.7**	**8.7**	**35.3**	**7.4**	**17.3**	**2.1**	**6.6**
College Sum/Avg	556.7	9.1	2896.9	3089.4	51.6	191.5	8.0	1110.9	654.7	37.1	49.6	7.0

Table 6. Teaching loads in the Queens College Division of Mathematics and Natural Sciences. Data are taken from the 2004-05 edition of the Queens College Fact Book [QC 2005], "Teaching Load Analysis - Derived Data," pages 198-208.

Over half of the teaching in our department is performed by adjuncts. As Table 6 shows, our department is about average compared with the rest of our division in this regard. However, were we to attempt to obtain accreditation for our program, *this fact would disqualify us*. The Computing Accreditation Commission (ABET) specifically requires: [ABET 2005, page 2]

> III-2. Full-time faculty members must oversee all course work.
> III-3. Full-time faculty members must cover most of the total classroom instruction.

With graduate student adjuncts carrying full responsibility for many of the courses, it is very difficult to assure high levels of expertise in the classroom. And with full-time faculty stretched thin covering their own heavy course loads, there is little "bandwidth" available for monitoring and mentoring adjuncts to be sure they deliver the best quality instruction possible. Furthermore, this use of teaching assistantships as a way of funding the equivalent of adjunct teaching staff means there are no teaching assistants in the traditional sense to help full-time faculty meet the demands of their own courses.

Service

As pointed out in the analysis of departmental service, our department is a particularly strong contributor to various college committees and administrative functions.

Faculty Development

Faculty development is a critical issue for the Computer Science Department. We reiterate here the point that the fundamental principles of computing change no more rapidly than the fundamental principles of other disciplines, but the manifestations of these principles change much more quickly. If we were to present fundamental principles to our students in the context of yesterday's technology we would appear to be teaching irrelevancies instead of the unchanging truths that they are. To track today's technologies requires constant monitoring of current trends and constant development of new technological skills on the part of faculty.

Just as our teaching cannot be allowed to stagnate, so too with our research efforts. In this regard we are not so different from other disciplines in the sciences. Arguably, computer science is subject to shorter term shifts in what the "hot" research topics are than other disciplines. Regardless, keeping up with current trends in one's research area requires a tremendous amount of effort. What seems to be special to computer science compared to other disciplines, however, is that faculty typically change the entire focus of their research more often than other scientists. We don't have hard data to support this assertion, but within our department we have seen numerous examples of faculty members who were hired when they worked in one area and who had switched to another one even before they were awarded tenure.

Aside from self-study, the major vehicle for faculty development is participation in events ranging from traditional workshops and conferences to more prosaic trade shows and vendor presentations. Aside from the time commitment required, there is a need for travel funds to support these efforts. One of our needs is to increase the availability of these funds to allow our faculty to take greater advantage of the opportunities available for attending a range of such events on an ongoing basis.

Staff Development

As an aside to the issue of faculty development, we would like to point out that our department also needs to address the issue of staff development as well. Maintaining the research and teaching infrastructure of a computer science department requires staff who are able to go beyond conventional IT skills to make sure that our networks, software, and computing platforms are all maintained, planned, and coordinated to meet the demands of faculty members who are intimately involved with various aspects of computing technology that extend far beyond the normal realm of a typical organization's information infrastructure.

We have been fortunate in being able to hire two individuals who provide excellent support for the unique nature of our infrastructure. But like any IT professionals, they need access to regular training to keep their skills in tune with current technologies. Furthermore, such training is perceived as in important job benefit that is necessary for keeping high-quality staff on board. Released time and funding for these individuals to attend workshops, training sessions, and vendor presentations are critical for the vitality of the department and must be fully funded.

Research and Funding

We are fortunate to have several world-class researchers in our department. Our most productive member in terms of outside funding is K. L. Kwok, whose work on natural language information retrieval has obtained over a million dollars in DARPA funding over the past five years. Several junior faculty members are currently bringing their research programs up to speed and actively engaged in efforts to attract outside funding. And a number of our faculty regularly take advantage of the resources available through the Professional Staff Congress - City University of New York (PSC-CUNY) Research Award Program.

The University Committee on Research Awards, a faculty committee, distributes the PSC-CUNY Research Award Program awards, and the Research Foundation of CUNY administers them. Preference is given to junior faculty in the allocation of funds, which generally amount to a few thousand dollars a year per awardee.

Adjunct Faculty

Recruitment

We draw our adjunct faculty from two pools: CUNY graduate students, and professionals drawn from local industry. There is very little in the way of recruitment in the case of graduate students: they generally come to us as part of the process of being students. In some cases, adjuncts who began as graduate students have stayed on as adjuncts even after completing their graduate studies.

So far, we have not actively recruited adjuncts from industry. We have one adjunct line that is paid for by Computer Associates that covers a CA employee who teaches for us. Otherwise, there are only two adjuncts who come to us from industry and one whose primary affiliation is another college. They have been teaching for us for a number of years.

Selection

The selection process for adjuncts occurs infrequently enough that it is not formalized. If we need someone to cover a course and can't find a graduate student who is qualified and capable of managing it, the chair engages in an informal process of evaluating unsolicited resumes, recommendations from colleagues, and similar approaches to try to locate a suitable individual who matches our needs.

Supervision and Development

We generally treat our adjuncts as responsible and self-sufficient individuals. We maintain syllabi of all courses that we offer and and make sure that new adjuncts receive copies of the appropriate material and discuss the nature of the course with one of the full-time faculty members who is most familiar with the course. By making a full-time faculty member the adjunct's point of contact for curricular matters we insure that the adjunct will not be left to flounder.

Evaluation

Adjuncts are included in the course evaluation process based on a questionnaire distributed by the College. The Personnel and Budget committee reviews the results of these questionnaires, as well as unsolicited feedback we regularly receive from students, in determining whether to reappoint adjunct faculty to their positions. Over the years we have established a "working set" of adjuncts who are a valuable resource for the department.

Curriculum and Enrollments

Enrollments

Following the "Dot.com Bust" of 2000-01, computer science enrollments declined nationwide, and at Queens as well. Nationally, "the number of newly declared CS majors has declined for the past four years and is now 39 percent lower than in the Fall of 2000. Enrollments have declined 7 percent in each of the past two years." [Vegso 2005] At Queens, from 1995 to the peak of the dot-com boom in 2000, the department's number of annual FTE students increased 78%, while from 2001 to 2005 the number decreased 50%. More recently, the total number of students in all sections of our undergraduate courses decreased 17 per cent for the Spring 2006 semester compared to a year earlier. At the same time there was an enrollment drop of 4 per cent in the enrollments in our Master's courses for those two semesters.

Although we think of ourselves as a normal department within the College's liberal arts curriculum, we must admit that students tend to view us as "the place to go if you want a job in technology," and our enrollments are subject to the vagaries of the economy and perceived availability of jobs in technology.

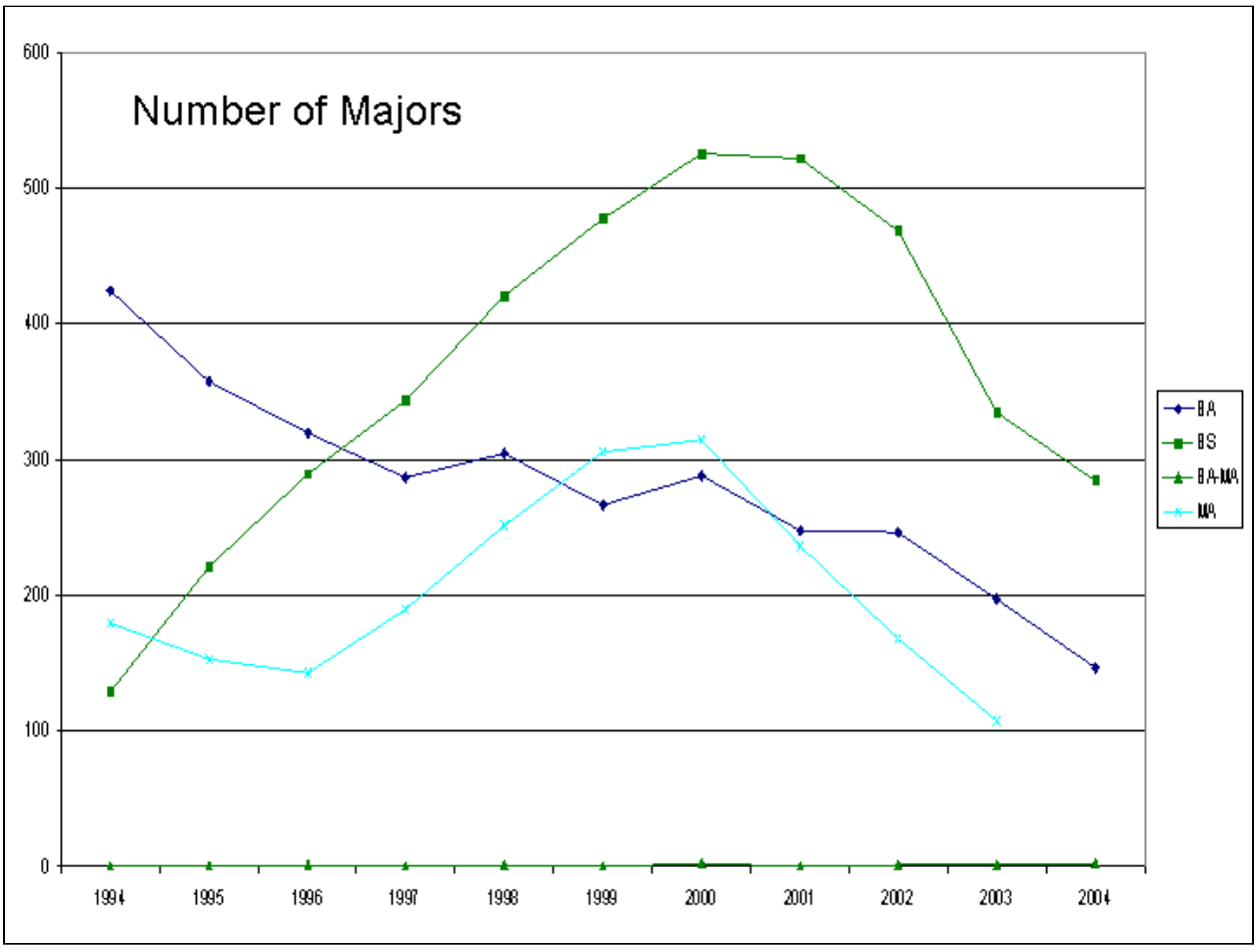

Figure 2. Number of Queens College Computer Science Majors: 1994-2004. Data are for students registered for the BS and BA degrees, the combined BA-MA degree, and the MA degree.

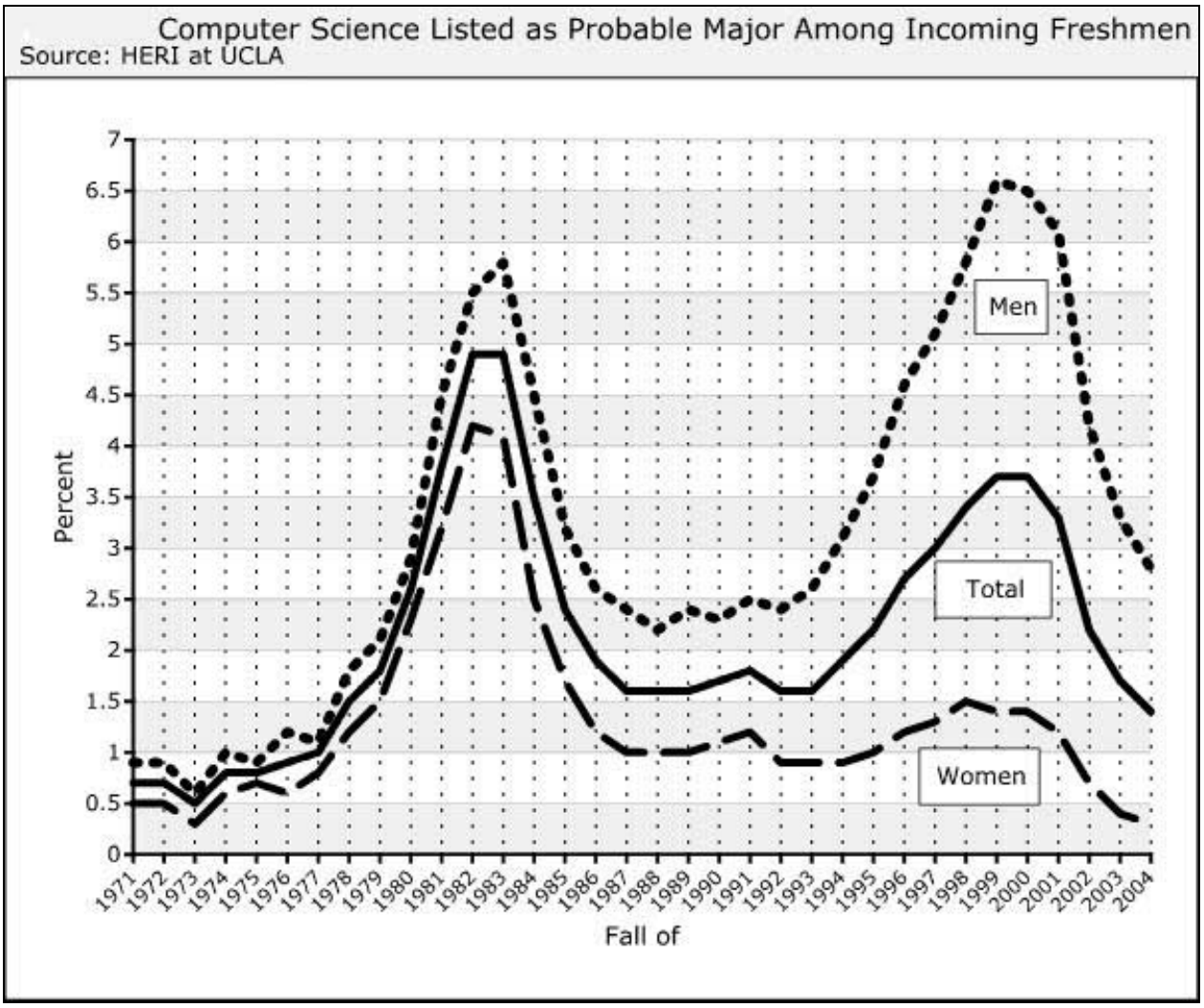

Figure 3. National data for number of Computer Science majors since 1971, taken from [Vegso 2005].

The department offers two undergraduate majors, one leading to the BA degree and another leading to the BS. These are described more fully in the Programs for Majors section below. We also offer a combined BA-MA degree option, as well as a separate MA degree. Figure 2 shows the enrollment trends for all of these degrees over the past decade. What appears to be most interesting about this data is the difference between the trends for BA and BS degree enrollments. BA enrollments have been declining at a smooth rate of about 5% a year over the period shown, while the number of BS majors closely parallels the national trend shown in the right-hand part of Figure 3. However, the explanation for the difference between the BA and BS trends is simply that the BS option is a recent addition to our curriculum, having been offered for the first time in 1993, just one year before the data presented in Figure 2 begin. Students generally prefer the BS option, and the left side of the figure reflects the ramping up of the new degree option at the expense of the BA.

Figure 4 shows the number of bachelor's and master's degrees in Computer Science awarded over the past ten years. These data lag the current number of majors and instead reflect the state of the "degree pipeline" rather than current enrollments. As such, the trends for the bachelor's degrees are still continuing upward, whereas the master's degree function has already peaked, reflecting the shorter pipeline for the 1-2 year master's pipeline compared to the 4+ year pipeline for the bachelor's degrees. Most importantly, however, the data suggest that our students are completing their degree requirements in a timely fashion.

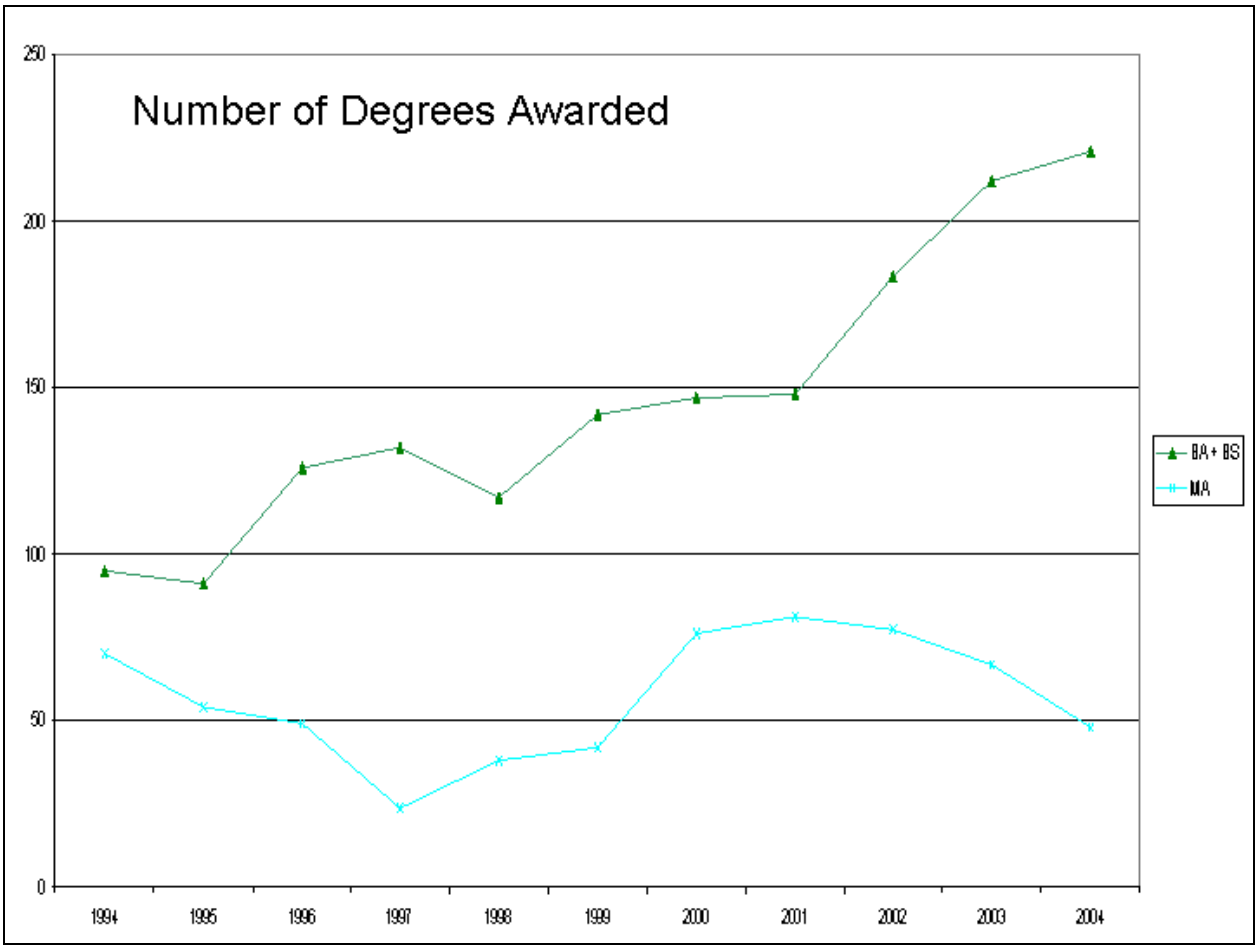

Figure 4. Number of CS degrees awarded: 1994-2004. Data are for the sum of BA and BS degrees, and the MA degree.

Minors

We present the data for the number of Computer Science minors in Figure 5. There is no clear trend over the time span shown. Given the small number of students who are registered for the program, we feel that there is little significance to the variations that are seen there.

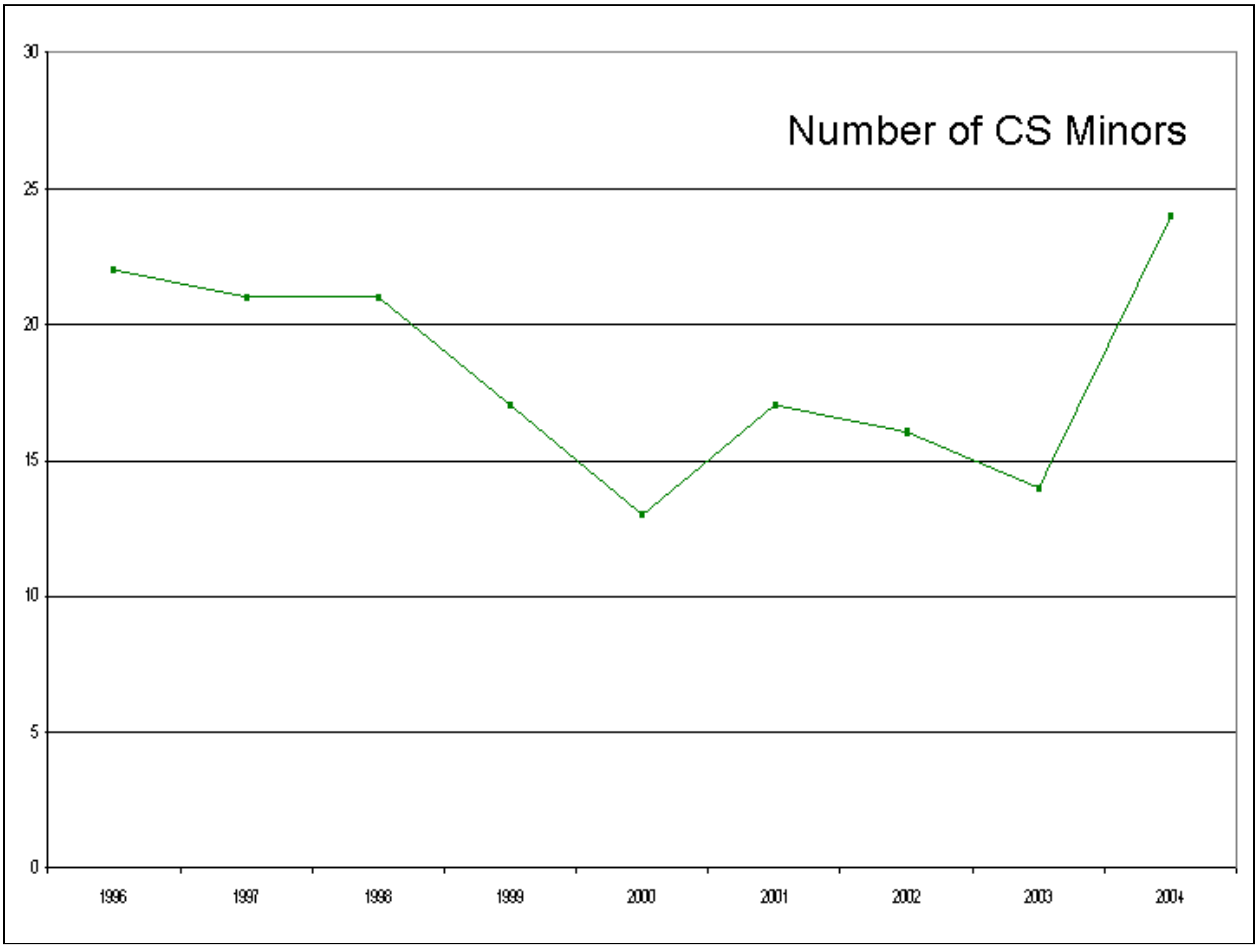

Figure 5. Number of CS Minors: 1996-2004. Data for our new CIT minor are not yet available.

In addition to the CS minor, which is a proper subset of the BA major, the department has a new "Computer Information Technology" (CIT) minor that was fully implemented for the first time during the 2005 academic year. Although there is no data available for this program yet, we think it holds considerable promise for attracting more students into the department. The CIT is described more fully in the Programs for Non-Majors section below.

FTEs

Figure 6 presents the number of Full-Time Equivalent (FTE) students served by the department since 1984. Comparing that figure with national data for the comparable time interval in Figure 3 shows that our department's number of FTE's has closely paralleled the national trend for number of CS majors as well as our own number of majors.

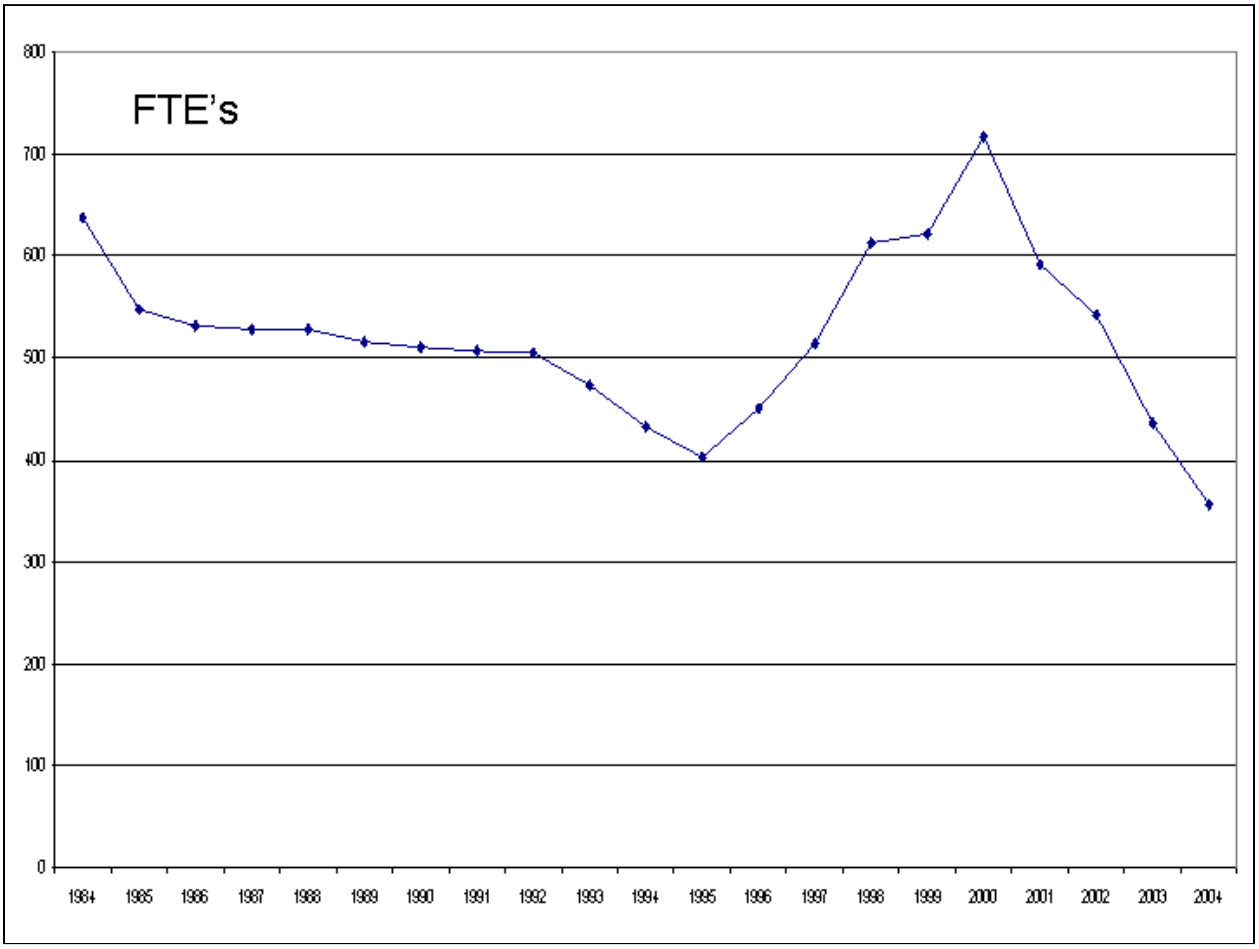

Figure 6. Number of CS FTE's: 1984-2004. Note the parallel to the total number of students majoring in Computer Science in the United States for the same time period, shown in Figure 3.

The latest figures available put the number of FTE students in the department (Bachelor's and Master's combined) at 357. This ranks us fourth in our division, with Psychology, Mathematics, and FNES ahead of us and four other departments behind us.

Curriculum: Contributions of Department to College Programs

General Education

Division: Currently we are contributing one course to the Division of Mathematics and Natural Sciences, a History of Science course being taught by K. Boklan.

College: A. Ryba of our department currently teaches a section of our introductory course especially structured for the mathematics students in the School of Education's Time 2000 program.

Computer Science 12 is our main service course for the college. Each semester hundreds of students take this course to learn fundamental concepts in various aspects of computing, including instruction in basic computing skills from word processing to basic web design. A critical feature of the design of this course is that we present all material in the context of accurate models of computation. Rather than just rote rules about how to perform tasks, we stress how to reason about getting tasks done using available computing resources.

LASAR

All courses in the Computer Science majors satisfy the "Scientific Methodology and Quantitative Reasoning" LASAR requirement for the BA and BS degrees. With the ongoing revision of the General Education requirements currently being undertaking at the College, we hope to integrate our department's offerings with a more up to date view of the role of technology as one of the core elements of a liberal education today.

Evening Division

It has been a long-standing policy of the department to accommodate the needs of the many students who have work commitments that make it impossible for them to attend classes during the day. We offer evening sections of all courses needed to complete both of our undergraduate majors. Although evening sections are more often taught by adjuncts than day sections, many evening sections are taught by full-time faculty.

Weekend College

For the past three semesters, between 55 and 60 students have taken the Weekend College version of CS-12, our service course for non-majors. The course has been taught by an adjunct each time it has been offered.

Summer Session

The department offers most of the core courses within our majors during the summer, and typically includes several electives as well. The teaching is about evenly divided between adjuncts and full-time faculty.

Interdisciplinary Offerings: As science and technology have become core elements of the fabric of society, it has become essential to integrate an understanding of them in the education of tomorrow's leaders. Although there is an important role to be played by the pure computer science major, it is also critical now more than ever to integrate the department's perspective on all things technical with the broader educational process at large.

In this context, we are excited at developments that are unfolding in cooperation with the Biology Department. Several of our faculty, including M. Song (who recently left the department) and R. Goldberg have been engaged in joint research with Biology faculty and one of our most recent hires, B. Reddy, is actively involved in developing research-oriented courses that focus on issues in Bioinformatics. We feel that courses like these, as well as the ones we tailor to the needs of other programs on campus, such as the Time 2000 course mentioned earlier, are important avenues for integrating computing principles into the liberal arts curriculum at the College.

MA/PhD: The department offers its own Master of Arts degree in Computer Science, described in the Master's Degree Section. We do not offer any courses as part of any other Master's program at the College.

Over three-quarters of our faculty are members of the Graduate Faculty of the CUNY Ph.D. Program in Computer Science, headquartered at the Graduate Center. However we do not offer any 800-level courses at Queens at this time.

Graduate School

Academic, Administrative, and Financial Roles: Queens CS faculty teach some courses at the Graduate Center, as mentioned elsewhere in this document. In addition, also mentioned elsewhere in this document, the Executive Officer of the Ph.D. Program in Computer Science at the Graduate Center is T. Brown of our department. Dr. Brown also serves as the director of the CUNY Institute for Software Design and Development, a position he holds independently of his position as EO of the Ph.D. program.

Curriculum: Programs for Majors

Outline

We provide our diverse student body with a two-layered curriculum for the CS major (BA or BS), which consists of a primary core and a flexible extension. The primary core focuses on the fundamentals of hardware (computer organization, assembly programming, computer architecture), software (OOP, data structures, databases, principles of programming languages, software engineering, OS), and theory (discrete structures, design and analysis of algorithms, theory of computation). These topics ensure a solid and long-lasting foundation in the scientific principles of computing both for graduate study in CS and for a career as a computing professional.

This primary core is augmented with elective courses that extend into numerous areas of application as well as frontiers of active research and development, including bioinformatics, cryptography, data mining, internet and web technologies.

Additional enhancements come from the math (calculus, probability and statistics) and lab-based science requirements. Students are also encouraged to supplement their classroom training with internships in a variety of organizations, ranging from software companies (e.g., CA Inc.) to financial institutions to city/state agencies.

With the permission of the department, students may work on a research project and receive elective credits. Outstanding students can take Honors Readings, Honors Problems, or Honors Thesis as an elective.

The two degree options, BA and BS, differ in that the BS also requires linear algebra, has a more demanding lab sequence, and calls for five CS electives instead of three.

Typical Student Paths Through Major

We offer two undergraduate majors in computer science, one leading to the Bachelor of Arts degree and the other to the Bachelor of Science. Figure 7 shows the prerequisite structure for the BA degree program, and Figure 8 shows the prerequisite structure for the BS degree.

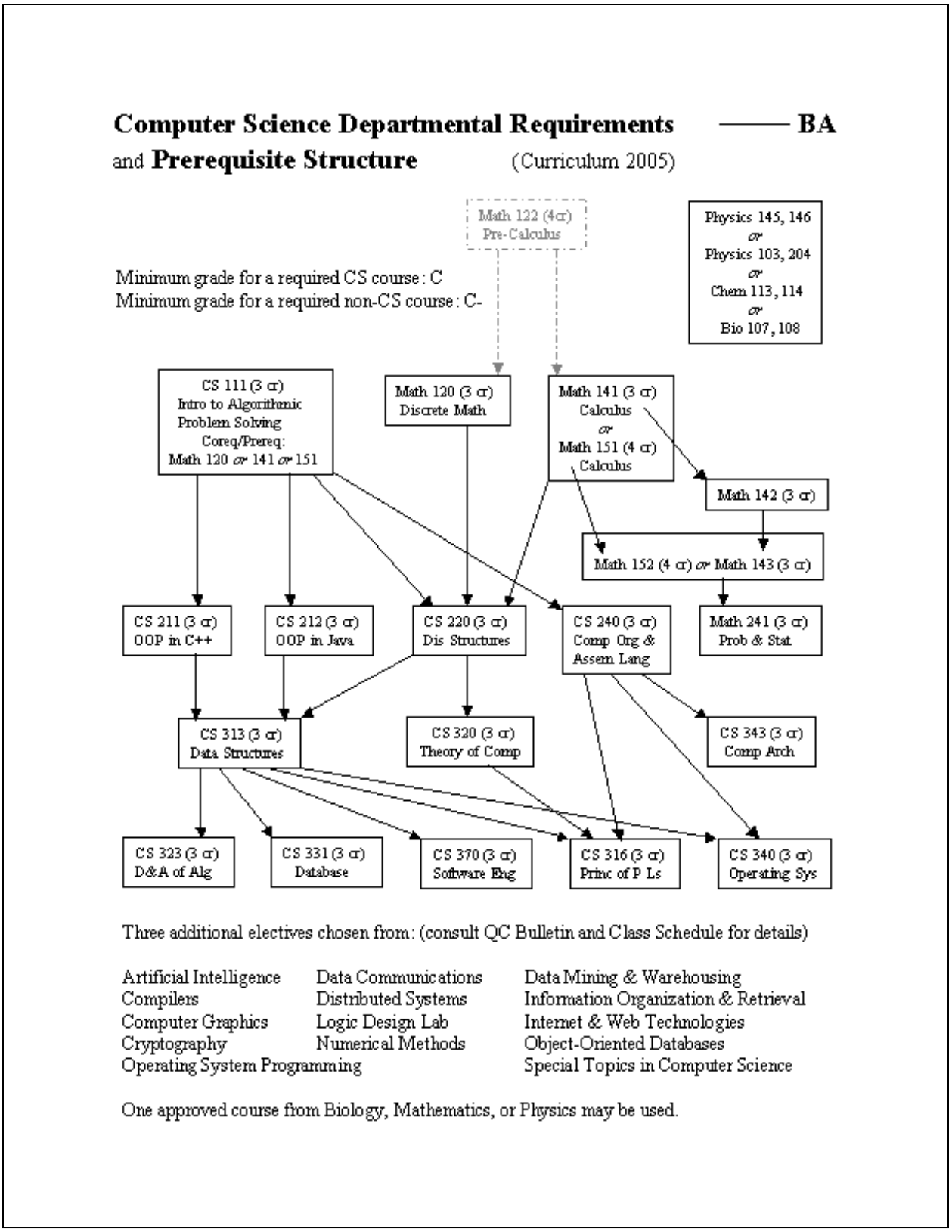

Figure 7. Prerequisite Structure for the BA degree. The diagram includes all required courses.

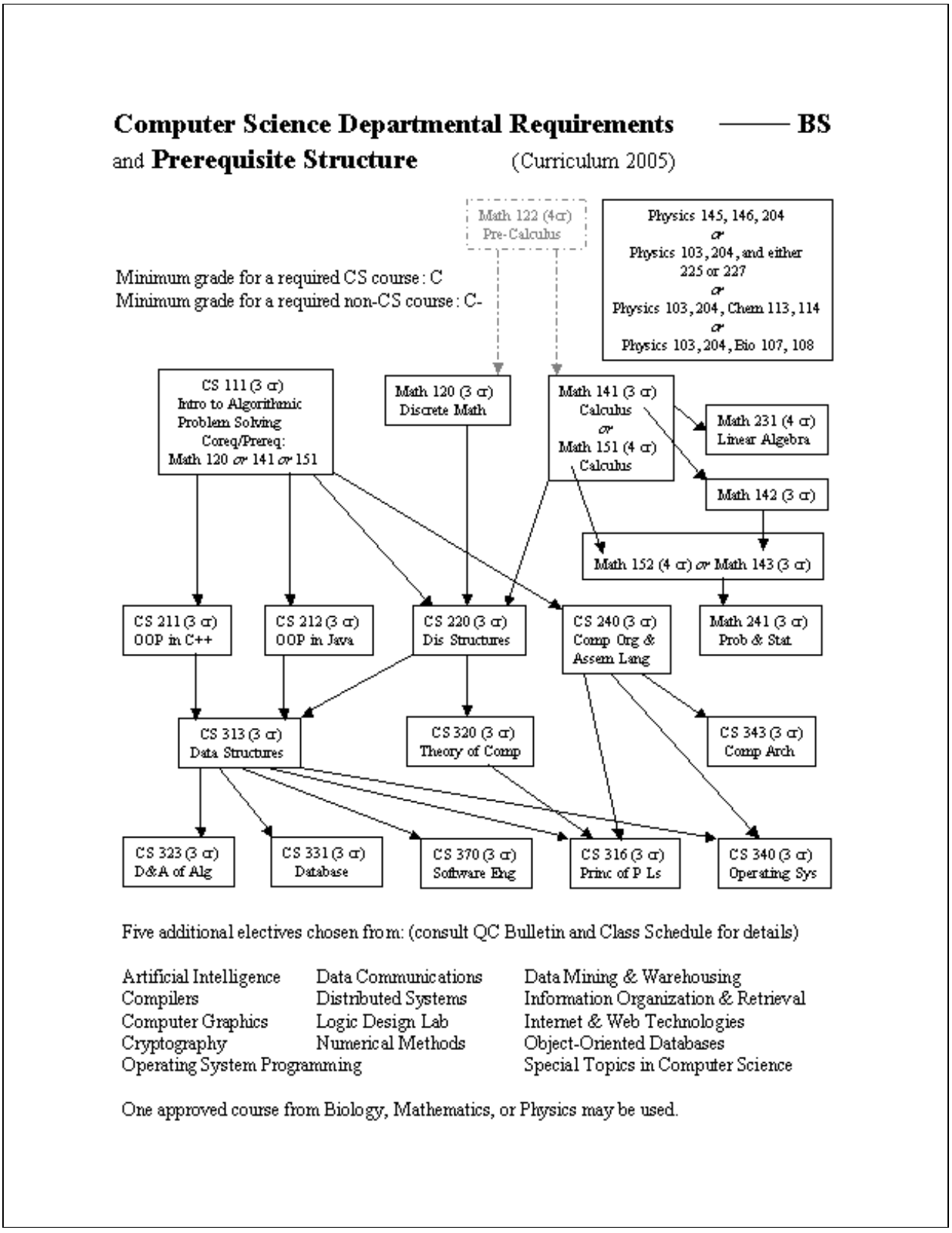

Figure 8. Prerequisite Structure for the BS degree. The diagram includes all required courses.

Students in both majors generally start with CS111 and a required math course, followed by 200-level, 300-level core, and 300-level elective courses. They also take the lab-based science courses and the College-required liberal arts courses along the way.

Transfer students from community colleges typically have CS111, one or two math courses, and two or three of the required 200-level courses. They simply start with what they don't have at the 200-level and proceed from there.

Analysis of Major

LASAR: Our students receive rigorous training in computer science and information technology along with a well-rounded liberal arts education. Every CS course satisfies the Scientific Methodology and Quantitative Reasoning area requirement of LASAR.

General Degree Requirements: Students who take internships to gain real-world experience receive general elective credits towards their degree.

Advanced and Integrated Study: CS students may elect to double major, with the most likely choices being math+CS and accounting+CS. Courses required by both majors can then be applied towards both sets of requirements.

Diversity of Talents/Ways of Learning: Each semester we strive to offer a rich set of electives that cater to the diverse interests/talents of our students and reflect the dynamic and multi-faceted nature of the discipline. For example, in Spring 2006 we have: Bioinformatics, Cryptography II, Data Communications, Data Mining and Warehousing, Distributed Systems, Information Organization and Retrieval, Internet and Web Technologies, Internet Security, Mobile Computing, Next Generation Network Services, Numerical Methods, Object Oriented Databases, and Voice Over IP/WLAN.

Quality of Advisement: We have several designated undergraduate advisers with office hours both during the day and in the evening. We also have an assistant chair for undergraduate studies who is the primary contact person for such matters as transfer credit evaluation and graduation approval. The assistant chair is a member of the departmental curriculum committee, which is headed by the department's deputy chair. This enables any special needs to be addressed consistently and expeditiously by people who are responsible for curriculum issues. The students may also drop by the department office to seek help from the office staff (general information, registration, etc.), and to meet the department chair whenever necessary.

In order to somewhat alleviate the problem of having no teaching assistants to coach students who encounter technical difficulties in their study, we solicit students in good academic standing to serve as tutors. They are paid ~$10/hr by the department.

Student/Faculty Contact Outside Class: All full-time faculty are available to meet students during published office hours and/or by appointment. In addition, students can send inquiries by email at any time, and talk to professors before/after classes.

The department participates in all College-sponsored advising activities including open house, transfer credit evaluation, and sophomore day.

Relationship between Major and Specialized or Pre-Professional Programs: Students with a GPA of at least 3.5 over 15 or more credits in courses required for the major may apply for the accelerated BA/MA program, which permits them to use up to four of the required graduate core courses towards both the BA and the MA degrees in CS. Students in the BA/MA program pay the undergraduate tuition for the graduate courses until they complete a total of 120 credits. As a result, rather than taking 150 credits for both degrees (120 for the BA and 30 for the MA) students may earn both degrees with a minimum of 138 credits.

Courses Appended

There are three sources of information about the courses offered by the department:

1. The official course listings are in the College Bulletin, which is available online at www.qc.edu/college_bulletins, and reproduced in Appendix A of this document.
2. The department keeps a list of courses, degree requirements, special topics course descriptions, and other information on its website at www.cs.qc.edu
3. Most faculty maintain their own web sites for the courses they teach. Links to these individual pages are kept on the department's web site.

Comparison with Other Institutions

Table 7 compares the BS degree requirements of our department with three comparable public institutions and one private institution in the New York metropolitan region.

Inside CUNY: Brooklyn College and City College are very similar to QC in terms of institutional organization, general student body, and overall academic reputation.

Our BS program is more demanding and rigorous than that of Brooklyn College. This is evidenced by our requiring OOP in two widely-used languages, algorithm analysis plus theory of computation, more CS electives, and the lab science sequence.

On the other hand, our program is very similar to that of City College, with a bit more flexibility given to our students as demonstrated by a smaller set of required software courses and a larger set of electives.

Outside CUNY: Polytechnic University is a regional private institution in Brooklyn. Comparing the requirements in software, hardware, theory, CS electives, and lab sciences it is evident that our BS program is stronger than theirs. From their catalog course descriptions, it appears that they generally award 4 credits for courses with equivalent content to 3-credit courses at Queens, suggesting that their total number of required credits may not be directly comparable with ours.

The CS program at SUNY/Stony Brook enjoys a fine national reputation. Their BS has a stronger math component than ours. They also afford their students more freedom in choosing core courses; in comparison our core requirements are more rigidly structured. However, our approach ensures that students coming into a higher-level course are all similarly prepared academically.

	Queens	Brooklyn	City	Polytechnic	Stony Brook
Total Credits CS + Math + Science	81	52-55	84	84	80
Calculus I & II	yes	yes	yes	yes	yes
Calculus III or higher	no	no	yes	yes	Finite Mathematical Structures
Linear Algebra	yes	yes	yes	yes	yes
Probability & Statistics	yes	yes	no	no	yes
Required software courses	OOP in C++ OOP in Java Data Structures Prog. Languages Software Engineering Operating Systems Database	Programming in C Data Structures Prog. Languages Operating Systems Project	Intro to Computing Data Structures Prog. Languages Software Engineering Operating Systems Simulation Software Lab Design Project	OOP Data Structures Prog. Languages Software Engineering Operating Systems Project	OOP Data Structures Software Engineering Three from: Prog. Languages or Compiler Operating Systems Database Graphics or User Interface
Required hardware courses	Comp. Organization Computer Architecture	Assembly Language Comp. Organization	Comp. & Assembly Comp. Organization Comp. Systems Lab	Arch. & Organization	Comp. Organization One from: Networks Architecture Communications
Required theory courses	Discrete Math Design/Analysis Algo. Theory of Comp.	Discrete Math Algorithms or Theory	Discrete Math Algorithms Numerical Issues Theory of Comp.	Discrete Math Design/Analysis Algo.	Discrete Math Algorithms or Theory
CS Electives (credits)	15	6	12	12	9
Lab Sciences (credits)	12		12	8	12

Table 7. Comparison of course requirements for the CS major at Queens, Brooklyn, City, Polytechnic University, and SUNY/Stony Brook. All programs for the BS degree degree.

Projections for Increases or Decreases in Enrollment

Consistent with the national trend, we had a 40% drop in enrollment following the burst of the internet bubble in 2001. However improvement has been evident in the past year, and it seems clear that we have passed the low point and are on the mend. Although we do not expect a repeat of the recent history, with hundreds of students rushing into our major in the coming years, we are confident that our enrollment will continue to move upwards since our discipline is at the heart as well as the forefront of the information revolution that is still in its infancy.

Plans for New or Revised Programs

Our curriculum committee, with the involvement of the entire faculty, constantly monitors the latest developments in the field and devises improvements to our programs. A major revision ("Curriculum 2005") was introduced recently and is now in full implementation. We plan to review this curriculum and make necessary changes as we observe its effectiveness in the next year or two.

Curriculum: Programs for Non-Majors

We serve non-majors through three primary avenues. The first is our course CS12, Understanding Personal Computers, which we offer to the entire college community. Each semester hundreds of students take CS12 to satisfy the Scientific Methodology and Quantitative Reasoning area requirement of LASAR. The course can also be used to satisfy the computer requirement of such majors as accounting. A variation of the course, with business applications, is offered to students in the economics department as CS18.

Our second path for non-majors is our newly implemented minor in Computer Information Technology (CIT). This offering is designed to give majors in other fields practical experience with currently important information technologies and a sound understanding of the principles behind those technologies. As Figure 9 shows, the CIT Minor consists of CS12 and five CS courses (outside the major) that are more or less skill-oriented, plus CS111 and one of the math courses required by the major.

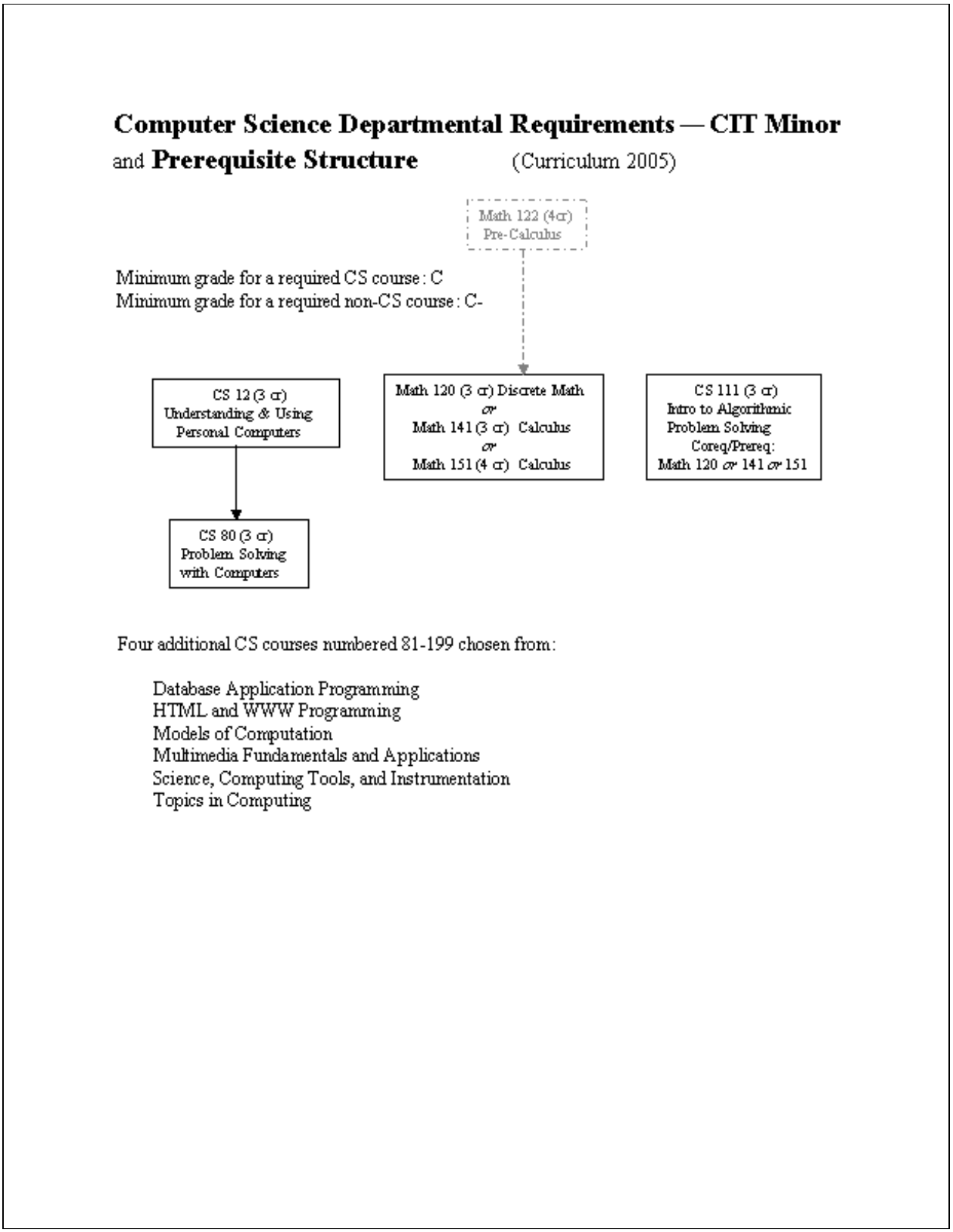

Figure 9. Prerequisite Structure for the CS Computer Information Technology Minor.

Finally, for those who want more rigorous CS training without majoring in CS, we have a CS minor consisting of nine courses. These courses constitute a subset of the CS and math courses required by the BA

major, starting with CS111. Thus a student minoring in CS can easily switch his/her major to CS or add a second major in CS. Figure 10 shows the prerequisite structure of the CS Minor.

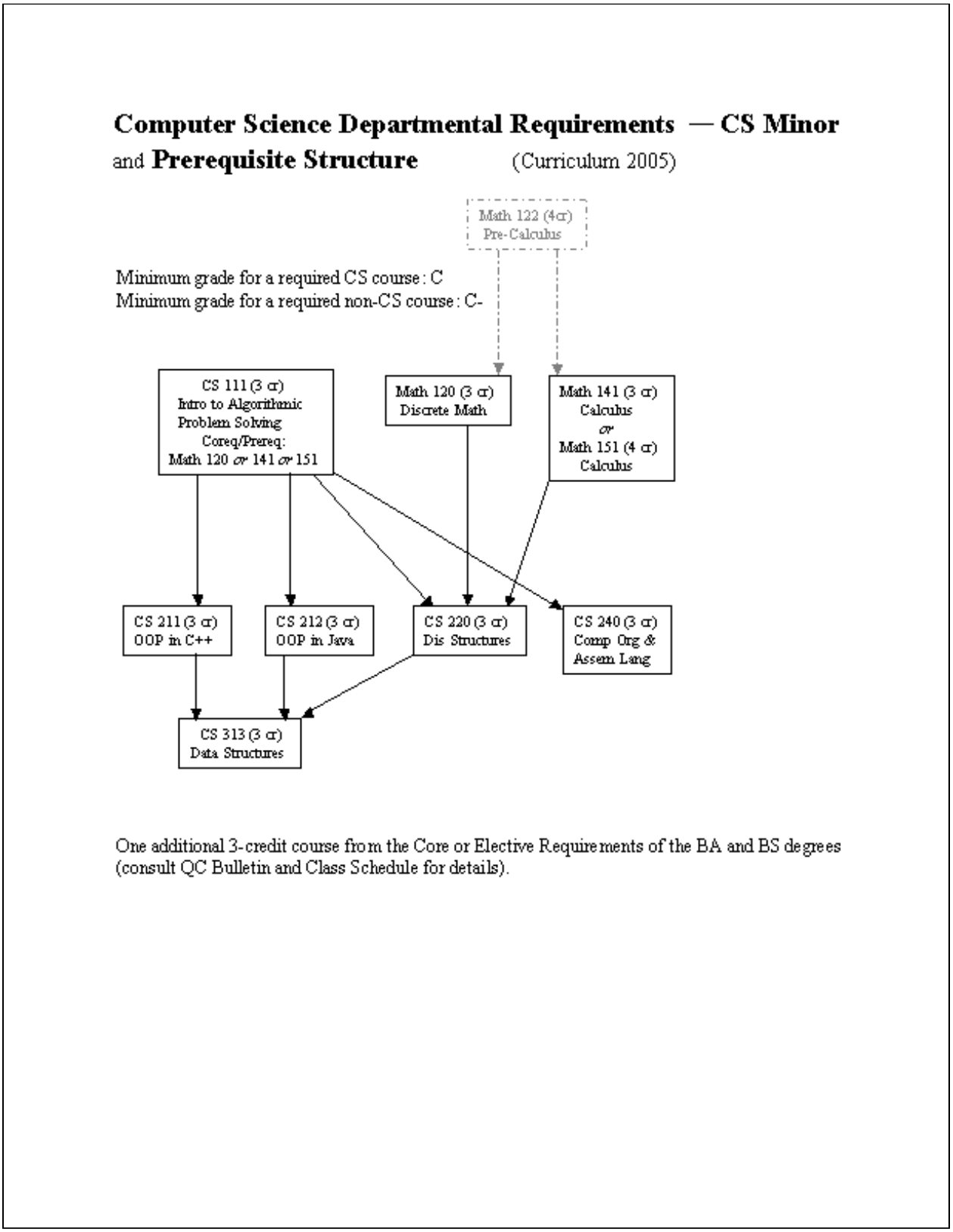

Figure 10. Prerequisite Structure for the CS Minor.

Master's Degree Program

Our Master's program consists of four *core* courses, a choice of three *semicore* courses, two *elective* courses, and a *capstone* course. The structure is given in more detail in Figure 11. Students with an undergraduate degree in some discipline other than computer science may enter the program, but only after they have completed six undergraduate courses that are essential components of our BA program. (These courses are shown in gray boxes at the top of figure Figure 11.) This allows us to accommodate students who want to make a career change or who are from foreign countries where programs in computer science comparable to those in this country were not readily available to them.

Several of our faculty, both established members of the department and our new hires, offer graduate-level special topics courses on subjects of current interest, such as bioinformatics, security, and wireless communication. We look forward to further strengthening this important part of our program in the future.

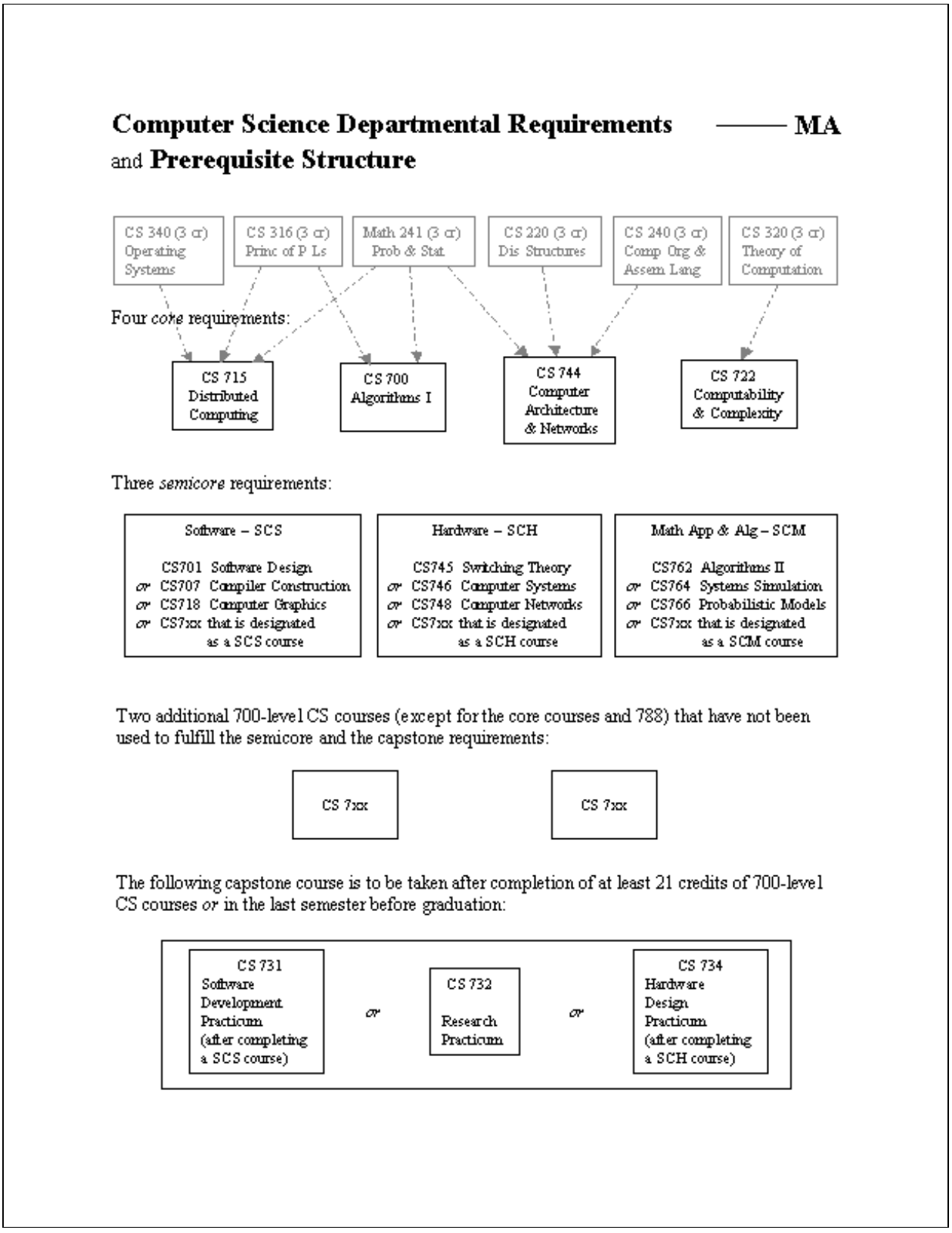

Figure 11. Prerequisite Structure for the MA in Computer Science.

Assessment of Effectiveness of Curriculum

Methods and Instruments Used

From the time of the department's inception, our curriculum has been based on national norms, starting with the curriculum known as "ACM '68" and continuing through to today's curriculum, which corresponds well to the current recommendations of the ACM and IEEE. However, we have always tailored our courses to meet what we perceive to be the particular needs of Queens College students and to reflect the particular strengths of our teaching faculty. To the extent that our curriculum implements national norms, we are confident that it accurately addresses the needs of computer science students in general.

We regularly review student course evaluations administered by the College's Teaching Excellence and Evaluation Committee to look for problems that may be occurring in our course offerings.

Student/Alumni Survey: In June of 2005 we conducted an online survey of our undergraduate students, graduate students, and alumni to gather more detailed information about the perceived effectiveness of our undergraduate and master's programs. The complete survey, with a numerical summary of the short answer questions, is given in Appendix C of this document. It is also available as a separate document (PDF): Survey Summary.

Measured Effectiveness in Achieving Desired Objectives

The survey was divided into separate parts targeted to current undergraduate students, current graduate students, undergraduate alumni, and graduate alumni. We had a total of 290 respondents to the survey, although 35 of these were discarded because they did not fall into one of our four target categories. Some individuals responded more than once because they fit into more than one category. In particular, many of the current graduate students were also undergraduate alumni.

The answer to Question 1 of the survey indicates that we received replies from 158 undergraduates, 41 graduate students, 39 undergraduate alumni, and 17 graduate alumni. While this is a gratifyingly large number of responses, especially from our current undergraduates, we should point out that there are certain sampling biases at work that affect the interpretation of the results. The first bias is that the survey was widely publicized among our current undergraduate and graduate students, but we did not have a way to contact alumni other than to put a note about the survey on the Department's home page where it might have been seen by alumni who happened to be visiting our web site. Thus, our alumni data probably draws most heavily on those graduates of our programs who are currently enrolled in the MA program and does not represent our alumni body at large. Furthermore, we discovered after the survey was closed that we made a mistake in constructing it. Based on the answer to the first question, participants were directed to one of four sets of questions based on their relationship to the department, or to a "thanks but no thanks" page if they were not current or previous students. Since we received no answers to the questions targeting graduate alumni, we infer that the 17 of them who answered the first question were misdirected to the "thanks but no thanks" page.

The first item of interest is the fact that 40% of the undergraduates who responded to the survey are transfer students from other colleges. Of these, over half transferred from a community college within CUNY. Our two biggest feeder colleges are Queensboro Community College and Laguardia College. We have anecdotal evidence that the preparation of these students varies greatly depending on which school they transferred from, and we recognize the need to provide meaningful articulation with the programs offered by the various CUNY community colleges.

Nine of the undergraduate respondents transferred from outside the US. Five transferred from other senior colleges within CUNY. Thirteen transferred from other four-year colleges in the New York metropolitan region (SUNY/Stony Brook, Columbia, NYU, St. John's, Adelphi, etc.)

Over half of the master's students who responded completed their bachelor's degree at Queens. Another 15% came from elsewhere in CUNY.

The full set of questions and summary data for short-answer questions are given in Appendix C. We summarize the data as follows:

- About one-third of our undergraduate students work full-time in addition to pursuing their studies. Another third work half-time, and the remainder do not work at all.
- Most undergraduates think it is reasonable to spend 2-6 hours a week outside of class on preparation for a 3-4 credit course, and that is also how much time they report actually spending. This result is consistent with the report of [Young 2002], indicating that college students no longer consider two hours of preparation for each classroom contact hour to be the norm.
- We asked the undergraduates to rate the program on sixteen attributes using a 5-point scale, with 5 being the best. The three highest ratings (over 3.6) were for the library and computing resources provided by the College, and for the relevance of the courses offered by the department.
- The lowest ratings (below 3.3) were for: preparation for work after graduation (3.01), reasonableness of time demands (3.16), proportion of courses taught by adjuncts (3.21), quality of advisement(3.26), responsiveness of the department to student needs (3.28), and availability of instructors outside of class (3.29). Since a score of 3.0 is equivalent to "Neutral," we feel that the results reflect very well on the department. Even our greatest perceived weakness (preparation for work after graduation) received a negative rating from only 26% of the respondents.
- We asked about the time demands of individual courses, but in only two cases did more than 10% of the respondents reply that the time demands for a course were "Too heavy!".
- More than 80% of our graduate students had undergraduate majors that were in computer science or a related discipline.
- The graduate students' ratings were generally lower than the undergraduates'. Our highest approval ratings were for fair grading, good preparation for further graduate study, course relevance, computing and library resources, and faculty expertise, but these ratings ranged only from 3.3 up to 3.5. Weaknesses (average ratings below 3.0) were choice of courses, preparation for work after graduation, availability of internships, and responsiveness to student needs.
- With only 36 graduates of our undergraduate program responding to the survey, the data become tenuous. Of these respondents, over 60% reported that they had pursued no formal education beyond the bachelor's degree. Over a quarter of the graduates who had done graduate work had partially completed a master's degree in a computer related field; we infer that these are our own master's students.
- We asked the students to describe their employment history since graduation, and received the following responses:
    - 50% had been regularly employed in jobs related to computing.
    - 22% had been regularly employed in jobs not related to computing.
    - 19% reported having multiple jobs, some of which were computing related, and some of which were not.
    - 8% had not been employed since graduation.

- Over half of the graduates of our undergraduate program reported that their time spent at Queens College was "rewarding and enjoyable." Most felt that the computer science major provided good preparation for work, but over a third disagreed with this assessment of the program.

We also asked respondents to give written answers to some questions. We asked our current undergraduates to tell us the two most important things they thought the Computer Science Department should do in order to improve (survey question 12). We received 78 answers to this question. By far the most common comments (24 of them) dealt with a perceived need for improved pedagogy, including the need for tutors, teaching assistants, and gripes/kudos for individual faculty members. We also received 15 responses dealing with the content level of the courses; these were about equally divided among those who thought the courses should be easier (5 responses) or harder (3), with the remainder asking for particular subject matter to be included or omitted. There were also several replies that expressed a desire for better scheduling of courses so that there would be fewer scheduling conflicts.

We also asked the alumni of our undergraduate programs what they felt the Department and the College should do to improve. Because of the way the survey was publicized, most respondents were also current students, so we also include responses by current MA students, who were also asked what the Department should do to improve. Far and away, the largest cluster of comments dealt with the perceived desire for more job-oriented, real-world skills, and more internships. Other comments generally reflected the same perceived shortcomings found in the short answer questions, mentioned above.

Use of Assessment to Improve Programs

The survey findings were quite consistent with the informal perceptions we have had about ourselves as a department from the time of our inception: We feel that we provide high-quality instruction in the core principles of computer science, but that many of our current students and recent graduates would prefer vocational training in information technology. It is our firm belief that the main benefit of our curriculum is that it provides students with the basis for life-long learning, and that to devote a significant amount of the curriculum to current "hot topics" leaves students ill-prepared for the long haul. (Even reviewing the particular topics students wanted us to teach about six months ago reveals an interest in "older" technologies, such as J2EE and Python, but no mention of current technologies such as Ajax and Ruby.)

For a long time, we tried to convince students that their interest in a BS degree was misguided and that the BA is the preferred degree from a liberal arts college such as Queens. Finally (over a decade ago), without substantially altering the degree requirements, we introduced the BS option. Students have flocked to it, and the department has been able to maintain its own perceived integrity of the curriculum at the same time. We take this case to be proof that the difference between students' perceived needs and the department's sense of mission do not have to be irreconcilable.

Currently, there is a large demand for courses that more properly fall under the information technology part of the computing umbrella, rather than computer science. We feel that we cannot incorporate this area into our major without losing focus on core principles of computer science. But we have been able to meet student interests by introducing our minor in Computer Information Technology (CIT). This minor is too new to evaluate at this time, but indications are that it will be a very popular option both for students majoring in other disciplines as well as some of our own majors. We expect enrollments in this minor to be even more volatile than those in our majors because of the vagaries of the perceived job market.

We are enthusiastic about the CIT minor for two reasons worth mentioning here: (1) The simple fact of its existence helps us explain to students (and colleagues) the difference between computer science and information technology. There has been a public relations problem leading to misconceptions about the department and its mission in the past, and the CIT minor helps us to articulate the nature of the department more clearly to others. (2) The CIT minor also provides a nice opportunity for our faculty to demonstrate their involvement with real-world problems. Research in computer science is often driven by issues arising from the practical applications of computing theory and principles to current technology. The CIT minor is a means for us to integrate some of our teaching with the issues that are driving computer science research today.

Students

Undergraduate

Diversity of Demographics

As reported above, about 40% of our undergraduate students are transfers from other colleges and of these, half are from community colleges within CUNY. The rest of the transfers come from other senior colleges within CUNY, other metropolitan area schools and, a not insignificant number transfer from colleges abroad. The other 60% come to us mostly after graduating from local high schools in the New York metropolitan area.

The ethnic and economic backgrounds of our majors generally reflect the diversity of the college as a whole. There are differences, however. Where the undergraduate gender ratio at the College is over 60% female, we estimate that the ratio is reversed in the Department, and that over 60% of our students are male. The undergraduate ethnic distribution for the College is 50% White, non-Hispanic, 22% Asian or Pacific Islander, 17% Hispanic, and 10% Black. We believe that reversing the College's percentages for the White and Asian categories would more closely approximate the Department's distribution.

Career Choices and Perceptions of Program

An important criterion in assessing the success of our program is the extent to which our graduates are able to secure appropriate professional employment. Five years ago the majority of them were able to find IT related positions quite easily. In fact, many students had multiple job offers to choose from. However the dot-com bust and the increasing trend toward outsourcing lower-level projects, has had a significant effect on the job prospects of graduating computer science students nationally. Employers are still hiring, but with fewer positions available and a large pool of candidates, it's pretty much a buyer's market. Given these circumstances, the fact that half of our graduates have found computer related jobs (see Assessment of Effectiveness of Curriculum) should be considered a significant accomplishment. The trend toward hiring high-quality talent means that half of our students were judged as such by the market.

It should be noted that the set of possible job categories for graduates of our program is quite large, and personality factors as well as skill plays an important role in the path eventually pursued. Assuming that a student is temperamentally suited for a particular type of job, different jobs require different skill levels, knowledge, and overall intellectual ability, and students seem to be quite good and determining where they stand with respect to these factors. We find that our most academically successful students tend to seek jobs as programmers in software companies (working in-house or as consultants) and, with increasing frequency, in the financial services sector. Second tier students are usually more interested in database and systems administration positions or in work as "business analysts", network specialists or in technical sales support. Those who can't find employment in the above two areas will gravitate toward "help desk" jobs, work in PC support or in lower-level networking and systems administration positions. While the above is clearly a generalization, it is in the main correct. Where do our students get the knowledge needed to pursue these positions and how did our curriculum contribute to this success?

Overall the undergraduates rated the relevance of our courses quite highly. The undergraduate computer science curriculum is designed primarily to give our students the tools to become first rate programmers and systems analysts. It emphasizes fundamental principles as well as provides for the teaching of a number of particular technologies. Our graduates find that much of what they need to know when they start their careers has been covered in one or more of their courses. If their job requires that they master something that they did not explicitly cover in their coursework, many report that the principles that they learned allow them to acquire new skills with confidence.

While the above speaks to the students' performance once they get a job, an especially important factor in the students' ability to land that all important first position is whether or not they are able to get an internship

while still in the program. This is the case for both undergraduate and graduate students. Potential employers consider a successful internship as an indication that the student is serious, industrious and able to function in the business world. In light of this, the department has stepped up efforts both in cooperation with the job placement office and through our own contacts to increase the number and quality of internship opportunities available to our students.

Not all our students go directly into industry, however. In recent years we have also seen a number of our students go on to pursue graduate studies at some of the top-ranked Computer Science programs in the country, including Princeton, Carnegie Mellon, UC Berkeley, Columbia, and NYU. In addition, we regularly send students to the highly-regarded regional programs at the CUNY Graduate Center and SUNY Stony Brook.

Graduate

Our graduate enrollment has dropped by about two-thirds since 9/11. This decline is attributable to the difficulty many foreign students have in obtaining visas to study in the US as well as the general drop in computer science enrollments nationwide. Though the number has declined, we believe that the quality has actually improved. This is very likely attributable a change in the backgrounds of our current students. We previously admitted many students who wanted to change majors for the graduate degree and whose preparation in computer science was weak or non-existent. Those students were required to take a complement of core undergraduate courses in the Department in order to prepare them for graduate-level work. But now more than 80% of of our graduate students have had undergraduate majors that were in computer science or a related discipline, and many have been our own undergraduates at Queens College.

Despite the drop, our graduate enrollment has been growing for the past three semesters for which we have data (Fall 2003, Spring 2004, Fall 2004). The graduate students give various reasons for enrolling in the program. Many believe that additional training at the master's level will help them get a good job in this tough employment climate. In fact, students with a master's degree tend to find it easier to get a job, and when they do they got a slightly higher starting salary and more interesting work. Others enroll in our program because they find our wide selection of courses very appealing and useful. Indeed, over the last three years we have added courses in such important emerging areas as cryptography, Internet and web technologies, Bioinformatics, Mobile Computing, Next Generation Network Services, Voice over IP / WLAN, and Internet Security. Aside from their intrinsic interest, knowledge of these topics is sought after in industry today. Such a wide variety of cutting edge courses is quite rare and these offerings have been an important factor in helping our graduate program grow.

We have also made a change in our admissions procedure in the past few years that we think contributes to our improved enrollments. Where we previously processed graduate applications just once a term, we now handle them on a "rolling admissions" basis. This means that qualified students are admitted as soon as we have their application in hand, reducing the problems students have arranging visas, work, and travel plans. The result has been positive: in 2001, just 28% of the students we admitted actually matriculated into the program. In 2005, the proportion was up to 63%. Despite the drop in absolute number of students, we remain the largest master's program in the division and are cautiously optimistic that our graduate enrollments will continue growing at a reasonable rate.

Self-Analysis and Plans

Strengths

The first and most important resource of any academic department, the core of its strength, is its faculty. The Department of Computer Science is proud of the professional standing and the distinguished research record of its members. Members of the department have been active mainly in the following research areas: information retrieval, cryptography and computer security, visual information processing, fundamental mathematical theory of computation, computer architecture, web development and finally a new area for the department, bioinformatics. In computer science research, many specialized areas tend to gain and lose centrality as the subject evolves. The faculty of our department have very successfully adapted to this situation, continually moving on to new and developing areas of research.

This Department has always emphasized undergraduate instruction, regarding this as one of the core missions of the College. This role is especially important in computer science, because of the special character of undergraduate education in a rapidly evolving field. In most of the sciences a post-graduate degree is a necessary minimum prerequisite to begin a professional career. This is not true in computer science. Many of our graduates begin a professional career with a BA or BS, and are able to continue their professional education while working in technological industries. Because computing technology develops so rapidly, essentially all computing professionals are obliged, if they wish to remain in the field, to pursue a lifelong process of continuing education. The undergraduate program our Department offers is designed to give them a solid foundation for this process. Members of our faculty have also devoted great efforts to curriculum development and mentoring undergraduates.

The Department has also developed a program in computer literacy that it offers to all members of the college community. Our introductory course, CS 12, has enrolled hundreds of undergraduates every year. We are proud of the record of success this course has achieved. It has become a core course in the education of many undergraduates, from diverse subject areas.

This semester the Department has completed the introduction of a new minor in Computer Information Technology. This June we will be celebrating the graduation of the first students concentrating in this area. This program emphasizes applications of computing including web programming, database, and multimedia design.

The master's program is a central program of the Department. In the recent past most of the students in this program had a bachelor's degree from other areas, and were retraining in computer science. The Department developed an extensive sequence of courses designed to rapidly bring these students up to the level required for a traditional master's program in computer science. In the last three years, the department has greatly enhanced its graduate course offerings, and in consequence been able to attract many more master's students with an undergraduate CS degree. This has strengthened the master's program considerably.

The Department also benefits from its excellent and dedicated technical staff. Peter Chen, our network manager, and Koya Matsuo, our system administrator, have developed and maintained our computing and network resources, despite having to work within the constraints of a very a narrow budget. The Department is also grateful to the Queens College administration, which has provided extensive computing facilities for the use of its undergraduates.

Weaknesses

The Department is acutely aware of certain areas of weakness, and is dedicated to solving the problems they represent. Many of these weaknesses arise ultimately from the unavoidable constraints imposed by the College budget.

It has proved impossible for the department to hire faculty in certain very competitive areas. In the more competitive areas of computer science, such as computational genomics and computer security, starting salaries are at least 50% above the level the College is able to offer, and typically come with start up monies far beyond the level we can approach. Recently, the Department was able to hire in the area of bioinformatics by working with the Biology Department and hiring a very highly qualified person from the more biological side of bioinformatics. A major goal of the department is more hires in this vital and growing area, in order to develop a functioning research group.

Similarly in computer security and cryptography, the salary scale of the College has restricted the types of candidates the department can recruit. Here too, the Department was able to hire very successfully, recruiting an exceptionally talented individual with a less applied background, who had trained in analytic number theory and had previously worked at the National Security Agency.

This general strategy has been a foundation of the department's hiring policy. Since the more theoretical areas of computer science generally command lower salaries, the department has tried to hire outstanding individuals whose research areas are on the more theoretical side, but who are also capable of teaching the very applied courses which the department's undergraduate curriculum requires.

However, in emerging research areas, it is vital to be able to hire at least one senior faculty member who can function as a research group leader and mentor to junior faculty. Such an individual can take the lead in organizing external grant applications and collaboration with research groups at other institutions. They can also organize and direct curriculum in development in new areas. Unfortunately, the department has been unable to hire such vital individuals. Such hires could radically transform and improve our department.

The department also acknowledges that so far it has not been able to develop the relationships it envisions for itself with neighboring institutions, such as Rockefeller University and Cold Spring Harbor Laboratory. The Department is pleased by its developing relationship with Computer Associates, but acknowledges that it needs to greatly enhance its relationship both with this company and with other regional technology companies. Of course, developing these relationships will require some investment of resources, both in funds and in released time for the faculty who undertake these duties.

The Department is grateful to the College for the released time which has been granted to new hires. However, the Department has been unable to offer its other faculty adequate released time for research. This gap is especially damaging in computer science, where faculty must continually update and revise courses in order to keep up with rapidly evolving technology. In a field such as mathematics, many undergraduate courses present material which has been fundamentally unchanged for over a century. In computer science, especially in software, a course which is not extensively revised every three years is badly out of date. It is unthinkable that we would run a software course the way it was run in 1990.

Proposed Changes

Department Organization

The Department envisages two major changes in its structure and organization which it would like to implement.

Firstly, the department needs to hire at least two senior faculty who can function as research group leaders in each of bioinformatics and computer security. Such individuals can organize grant applications and mentor both junior faculty and advanced students. They can organize curriculum development and lead in setting up collaboration with neighboring institutions. They also relieve junior faculty of the research isolation which can so severely inhibit their productivity.

Secondly the department intends to expand and solidify its new technology minor. This program is an important resource for the College, and offers a career path for many students in other departments who are

not now served by the department's courses for its majors. In addition it will help to even out fluctuations in the department's student enrollments, which tend to reflect the job market in the computer industry.

Programs and Curriculum

We would divide our curriculum into macro and micro levels. At the macro level, our curriculum is quite stable in that the core principles on which computer science is based have not altered greatly since the earliest days of programmable digital systems in the mid-twentieth century. As with any science, the core of the discipline generally changes slowly, and we do not often need to make drastic changes to the set of courses we offer in order to track these changes.

On the other hand, the micro level of the curriculum is has always been under active revision from the day the department was founded over thirty years ago. At the micro level we deal with issues like like what programming language to use for projects, what computing environment to work with, and what are the current best practices in software design. These changes typically don't show up in the College Bulletin, but they do consume a considerable portion of our curriculum development activities.

Where we do see macro-curricular developments taking place over the next five to seven years is in the area of cross-disciplinary interactions with other departments on campus. We are already working with the Biology and Economics departments to provide courses that will give their students the technological understanding they need, and we anticipate that this sort of activity will play an increasingly important part in our role on campus.

Our curriculum provides an essential part of a liberal arts education in the 21st century, and one of our goals is to project an accurate image of that role, one that avoids hype and job-market frenzy in favor of recognition of the core role a working knowledge of computing plays in an educated person's life.

Resources

The Department has outgrown its office and research space allotments and must deal with these issues for both short-term and long-term time frames.

We are currently providing new faculty with windowless offices and research space that must be shared with instructional labs or departmental servers. Rather than deal with these problems in an *ad hoc* case by case basis, we would like to plan now for the addition of six additional faculty offices that are of the same quality as most of our present offices with respect to space, light, and access to departmental networking facilities. The most natural location for additional office space would be on the third floor of the "A" wing of the Science Building.

Two main research foci, bioinformatics and information security, need research spaces that address their needs in terms of workstations and meeting facilities. Our work in Web services needs its own research space in addition to the educational lab being established in A-103 from Technology Fee funds, and we have no facility for our work on embedded systems and small-area networks. The most natural location for these laboratories would be on the first floor of the "A" wing of the Science Building. Additional research space is critical to our ability to obtain outside funding for our research efforts. However, funding agencies have not normally supported the establishment of an institution's research infrastructure, so it is imperative for the College to obtain the needed funding for converting classrooms to research laboratories from alternate channels.

Future of Department for Next Five to Seven Years

Hiring

The central element of the Department's mid-range planning is its hiring strategy. Over this time period, the Department approximates it will have two retirements, with corresponding replacement faculty lines. Additionally, we expect to obtain some new lines in the near future.

The Department's faculty pursue fundamental research in many areas of computer science. But, in addition to this core research, members of our faculty have been engaged in collaborative research with faculty from many other departments. We expect a great increase in opportunities for such collaborative research in the years ahead, as computational methods invade new fields. Biology is witnessing the rise of sub-disciplines, such as computational genomics, which apply sophisticated methods of mathematical and computational analysis to vast bodies of data that are now available. Computational revolutions are also taking place in other sciences, because of the enormous growth in recent years in the processing power and memory size of computers that are readily available to researchers. The Department welcomes its role as a collaborator with other departments in the College.

We have concluded that the Department will make the most effective use of its resources if it attracts and hires researchers in cluster groups, especially where it can take advantage of interdisciplinary collaboration with allied departments. To this end, the Department has identified the following two areas where it would like to concentrate its resources. These areas have been chosen not only because they are of much current interest in our discipline, but also because of their intrinsic scientific importance, and the potential contribution they would make to the College as a whole.

Bioinformatics: This field combines methods of biology and computer science, especially in areas where new sequencing technology has produced an enormous volume of genetic data that provides unprecedented opportunities. For example, it is now possible to determine a huge portion of the genomic variation in thousands of patients in a disease study. But the torrent of available data also presents great computational challenges. The Department would like to collaborate with the Biology and the Chemistry and Biochemistry Departments to build a significant research group in this area. We believe it is crucial to hire at least one senior scientist--someone who will be a group leader, organize and lead grant applications, attract and mentor younger co- workers, and effectively foster interaction with others in the bioinformatics community (which we believe is important, as a sense of isolation can greatly inhibit the productivity of young scientists). In addition, we envisage hiring junior faculty in this area.

Information Security: This is another area of great scientific interest that has very important applications. The Department already has two members in this area, one in cryptography and one who works in information assurance. Our development plan is to hire one senior scientist in this area and additional junior faculty members.

Hiring in both of these core areas would bring many advantages to the wider College community. Both fields are inter-disciplinary, and would energize collaboration with allied departments. Both fields offer students many opportunities for employment after graduation and for graduate study, and both are very rich in research opportunities for undergraduates.

In addition to hiring in these two core development areas, the Department hopes to hire other faculty members. The specializations we are most interested in now are architecture, programming languages, and human-computer interaction. However, past experience has taught us that over a seven-year period new areas of importance are likely to emerge.

Curriculum Development

The Computer Science curriculum is in a constant state of redevelopment and evolution, partly because the lifespan of a technology era is rarely as long as ten years. Nevertheless, the basic content and structure of the

major, which is largely dictated by norms developed by professional societies in the field and other academic institutions, may not change too much over the next five to seven years. One significant change we plan to implement over this period is to offer more undergraduate courses in the above- mentioned areas of bioinformatics and information security. We hope to develop a strong sequence of graduate courses in each area as well.

A master's program in bioinformatics is currently in the planning stages with the Biology Department. We have both new hires and established faculty who are actively involved in various aspects of this exciting discipline, and we have established good rapport with several members of the Biology faculty who have complementary interests. We feel that a master's program in this field will draw well-qualified students in the region.

The Department also hopes to develop a collaborative undergraduate program with the Economics Department in computational finance, linked to the BBA program.

In addition, the Department plans to strengthen and expand both its Computer Information Technology (CIT) minor and its service-course offerings for non-majors. The recently-introduced technology minor provides instruction in the design and deployment of internet-based applications. While courses in this minor could be taught from an Information Technology perspective and stress the use of commercial tools, our courses stress design principles and realistic models based on algorithmic problem-solving. We believe that this minor will be seen by students as relevant and immediately stimulating, and will also motivate some of them to dig deeper and become computer science majors.

In an era where technological skills and a sound understanding of technological issues and trends are increasingly expected of college graduates, we feel our curriculum must address the needs of the Queens College student population--not just the needs of Computer Science majors. This is one reason why it is important for us to expand our CIT minor and other course-offerings for non- majors.

A second reason is that this is a good way for us to increase and stabilize our enrollment. Historically (if one can speak historically of the youngest discipline in our division!), Computer Science has been a "big major," with around sixty credits of required courses, and a "big department," with the fourth largest number of majors at the College in 2003. But, as "the technology department" at the College, Computer Science attracts many students who pursue their undergraduate education with a quite limited, career-oriented objective: to prepare themselves for their first job. While this relates to only one part of the Department's mission, it has led to a large fluctuation in our enrollment over the past few years as the regional technology-job market has fluctuated. From 2001 to 2004 our FTEs dropped by close to 40% -- reflecting the "dot-com bubble burst" of 2001-02 and subsequent concerns about off-shoring of programming jobs -- though more recent enrollment figures indicate that we are now past the low point and the number of students majoring or minoring in our subject is moving up again. We expect the planned expansion of our technology minor and service-course offerings for non-majors to significantly increase our student numbers, both directly and by attracting more well-qualified students to pursue our major, and so provide a more stable basis for the Department's future growth.

Projecting Our Identity

The Department needs to make its strengths and role on campus better understood by two audiences: prospective students, and our peers in other departments.

It is important for us to make clear to prospective students how and why programs in computer science, and our majors/minors in particular, are so important in today's liberal arts education. Students need to understand the five computing sub-disciplines identified by the IEEE/CS report cited in the Introduction, and how our department relates to those disciplines.

We believe that our peers in other departments are generally very much aware of the central role that technology plays in today's society and how it affects their own disciplines. Still, we feel it is important to

make it clear that, in addition to using technology effectively, the College needs to integrate an understanding of technology into the core of its curriculum, and that the Computer Science Department is the entity that is uniquely qualified to serve as the focal point of this integration process.

Recruitment and Retention of Faculty and Staff

Faculty

The Department has been fortunate to attract young and talented faculty members for tenure-track Assistant Professorships. Since Fall 2003 the following faculty members have joined the Department: Jinlin Chen (web design), Kent Boklan (cryptography), Jun Zheng (computer architecture) and Boojala Reddy (bioinformatics). We have been able to compete in the computer science job market, despite lower starting salaries, by offering start-up packages that boost our offers: equipment budgets up to $80,000, travel money for the first two years, and summer money for one or two months after the first academic year of employment. In addition, the College offers new faculty 12 hours release time over the first three years. We believe that we must continue to offer salaries at the top of the CUNY Assistant Professor scale to attract the best candidates, especially in highly competitive areas such as bioinformatics and information security.

Two faculty members have left the Department over the last three years: Carol Friedman (biomedical informatics) joined the Columbia Biomedical Informatics Department in Summer 2004 as a tenured full professor. Mingzhou Song (bioinformatics) joined the Bioinformatics program at New Mexico State University in Fall 2005 as an Assistant Professor.

The College was extremely supportive in our attempts to retain Carol Friedman, offering attractive salary and release time incentives. Although Columbia ultimately made it too difficult for Carol to return to us, we see that the College has demonstrated its willingness and ability to help us attract and retain excellent faculty insofar as it is possible.

Although most of our faculty have remained in the Department and obtained tenure, it is clear that faculty in some sought-after areas such as bioinformatics will have other opportunities: larger salaries, lower teaching loads, and more resources.

Technical Staff

As mentioned elsewhere, the Department must of necessity rely on its own technical staff to manage and maintain our networking and computing infrastructure. The College's Office of Converging Technologies is not positioned to provide the level of technical expertise and responsiveness we need to deal with either our day to day or our long-term requirements.

We currently have two full-time technical staff (Peter Chen and Koya Matsuo), and one part-time college assistant (Xiuyi Huang). Chen manages the Department's network infrastructure, Unix workstations, and handles administrative duties such as budget preparation and purchasing as well. While we are extremely fortunate to have such a talented and hardworking individual providing these services, the Department is so dependent on his services that we feel vulnerable because so much of our operations are so dependent on this single individual.

Matsuo can provide backup for Chen in some day-to-day network management tasks, but his real talent is in managing the department's numerous Linux and Windows systems. Huang provides support for application software and web development for the department. She also provides some support for hardware management. Although she is a skilled and dedicated resource for the Department, we are constrained by the fact that she is not a full-time employee.

An area where we feel we have been deficient is in providing professional development resources for our technical staff. They need to be funded for ongoing training so that they can continue to provide the department with the flexible state of the art infrastructure that we have come to depend on. Because there is

no realistic alternative to being self-sufficient with regard to planning, installing, and maintaining our technical infrastructure, it is important that we develop as much cross-training among the members of our staff as possible in order to minimize our exposure to overdependence on single individuals.

Questions for and Advice Sought from External Reviewers

- We feel that the main problem facing the department is its high teaching load. Do you agree?
- Given that tenure and promotions are based on research productivity, how can faculty balance their teaching duties and their research needs?
- Is there a precedent we can cite to convince the administration to take into account the fact that teaching in computer science often requires more preparation than teaching in most other disciplines, owing to the continual and rapid evolution of our field?
- We believe that the Department needs to establish research leadership in cluster areas in order to improve external funding. Do you agree?
- Do you think the areas we have chosen for growth, bioinformatics and information security, are appropriate given the current state of the discipline and our current faculty's credentials in these areas?
- What actions should the department take to attract leaders in these areas?
- What other steps should be taken to increase our research productivity and external funding?
- Are there changes we should make to improve our curriculum?
- How can we take advantage of the fact that we are located in New York City and the unique resources it provides?
- Do you see other weaknesses we are overlooking, but should attend to?
- Do you see ways in which we could better exploit our strengths?

Web Links

Association for Computing Machinery (ACM)
www.acm.org

Computer Research Association (CRA)
www.cra.org

Institute for Electronics and Electrical Engineers
www.ieee.org

Intel Corporation
www.intel.com

National Education Association (NEA)
www.nea.org

Queens College
qcpages.qc.cuny.edu

Safari Bookshelf
safaribooksonline.com

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[QC 2005]	Office of Institutional Research	Queens College Fact Book 2004-2005. *Queens College Office of Institutional Research, 2005.*
[Vegso 2005]	Vegso, J.	Interest in CS as a Major Drops Among Incoming Freshmen. *Computing Research News, 17(3), May 2005. Online Link.*
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Appendices

- Appendix A: Course Descriptions
- Appendix B: Faculty Vitae
- Appendix C: Student/Alumni Survey

Appendix A: Course Descriptions

12. Understanding and Using Personal Computers. 2 lec., 2 lab. hr.; 3 cr. Prereq.: Two and one-half years of high school mathematics, including intermediate algebra, or Mathematics 6 or 8. Hands-on introduction to computers, computation, and the basics of computer hardware and software. Students will have experience during the instructed microcomputer lab with a number of software environments including an operating system, a word processor, a spreadsheet and a database package. The course will focus on problem solving and programming with the context of these packages. In addition, students will acquire the skills needed to learn other software packages on their own. Not open for credit to students who have taken Computer Science 18. (SQ)

18. Computers with Business Applications. 2 lec., 2 lab. hr.; 3 cr. Prereq.: Admission to the Business and Liberal Arts minor or the Business Administration major. Fundamentals of using the operating system and application software. Business-oriented uses of software applications including: word processing, spreadsheets, presentations, and database management. Emphasis on realistic situations and problem-solving strategies used in business. An important part of the course is a research project/presentation of topics involving current issues arising from the use of computer technology in a business environment. Some sections will be limited to those admitted to the major in business administration, and others will be limited to those admitted to the minor in Business and Liberal Arts (BALA). (SQ)

80. Problem Solving with Computers. 2 lec., 2 lab hr.; 3 cr. Prereq.: Computer Science 12. An introduction to computer science through problem solving, focusing on the methodology of problem solving rather than specific hardware or software tools. Students will learn how to select and use specific software tools advantageously. Lab exercises will exemplify the problem solving methodology. (SQ)

81. HTML and WWW Programming. 3 hr.; 3 cr. Prereq.: Computer Science 80. Introduction to computer networks from a user's perspective and the World Wide Web. The course will provide hands-on experience with electronic mail, file transfer, Telnet, and Web browsers, including the creation of Web pages using HTML, Javascript, and CGI scripts; image preparation and editing; scanning and OCR.

82. Multimedia Fundamentals and Applications. 3 hr.; 3 cr. Prereq.: Computer Science 80. A comprehensive introduction to the fundamental concepts, techniques, and tools that underlie the use of multimedia in scientific and business applications. Major topics include the principles of image, sound, and video synthesis; software and industry standards; and typical applications.

84. Models of Computation. 3 hr.; 3 cr. Prereq.: Math 122. This course is intended to develop the ability to solve problems using differing models of computation. It will develop reasoning ability by creating a computing environment with very few rules which will then be used to develop algorithms within the scope of the model of computation. These environments will be models of actual computing environments. The nature of what an algorithm is will be developed.

85. Database Application Programming. 3 hr.; 3 cr. Prereq.: Computer Science 80. A continuation of Computer Science 80. Students will learn to program databases using SQL. Microsoft Access integrated with Visual Basic. In addition, object-oriented database programming such as Oracle and Jasmine will be covered.

86. Science, Computing Tools, and Instrumentation. 4 hr.; 3 cr. Prereq.: Math 122. Science and society; principles for scientific exploration; scientific visualization and mathematical analysis: concepts and techniques; computing tools for visualization and computational analysis; Internet tools for science exploration; concept of integrated computing environment for scientific study and collaboration; PC-instrumentation. Applications to social science, biochemistry, psychology, physical, chemical, and earth science. (SQ)

90.1, 90.2, 90.3. Topics in Computing. 1 hr.; 1 cr., 2 hr.; 2 cr., 3 hr.; 3 cr. Topics in computer programming and applications at a level appropriate for students who are not majoring in computer science.

Topics and prerequisites will be announced at registration time. The course may be repeated for credit providing the topic is different, and may not be applied toward the major in computer science.

111. Introduction to Algorithmic Problem Solving. 2 lec., 2 lab. hr.; 3 cr. Prereq. or coreq.: Math 120 or 151 or equivalent. Introduction to the principles and practice of programming. Topics include primitive data types; concepts of object, class, and method; control structures; arrays; procedures and functions; parameter passing; scope and lifetime of variables; input and output; documentation.

112. Introduction to Algorithmic Problem Solving in Java. 2 lec., 2 lab. hr.; 3 cr. Prereq. or coreq.: Math 120 or 151 or equivalent, and open only to students in the TIME-2000 program (consult the Department of Secondary Education for details). Introduction to the principles and practice of programming. Topics include primitive data types; concepts of object, class, and method; control structures; arrays; procedures and functions; parameter passing; scope and lifetime of variables; input and output; documentation.

211. Object-Oriented Programming in C++. 2 lec., 2 lab. hr.; 3 cr. Prereq.: Computer Science 111. Object-oriented algorithmic problem solving in C++, with attention to general as well as language-specific issues including pointer and pointer arithmetic; linked lists; memory management; recursion; operator overloading; inheritance and polymorphism; stream and file I/O; exception handling; templates and STL; applications of simple data structures; testing and debugging techniques.

212. Object-Oriented Programming in Java. 2 lec., 2 lab. hr.; 3 cr. Prereq.: Computer Science 111. Object-oriented algorithmic problem solving in Java, with attention to general as well as language-specific issues including applications, event- driven programming; elements of graphical user interfaces (GUIs); linked lists; recursion; inheritance and polymorphism; file I/O; exception handling; packages; applications of simple data structures; applets; concept of multi-threading; testing and debugging.

220. Discrete Structures. 3 lec. hr.; 3 cr. Prereq.: Mathematics 120 and 151 or 141; Computer Science 111. Algorithms, recursion, recurrences, asymptotes, relations, graphs and trees, applications. (SQ)

240. Computer Organization and Assembly Language. 3 lec., 1 lab. hr.; 3 cr. Prereq.: Computer Science 111. Principles of computer design and implementation. Instruction set architecture and register transfer level execution; storage formats; binary data encoding; bus structures; assembly language programming. (SQ)

280. Self-Study Programming. 3 hr.; 1 cr. Prereq.: Computer Science 313. Self-study and mastery of a programming language or package through reading and practice. Students should consult the department at the beginning of the semester for reading materials and assignments. May be repeated for a maximum of five credits provided the topic is different.

310. WWW Programming. 1 hr.; 1 cr. Prereq.: Permission of the instructor. Students will learn to do server-side programming for Web pages through hands-on assignments. Topics include the Common Gateway Interface (CGI), UNIX scripts in PERL, Javascript, image manipulation, and text scanning. May not be used as an elective for the computer science major.

313. Data Structures. 3 hr.; 3 cr. Prereq.: Computer Science 211, 212, and 220. Fundamental data structures and their implementations: stacks, queues, trees (binary and AVL), heaps, graphs, hash tables. Searching and sorting algorithms. Runtime analysis. Examples of problem-solving using divide-and-conquer, backtracking, and greedy-algorithm. (SQ)

316. Principles of Programming Languages. 3 lec. hr.; 3 cr. Prereq.: Computer Science 220, 240, 313, and 320. Principles and implementation of programming languages. Topics include: the procedural, object-oriented, functional, and logic programming paradigms; syntax (BNF, expression grammars, operator precedence and associativity); variables (scope, storage bindings, and lifetime); data types; control

structures; function call and return (activation records and parameter passing); formal semantics. Programming assignments.

317. Compilers. 3 hr.; 3 cr. Prereq.: Computer Science 316. Formal definitions of programming languages: introduction to compiler construction including lexical, syntactic, and semantic analysis, code generation, and optimization. Students will implement portions of a compiler for some structured language. (SQ)

320. Theory of Computation. 3 hr.; 3 cr. Prereq.: Computer Science 111 and 220. Finite state machines, regular languages, regular expressions, grammars, context-free languages, pushdown automata, Turing machines, recursive sets, recursively enumerable sets, reductions, Halting problem, diagonalization.

323. Design and Analysis of Algorithms. 3 hr.; 3 cr. Prereq.: Computer Science 220 and 313. Advanced data structures: B-trees, graphs, hash-tables. Problem-solving strategies including divide-and-conquer, backtracking, dynamic programming, and greedy algorithms. Advanced graph algorithms. Time complexity analysis. NP-complete problems. Applications to sorting, searching, strings, graphs. Programming projects. (SQ)

331. Database Systems. 3 hr.; 3 cr. Prereq.: Computer Science 220, 313. ER modeling; functional dependencies and relational design; file organization and indexing; relational algebra and calculi as query languages; SQL; transactions, concurrency and recovery; query processing. Programming projects.

332. Object-Oriented Databases. 3 hr.; 3 cr. Prereq.: Computer Science 331. Review of basic database components and architecture; comparisons of OO databases with relational databases; modeling languages and methods, data definition languages; schema design methodology; the role of inheritance, object identity, and object sharing in OODBs; file structures and indexes for OODBs; transaction processing; concurrency control and recovery; development of database applications using a commercial OODB system.

334. Data Mining and Warehousing. 3 hr.; 3 cr. Prereq.: Math 241 and Computer Science 313. Data mining and data warehousing: data warehouse basics; concept of patterns and visualization; information theory; information and statistics linkage; temporal-spatial data; change point detection; statistical association patterns; pattern inference and model discovery; Bayesian networks; pattern ordering inference; selected case study.

335. Information Organization and Retrieval. 3 hr.; 3 cr. Prereq.: Computer Science 331. Concepts of information retrieval: keywords and Boolean retrieval; text processing, automatic indexing, term weighting, similarity measures; retrieval models: vector model, probabilistic model; extended Boolean systems: fuzzy set, p-norm models; linguistic model; extensions and AI techniques: learning and relevance feedback; term dependence; document and term clustering; network approaches; linguistic analysis and knowledge representation. Implementation: inverted files; efficiency issues for large-scale systems; integrating database and information retrieval.

340. Operating Systems Principles. 3 hr.; 3 cr. Prereq.: Computer Science 220, 240, and 313. Principles of the design and implementation of operating systems. Concurrency, multithreading, synchronization, CPU scheduling, interrupt handling, deadlocks, memory management, secondary storage management, file systems. Programming projects to illustrate portions of an operating system. (SQ)

342. Operating-System Programming. 3 hr.; 3 cr. A study of the internal structures of a particular operating system such as Unix, or another chosen by the department. (The operating system to be studied is announced at registration time.) Projects are assigned which involve system calls, use of the I/O and file systems, memory management, and process communication and scheduling. Projects may also involve developing new or replacement modules for the operating system Such as the command interpreter or a device driver. A student may receive credit for this course only once. (SQ)

343. Computer Architecture. 3 hr.; 3 cr. Prereq.: Computer Science 240. Instruction set architectures, including RISC, CISC, stack, and VLIW architectures. The memory hierarchy, including cache design and performance issues, shared memory organizations, and bus structures. Models of parallel computing, including multiprocessors, multicomputers, multivector, SIMD, PRAM, and MIMD architectures. Pipelining models, including clocking and timing, instruction pipeline design, arithmetic pipeline design, and superscalar pipelining. (SQ)

344. Distributed Systems. 3 lec., 1 lab. hr.; 3 cr. Prereq.: Computer Science 340. Issues in the implementation of computer systems using multiple processors linked through a communication network. Communication in distributed systems including layered protocols and the client-server model; synchronization of distributed processes and process threads.

345. Logic Design Lab. 2 lec., 3 lab. hr.; 3 cr. Prereq.: Computer Science 340. Design principles and laboratory implementation of logical devices from flip-flops to peripheral interfaces.

348. Data Communications. 3 hr.; 3 cr. Prereq.: Computer Science 343. Computer communications and networks; carriers, media, interfaces (RS 232, RS 422, CCITT); circuit types, data codes, synchronous and asynchronous transmission; protocols (OSI, TCP/IP); modems, multiplexors, and other network hardware; error correction and encryption; voice and data switching: local area networks, ISDN, packet switching; issues in the architecture, design, and management of networks. (SQ)

352. Cryptography. 3 hr.; 3 cr. Prereq.: Computer Science 313. An introduction to cryptographic practices, concepts and protocols. Topics include the mathematical foundations for cryptography, public key methods (e.g., RSA and El Gamal), block ciphers (e.g., DES and Rijndael), key agreement architectures (Diffie-Hellman), linear feedback shift registers and stream ciphers (e.g., A5 for GSM encryption), signatures and hash functions, (pseudo) random number generators and how to break the ENIGMA machine.

355. Internet and Web Technologies. 3 hr.; 3 cr. Prereq.: Computer Science 313. Internet protocol stack, analysis of representative protocols; Internet applications: client-server architecture, popular Internet application protocols, Internet application design, client side programming, server side programming, Web application and website design; programming projects.

361. Numerical Methods. 3 hr.; 3 cr. Prereq.: Computer Science 211 and Math 201. Numerical methods and efficient computation, approximation, and interpolation. Computer solution of systems of algebraic and ordinary differential equations.

363. Artificial Intelligence. 3 hr.; 3 cr. Prereq.: Computer Science 316. Principles of artificial intelligence. Topics include logic and deduction; resolution theorem proving; space search and game playing; language parsing; image understanding; machine learning and expert systems. Programming projects in LISP, PROLOG, or related languages. (SQ)

368. Computer Graphics. 3 hr.; 3 cr. Prereq.: Computer Science 220 and 313. Introduction to the hardware and software components of graphics systems, representations of 2D and 3D primitives, geometric and viewing transformations, techniques for interaction, color models and shading methods, algorithms for clipping, hidden surface removal, and scan-conversion. Programming projects using a graphics API to demonstrate the process of computerized image synthesis. (SQ)

370. Software Engineering. 4 lec., 1 lab. hr.; 3 cr. Prereq.: Computer Science 220 and 313. Principles of software engineering including the software life cycle, reliability, maintenance, requirements and specifications, design, implementation and testing. Oral and written presentations of the software design. Implementation of a large programming project using currently-available software engineering tools.

381. Special Topics in Computer Science. 381.1-381.4, 1-4 hr.; 1-4 cr. Prereq.: Permission of department. No more than 3 credits of CS 390-397 may be used as an elective for the Computer Science major or minor.

390. Honors Readings in Computer Science. 3 hr.; 3 cr. Prereq.: Junior or senior standing and permission of instructor. Students will study and report on survey and research papers dealing with various current topics in computer science selected by the instructor. Topics for each offering of the course will be announced at registration time.

391. Honors Problems in Computer Science. 391.1-391.3, 1-3 hr.; 1-3 cr. Prereq.: Permission of department. Open to students majoring in computer science who, in the opinion of the department, are capable of carrying out the work of the course. Each student works on a research problem under the supervision of a member of the staff.

393. Honors Thesis. 3 hr.; 3 cr. Prereq.: Junior or senior standing and approval of the Department's Honors and Awards Committee. The student will engage in significant research under the supervision of a faculty mentor and a thesis committee consisting of the mentor and two additional faculty members. The thesis proposal and committee must be approved by the Departmental Honors and Awards Committee. Upon completion of the research paper, an oral presentation of the results, open to the public, will be given. With the approval of the mentor, thesis committee, and the Department's Honors and Awards Committee, the course may be repeated once for credit when the level of the student's work warrants a full year of effort.

395. Research Projects. 395.1-395.3, 1-3 hr.; 1-3 cr. Prereq.: Permission of department. Open to majors and non-majors who, in the opinion of the department, are capable of carrying out an independent project of mutual interest under the supervision of a member of the staff.

398. Internship. 398.1, 45 hr.; 1 cr.; 398.2, 90 hr., 2 cr.; 398.3, 135 hr.; 3 cr. Prereq.: Completion of 15 credits in computer science and departmental approval. Computer science students are given an opportunity to work and learn for credit. Students should consult the College's Office of Career Development and Internships for listings of available internships and procedures for applying. A proposal must be approved by the department before registration. The student's grade will be based on both the employer's and faculty sponsor's evaluations of the student's performance, based on midterm and final reports. A limit of 6 credits of internships may be taken. Computer Science 398 may not be applied to the computer science major or minor.

Appendix B: Curriculum Vitae

Dr. Kent D. Boklan

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Education

PhD in Mathematics (1992) [Univ. of Michigan, Ann Arbor, MI]: Analytic Number Theory

SB in Mathematics (1986) [Massachusetts Institute of Technology, Cambridge, MA]

Professionalized as a Cryptologic Mathematician (1998) [National Security Agency, Ft. Meade, MD]

Industry and Government Professional Experience

Umbanet, Inc (2002–Present) [New York, NY] Vice President and Head of Technical Development
Designing and overseeing the creation of technology enabling secure auditable transactions through electronic mail

Cryptographic Consulting, LLC (2003 – Present) [New York, NY]
Providing ESRA compliance consulting services (to the NYC Police Department, NYC Sanitation Department and NYC Department of Information Technology and Telecommunications), data security, privacy, and database de-identification consulting

Decode Genetics (2001) [Reykjavík, Iceland] Research Scientist in Bioinformatics, Database, Data Mining Groups, designed inference controls for identity masking in health databases, enabled data transmission security and created software for the detection of errors and inversions in the sequencing of the human genome

National Security Agency (1996-1999) [Ft. Meade, MD] (Most work CLASSIFIED)
Engaged in cryptographic and cryptanalytic research, data mining and work with large sets

New York Software Industry Association (2003 – Present) Security and Privacy Rights SIG moderator

Grant proposal reviewer for the National Science Foundation, NSERC [Canada] and MSP [NSA] and referee for scholarly journals and texts (1992- Present)

Advisory Panel member for the Committee on American Mathematics Competitions (1996-Present), principle contributing representative (for Iceland) to several European competitions and to domestic contests (such as the W L Putnam examination)

Academic Appointments*:*

Queens College (2004 – Present) [Queens, NY], Department of Computer Science *concurrent with*

CUNY Graduate Center (2004 – Present) [NY,NY]. Department of Computer Science

New York University (2003 – 2004) [NY,NY], Gallatin School

University of Iceland (2002) [Reykjavík, Iceland], Department of Computer Science

University of Reykjavík (2000) [Reykjavík, Iceland], School of Business

Menntaskólinn við Sund (1999-2000) [Reykjavík, Iceland], Department of Mathematics

Westminster College (1995-1996) [New Wilmington, Pennsylvania], Department of Mathematics

University of Michigan (1987-1991, 1994-1995) [Ann Arbor, Michigan], Department of Mathematics

Vanderbilt University (1992-1994) [Nashville, Tennessee], Department of Mathematics

Massachusetts Institute of Technology (1983-1985) [Cambridge, Mass], Department of Mathematics

Grants

NSF PFI (Partnership for Information) Grant (awarded March 2005) through the CUNY Institute for Software Design and Development for improved flow treatments for confidential information in a broadband environment

Publications

[1] *Password Verification Without Fingerprint Storage*, in preparation
[2] (with D. Bormotov) *Braid Groups and a New Method for Key Hiding*, in preparation.
[3] *Twin Primes Without Sieving – and Brun's Constant*, in preparation
[4] *How I Broke The Confederate Code (137 Years Too Late)*, submitted to Cryptologia
[5] *Inference Control for the Icelandic Health Database*, deCODE Genetics, 2001.
[6] *Data Security in Transmission and Key Length Security Projections*, deCODE Genetics, 2001.
[7] *A Path Algorithm for Microlocal Corrections and Inversion Detection in the Human Genomic Sequence*, deCODE Genetics, 2001.
[8] (with T. D. Wooley) *On Weyl Sums for Smaller Exponents*, in preparation.
[9] *Remarks on Bayes' Formula*, National Security Agency, 1999. [Classified]
[10] *Applications* of *Cyclotomic Polynomials to Cryptography*, National Security Agency, 1998. [Classified]
[11] *Algebraic Varieties and Cryptography*, National Security Agency, 1999. [Classified]
[12] *Fugitive Pieces: Elementary Results for Twin Primes*, National Security Agency, 1999.
[13] (with J. Kraft) *On the Distribution of Large Primes*, National Security Agency, 1998. [Classified]
[14] *A New Approach for Analyses of Large Data Sets*, National Security Agency, 1997. [Classified]
[15] *A New Software Tool for Analyzing Large Data Sets*, National Security Agency, 1997. [Classified]
[16] *Applications of a New Method in Graph Theory*, National Security Agency, 1998. [Classified]
[17] (with J. Keiser) *Permutations and Poisson Distributions*, National Security Agency, 1996. [Classified]
[18] *A Quantitative Roth's Theorem on Arithmetic Progressions*, National Security Agency, 1996.
[19] *On a Certain Double Map and its Cryptographic Significance, I* , National Security Agency, 1998. [Classified]
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[26] *On Writing Papers in Mathematics*, (incl. in) Rhetoric Across the Curriculum (ed. M. McPhail), Harcourt-Brace-Jovanovich.
[27] Differential Equations: A Systems Approach, Solution Manual, Prentice Hall, 1998.
[28] *The n-Number Game*, Fibonacci Quarterly, 22 (1984), 152-155.

Theodore Brown

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Computer Science Department
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New York, New York 10016
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tbrown@gc.cuny.edu

EDUCATION:

New York University, New York
PhD awarded 1971 in Operations Research and Industrial Engineering

New York University, New York
Masters of Science awarded 1968 in Operations Research

City College of New York, New York
Bachelor's Degree awarded 1966 in Mechanical Engineering

EMPLOYMENT:

Executive Officer, CUNY Ph.D. Program in Computer Science, Graduate Center, City University of New York (2000 to present)

Executive Director, CUNY Institute for Software Design and Development, City University of New York (2000 to present)

Professor, Computer Science Department, Queens College, City University of New York (1991 to present)

Chairman of Computer Science, Computer Science Department, Queens College, CUNY (1988 – 2000)

Associate Professor, Computer Science Department, Queens College, CUNY (1981-1991)

Assistant Professor, Computer Science Department, Queens College, CUNY (1971-1981)

Adjunct Associate Professor, Einstein College of Medicine (1982-1989)

Consultant, Operations Research, Chemical Bank (1967-1971)

Graduate Assistant, Operations Research Department, New York University (1966-1967)

Mechanical Engineer, General Electric Company (1965-1966)

SELECTED PUBLICATIONS:

Katzman R., T. Brown, P. Fuld, A. Peck, R. Schechter, and H. Schimmel, *"Validation of a Short Orientation-Memory-Concentration Test of Cognitive Impairment,"* **American Psychiatry**, 140:6, 734-739, June 1983.

Katzman, R., R. Terry, R.D. Teresa, T. Brown, P. Davies, P. Fuld, R. Xiong, and A. Peck, *"Clinical, Pathological, and Neurochemical Changes in Dementia: A Subgroup with Preserved Mental Status and Numerous Neocortical Plaques,"* **Annals of Neurology**, 23,2, p138, 1988.

Brown, T., *"A Note on the System Congestion of the Parallel Divide and Conquer Paradigm,"* **J of the Institute of Mathematics & Computer Science** (Computer Science Series), 1,2, 55-61 Dec. 1990.

Xiong, R. and T. Brown, *"Parallel Median Splitting, k-splitting, Merging and Sorting,"* **IEEE Transactions on Parallel and Distributed Systems**, 4,5 559-565, May 1993.

Brown, T. and R. Xiong, *"A Parallel Quicksort Algorithm,"* **J of Parallel and Distributed Computing**, 19, 83-89, 1993.

Brown, T. *"On Producing an Optimal Schedule for an M/G/1 Priority Feedback Queue,"* ***Informs New Orleans***, Fall 1995.

SERVICE: (selected)

Chair of the Computer and Information Sciences Section, The New York Academy of Sciences, 1998 to present
Member, The New York Regional Consortium, 2000 to present
Chair, Computer Science Discipline Council, CUNY, 1998 to present
Executive Board, New York Industry Software Association, 2001 to present
Board, New York Industry Software Association, 1999- 2001

PROFESSIONAL SOCIETIES:

Member, Informs
Association for Computer Machinery
IEEE Computer Society

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PhD, Assistant Prof.

Queens College, CUNY

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Flushing, 11367, NY

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Education

- PhD of Engineering — Joint program in Dept. of EE and Information Tech., Technical Univ. of Munich and School of Information Science and Technology, Tsinghua Univ.1999
- B. Engineering — School of Information Science and Technology, Tsinghua Univ.1994
- B. Economics — School of Economics and Management, Tsinghua Univ. 1994

Research Experiences

- 09/2003 ~ **Dept. of Computer Science, Queens College, CUNY**

  Assistant Professor: Teaching Internet Technology & Web Design, Data Structures, etc. Research on web technology, software engineering, embedded systems

- 01/2002 ~ 08/2003 **Dept. of Information Science & Telecommunications, University of Pittsburgh**

  Visiting Assistant Professor: Teaching Programming Techniques, Software Engineering, Human Computer Interface, etc.

  Project leader: Information Fusion for Command and Control: from Data to Actionable Knowledge and Decision, a joint project with Carnegie Mellon University and US Air Force Research Lab.

- 01/2003 ~ 05/2003 **Dept. of Mathematics & Computer Science, Edinboro University of Pennsylvania**

  Assistant Professor: Teaching Internet Technologies, Project Management, Essential Computing. Research on adaptive web content service.

- 7/1999 ~ 12/2001 **Media Management Group, Microsoft Research Asia**

  Researcher: Web content authoring, adaptation and delivery project

  Invented Function-based Object Model (FOM) which understands authors' intention by identifying object function. Won Highlight Paper Award in the 10th World Wide Web Conference. Developed a new product – Automatic Web Adaptation Tool.

  Invented Web Information Presentation Structure (WIPS), with which web authors can easily perform content authoring and adaptation. Designed a system framework for web information extraction/retrieval and data mining based on WIPS.

  Designed and developed a system framework for adaptive web content delivery in heterogeneous Internet environments (user, network and device).

  Developed a prototype for user access pattern based website link structure evaluation and improvement.

- 12/1997 ~ 12/1998 **Dept. of EE and Information Tech., Technical Universiy of Munich**

  Visiting Scholar: VIMP (Decentralized Intelligent Microsystems for Private House)

  Developed the control and communication system for intelligent house based on European Installation Bus. (VIMP is a joint project with 7 members from academic and industry sponsored by Ministry of Science and Technology, Germany)

- 03/1996 ~ 07/1999 **Dept. of Automation, Tsinghua Univ.**

  Founder and Project Leader: Intelligent House Lab

  Designed and Developed a real time multitask embedded operating system. Built a model of Intelligent House and a service terminal.

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E-mail: jchen@cs.qc.edu

- 10/1995 ~ 02/1996 **JingSheng Corp.**
  System Engineer (Part Time): petroleum detection system project
  Developed the control & communication subsystem for a petroleum detection system.
- 05/1995 ~ 09/1995 **Qian Shan Electronics Corp.**
  Team Leader: Management Information System project
  Developed a Management Information System for the company.
- 09/1993 ~ 07/1994 **Tsinghua Univ.**
  Team Leader: Computer Communication Card project
  Developed a voice, fax and modem communication card for personal computer.
- 06/1993 ~ 08/1993 **China Academy of Science**
  Intern, Team Leader: User Interface of Coarseness Detection Instrument
  Developed the User Interface of Coarseness Detection Instrument.
- 09/1992 ~ 06/1994 **Ju Ye Corp.**
  Software Design Engineer (part time): Vibration Balance Instrument
  Developed an embedded operating system and some applications.
- 08/1991 ~ 08/1992 **Tsinghua Univ.**
  Team Leader: One-key Electrical Musical Instrument
  Developed a one-key electrical musical instrument with Intel 8051 as CPU.

Teaching Experiences

- 09/2003 ~ **Dept. of Computer Science, Queens College, CUNY**
  Assistant Professor: Teaching Internet Technology & Web Design, Data Structures, etc.
- 01/2002 – 08/2003 Visiting Assistant Professor, Data Structure, Programming tools.
  Dept. of Information Science and Telecommunications, Univ. of Pittsburgh
- 01/2003 – 05/2003 Assistant Professor, Internet Technology, Project Management, Essential Computing
  Dept. of Mathematics & Computer Science, Edinboro University of PA
- 12/1997 – 12/1998 Teaching Assistant, Electrical Measurement
  Dept. of EE and Information Tech., Technical Univ. of Munich, Germany
- 08/1996 – 11/1997 Teaching Assistant, Tutor of undergraduates
  School of Information Science and Technology, Tsinghua University
- 02/1996 – 07/1996 Teaching Assistant, Principle of Microcomputer
  School of Information Science and Technology, Tsinghua University
- 09/1995 – 01/1996 Teaching Assistant, Technology of Analog Electronics
  School of Information Science and Technology, Tsinghua University

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Professional Activities and Honors

- Program Committee Member /Reviewer
  - IADIS International Conference WWW/Internet 2003
  - Advanced Visual Interfaces Conference (AVI2002)
  - IADIS International Conference WWW/Internet 2002
  - The Tenth International World Wide Web Conference (WWW10).
  - The 2001 IEEE Pacific Rim Conference on Multimedia (PCM 2001)
- Professional Affiliations
  - ACM (Association for Computer Machinery)
  - ACM SigWeb(Special Interest Group on Web)
  - IEEE (Institute of Electrical and Electronics Engineers)
  - Scientific Partner of European Installation Bus Association
- Honors
  - Highlight Paper Award, the 10th International World Wide Web Conference (2001)
  - Top Ten Elite, Automation Department, Tsinghua Univ. (out of 1,000 students) (1997)
  - Consecutive outstanding student scholarships in Tsinghua Univ. for 9 years

Patents (US)

- Function-based Object Model for Use in Website Adaptation (09/893,335)
- Web Information Presentation Structure for Web Page Authoring (Pending status)
- FOM based Website Adaptation for Mobile Devices (Pending status)

Publications

- Improving Hidden Markov Model for web information extraction, INFORMS 2005, New Orleans
- UTSAF: A Simulation Bridge between OneSAF and the Unreal Game Engine. In: 2003 IEEE International Conference on Systems, Man & Cybernetics, October 5–8, 2003, Washington, D.C., USA
- UTSAF: A Multi-Agent based Framework for Supporting Military-based Distributed Interactive Simulations in 3D Virtual Environments. In: 2003 Winter Simulation Conference, Dec. 7 – 10, 2003, Louisiana, USA
- UTSAF: Getting the Best of Consumer Graphics into Military Simulations, In: Proceedings of the Human Factors and Ergonomics Society 47th Annual Meeting 2003, October 13-17, 2003, Denver, Colorado, USA
- User Behavior based Website Link Structure Evaluation and Improvement. In: IADIS International Conference WWW/Internet 2002, Nov. 13 - 15, 2002, Portugal
- Visual Based Content Understanding towards Web Adaptation. In: Second International Conference on Adaptive Hypermedia and Adaptive Web-based Systems, May 29 - 31, 2002, Spain
- Website Link Structure Evaluation and Improvement Based on User Visiting Patterns. In: The 12th ACM Conference on Hypertext and Hypermedia (Hypertext 01), Aug. 14-18, 2001, Denmark
- Function-based Object Model Towards Website Adaptation, In: 10th International World Wide Web

Jinlin Chen
PhD, Assistant Prof.

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E-mail: jchen@cs.qc.edu

Conference (Highlight Paper Award), Hong Kong, May 1-5, 2001

- An Adaptive Web Content Delivery System, International Conference on Adaptive Hypermedia and Adaptive Web-based Systems (AH2000), Aug. 28 – 30, 2000
- Research on Internet Connection and Intelligence of Home Automation System, Computer Engineering, Vol 26, No.8, 2000
- Adaptive Delivery of HTML Contents, 9th International World Wide Web Conference, Poster Proceedings, pp24-25, Amsterdam, The Netherlands, May 15-19, 2000
- Study on Message Server Based Embedded Real Time System Process Management, Computer Engineering and Science, No. 5, 2000
- Study on Message Port Based O(1) Distributed Exception Handling Mechanism, Computer Engineering, No.4, 2000
- Study on Determinate Periodic Task Based Process Management and its Schedulability, Journal of Computer Research and Development, Vol. 37, no.2, 2000
- An OOD Approach for Embedded Real Time Control System Based on EIB. International European Installation Bus Scientific conference'99, Munich, Germany, October 1999
- Port Object Based OOD Approach for Embedded Real Time System. In: International Symposium on Future Software Technology'99, Nanjing, China, October 1999
- Study on reliability index system of repairable systems with undetectable failures. In: the 8th Computer Fault Tolerance Conference, Wuhan, China, October 1999
- Reliability Analysis of repairable k-out-of-n: G System with Unrecoverable Failures. In: SAFEPROCESS'99, Beijing, China, March 1999
- Research on Reliability Index of Repairable System with Unrecoverable Failure, Journal of Tsinghua University science and technology, Vol. 38, no. 9, Sept. 1998
- Reliability Analysis of k-out-of-n: G Repairable System, Journal of Tsinghua University science and technology, Vol. 38, no. 3, Sept. 1998

Professional Skills

- Programming languages: Proficient in C, C++, Embedded C (Keil, Tasking), Assemble, PLM
  Experienced in C#, COM, SQL, UML, Java, VB
- Internet-related technologies and protocols: With solid background on HTTP, TCP/IP, XML, DHTML, WML, SOAP (Simple Object Access Protocol), ICAP (Internet Content Adaptation Protocol), IIS Server

Curriculum Vitae
Simina Fluture

Computer Science Department
Queens College, CUNY
Email: fluture@cs.qc.edu

Education

Oct. 2004	**Ph.D. in Computer Science** The Graduate School and University Center CUNY, New York, NY
02/1999	**MA Computer Science** Queens College, CUNY, Flushing , NY
06/1986	**BS Applied Mathematics** Institute for Construction Engineering, Bucharest, Romania

Employment

Sep. 2004 – Present	**Wagner College** Adjunct Assistant Professor
Aug. 2004 – Present	**CUNY – Queens College** Lecturer with CCE
Fall 1999 – Aug. 2004	**CUNY – Queens College** Lecturer
Jan. 2000 –Aug. 2002	**Weill Medical College** Research Associate in Radiology
1998 – Summer 1999	**CUNY – Queens College** Substitute Instructor
1997	**CUNY – Queens College and Hunter College** Adjunct Lecturer
1995 – Oct. 1999	**Medical Billing, Flushing, NY** Self Employed
1992 – 1995	**Alpha Omega Imaging, New York, NY** Senior Analyst
1989 – 1992	**Institute For Hydroelectric Studies, Bucharest, Romania** Project Engineer
1986 – 1989	**Office for Territorial Land Management, Timisoara, Romania** Engineer

Teaching Experience

1997 – Present **CUNY – Queens College and Hunter College**
1 semester (Fall 1997) teaching load of 9 hours/week
1 semester (Spring 1998) teaching load of 10 hours/week
2 semesters (Fall 1998, Spring 1999) teaching load of 11.2 hours/week
9 semesters (Fall 1999 – Spring 2004) teaching load of 11.2 hours/week

Last semesters taught courses:

Spring 2004: CS340: Operating Systems Principles (2 sections)
CS344: Distributed Systems (2 sections)
CS715: Distributed Systems (2 sections)

Fall 2004: CS340: Operating Systems Principles (2 sections)
CS344: Distributed Systems (2 sections)
CS715: Distributed Systems (2 sections)

Fall 2003: CS340: Operating Systems Principles (1 section)
CS350/715: Parallel and Distributed Computing (3 sections)

Summer II 2003: CS220: Discrete Structures (1 section)
CS340:Operating Systems Principles (1 section)

Spring 2003: CS220: Discrete Structures (1 section)
CS340: Operating Systems Principles (2 sections)
CS350: Parallel and Distributed Computing (1 section)

Fall 2002: CS241: Operating Systems Principles (2 sections) – old major
CS340: Operating Systems Principles (1 section) – new major
CS350: Parallel and Distributed Computing (1 section)

Spring 2002: CS220: Discrete Structures (2 sections)
CS241: Operating Systems Principles (3 sections)

Fall 2001: CS220: Discrete Structures (1section)
CS241: Operating Systems Principles (2 sections)
CS350: Parallel and Distributed Computing (1section)

Summer 2001: CS241: Operating Systems Principles (1 section)
CS350/715: Parallel and Distributed Systems (1 section)

Spring 2001: CS241: Operating Systems Principles (2 sections)
CS350/715: Parallel and Distributed Systems (2 sections)
CS398.1, 398.2, 398.3: Internship Course - Undergraduate Program
CS788.2,788.3: Internship Course - Graduate Program

Fall 2000: CS220: Discrete Structures (1section)
CS241: Operating Systems Principles (3 sections)
CS350/715: Parallel and Distributed Systems (2 sections)
CS398.1,398.2, 398.3: Internship Course – Undergraduate Program
CS788.1,788.2,788.3: Internship Course – Graduate Program

I am currently teaching three core courses in the undergraduate program of Computer Science Department: Discrete Structures, Operating Systems Principles, Parallel and Distributed Computing.
I am the course coordinator responsible for defining the syllabus for CSCI 241/340 (Operating Systems Principles).
I have also taught a variety of other courses such as Computer Architecture and Computability.

Research

My research involves developing new advanced computer-aided mathematical methods based on computer vision techniques such as image processing, pattern recognition and characterization that can be used in the detection and classification of objects seen on radiological images.

Papers

Evaluation of Three-Dimensional Growth Assessment of Pulmonary Nodules
William J. Kostis, Anthony P. Reeves, Simina C. Fluture, David F. Yankelevitz, Claudia I. Henschke.
accepted for publication by Journal of Radiology, pending revision

Volumetric Assessment of Emphysema on Low-Dose Screening CT Scans
William J. Kostis, Simina C. Fluture, Ali O. Farooqi, David F. Yankelevitz, Claudia I. Henschke.
Proceedings of SPIE on Image Processing, February 2003

Method for Analysis and Display of Distribution of Emphysema in CT Scans
William J. Kostis, Simina C. Fluture, David F. Yankelevitz, Claudia I. Henschke.
Proceedings of SPIE on Image Processing, February 2003

Reproducibility of Pulmonary Nodule Volume Estimation on Current and Next-generation CT Scanners
William J. Kostis, Deborah J. Walter, Simina C. Fluture, David F. Yankelevitz and Claudia I. Henschke.
accepted for publication

Papers in progress

Intersection Digraphs: Minimal Representation for Transform Diagraphs
Christina M. Zamfirescu, Simina C. Fluture (*work in progress*)

Conferences

Graph Theory Day 44 at Graduate Center, November 2002 *(member of the organizing committee)*

Presented posted "Specific Applications of Computer Vision Methods and Tools in Radiology" at **4th Annual Science Day at CUNY – Graduate Center, March 2003**

Web Publications

Lecture notes in Operating Systems Principles (200 pages)

Lecture notes in Distributed Systems (150 pages)

Lecture notes in Discrete Mathematics (120 pages)

Grants awarded

PSC – CUNY Research Program: PSC – CUNY Award # 64394-0033 ($ 4190.00) 2002 – 2003
Determination of Malignancy in Solitary Pulmonary Nodules based on Volumetric Growth Rate

PSC-CUNY Research Program:PSC-CUNY Award #65379-0034 ($3,453.00) 2003-2004
A novel Method for Assessment of Degree of Emphysema and for Analysis and Display of Distribution of Emphysema in Chest CT Scans.
(grant in progress)

PSC-CUNY Research Program:PSC-CUNY Award #66425-0035 ($4,425.00) 2004-2005
A Fully-Automated Modular Segmentation Algorithm for Screening, Low-Dose Radiation, Lung CT-Scan Images

Curriculum Vitae : (as of April 1, 2005)

Dr. Robert Goldberg
Computer Science Department
Queens College of CUNY
65-30 Kissena Blvd.
Flushing, New York 11367

Work Experience :

2000-Present	Professor of Computer Science at QC of CUNY
1995-Present	Doctoral Faculty, Department of Computer Science, CUNY Graduate Center
1995-1999	Associate Professor of Computer Science at QC of CUNY
1989-1994	Assistant Professor of Computer Science at Queens College (QC) of the City University of NY Tenured, 1994
1988	Instructor of Computer Science at Queens College of the City University of New York (CUNY)
1987	Assistant Research Scientist at Courant Institute, New York University (NYU) Robotics Laboratory
1983 - 1987	Office of Naval Research (ONR) Graduate Research Fellow at Courant Institute of Mathematical Sciences, NYU

Education :

1983-1989	Courant Institute of Mathematical Sciences (CIMS) at New York University (NYU)
Feb. 1989	Ph. D. in Computer Science
June 1987	M. Ph. in Computer Science
June 1985	M. S. in Computer Science
1981-1983	Queens College of the City University of New York
June 1983	B. A. in Computer Science and Mathematics, Summa Cum Laude, and Departmental Honors

Articles :

Submitted :

A) Natalie Hammerman and Robert Goldberg, "Evaluation Strategies for a Genetic Algorithm," submitted to *IEEE Trans. on SMC,* 19 pp.

B) Reuven Gallant and Robert R. Goldberg, "Teaching Formal Methods To Non-Mathematicians: A Case Study Using Statecharts," submitted to the *Mathematics and Computer Education Journal*, 14pp.

C) Minette Carl, Robert Goldberg and Jerry Waxman, “Are High Schools Enabled For Computer-Based Learning Technologies?” *submitted* to the *Mathematics and Computer Education Journal*, 16 pp.

D) Isak Taksa and Robert Goldberg, "Using Web Resources for On-Demand Discovery and Delivery of Supplemental Instruction," submitted to the *36th Annual Meeting of the Decision Sciences Institute, San Francisco, November 2005*.

E) Robert Goldberg and Minette Carl, “Review of ‘Matrix Analysis For Scientists And Engineers’ by Alan Laub,” submitted to *ACM Computing Reviews*, 2005.

Published :

1. Ajith Abraham, Lakhmi Jain and Robert Goldberg (Editors), *Evolutionary Multiobjective Optimization: Theoretical Advances And Applications* (Advanced Information and Knowledge Processing Series), Springer-Verlag, New York; ISBN: 1-8523-3787-7, April 2005.

2. Robert R. Goldberg and Natalie Hammerman, "Multi-Criteria Optimization of Finite State Automata: Maximizing Performance while Minimizing Description Length,” *Evolutionary Multiobjective Optimization*, Abraham et al. (eds.) *to appear*.

3. Robert Goldberg, “Preparing Society for Virtual Learning in the 21st Century,” A Foreward to *Innovations in Knowledge-Based Virtual Education*, Ghaoui, C.; Jain, M.; Bannore, V.; Jain, L.C. (Eds.), Springer-Verlag New York Inc; ISBN: 3-540-25045-X, *to appear*.

4. Robert Goldberg and Minette Carl, “Review of ‘Stochastic local search: Foundations and Applications’ by Holger Hoos and Thomas Stützle,” *ACM Computing Reviews*, 2005.

5. Robert Goldberg and Jerry Waxman, “A Progress Report on an Exploratory Mathematics Course: Incorporating a Programming Component,” *Mathematics and Computer Education Journal*, Vol. 38(1) Winter 2004, pp. 44-63.

6. Robert R. Goldberg and Natalie Hammerman, “Adapting Computational Data Structures Technology To Reason About Infinity,” *Mathematics and Computer Education Journal*, Vol. 38(1), Winter 2004, pp. 69-82.

7. Minette Carl, Robert Goldberg and Jerry Waxman, "A Summative Report On Exploring Quantitative Relationships," *Mathematics and Computer Education Journal*, Vol. 38(2), Spring 2004, Special Issue on Pedagogy, pp. 132-151.

8. Natalie Hammerman, Anthony Tolvo, Robert Goldberg, "Using Mathematics to Bridge the Gap Between Biology and Computer Science," *Mathematics and Computer Education Journal*, Vol. 38(3), Fall 2004, pp. 271-290.

9. Isak Taksa and Robert Goldberg, "Web-Delivered Supplemental Instruction: Dynamic Customizing of Search Algorithms to Enhance Independent Learning for Developmental Mathematics Students." *Mathematics and Computer Education Journal*, Vol. 38(2),Spring 2004, Special Issue on Pedagogy, pp. 152-164.

10. Jared Rifkin and Robert Goldberg. (2004). "Motility Patterns of Dictyostelium Amoebae: A Vector Analysis." Gordon Research Conference on Sensory Transduction In Microorganisms, Ventura, Calif., Jan. 2004.

11. Robert Goldberg and Isak Taksa, "Mathematical Complexity of Ranking Similar Documents Retrieved by Search Engines on the Web," *Congressus Numerantium*, Vol. 165, pp. 181-188, 2003.

12. Jacob Shapiro, Isak Taksa, Robert Goldberg, "Using Multiple Query Representations to Improve Quality of Information Retrieval," *Proceedings of the Decision Sciences Institute Annual Meeting*, Washington, DC, November 22-25, 2003.

13. Robert Goldberg and Jerry Waxman, "A Novel Approach to Curing Quantiphobia," *Mathematics and Computer Education Journal*, Vol. 37(1), Winter 2003, pp. 39-54.

14. Natalie Hammerman and Robert Goldberg, "Strategies for Mathematics Remediation at the College Level," *Mathematics and Computer Education Journal*, Vol. 37(1), Winter 2003, pp. 79-95.

15. Natalie Hammerman and Robert Goldberg, "On the Effectiveness of Cellular Automata to Add Real Numbers," *International Journal of Computer Mathematics*, Vol. 80(10), pp. 1207 – 1213, 2003.

16. Robert Goldberg, Jacob Shapiro, Isak Taksa, "Comparison Of Greedy And Best-Fit Scheduling Heuristics For General And Ideal Sets", *Congressus Numerantium*, Vol. 158, pp. 191-200, 2002.

17. Robert Goldberg, Ronald R. Kelly, Mark Shore, Selina Vasquez, Jerry Waxman, "Reforming Developmental Mathematics Cluster," Twenty-Sixth Annual Conference of the National Association For Developmental Education (NADE), Orlando, Florida, March 2002.

18. Robert Goldberg, Ronald R. Kelly, Mark Shore, Selina Vasquez, Jerry Waxman, "In Pursuit of Quality Mathematics Learning for Diverse Student Populations,"

Thirteenth International Conference on College Teaching and Learning, Jacksonville, Florida, April 2002. (Invited)

19. Jacob Shapiro, Isak Taksa, Robert R. Goldberg, "Analysis of Tight upper Bounds on a Class of Heuristics for Scheduling Problems Over Two Processors," abstracted in the Proceedings of Thirty-third Southeastern International Conference on Combinatorics, Graph Theory, and Computing, Boca Raton, Florida, March 2002.

20. Robert Goldberg, Ronald R. Kelly, Mark Shore, Selina Vasquez, Jerry Waxman, "Comprehensive Program (CP3): Reforming Developmental Mathematics," U.S. Department of Education FIPSE/LAAP Project Directors' Meeting, November 2001.

21. Robert R. Goldberg and Jacob Shapiro, "Extending Graham's Result on Scheduling to Other Heuristics," *Operation Research Letters*, (29/4), pp. 149-153, 2001.

22. Robert Goldberg and Natalie Hammerman, "On the Application of Reorganization Operators for Solving a Language Recognition Problem," in Lance Chambers, Editor: Practical Handbook of Genetic Algorithms: Applications, Second Edition, Chapter 2, CRC Press, 2000, pp. 63-96.

23. Robert R. Goldberg and Jacob Shapiro, "Partitioning Under the Lp Norm," *European Journal of Operations Research*, Vol. 123 (3), pp. 150-157, 2000.

24. Robert R. Goldberg and Jacob Shapiro, "Partitioning Ideal Sets," *International Journal of Computer Mathematics*, Vol. 71, pp. 337-349, 1999.

25. Robert R. Goldberg and Jacob Shapiro, "A Tight Upper Bound for the k-Partition Problem on Ideal Sets," *Operation Research Letters*, Vol. 24, pp. 165-173, 1999.

26. Robert Goldberg, "Remarks on Classic Scheduling," abstracted in the *Proceedings of the INFORMS Annual Meeting*, Fall 1999, Philadelphia, Pennsylvania, November 1999.

27. Robert Goldberg and Isak Taksa, "Error Analysis of Scheduling in an Ideal Situation," abstracted in the *Proceedings of the INFORMS Annual Meeting*, Fall 1999, Philadelphia, Pennsylvania, November 1999.

28. Robert Goldberg, "Empirical Analysis Of Scheduling Algorithms," abstracted in the *Proceedings of the 12th International Conference on Mathematical and Computer Modeling (ICMCM) Conference*, Chicago, Illinois, July 1999.

29. Robert Goldberg and Jacob Shapiro, "New Results In Worst-Case Analysis Of Scheduling," abstracted in the *Proceedings of the 12th International Conference*

on Mathematical and Computer Modeling (ICMCM) Conference, Chicago, Illinois, July 1999.

30. Robert R. Goldberg and Michael R. Goldberg, "Computational Analysis of Biological Phenomena," *Machine Vision Systems for Inspection*, Bruce G. Batchelor, John W. Miller, Susan Snell Solomon, Editors, Proceedings of the SPIE, Vol. 3836, Boston, Massachusetts, pp. 18-28, 1999. (Invited)

31. Robert R. Goldberg and Jonathan Robinson, "Application of Geometric Hulls to Digital Curve Characterizations," *Machine Vision Systems for Inspection*, Bruce G. Batchelor, John W. Miller, Susan Snell Solomon, Editors, Proceedings of the SPIE, Vol. 3836, Boston, Massachusetts, pp. 29-40, 1999. (Invited)

32. R. Goldberg, J. Shapiro, I. Taksa, "The Role of Ideal Sets for the Set Partitioning Problem," abstracted in the *Proceedings of the Thirtieth International Conference on Combinatorics, Graph Theory and Computing*, Boca Raton, Florida, March 1999.

33. Michael R. Goldberg, Robert Goldberg, and Courtney Peshkovsky, "Quantitative Analysis of Alveolization Using Confocal Microscopy," *American Journal of Respiratory and Critical Care Medicine*, Vol. 159(3), A669, 1999.

34. Robert R. Goldberg and Michael R. Goldberg, "Success of Segmentation in a Sequence of Images Tracking the Growth of Endogenously Fluorescent Kidneys," *Three-Dimensional and Multidimensional Microscopy: Image Acquisition and Processing VI*, D. Cabib, C. J. Cogswell, J. Conchello, J. M. Lerner, T. Wilson, Editors, Proceedings of the SPIE, Vol. 3605, San Jose, California, pp. 200-208, January 1999. (Invited)

35. Robert Goldberg, "Review of 'Handbook of Discrete and Computational Geometry' by Jacob E. Goodman," *ACM Computing Reviews*, 1999.

36. Robert Goldberg, "Review of 'Computational Geometry in C, 2nd Edition' by Joseph O'Rourke," *ACM Computing Reviews*, 1999.

37. Robert Goldberg, Jacob Shapiro, and Jerry Waxman, "Analysis of Partition Variance for the Number Partition Problem," *Congressus Numerantium*, Vol. 130, pp. 29-46, 1998.

38. Robert R. Goldberg and Michael R. Goldberg, "Identification of Junction Structures During Lung Development," *Machine Vision Systems for Inspection*, Bruce G. Batchelor, John W. Miller, Susan Snell Solomon, Editors, Proceedings of the SPIE, Vol. 3521, Boston, Massachusetts, pp. 366-373, November 1998. (Invited)

39. Robert R. Goldberg and Jonathan Robinson, "A Platform Independent Optical Character And Curve Recognition System," *Machine Vision Systems for*

Inspection, Bruce G. Batchelor, John W. Miller, Susan Snell Solomon, Editors, Proceedings of the SPIE, Vol. 3521, Boston, Massachusetts, pp. 342-350, November 1998. (Invited)

40. Michael R. Goldberg, Courtney Peshkovsky, and Robert Goldberg, "Morphometric Analysis of Lung Development by Confocal Microscopy," *American Journal of Respiratory and Critical Care Medicine*, Volume 157(3), A191, 1998.

41. Natalie Hammerman and Robert Goldberg, "Algorithms to Improve the Convergence of a Genetic Algorithm with a Finite State Machine Genome," in Lance Chambers, Editor: *Handbook of Genetic Algorithms*, Vol. 3, CRC Press, pp. 119-238, 1998.

42. Natalie Hammerman and Robert Goldberg, "Effectiveness Of Cellular Automata To Compute Arithmetic Functions," Mathematical Modeling and Scientific Computing, Vol. 8, pp. 329-334, 1998.

43. Robert Goldberg, "Review of 'Computer Graphics and Geometric Modeling for Engineering' by Vera Anand," *Computer Engineering*, 1998.

44. Robert Goldberg, "Review of 'Automated Information Retrieval: Theory and Methods' by Frants, Shapiro, Voiskunskii," *ACM Computing Reviews*, pp. 99-100, February 1998.

45. Robert Goldberg, Jacob Shapiro, and Jerry Waxman, "Approximation Algorithm for the Optimal Partition Problem," *Congressus Numerantium*, Vol. 124, pp. 197-210, 1997.

46. Natalie Hammerman and Robert Goldberg, "Can Cellular Automata Compute Arithmetic Functions?" abstracted in the *Proceedings of the 11th International Conference on Mathematical and Computer Modeling (ICMCM) Conference*, Boston, Massachusetts, November 1997.

47. Robert Goldberg, Jacob Shapiro, and Jerry Waxman, "Error Metrics for the Optimal Partition Problem," abstracted in the *Proceedings of the 11th International Conference on Mathematical and Computer Modeling (ICMCM) Conference*, Boston, Massachusetts, November 1997.

48. Robert Goldberg, Jacob Shapiro and Jerry Waxman, "Different Measures for Evaluating Quality of a Partition," abstracted in the *Proceedings of the Twenty-Eighth International Conference on Combinatorics, Graph Theory and Computing*, Boca Raton, Florida, February 1997.

49. Robert Goldberg, Jacob Shapiro and Jerry Waxman, “Shortest Path Heuristics Under Heavy Traffic Conditions,” abstracted in the *Proceedings of the Twenty-Eighth International Conference on Combinatorics, Graph Theory and Computing*, Boca Raton, Florida, February 1997.

50. Robert Goldberg and Meir Roth, "Parallel Algorithms for Real Time Tracking," *Machine Vision Applications, Architectures and Systems Integration*, Bruce G. Batchelor, Susan Snell Solomon, Frederick M. Waltz, Editors, Proceedings of the SPIE, Vol. 2637, Boston, Massachusetts, pp. 121-128, November 1996. (Invited)

51. Robert Goldberg, Jerry Waxman and J. Shapiro, “Network Modeling Using Level Graphs,” *Mathematical Modeling and Scientific Computing*, Vol. 6, pp. 202-208, 1996.

52. Michael Erlbaum, Robert Goldberg and Jacob Shapiro, “Experimental Evaluation of Various Power Set Implementations,” *Mathematical Modelling and Scientific Computing*, Vol. 6, pp. 209-219, 1996.

53. Robert Goldberg, Jacob Shapiro, and Jerry Waxman, "Optimal k-Partitions," *Congressus Numerantium*, Vol. 108, pp. 17-32, 1995.

54. Diego Betancour, Robert Goldberg, Aron Goykadosh, Jacob Shapiro, and Jerry Waxman, "Link Factors for Parameterized Level Graph Searches," *Congressus Numerantium*, Vol. 110, pp. 107-119, 1995.

55. Robert Goldberg, "Computational Geometry for Real Time Tracking," *Machine Vision Applications, Architectures and Systems Integration*, Bruce G. Batchelor, Susan Snell Solomon, Frederick M. Waltz, Editors, Proceedings of the SPIE, Vol. 2540, Boston, Massachusetts, pp. 468-474, November 1995. (Invited)

56. Diego Betancour, Robert Goldberg, Aron Goykadosh, Jacob Shapiro, and Jerry Waxman, "Parametric Level Graph Searches," abstracted in the *Proceedings of the Twenty-Sixth International Conference on Combinatorics, Graph Theory and Computing*, Boca Raton, Florida, February 1995.

57. Moshe Erlbaum and Robert Goldberg, "Efficient Modeling of the Power Set: Experimental Evaluations," abstracted in the *Proceedings of the 10th International Conference on Mathematical and Computer Modeling (ICMCM) Conference*, Boston, Massachusetts, July 1995.

58. Robert Goldberg and Philip Listowsky, "The Vehicle Routing Problem Applied to an Emergency Services Vehicle Domain: Best-Path Selection by an Expert System," abstracted in the *Proceedings of the 10th ICMCM Conference*, Boston, Massachusetts, July 1995.

59. Robert Goldberg, Jacob Shapiro and Jerry Waxman, "Modeling Layered Networks," abstracted in the *Proceedings of the 10th ICMCM Conference*, Boston, Massachusetts, July 1995.

60. Robert Goldberg, "Constrained Pose Refinement of Parametric Objects," *International Journal of Computer Vision*, Vol. 13 (2), pp. 181-211, 1994.

61. Robert Goldberg, "Algorithmic Analysis of Transforming Finite State Automata into Regular Expressions," *International Journal of Theoretical Computer Science*, Vol 2 (1), pp. 125-162, 1994.

62. Robert Goldberg and Phil Listowsky, "Critical Factors for Emergency Vehicle Routing Expert Systems," *International Journal of Expert System with Applications*, Vol. 7 (4), pp. 589-602, 1994.

63. Robert Goldberg, Jacob Shapiro, and Jerry Waxman, "Path Quality of Level Graph Searches," *Congressus Numerantium*, Vol. 102, pp. 13-28, 1994.

64. Robert Goldberg and Jerry Waxman, "Identification of Critical Points in a Network Topology," *Congressus Numerantium*, Vol. 101, pp. 129-150, 1994.

65. Robert Goldberg, Jacob Shapiro and Jerry Waxman, "Analytical Results Regarding the Asymptotic of Level Graph Search," abstracted in the *Proceedings of the Twenty-Fifth SE International Conference on Combinatorics, Graph Theory and Computing*, Boca Raton, Florida, March 1994.

66. Robert Goldberg and Jerry Waxman, "To Break a Graph into Pieces," abstracted in the *Proceedings of the Twenty-Fifth SE International Conference on Combinatorics, Graph Theory and Computing*, Boca Raton, Florida, March 1994.

67. Robert Goldberg, "Recognizing Parameterized Three-Dimensional Objects," *Machine Vision Applications, Architectures and Systems Integration*, Bruce G. Batchelor, Susan Snell Solomon, Frederick M. Waltz, Editors, Proceedings of the SPIE, Vol. 2305, Boston, Massachusetts, pp. 121-132, November 1994. (Invited)

68. Robert Goldberg, "Pose Determination of Parameterized Object Models from a Monocular Image," *Image and Vision Computing*, Vol. 11 (1), pp. 49-62, 1993.

69. Robert Goldberg, "Finite State Automata from Regular Expression Trees," *The Computer Journal*, Oxford University Press, Vol. 36 (7), pp. 623-630, 1993.

70. Robert Goldberg, Jacob Shapiro and Jerry Waxman, "A Syntactic Method for Semantic Database Integrity Constraints," *CIT, Journal of Computing and Information Technology*, Vol. 1 (2), pp. 111-121, 1993.

71. Robert Goldberg and Jerry Waxman, "Skeletal Graphs and Structural Properties of Languages," *Congressus Numerantium*, Vol. 94, pp. 177-186, 1993.

72. Robert Goldberg and Jerry Waxman, "Parallel Decision Procedures for Finite State Automata," *International Journal of Computer Mathematics*, Vol. 49 (1-2), pp. 33-40, 1993.

73. Robert Goldberg and Jerry Waxman, "A Graph Theoretic Approach to the Classification Problem for Finite State Machines," abstracted in the *Proceedings of the Twenty-Fourth SE International Conference on Combinatorics, Graph Theory and Computing*, Boca Raton, Florida, February 1993.

74. Robert Goldberg, "Recovering Constrained Model Parameters from a Monocular Image," *Machine Vision Applications, Architectures and Systems Integration*, Bruce G. Batchelor, Susan Snell Solomon, Frederick M. Waltz, Editors, Proceedings of the SPIE, Vol. 1823, Boston, Massachusetts, pp. 322-333, November 1992. (Invited)

75. Robert Goldberg, "Verification Vision Systems," *Machine Vision Architectures, Integration, and Applications*, Bruce G. Batchelor, Michael J. W. Chen, Frederick M. Waltz, Editors, Proceedings of the SPIE, Vol. 1615, Boston, Massachusetts, pp. 9-17, November 1991. (Invited)

76. Robert Goldberg and David Lowe, "Hessian Methods for Verification Vision," *Sensor Fusion, Spatial Reasoning and Scene Interpretation,* Paul S. Schenker, Editor, Proceedings of the SPIE, Vol. 1003, Boston, Massachusetts, pp. 63-67, November 1988.

77. Robert Goldberg, "Verification Vision as a Nonlinear Least Squares Problem", abstracted in the *Proceedings of the SIAM Annual Conference*, Minneapolis, Minnesota, July 1988.

78. Robert Goldberg and David Lowe, "Verification of 3D Parametric Models In 2D Image Data", *Proceedings of the IEEE Computer Society Workshop on Computer Vision*, Miami Beach, Florida, pp. 255-257, November 1987.

79. Robert Goldberg and Jerry Waxman, "On the Equivalence of Articulation and Critical Points in Directed Graphs," *Queens College Technical Report CS-94-001*, 1994.

80. Robert Goldberg and Natalie Hammerman, "A Template Proof for Diagonalization Arguments Over Uncountable Sets," *Queens College Technical Report CS-94-002*, 1994.

81. Robert Goldberg, Jacob Shapiro and Jerry Waxman, "Analytical Results Regarding the Path Quality of Level Graph Searches," *Queens College Technical Report CS-94-003*, 1994.

82. Robert Goldberg and Michael Erlbaum, "Experimental Evaluation of Various Power Set Implementations," *Queens College Technical Report CS-94-005*, 1994.

83. Robert Goldberg and Jerry Waxman, "Skeletal Graphs and Structural Properties of Languages," *Queens College Technical Report CS-93-002*, 1993.

84. Robert Goldberg, "Versatility of Tree Structures for Regular Expression Applications," *Queens College Technical Report CS-93-004*, 1993.

85. Robert Goldberg, Jacob Shapiro and Jerry Waxman, "A Syntactic Method for Enforcing Semantic Database Integrity Constraints," *Queens College Technical Report CS-92-004*, 1992.

86. Robert Goldberg and Jerry Waxman, "Parallel Decision Procedures for Finite State Automata," *Queens College Technical Report CS-92-005*, 1992.

87. Robert Goldberg, "Verification of 3D Model Parameters from 2D Image Data," Ph.D. Thesis, CIMS at New York University, January 1989.

Grants and Donations:

"P6 Processing Cluster," Robert Goldberg, submitted to NSF-DMS Infrastructure, $131,268.

"Virtual Cystoscopy for Bladder Cancer Screening", Lihong (Connie) Li and Robert Goldberg, submitted to the CUNY Collaborative Initiative, $80,000.

"A Cooperative Genetic Algorithm for Worst-Case Analysis of a NP-hard Problem," Robert Goldberg, PSC-CUNY, 2005-2006, awarded (amount to be determined).

"Enforcing Co-ocurrence Constraints on Point Sets for Model-Based Vision," Robert Goldberg, PSC-CUNY, 2004-2005, $3,495.

"Computing the Passing Area of World Curves from Digital Images," Robert Goldberg, PSC-CUNY, 2002-2004, $6,704.

"Incorporating a Writing Component into a Discrete Mathematics Course," Robert Goldberg, Queens College Writing Intensive Initiative, Spring 2004, $4,000.

"Determining the Domain of a Digital Curve," Robert Goldberg, PSC-CUNY, 2001-2002, $3,314.

"Exploring Quantitative Relationships," Jerry Waxman and Robert Goldberg, DOE-FIPSE, 2000-2003, $281,425.

"CS12 Computer Literacy Upgrade to MS OFFICE 2000," Robert Goldberg, Prentice-Hall Publ. Corp., 2000, 320 licenses of Microsoft Office, Version 2000 (donation).

"A Parallel Processing Image Analysis for Studying Chemotaxis," Robert Goldberg, Jared Rifkin and Jacob Shapiro, PSC-CCI, 1999-2002, $26,000.

"Identifying Significant Structures In Morphogenesis Image Data," Robert Goldberg, PSC-CUNY, 1999-2000, $3,374.

"Customizing Personal Computer Applications," Robert Goldberg, Ford Foundation Diversity Initiative, Queens College, 1999, $6,000.

"A Laboratory for an Enriched Non-Major's Second Level Computer Science Course," Jerry Waxman and Robert Goldberg, NSF-ILI, 1998-2000, $99,080 (with equal matching funds)

"A Platform Independent Optical Character and Curve Recognition System," Robert Goldberg, PSC-CUNY, 1998-1999, $3,613.

"Load Balancing Heuristics For Parallel Processing Systems," Robert Goldberg, PSC-CUNY, 1997-1998, $3,909.

"CS95 Computer Programming in Java," Robert Goldberg, Prentice-Hall Corp., Summer 1997, Full Week training seminar (lecture and lab) for all faculty and staff in Java (donation).

"Automata Specific Operators for Genetic Algorithms," Robert Goldberg, PSC-CUNY, 1996-1997, $3,432.

"Pose Determination of Parametric Models in a Distributed Computing Environment," Robert Goldberg, PSC-CUNY, 1995-1996, $3,519.

"CS12 Computer Literacy Course," Robert Goldberg, ITP Publ. Corp., Fall 1995, 60 licenses of Microsoft Office for Windows, Version 4.3 (donation).

"Frame to Frame Coherence Constraints in Model-Based Vision Systems," Robert Goldberg, PSC-CUNY, 1994-1995, $3,899.

"Design and Implementation of a Vehicle Routing Expert System," Robert Goldberg, PSC-CUNY, 1993-1994, $2,519.

"Verification Module for Model-Based Recognition Systems," Robert Goldberg, PSC-CUNY, 1992-1993, $2,743.

"Preprocessing Issues in Computer Vision Analysis," Robert Goldberg; Faculty In Residence Award, Queens College, Fall 1989, $2,500.

Professional Activities :

College/University

Created a new course on Genetic Algorithms	2004
Modified Discrete Structures Course to incorporate a "writing intensive" component.	2002-
Conducted Surveys of CS12 students for formative and summative analysis	2002-
Mentored doctoral students (CUNY Graduate Center)	1995-
Member, Board of Directors for Queens College Hillel	1993-
QC Academic Senate, Senator Alternate	1998-
QC Computer Science Colloquia Committee	2000-
CUNY Committee on Research Awards, Computer Science Panel	1993-
QC Computer Science Library Committee,	1988-
Assistant Chair, QC Computer Science Department	2000-2002
Prepared Lecture Notes for the JAVA Course at QC (122pp.)	1997-2000
Managed and Redesigned CS95 Programming Course (JAVA)	1997-2000
Organized a Free JAVA Training Course for Faculty and Staff	1997
QC Academic Senate, Senator	1995-7
Managed and Redesigned CS12 Literacy Course (Windows-based)	1995-6
QC Computer Science and Mathematics Liaison Committee,	1995-9
Video Instruction for CESL Laboratory,	1995
CUNY University Faculty Senate, Senator,	1991-94
QC Computer Science Research and Awards Committee,	1988-94
QC Personal Computing Seminar, (Founder and Chair), (Extra-Curricular in cooperation with the ACM Student Chapter)	1989-94
Mentor to Adjunct Lecturer for Formal Languages and Automata,	1993
Developed with Students "Automata" Visualization Tool	1992-93

Faculty Consultant to QC Asian-American Workforce Conference, 1992
Ad Hoc Committee on Unix in the Curriculum 1992
Developed with Students "Greibach" Grammar Visualization Tool 1990-92

QC Computer Science Co-op & Internship Committee, 1989-99

Professional (General)

Editorial Board, International Journal of Hybrid
Intelligent Systems, http://www.cs.okstate.edu/~ijhis/ 2003-
Co-Editor of Special Issue for MACE. Journal 2002-3
Science Advisory Board for Life Sciences 1999-

Chair of Session on Scheduling, INFORMS, Philadelphia, Penn. Nov. 1999
SPIE Course on Confocal Microscopy, San Jose, California Jan. 1999
SPIE Course on Advanced Morphological Techniques,San J.,Calif. Jan. 1999
SPIE Course on Neural Net Applications, San Jose, California Jan. 1999

Digital Microscopy, University of Delft,
Delft, Netherlands, April 1998
(Invited by the European Molecular Biology Organization, EMBO).
Assistant Editor to Special Issue of the Journal July 1998

Mathematical Modeling and Scientific Computing
Workshop on Randomness and Computation, Hebrew University,
Jerusalem, Israel, June 1997

Bar-Ilan Symposium for Foundations of AI, Bar-Ilan University,
Ramat Gan, Israel, June 1995,97
Java Programming I, Queens College, New York, June 1997
Java Programming II, Focus Systems, New York, July 1997

Assistant Editor to Special Issue of the Journal April 1996

Mathematical Modeling and Scientific Computing
Chair of session for 10th ICMCM Conference, Boston, Mass. July 1995
Color I/O Devices and Presentation, PGSS, New York Jan. 1995
ONR Invited Panelist for Computer Science Graduate Fellowships,
Washington, D.C., (closed in 1995) 1989-91,93-5

NSF Doctoral Recipients Research Survey (biennial) 1989, 91,93

Participated in NSF Workshop for Faculty Enhancement in
Software Engineering, Rochester Institute of Technology,
Rochester, New York, June 1992

Honors and Awards :

Fellow, Institute for Combinatorics and its Applications (ICA);
ACM Faculty Recognition Award (QC); Faculty in Residence Award (QC);
Teacher of the Year Award (Hillel, Queens County)
Presidential Award for Excellence in Teaching, Nominated (QC);
ONR Graduate Fellowship (CIMS); Phi Beta Kappa Honor Society;
Pi Mu Epsilon Mathematics Honor Society; Summa Cum Laude (QC);
Queens College Merit Scholarship; New York State Regents Scholarship;
Graduating Honors in Mathematics and Computer Science (QC);
Robert Spector Award for Excellence in CS (QC)
Samuel Jacobs Award for Mastering the Calculus (QC)
Student Service Award (QC); Dean's List all semesters (QC)

Professional Memberships :

AACE, ACM, IEEE, SIAM, SPIE.

Ari D. Gross

Associate Professor of Computer Science
Queens College & Grad Ctr/CUNY
Email: ari@vision.cs.qc.edu

Associate Professor appointment as of Sept. 1, 1996.

Five publications (representative of my work):

1. L. J. Latecki, V. Rajagopal, and A. Gross: Image retrieval and reversible illumination normalization. *Proc. of the IS&T/SPIE Conf. Internet Imaging VI*, San Jose, January 2005.

2. A. Giraldo, A. Gross, and L. J. Latecki: Digitizations Preserving Shape. *Pattern Recognition (PR)* 32, pp. 365-376, 1999

3. A. Gross and L. Latecki: Digital Geometric Methods in Image Analysis and Compression. *Proc. of the Third Asian Conference on Computer Vision (ACCV 98)*, Volume I, pp. 184-191, Springer-Verlag, Hong Kong, January 1998.

4. A. Gross and L. Latecki: Modeling Digital Straight Lines. *Proc. of the International Conference on Pattern Recognition (ICPR 96)*, Volume II, pp. 156-160, Vienna, August 96.

5. A.D. Gross and T.E. Boult. ``Error of Fit Measures for Recovering Parametric Solids". Proc. of the IEEE International Conf. on Computer Vision, pages 690-695, 1988

Research: I have research interests in the following areas: computer vision, digital geometry, digital topology, 3D shape modeling & perception, data compression, document understanding, optical character recognition, and digital media indexing.

Teaching: I have taught courses in the following areas: Algorithms I, Algorithms II, Computability & Complexity, Computer Vision, Design and Analysis of Algorithms, Theory of Computation, and Research Praticum.

Journal Papers

A. Giraldo, A. Gross, and L. J. Latecki: Digitizations Preserving Shape. *Pattern Recognition (PR)* 32, pp. 365-376, 1999.

A. Gross and L. J. Latecki: Digital Geometric Methods in Document Image Analysis. *Pattern Recognition (PR)* 32, pp. 407-424, 1999.

L.J. Latecki, C. Conrad, and A. Gross: Preserving Topology by a Digitization Process. *Journal of Mathematical Imaging and Vision* 8, pp. 131-159, 1998.

A. Gross and L. J. Latecki: A Realistic Digitization Model of Straight Lines. *Computer Vision and Image Understanding (CVIU)* 67, pp. 131-142, 1997.

A. Gross and T.E. Boult. Recovery of SHGCs from a Single Intensity View , *IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI), Feb 1996.*

A. Gross and L. Latecki: Digitizations Preserving Topological and Differential Geometric Properties. *Computer Vision and Image Understanding (CVIU)* 62, pp. 370-381, 1995.

A.D. Gross and T.E. Boult. ``Analyzing Skewed Symmetries." *International Journal of Computer Vision*, Nov 1994.

Book Chapters

L. J. Latecki and A. Gross: From Mathematical Digitization Models to Discrete Shape Constraints. In R. Klette, A. Rosenfeld, and F. Sloboda (eds.): *Advances in Digital and Computational Geometry*, Springer-Verlag, Singapore, pp. 195-226, 1998.

A. Gross and L. Latecki: Toward Non-Parametric Digital Shape Representation and Recovery. In M. Hebert, J. Ponce, T. Boult, and A. Gross (eds.): *Object Representation in Computer Vision*, Springer-Verlag, Berlin, pp. 313-325, 1995.

Edited Books and Special Issues of Journals:

L. J. Latecki, A. Gross, and R. Melter (eds.): Special Issue on Shape Representation and Similarity for Image Databases. *Pattern Recognition,* Vol. 35, No. 1, 2002.

M. Hebert, J. Ponce, T.E. Boult, A. Gross and D. Forsyth (eds) ``*3-D Object Representation for Computer Vision"* Springer Verlag Series: Lecture Notes in Compter Science., # 994, 1995.

Reviewed Conference Papers

L. J. Latecki, V. Rajagopal, and A. Gross: Image retrieval and reversible illumination normalization. *Proc. of the IS&T/SPIE Conf. Internet Imaging VI*, San Jose, January 2005.

A. Gross and L. Latecki: Digital Geometric Methods in Image Analysis and Compression. *Proc. of the Third Asian Conference on Computer Vision (ACCV 98)*, Volume I, pp. 184-191, Springer-Verlag, Hong Kong, January 1998.

A. Gross and L. Latecki: Homeomorphic Digitization, Correction, and Compression of Digital Documents, *IEEE CVPR '97 Workshop on Document Image Analysis*, San Juan, Puerto Rico, June 1997.

A. Gross and L. Latecki: Modeling Digital Straight Lines. *Proc. of the International Conference on Pattern Recognition (ICPR 96)*, Volume II, pp. 156-160, Vienna, August 96.

A. Gross and T.E. Boult. ``Understanding Straight Homogeneous Generalized Cylinders: A Case Study", *IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI), Feb 1996.*

M. Hebert, J. Ponce, T.E. Boult, A. Gross and D. Forsyth (eds) ``*3-D Object Representation for Computer Vision"* Springer Verlag Series: Lecture Notes in Compter Science., # 994, 1995.

L. Latecki, C. Conrad, and A. Gross: An Object and its Digital Image. *Proc. of the Second Asian Conference on Computer Vision (ACCV 95)*, Singapore, December 1995.

L. Latecki and Gross, A.: Digitization Constraints that Preserve Topology and Geometry. *Proc. of the IEEE International Symposium on Computer Vision (ISCV 95)*, Florida, USA, November 1995.

Gross, A. and L. Latecki: Digital Geometric Invariance and Shape Representation. *Proc. of the IEEE International Symposium on Computer Vision (ISCV 95)*, Florida, USA, November 1995.

L. Latecki, C. Conrad, and A. Gross: Conditions that Guarantee a Digitization Process Preserves Topology. *Proc. of 17. DAGM-Symposium Mustererkennung (Pattern Recognition)*, Bielefeld, Germany, September 1995.

Ari D. Gross and T.E. Boult. ``SYMAN: a SYMmetry ANalyzer." Proc. of the IEEE Conf. on Computer Vision and Pattern Recognition, pages 774-777, June 1991.

Ari D. Gross and T.E. Boult. ``Recovery of Straight Homogeneous Generalized Cylinders from Contour and Intensity Information". in Proc. of IEEE Conf. on Robotics and Automation, pages 790-795, 1990.

A.D. Gross and T.E. Boult. ``Error of Fit Measures for Recovering Parametric Solids". Proc. of the IEEE International Conf. on Computer Vision, pages 690-695, 1988

Other Conference & Workshop Papers

A. Gross and L. Latecki: Topologically-Invariant Methods in Document Image Analysis. *Proc. of the SPIE´s Conference on Vision Geometry*, Vol. 3168, San Diego, California, pp. 61-68, July 1997.

A. Gross and L. Latecki: Digitizations Preserving Topological and Differential Geometric Properties. *Proc. of the SPIE´s Conference on Vision Geometry*, Vol. 2356, Boston, Massachusetts, USA, November 1994.

Ari D. Gross and T.E. Boult. Recovery of Generalized Cylinders from a Single Intensity View. In *Proc. of the DARPA Image Understanding Workshop*, pages 557-564, 1990.

Ari D. Gross and T.E. Boult. Recovery of Straight Homogeneous Generalized Cylinders from Contour and Intensity Information. In *Proc. of the SPIE Symposium on Intelligent Robots and Computer Vision*, 1989.

A.D. Gross and T.E. Boult. ``Straight Homogeneous Generalized Cylinders: Analysis of Reflectance Properties and a Necessary Condition for Class Membership". In Proc. of the IEEE Conference on Systems, Man and Cybernetics, 1989.

T.E. Boult and Ari D. Gross. On the Recovery of Superellipsoids. In *Proc. of the DARPA Image Understanding Workshop*, pages 1052-1063, 1988.

T.E. Boult and Ari D. Gross. ``Recovery of Superquadrics from Depth Information". In Proc. of the AAAI Workshop on Spatial-Reasoning and Multisensor Integration, pages 128-137, 1987.

T.E. Boult and Ari D. Gross. Recovery of Superquadrics from 3-D Information. In *Proc. of the SPIE Symposium on Intelligent Robots and Computer Vision*, pages 358-365, 1987.

T. Y. Kong

Home Address: 82 Hillside Avenue, Roslyn Heights, NY 11577
Phone: (516) 625-4346 Fax: (718) 504-4305 E-mail: ykong@cs.qc.edu

UNIVERSITY EDUCATION

1978 – 81: Mathematics undergraduate at Trinity College, Cambridge University, England
Cambridge University Mathematical Tripos examination results:

Part IA, 1979:	1st Class Hons.
Part IB, 1980:	1st Class Hons.
Part II, 1981 (B.A. Finals):	1st Class Hons. (Wrangler)

Cambridge University B.A. degree taken in June 1981.

Exhibitioner of Trinity College, Cambridge University, 1978–80
Senior Scholar of Trinity College, Cambridge University, 1980–82

1981 – 82: Postgraduate at Trinity College, Cambridge University, England, studying for Part III of the Mathematical Tripos (Certificate of Advanced Study in Mathematics).
Certificate awarded in June 1982.

1982 – 85: Doctoral student at the Computing Laboratory, Oxford University, England.
Oxford University D. Phil. degree: passed in December 1985, taken in March 1986.

Doctoral thesis directed by Dr. A. W. Roscoe and Prof. C. A. R. Hoare, F.R.S.
Thesis title: Digital Topology with Application to Image Processing

POSITIONS HELD

Sept. 1985 – Aug. 1989: Ohio University
Assistant Professor of Computer Science
(On leave Sept. 1988 – Aug. 1989)

Sept. 1988 – Aug. 1989: City College, City University of New York
Visiting Assistant Professor of Mathematics

Sept. 2000 – June 2001: Temple University
Visiting Professor, Dept. of Computer and Information Sciences

Sept. 1989 – present: Queens College, City University of New York

9/89 – 12/96	Associate Professor of Computer Science
1/97 – present	Professor of Computer Science

(On sabbatical leave 2/00 – 7/00. On unpaid leave 9/00 – 8/01.)
Tenured since 9/94.

Short-term Positions (1 month to 1 semester):

9/84 – 12/84: University of Maryland, College Park
Faculty Research Assistant, Center for Automation Research

1/92 – 5/92: University of Pennsylvania
Visiting Associate Professor, Medical Image Processing Group, Radiology Dept.

7/93 – 8/93: University of Pennsylvania
Consultant on digital topology, Medical Image Processing Group, Radiology Dept.

7/98 – 8/98: University of Pennsylvania
Visiting Scientist, Medical Image Processing Group, Radiology Dept.

2/00 – 5/00: University of Pennsylvania
Visiting Scholar, Medical Image Processing Group, Radiology Dept.
(4-month appointment during a 6-month sabbatical leave from Queens College)

TEACHING

At Queens College and Ohio University: Undergraduate courses on programming language principles, compilers, introductory Lisp and C, Pascal, and discrete math for computer science. Master's level introductory course on compilers (C SCI 707).

At City College: 1st and 3rd semester undergraduate calculus courses, Fall 1988 and Spring 1989.

At Graduate Center of the City Univ. of New York: Doctoral level course (Comp. Sci. U820.11) on Digital Topology, Fall1991 and Fall1993.

At University of Pennsylvania: Graduate course (Computer and Information Sci. 661) on Digital Topology, Spring 1992.

At Temple University: Discrete mathematics courses for Computer and Information Science undergraduates (CIS 166) and graduates (CIS 540), Fall 2000 and Spring 2001.

RESEARCH

Principal area: Topological and geometrical properties of digital images, especially digital topology.

In image processing and computer graphics, objects in the plane or 3-space are often represented by a set of pixels or voxels in a digital image. Digital topology studies properties of the digital image that correspond to *topological* properties of the represented objects. (Topological properties are, roughly speaking, properties which are unaffected when the objects are stretched, compressed, twisted or otherwise continuously deformed. Examples are the numbers of connected components, holes and cavities in 3-d objects.) Concepts and results of digital topology are used to specify and justify important image processing algorithms, including algorithms for thinning and boundary extraction.

PUBLICATIONS

1. KONG, T.Y. and ROSCOE, A.W., Continuous analogs of axiomatized digital surfaces, *Computer Vision, Graphics and Image Processing*, vol. 29, 1985, pp. 60–86.

2. KONG, T.Y. and ROSCOE, A.W., A theory of binary digital pictures, *Computer Vision, Graphics and Image Processing*, vol. 32, 1985, pp. 221–243.

3. KONG, T.Y. and ROSCOE, A.W., Characterizations of simply connected finite polyhedra in 3-space, *Bulletin of the London Mathematical Society*, vol. 17, 1985, pp. 575–578.

4. WERMAN, M., PELEG, S., MELTER, R., and KONG, T.Y., Bipartite graph matching for points on a line or a circle, *Journal of Algorithms*, vol. 7, 1986, pp. 277–284.

5. KONG, T.Y., MOUNT, D.M., and WERMAN, M., The decomposition of a square into rectangles of minimal perimeter, *Discrete Applied Mathematics*, vol. 16, 1987, pp. 239–243.

6. LI, W.K. and KONG, T.Y., Occam and the transputer, 1988 Columbus ISA / IEEE Conference & Exhibit, Columbus, OH, April 1988: Paper Presentations, pp. 123–132.

7. KONG, T.Y., MOUNT, D.M., and ROSCOE, A.W., The decomposition of a rectangle into rectangles of minimal perimeter, *SIAM Journal on Computing*, vol. 17, 1988, pp. 1215–1231.

8. KONG, T.Y., A digital fundamental group, *Computers and Graphics*, vol. 13, 1989, pp. 159–166.

9. KONG, T.Y. and ROSENFELD, A., Digital topology: introduction and survey, *Computer Vision, Graphics and Image Processing*, vol. 48, 1989, pp. 357–393.

10. KONG, T.Y. and KHALIMSKY, E., Polyhedral analogs of locally finite topological spaces, in: R. M. Shortt, Ed., *General Topology and Applications: Proceedings of the 1988 Northeast Conference*, Marcel Dekker, New York, 1990, pp. 153–164.

11. KONG, T.Y. and ROSENFELD, A., If we use 4- or 8-connectedness for both the objects and the background, the Euler characteristic is not locally computable, *Pattern Recognition Letters*, vol. 11, 1990, pp. 231–232.

12. KONG, T.Y., LITHERLAND, R., and ROSENFELD, A., Problems in the topology of binary digital images, in: J. van Mill and G. M. Reed, Eds., *Open Problems in Topology*, North-Holland, New York, 1990, pp. 375–384.

13. KOPPERMAN, R.D. and KONG, T.Y., Using general topology in image processing, in: U. Eckhardt et al., Eds., *Geometrical Problems of Image Processing: Proceedings of the 5th Workshop Held in Georgenthal, March 11–15, 1991*, Academie Verlag (Research in Informatics, Vol. 4), Berlin, 1991, pp. 66–71.

14. ROSENFELD, A. and KONG, T.Y., Connectivity of a set, its complement, and their common boundary, in: R. A. Melter et al., Eds., *Vision Geometry: Proceedings of an AMS Special Session Held October 20–21, 1989,* American Mathematical Society (Contemporary Math., vol. 119), 1991, pp. 125–128.

15. KONG, T.Y., KOPPERMAN, R.D., and MEYER, P.R., Which spaces have metric analogs?, in: S.J. Andima et al., Eds., *General Topology and Applications: Fifth North-east Conference,* Marcel Dekker, New York, 1991, pp. 209–215.

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21. KONG, T.Y., ROSCOE, A.W., and ROSENFELD, A., Concepts of digital topology, *Topology and Its Applications*, vol. 46, 1992, pp. 219–262.

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26. KONG, T.Y. and RIBENBOIM, P., Chaining partially ordered sets, *C. R. Acad. Sci. Paris*, t. 319, Série I, 1994, pp. 533 – 537.

27. KONG, T.Y., On topology preservation in 2-d and 3-d thinning, *International Journal of Pattern Recognition and Artificial Intelligence*, Vol. 9, 1995, pp. 813 – 844.

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45. KONG, T.Y., The Khalimsky topologies are precisely those simply connected topologies on $\mathbf{Z}^n$ whose connected sets include all $2n$-connected sets but no $(3^n - 1)$-disconnected sets, *Theoretical Computer Science*, Vol. 305, 2003, pp. 221 – 235.

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47. FOUREY, S., KONG, T.Y., and HERMAN, G.T., Generic axiomatized digital surface-structures, *Discrete Applied Mathematics*, Vol. 139, 2004, pp. 65 – 93.

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49. KONG, T.Y. and GAU, C.J., Minimal non-simple sets in 4-dimensional binary images with (8,80)-adjacency, in: R. Klette and J. Zunic, Eds., *Proceedings of the 10th International Workshop on Combinatorial Image Analysis (IWCIA 2004, Auckland, New Zealand, December 2004)*, Springer-Verlag, Berlin, 2004, pp. 318 – 333.

PUBLICATIONS EDITED

Special issue of the mathematical journal *Topology and Its Applications* [Vol. 46, no. 3, 1992] on "Digital Topology". Editors: T.Y. Kong, R.D. Kopperman, and P.R. Meyer.

Proceedings of the Eighth Summer Topology Conference [*Papers on General Topology and Applications: Eighth Summer Conference at Queens College*, Annals of the New York Academy of Sciences, Vol. 728, 1994]. Editors: S. Andima, G. Itzkowitz, Y. Kong, R. Kopperman, P. Misra, L. Narici, and A. Todd.

Special double issue of the *Journal of Mathematical Imaging and Vision* [Vol. 6, nos. 2/3, 1996] on "Topology and Geometry in Computer Vision". Editors: T.Y. Kong and A. Rosenfeld.

Proceedings of the Eleventh Summer Topology Conference [*Papers on General Topology and Applications: Eleventh Summer Conference at the University of Southern Maine*, Annals of the New York Academy of Sciences, Vol. 806, 1996]. Editors: S. Andima, R. C. Flagg, G. Itzkowitz, Y. Kong, R. Kopperman, and P. Misra.

Topological Algorithms for Digital Image Processing, Elsevier/North-Holland, 1996.
Editors: T. Y. Kong and A. Rosenfeld.

Electronic publication: Proceedings of the 8th International Workshop on Combinatorial Image Analysis (IWCIA 2001, Philadelphia, August 23 – 24, 2001), *Electronic Notes in Theoretical Computer Science*, Vol. 46, 2001. URL: http://www.sciencedirect.com/science/journal/15710661
Editors: S. Fourey, G. T. Herman, and T.Y. Kong.

Special Triple Issue of *Discrete Applied Mathematics* [Vol. 139, nos. 1 – 3, 2004] for papers relating to the 2001 International Workshop on Combinatorial Image Analysis (IWCIA 2001).
Editors: S. Fourey, G. T. Herman, T.Y. Kong, and A. Rosenfeld.

INVITED TALKS

KONG, T.Y., Topology preservation in 2-d and 3-d thinning, 3rd International Workshop on Parallel Image Analysis, Washington, DC, June 1994. (1-hour lecture.)

KONG, T.Y., Topology preservation in 3-d thinning, 23ème École de Printemps d'Informatique Théorique: Géométrie et Topologie Discrètes, Le Lioran, Cantal, France, May 1995**.** (2-hour lecture.)

KONG, T. Y, Topology preserving deletion of 1's in 2-, 3- and 4-dimensional binary images, 7th International Workshop on Discrete Geometry for Computer Imagery (DGCI '97), Montpellier, France, December 1997. (Two 1-hour lectures.)

KONG, T.Y., Khalimsky topologies are the only simply connected topologies on $\mathbf{Z}^n$ whose connected sets include all $2n$-connected sets but no $(3^n - 1)$-disconnected sets, 2000 International Workshop on Combinatorial Image Analysis (IWCIA 2000), Caen, France, July 2000. (1-hour lecture).

THESIS DIRECTION

Directed: C. M. MA, *Connectivity Preserving Transformation of Digital Images: Theory and Applications*, Ph.D. Dissertation, City University of New York, 1994.

Directed: C. J. GAU, *Minimal Non-Simple Sets on 3D and 4D Geometric Grids*, Ph.D. Dissertation, City University of New York, 2004.

GRANTS

HERMAN, G.T. and KONG, T.Y., Principal Investigators, Technology for Retrieval of Information from High-Resolution Electron Microscopy Databases, CUNY Collaborative Incentive Grant Program (Round 9), $47,730 per year for 2 years (3/1/2003 – 2/28/2005).

SERVICE

Have served or am currently serving on the following departmental committees at Queens College and the CUNY Graduate Center:

Queens College Computer Science Department P&B Committee
Queens College Computer Science Department Graduate Curriculum Committee
Graduate Center Computer Science Department Executive Committee

Have refereed papers on many occasions for a variety of journals.

PERSONAL INFORMATION

Date of Birth: September 4, 1959
Sex: Male
Married; one child (son, born in 1998)
U.S. citizen
British citizen

Curriculum Vitae

Name: **KWOK, Kui-Lam**, Ph.D.

Universities Attended	Location	Subject	Degree Awarded	Year
Univ. of Hong Kong	Hong Kong	Science	B.Sc.	1960
Univ. of Hong Kong	Hong Kong	Physics	B.Sc.(Sp)	1961
Univ. of Manchester	Manchester, England	Physics	Ph.D.	1965

Recent Appointments	Organization	Date
Associate Professor	Computer Science Department Queens College, CUNY, NY	2/83-1/94
Professor	Computer Science Department Queens College, CUNY, NY	2/1/94-now

Member: ACM (Association for Computing Machinery), ACL (Association for Computational Linguistics)

External Awards/Grants/Contracts (since 1990):

"A network approach to probabilistic information retrieval". ARPA/NIST TREC-1 Contract, 2/1992-11/92. $12,500.
"A network approach to probabilistic information retrieval". ARPA/NIST TREC-2 Contract, 2/1993-11/93. $26,200.
"Information retrieval using PIRCS". Paragon Developments Pty. Ltd. Grant, 8/94-12/95. $20,000.
"Information retrieval using PIRCS" renewal. Paragon Developments Grant, 1/96-12/ 97. $20,000.
"Probabilistic Indexing and Retrieval Components Systems (PIRCS)" DoD/DARPA Contract MDA904-96-C-1481, 10/96-9/97. $129,015.
"Probabilistic Indexing and Retrieval Components Systems (PIRCS)" renewal. DoD/ DARPA Contract MDA904-96-C-1481, 10/97-9/98. $110,000.
"Studies of English Chinese Cross Language" Paragon Developments Grant, 1/99-12/00. $20,000.
“Translingual Access of Chinese Text Using English” DARPA Grant N66001-00-1-8912, 4/00-3/01 (with Chinese University of Hong Kong as subcontractor). $200,000.
“Translingual Access of Chinese Text Using English” renewal of previous DARPA Grant, 4/01-3/02. $299,675.
“Translingual Access of Chinese Text Using English” renewal of previous DARPA Grant, 4/02-3/03, extended to 3/04. $146,479
“Prototype Chinese Name Finder System for Document Triage” Advanced Technology Program, US Government, 7/03-7/04, extended to 4/05. $550,000.

Internal Awards/Grants/Contracts:

"Information Retrieval of Scientific Documents based on Cited Titles and Probability Theory". PSC-CUNY-16 No.665238, 1985-86, $3,198.
"An Investigation of Using Document Components for Information Retrieval". PSC-CUNY-18 No.667292, 1987-88, $3,800.
Second year extension of 667292. PSC-CUNY-19 No.668292, 1988-89, $1,823.
"Neural Network and Probabilistic Indexing and Retrieval". CSU-AAUP Research Grant, 6/1989-12/1989, $3,400.
"An Artificial Neural Network Approach to Information Retrieval". PSC-CUNY-22 No.662476, 1991-92, $4,500 (later reduced to $2,250 due to budget problems).
"Applying error backpropagation to information retrieval". PSC-CUNY-23 No.663288, 1992-93, $2,743.
"Collection-based query expansion for Information Retrieval ". PSC-CUNY-26 No.666324, 1995-96, $3,195.
"Extending the PIRCS system for Chinese Text Processing & IR". PSC-CUNY-27 No.667335, 1996-97, $3,250.
“Chinese Language Information Retrieval” PSC-CUNY-30 No.61390-00 30, 1999-2000, $3374.
“Cross Language Information Retrieval of Arabic Texts using English” PSC-CUNY-33 No. 64405-00 33, 2002-2003. $3352

5 Representative Publications:

1. Kwok, K.L. "A network approach to probabilistic information retrieval". ACM Transactions on Office Information System, 13:324-353, July 1995.
2. Kwok, K.L. "Employing multiple representations for Chinese information retrieval". Journal of the American Society for Information Science. 50:8 pp.709-723, 1999.
3. Kwok, K.L. “Improving English and Chinese Ad-Hoc Retrieval: A Tipster Text Phase 3 Project Report”. Information Retrieval, 3:313-338, 2000.
4. Kwok, K.L. “Exploiting the LDC Chinese-English Bilingual Wordlist for Cross language Information Retrieval”, Intl. J of Computer Processing of Oriental Languages, 14(2):173-191, 2001.
5. Kwok, K.L, Grunfeld, L, Sun, H.L & Deng, P. “TREC 2004 Robust Track experiments using PIRCS”. to be published in: Information Technology: The Thirteenth Text REtrieval Conference, TREC 2004. E.M. Voorhees & L.P. Buckland, eds. NIST Special Publication 500-261, US GPO: Washington, DC. (available at http://trec.nist.gov/pubs.html/).

Publications – Journals (since 1990)

Kwok, K.L. "Experiments with a component theory of probabilistic information retrieval based on single terms as document components" ACM TOIS 8:363-386; 1990.

Kwok, K.L. "A network approach to probabilistic information retrieval". ACM Transactions on Office Information System, 13:324-353, July 1995.

Kwok, K.L. "Information Storage & Retrieval" - Book Review. Information Processing & Management, 34:4 pp.490-492; 1998.

Kwok, K.L. "Employing multiple representations for Chinese information retrieval". Journal of the American Society for Information Science. 50:8 pp.709-723, 1999.

Kwok, K.L. “Improving English and Chinese Ad-Hoc Retrieval: A Tipster Text Phase 3 Project Report”. Information Retrieval, 3:313-338, 2000.

Kwok, K.L. “Exploiting the LDC Chinese-English Bilingual Wordlist for Cross language Information Retrieval”, Intl. J of Computer Processing of Oriental Languages, 14(2):173-191, 2001.

Luk, Robert, W.P. & Kwok, K.L. “A comparison of {Chinese} document indexing strategies and retrieval models”, ACM Transaction on Asian Language Information Processing, 1(3):225-268, 2002

Publications – Conference Proceedings (since 1990)

Kwok, K.L. "Application of neural network to information retrieval" Proc. Intl. Joint Conf. on Neural Network. Washington D.C. Jan 15-9, 1990 (ed. M.Caudill). Vol.2 pp.623-626.

Kwok, K.L "Query learning using an ANN with adaptive architecture". Proc. Machine Learning 8th Intl. Workshop. Evanston, IL. pp.260-264. 1991.

Kwok, K.L "Query modification and expansion in a network with adaptive architecture". Proc. ACM SIGIR'91 Conf. Chicago, IL. pp.192-201. 1991.

Kwok, K.L. "Retrieval of relevant documents from text databases." Invited Work in Progress Abstract in Forefronts (Cornell Theory Center) 8, p.9; 1992.

Kwok, K.L., Papadopoulos, L. & Kwan, Kathy Y.Y. Retrieval experiments with a large collection using PIRCS. In: The First Text REtrieval Conference (TREC-1), D.K. Harman, ed. NIST Special Publication 500-207, US GPO: Washington, DC. pp.153-172, 1993.

Kwok, K.L. "Information retrieval from large textbases". Site report in Proc. of ARPA Human Language Technology Workshop 1993, Plainsboro, N.J. p.410, 1993.

Kwok, K.L. & Grunfeld, L. "TREC2 Document retrieval experiments using PIRCS". In: The Second Text REtrieval Conference (TREC-2), D.K. Harman, ed. NIST Special Publication 500-215, US GPO: Washington, DC. pp. 233-242, 1994.

Kwok, K.L. & Grunfeld, L. "Learning from relevant documents in large scale routing retrieval". In: Proc. ARPA Human Language Technology Workshop, 1994, Plainsboro, NJ. Morgan Kaufmann, San Francisco, pp. 358-363, 1994.

Kwok, K.L. "A network-based document routing and retrieval system". Site report in Proc. of ARPA Human Language Technology Workshop 1994, Plainsboro, N.J. p.469, 1994.

Kwok, K.L., Grunfeld, L. & Lewis, D.D. "TREC-3 Ad-hoc, routing retrieval and thresholding experiments using PIRCS". In: The Third Text Retrieval Conference (TREC-3), D.K. Harman, ed. NIST Special Publication 500-225, US GPO: Washington, DC. pp. 247-255, 1995.

Kwok, K.L. "PIRCS: An effective text detection system". AIPA95 Symposium on Advanced Information Processing & Analysis, Tysons Corner, VA, March 1995. p.79, 1995.

Kwok, K.L. "An investigation into thresholding for batch routing". Tipster Phase II 12-Month Workshop 16-19 May, 1995, Chantilly, VA.

Kwok, K.L. & Grunfeld, L. "TREC-4 Ad-hoc, routing retrieval and filtering experiments experiments using PIRCS". In: The Fourth Text REtrieval Conference (TREC-4), D.K. Harman, ed. NIST Special Publication 500-236, US GPO: Washington, DC. pp.145-152, 1996.

Kwok, K.L. "A new method of weighting query terms for ad-hoc retrieval". Proc. 19th Annual Intl. ACM SIGIR Conf. on R&D in IR. ETH, Zurich, Aug. 18-22, 96. pp.187-195, 1996.

Kwok, K.L. "Evaluation of an English-Chinese cross-lingual retrieval experiment". AAAI-97 Spring Symposium Series Working Notes, Stanford Univ., Mar. 24-6, 1997. (poster paper) pp.110-114.

Kwok, K.L. "Comparing representations for Chinese information retrieval". Proc. 20th Annual Intl. ACM SIGIR Conf. on R&D in IR. Philadelphia, Jul 27-31, 1997. pp.34-41.

Kwok, K.L. "Lexicon effects on Chinese information retrieval". Proc. of 2nd Conf.on Empirical Methods in NLP. Cardie, C. & Weischedel, R. (eds). Brown Univ., Aug.1-2, 1997. pp.141-148.

Kwok, K.L. & Grunfeld, L. "TREC-5 English and Chinese retrieval experiments using PIRCS". In: Information Technology: The Fifth Text REtrieval Conference (TREC-5), E.M. Voorhees &

D.K. Harman, eds. NIST Special Publication 500-238, US GPO: Washington, DC. pp.133-142, 1997.

Kwok, K.L., Grunfeld, L. & Xu, J.H. "TREC-6 Chinese and English retrieval experiments using PIRCS". In: Information Technology: The Sixth Text REtrieval Conference (TREC-6), D.K. Harman, ed. NIST Special Publication 500-240, US GPO: Washington, DC. pp.207-214, 1998.

Kwok, K.L & Chan, M "Improving two-stage ad-hoc retrieval for short queries." Proc. 21st Ann. Intl. ACM SIGIR Conf. on R&D in IR. pp.250-256, 1998.

Kwok, K.L., Grunfeld, L., Chan, M, Dinstl, N. & Cool, C. "TREC-7 Ad-Hoc, high precision and filtering experiments using PIRCS". In: Information Technology: The Seventh Text REtrieval Conference (TREC-7), D.K. Harman, ed. NIST Special Publication 500-242, US GPO: Washington, D.C. pp.343-352, 1999.

Kwok, K.L. "English-Chinese Cross-Language Retrieval based on a Translation package". MT Summit VII Workshop: MT for Cross Language Information Retrieval. pp.8-14; Sept. 17, 1999.

Kwok, K.L. “Exploiting Chinese-English Bilingual Wordlist for English-Chinese Cross Language Information Retrieval”. Proc. 5th Intl. Workshop on Information Retrieval with Asian Languages (IRAL’00), pp.173-179, 2000.

Kwok, K.L., Grunfeld, L. & Chan, M. "TREC-8 Ad-Hoc, Query and Filtering Experiments using PIRCS". In: Information Technology: The Eighth Text REtrieval Conference (TREC-8), E.M. Voorhees & D.K. Harman, eds. NIST Special Publication 500-246, US GPO: Washington, DC. pp.217-227, 2000.

Kwok, K.L, Dinstl, N & Deng, P. “English-Chinese CLIR using a Simplified PIRCS System”, Proc. of HLT2001: First Intl. Conference on Human Language Technology Research, J. Allan (ed.). pp.87-90, 2001

Kwok, K.L. “NTCIR-2 Chinese and Cross Language Experiments using PIRCS”, Proc. of Second NTCIR Workshop on Research in Chinese & Japanese Text Retrieval and Summarization, K. Eguchi, N. Kando & J.Adachi (eds.) pp.111-118, NII: Tokyo, 2001.

Kwok, K.L, Grunfeld, L, Dinstl, N & Chan, M. “TREC-9 Cross Language, Web and Question-Answering Track experiments using PIRCS ”, In: Information Technology: The Nineth Text REtrieval Conference (TREC-9), E.M. Voorhees & D.K. Harman, eds. NIST Special Publication 500-249, US GPO: Washington, DC. pp.417-426, 2001.

Kwok, K.L., Grunfeld, L. Dinstl, N & Chan, M. "TREC 2001 Question-answering, web and cross language track experiments using PIRCS". In: Information Technology: The Tenth Text Retrieval Conference, TREC 2001. E.M. Voorhees & D.K. Harman, eds. NIST Special Publication 500-250, US GPO: Washington, DC. pp.452-456, 2002.

Kwok, K.L. “Higher precision for two word queries”. Proc. 25th Annual Intl. ACM SIGIR Conf. on R&D in IR. Tampere, FInland, Aug 11-15, 2002. pp.395-6.

Kwok, Kui-Lam & Peter Deng “Corpus-based Pinyin Name Resolution”. Proc. 1st SIGHAN Workshop on Chinese Language Processing (COLING 2002). Taipei, Sept 1, 2002. pp. 41-47.

Kwok, K.L. “An analysis of the TREC-9 English-Chinese CLIR Experiments”. Proc. of IEEE SMC’02 (Information Retrieval - NLPKE), Oct 6-9, 2002, Tunisia.

Kwok, K.L. “NTICR-3 Chinese, Cross Language Retrieval Experiments using PIRCS” in Proc. of the Third NTCIR Workshop on Research in IR, Automatic Text Summarization & QA. NII: Tokyo, 2003.

Kwok, Kui Lam and Deng, Qiang “GeoName: a system for back-transliterating pinyin place names”. Proc. of HLT-NAACL 2003 Workshop – Analysis of Geographic References. pp.26-30, 2003.

Kwok, K.L, Deng, P, Dinstl, N & Chan, M. “TREC2002 Web, Novelty and Filtering Track Experiments using PIRCS”. In: Information Technology: The Eleventh Text REtrieval Conference, TREC 2002. E.M. Voorhees & L.P. Buckland, eds. NIST Special Publication 500-251, US GPO: Washington, DC. pp.520-528, 2003.

Kwok, K.L. Deng, Q. & Dinstl, N. “Topic Distillation: Content-Based Key Resource Finding”. Proceedings of IEEE/WIC Web Intelligence/Intelligent Agent Technology 2003 Workshop on Applications, Products and Services of Web-based Support Systems. Pp.111-118, 2003.

Laszlo, G, Kwok, K.L, Dinstl, N & Deng, P. “TREC 2003 Robust, HARD and QA Track Experiments using PIRCS”. In: Information Technology: The Twelfth Text REtrieval Conference, TREC 2002. E.M. Voorhees & L.P. Buckland, eds. NIST Special Publication 500-255, US GPO: Washington, DC. pp.510-521, 2004.

Deng, Peter & Kwok, Kui-Lam. “A cross language name finding system”. First Intl. Joint Conf. on NLP, IJCNLP-04, Interactive Posters/Demos, p.9-12. 2004.

Kwok, K.L, Dinstl, N & Choi, S. “NTICR-4 Chinese, English Korean Cross Language Retrieval Experiments using PIRCS” to be published in Proc. of the Fourth NTCIR Workshop Meeting. NII: Tokyo, 2004. (available at http://research.nii.ac.jp/ntcir-ws4/NTCIR4-WN/CLIR/)

Kwok, K.L, Grunfeld, L, Sun, H.L & Deng, P. “TREC 2004 Robust Track experiments using PIRCS”. to be published in: The Thirteenth Text REtrieval Conference, TREC 2004. E.M. Voorhees & L.P. Buckland, eds. NIST Special Publication 500-261, US GPO: Washington, DC. (available at http://trec.nist.gov/pubs.html/).

Kwok, K.L, Deng, P, Dinstl, N, Sun, H.L, Xu, W, Peng, P & Doyon, J. “CHINET: a Chinese name finder system for document triage”. Accepted at 2005 Intl. Conf. on Intelligence Analysis, May 3-5, 2005.

Other Scholarly Activities:

Editorial board member:
Information Retrieval Journal: 1999-present
Program committee member:
ACM SIGIR: 05-03; best paper award committee: 02, 01, 00
ACM CIKM: 05-00.
Information Retrieval for Asian Languages: 05-00.
IEEE NLPKE: 02, 01.
COLING and SigHan Workshop: 05-02.
Intl. Conf. on Chinese Language Computing: 04-00
Visiting Scientist:
Microsoft Research, Beijing, China: April, 2000
Chinese University of Hong Kong: June, 2001
Chinese University of Hong Kong: June, 2002

Curriculum Vitae

Dr. Kenneth Lord

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Department of Computer Science
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Employment

2002-present	Assistant to the Provost for Educational Technology
2000-present	Lecturer (CCE), Computer Science, Queens College of CUNY
1995 - 2000	Assistant Professor, Computer Science, Queens College of CUNY
1984 - 1995	Lecturer (CCE), Computer Science, Queens College of CUNY
1980 - 1984	Instructor in Computer Science, Queens College of CUNY
1979 - 1980	Adjunct Lecturer in Computer Science, Queens College of CUNY

Education

1995	Ph.D.	Graduate Center, CUNY
1980	M.A.	Queens College, CUNY
1978	B.A.	Queens College, CUNY

Professional Organizations

Association for Computing Machinery (ACM, National and NYC)
ACM Special Interest Group - Computer Science Education
UPE (*Upsilon Pi Epsilon*) Computer Science Honor Society
American Guild of Organists

Professional Activities

Assistant Chair for Undergraduate Studies, Computer Science (2003-)
Chair, Dean of Math and Natural Sciences Sarch Committee (2003)
Assistant Chairman, Computer Science Department (1988-1999, 2000-2001)
Chair, Queens College Undergraduate Curriculum Committee (1994-)
Chair, Math and Natural Sciences Division Curriculum Committee (2000-)
Chair, Computer Science Undergraduate Curriculum Committee (1988-2001)
Secretary, Computer Science Undergraduate Curriculum Committee (1980-2001)
Undergraduate Adviser, Computer Science Department (1980-2001)
ACM Student Chapter Adviser (1980-)
IEEE Student Branch Adviser (1988-1997)
UPE (Computer Science Honor Society) Chapter Adviser (1988-)
Academic Advising Search Committee (2001)
Journalism Director Search Committee (1997)
Dean of Students Search Committee (Chair) (1993)
Executive Committee, Academic Senate (1988-93)
Secretary, Academic Senate (1989-93)
Queens College Association (Exec. Committee & Budget Committee) (1992-1997)
Dean of Education Search Committee (1980)

Grants and Awards

President's Award for Service by Teaching Faculty (2000)
Divisional Award for Service (2001)
Undergradaute Mentoring Research Grant for Course Development (2001)
PSC-CUNY (1999)
PSC-CUNY (1997)
Undergradaute Mentoring Research Grant for Course Development (1996)
NSF College Instrumentation Grant (participant), 1985
Certificate of Continuous Employment, 1984
Intel Software Development Grant, 1984
Mellon Foundation Grant, 1982

Teaching Experience

Operating Systems
Software Engineering
Computer Organization and Assembly Language
Introduction to Computer Science
Programming Languages
Data Structures
Web Database
Web Programming

Publications

Lord, K.,"Computer Science 95 - Lecture Notes", QC Press, 1996
Lord, K., "Computer Science 201 - Lecture Notes", QCPress, 1983,84,85,86,89,92,95,97,99
Lord, K.,"Computer Science 101 - Lecture Notes", QCPress, 1990,91,92,93,97
Lord, K. and C. Vickery, "Computer Science 201 - A Reference Manual", QCPress, 1979,80,81,82

Bojana Obrenić

PROFILE
Prof. Obrenić has over twenty years of experience in teaching and research, software design and development, system programming and administration, systems analysis and systems building, and technical management. She has published several research articles on algorithmic advances in the theory of parallel and switching architectures; her algorithms exponentially outperform those previously known. She relies on a strong background in mathematics, physics, and electrical engineering.

PROFESSIONAL EXPERIENCE
Department of Computer Science, Queens College, City University of New York
Associate Professor, 1/2005 – present;
Assistant Professor, 9/1993 – 12/2004, tenured as of 9/1999.

Teaching
Prof. Obrenić has been a leader in defining and establishing the undergraduate theory program. At Queens, she has designed and taught numerous theory courses, whose subjects range from introductory undergraduate mathematics to advanced, focused, extra-curricular, doctoral-level studies.

- Independently designed and taught seventy instances of ten different courses, regularly offering three different courses each semester.
- Wrote a book on problem solving in introductory computation theory, and informally published compendia of her own solved practice problems in automata, formal languages, grammars, computability, algorithms, and discrete mathematics. These problem compendia serve as supplementary texts for her theory courses, and their purpose is to build and advance problem solving abilities on the part of the students. Prof. Obrenić prepares all the problem sets and grades all submissions for her frequent, strictly proctored, rigorously graded, in-class problem-solving tests, which provide a faithful measure of student accomplishments and their ability to respond competently to novel scenarios.
- Established and maintained a strong and demanding program in computation theory. For several years, each semester, Prof. Obrenić has offered a section of each of the two undergraduate core theory courses: a junior level course in the introductory discrete mathematics, and a senior level course in computability, automata, and formal languages.
- Fall 1995, Spring 1996, Spring 1998, Spring 1999, designed and taught undergraduate courses in algorithm analysis.
- Spring 1995, Fall 1997, designed and taught graduate courses in fundamental and advanced algorithms.
- Fall 1994, designed and taught a course in parallel algorithms, using Leighton's book as the text. The audience comprised graduate and undergraduate students interested in research in this field.

In the area of database design, development, and management, Prof. Obrenić has established a strong core course and provided unique learning opportunities for outstanding students through advanced extra-curricular courses. She has written a compendium of her own solved practice problems in database systems.

- Fall 1999 — Fall 2003, designed and taught undergraduate database systems courses, with foci on relational database design theory, implementation issues of storage, concurrency and optimization, and SQL programming with ORACLE.

- Fall 1998, designed and taught a course in the theory of relational databases, using Ullman's original monograph as the text. The course presented the algorithmic support required for the design, development, and manipulation of relational databases. The audience comprised graduate students and a small number of truly exceptional undergraduates, some already employed in database development and administration.
- Fall 1996, designed and taught without a textbook a course in the theory of database concurrency control, which presented the state-of-the-art results in this field, as elaborated on in Papadimitiou's monograph. The audience comprised graduate students and outstanding undergraduates.

Research
As a researcher in the theory of parallel architectures, Prof. Obrenić has authored several new algorithms, most of which dramatically outperform those previously known. Whereas her results appear in the specific area of graph embeddings and network emulations, the nature of the insights that she has developed over the years and the sophistication of her arguments form a strong generic base for solving problems of concurrency, congestion, synchronization, scheduling, parallelism, in all areas of process communication and control, as well as in data management.

Together with her coauthor, Dr. Baumslag, Prof. Obrenić constructed the family of index-shuffle graphs, a new interconnection network for parallel computers. Subsequently focusing on the performance of the new graph, Prof. Obrenić designed several routing algorithms that enabled the new graph to exponentially outperform its traditional counterparts. Her papers detail these algorithms to a level sufficient for their immediate implementation on a SIMD parallel computer, thereby enabling practical realizations of the new communication network.

- Prof. Obrenić and Dr. Baumslag introduced index-shuffle graphs as candidate interconnection networks for parallel computers. They proved that the new graph: *(a)* emulates shuffle-exchange graphs *without any slowdown*; *(b)* emulates the butterfly graph with a slowdown *in the order of the logarithm* of the slowdown of the same emulation by a shuffle-like graph; *(c)* emulates the hypercube that executes an on-line leveled algorithm with a slowdown *in the order of the logarithm* of the slowdown of the same emulation by a shuffle-like graph or butterfly.
- Prof. Obrenić proved that the index-shuffle graph efficiently approximates the direct-product structure of the hypercube, and thereby has a unique potential to approximate efficiently all of its derivatives, thus emerging as a "universal" bounded-degree hypercube substitute. One of the consequences of her results is that any member of the following group of standard bounded-degree hypercube derivatives: butterflies, shuffles, tori, meshes of trees, is emulated by the index-shuffle graph with a slowdown *in the order of the logarithm* of the slowdown of the most efficient emulation achieved by any other member of this group. Moreover, by containing shuffle-like graphs, index-shuffle graphs demonstrate communication power currently not known to be possessed by the hypercube itself.

Together with her coauthor, Dr. Gottlieb, Prof. Obrenić constructed an algorithm for multiprocessor scheduling of computations whose precedence graphs are arbitrary trees. While algorithms for scheduling these computations in optimal time were previously known, Prof. Obrenić's algorithm controls simultaneously the running time and the computational space.

- The completion time of Prof. Obrenić's schedule is optimal within a factor not exceeding 3, while the size of the data space exceeds the optimal by a factor not exceeding the number of processors. The family of complete binary trees provides an example where this algorithm achieves an *exponential improvement* in the size of the data space, compared to that of the previously known time-optimal schedule.

9/1993– 7/1994 participated in the research of real-time simulations for embedded microprocessor applications. She was a member of a team that designed and developed a production-version of such a simulator for intel.

- Contributed to all the design and development stages of the project, from the initial formulations to the coding of the shared files.
- Designed and documented the grammar and implemented the parser for the control language of the simulation environment, using C on iRMX.

New York University, School of Continuing and Professional Studies, 7/2001 – present
Subject Matter Expert, Online Instructor, and Research Supervisor in the Graduate Program

Designed and taught online a Web based, distance-learning, graduate course in Management of Telecommunications, for a credit bearing graduate program in Management and Systems.

- Summer 2001, independently designed the course content and wrote the entire Web session script for an intensive 6-week introduction to technical aspects of computer communications and networks, with an emphasis on the public INTERNET, for audiences of professional business administrators, employed in the areas of communications and software.
- Spring 2002, Spring and Summer 2003, Spring and Fall 2004, taught Management of Telecommunications, according to her own session script, using the book by Kurose and Ross as the additional required text. Delivered weekly online interactive audio lectures, and prepared and graded all assignments.
- Fall 2002, supervised a (award-winning) master thesis in the analysis and planning of wide-area networks.

Yeshiva College, Yeshiva University, 2/2000 – 6/2001
Adjunct Assistant Professor of Computer Science

Assisted in the efforts to advance the Department of Computer Science at Yeshiva College.

- Spring 2000, Spring 2001, designed and taught senior elective undergraduate courses in computer networks, which focused on the INTERNET protocol stack and application programming with the UNIX socket interface.
- Spring 2001, designed and taught a senior elective undergraduate course in introductory information theory and the theory of error-correcting codes.
- Fall 2000, designed and taught a required course in the theory of computation.
- Summer 1999, participated in a series of technical discussions on the development of the new curriculum for the major in Computer Science.

University of Massachusetts at Amherst, 5/1992 – 9/1993
Research Assistant in Project Pilgrim

Prof. Obrenić was a member of the Project Pilgrim team, the center of efforts to build a comprehensive, sophisticated, and self-regulating distributed computing environment for the University, with the OSF DCE as the technical core. Prof. Obrenić designed and started implementing a system-oriented utility for resource monitoring. This design was noted as an early published proposal for genuine reporting-based monitoring, in contrast to the standard, polling-based, centralized solutions.

- Designed and documented the MEGASCOPE, a utility for monitoring, reporting, managing, and presenting the status information about computer systems and software services in large, heterogeneous distributed environments. As do all the utilities in the Pilgrim environment, MEGASCOPE relies on the OSF DCE distributed-computing services for remote execution, timing, naming, file system, and security. The salient point of the MEGASCOPE design are autonomous, sophisticated sensors, attached to the monitored systems in order to collect system status information and report it to various recipients. The most important recipient is the MEGASCOPE panel, which acts as an on-line in-memory database with elaborate data definition. The panel records dynamically the current values and recent history of the status data, superimposing them on a persistent but dynamically modifiable description of the system. The MEGASCOPE observers query the panel to retrieve the current status information.
- Started an implementation of the first version of MEGASCOPE. Focused on sensors in operating systems, mostly in UNIX, in particular SunOS and ULTRIX. The programming environment was C++ and MOTIF/X on UNIX and OSF DCE.

University of Massachusetts at Amherst, 12/1991 – 5/1992
Teaching Assistant for Software Engineering

Supervised and guided eight groups of senior undergraduate students through a project of design and implementation of a tetris board game. Held mandatory weekly progress report meetings with each group. Evaluated each project throughout all the stages of the software building process, from the initial specifications to the final code. The evaluations consisted of written critical reviews of the submissions, which were returned to the students as technical recommendations, along with numerical grades. The programming environment was ADA on VAX/VMS.

University of Massachusetts at Amherst, 5/1990 – 12/1991
Research Assistant in the Group for Parallel Architectures Theory

Prof. Obrenić's dissertation research was motivated by analysis and conceptual design of interconnection networks for parallel architectures, and her results comprise a significant contribution to the theory of graph embedding and network emulations. She authored several new algorithms, some of which are remarkably faster than those previously known.

- Prof. Obrenić designed an optimal (within a small constant factor) solution to the last open case of the book-embedding problem for a major network family, namely, shuffle-like networks (specifically, de Bruijn and shuffle-exchange networks), a problem that had remained open since 1984. The problem of finding a book-embedding with the minimum number of pages is NP-complete for general graphs. Optimal or near-optimal (in number of pages) book-embeddings had been constructed for virtually all graphs on which popular interconnection networks are based, with the exception of shuffle-like graphs. There had been known only a non-constructive proof guaranteeing a weak upper bound of $O(\sqrt{n})$ for the pagenumber of an n-node shuffle-like graph. Prof. Obrenić's solution is constructible in linear time and requires five pages only; it is known that at least three pages are necessary, so while the solution may not be optimal, it is not far from optimal.
- In her dissertation, Prof. Obrenić defined a communication abstraction called cell graphs and employed cell graphs to solve network emulation problems related to congestion control. She constructed the first asymptotically optimal algorithm for emulations of arbitrary bounded-degree graphs with sublinear node-separators by shuffle-like networks. Optimal emulations of these graphs by butterfly-like networks and hypercubes had been known since 1987. However, these results did not extend directly to shuffle-like graphs, for which the

best emulation cost achieved by the old algorithm had remained on the order of the square of the optimal, until the problem was closed by Prof. Obrenić's solution.

- Together with her coauthors, Prof. Obrenić employed network emulations to devise practical schemes for enhancing the performance of parallel architectures, by logical reconfiguration. It had been a long standing observation on the part of researchers in parallel hardware that it is desirable for a parallel architecture to be able to reconfigure itself dynamically, in order to adapt to the granularity of parallelism inherent in the processed data. To support even restricted versions of such multigauge behavior by hardware enhancements is prohibitively expensive. Prof. Obrenić and her coauthors developed a suite of algorithms that endow a bit-serial processor array with a family of semantically consistent virtual instruction sets, which enable the bit-serial array to behave as a family of word-parallel architectures, without any hardware modifications. The reconfiguration itself is rendered an ordinary computation step invoked by the reconfiguration instruction. The strength of this approach is illustrated by a complete implementation of the algorithms, as a separate software layer residing on top of the architecture's native instruction set, in a pseudo-code for an extremely modest hardware platform, assuming only a rudimentary SIMD machine with single-bit masking.
- Building on her previous results, Prof. Obrenić employed cell graphs to design virtual multigauge architectures. She introduced multigauge behavior in networks that do not have direct-product structure (trees, X-trees, meshes, butterflies), improved the performance of multigauge shuffle-like networks, and extended the repertoire of efficiently supported virtual word-parallel instructions, while further relaxing the already modest constraints on the hardware capabilities.

University of Massachusetts at Amherst, 1/1990 – 5/1990
Teaching Assistant for Analysis of Algorithms

Graded and commented bi-weekly take-home problem solving assignments in algorithm theory for a class of senior undergraduate students. Wrote the reference solutions to all assignments, for distribution to the class. Held regular office hours for technical advisement.

University of Massachusetts at Amherst, 1/1989 – 1/1990
Research Assistant in the Group for Object Oriented Systems

Participated in the performance studies of a prototype of a novel, high-performance, persistent object store. Programmed sophisticated experiments for evaluating with high accuracy the access speed in various traversal patterns. The environment of choice was C on VAX/VMS, due to the ability of VMS to allow privileged physical access to devices, which eliminated intermediate and otherwise transparent system buffering, and isolated actual disk accesses for accurate performance measurements.

University of Massachusetts at Amherst, 9/1988 – 1/1989
Teaching Assistant for Computation Theory

Graded and commented bi-weekly take-home problem solving assignments in automata theory, formal languages, and computability, for a class of senior undergraduate students. For each assignment, compiled a reference solution for distribution to the class, by selecting, annotating, and composing creditable submissions of the students, supplemented by her own solutions. Held regular office hours for technical advisement.

Physics Laboratory, Boris Kidrič Institute of Nuclear Sciences, Belgrade, 5/1988 – 8/1988
Systems Analyst

Head of a general purpose computing facility that served a group of nuclear physicists. Served as a system programmer, system manager, and administrator.

- Conceived, designed, and implemented system software for improving VAX/VMS performance by dynamic adjustment of process priorities, using VAX PASCAL. This package enabled a small micro-VAX to support simultaneously, without perceptible performance degradation, a large number of interactive users, whose typical usage pattern interleaved highly interactive editing and data viewing with periods of intensive, processor-bound numerical computation.

Electric Power Dispatch Center, ZEP, Belgrade, 4/1983 – 8/1988
Systems Analyst

System programmer, system manager, and administrator for VAX/VMS, application programmer and supervisor, data administrator and database administrator, instructor.

- Conceived, designed, and implemented a customized, interactive database for off-line recording and inspection of energy flow in a power system, and for maintaining information about the equipment employed in the flow measurements. The available software platform comprised only VMS and two compilers, PASCAL and FORTRAN. The application was written in PASCAL, with many FORTRAN wrappers around low level system services, due to the specifics of the calling standard in the contemporary system version. The database included a locking concurrency control mechanism, built on top of VMS file and record management services, to support multiuser interactive access. A dedicated, form-based, QBE-like user interface was built from scratch on top of a plain VT-100 terminal, using VMS terminal driver. The data definition and data manipulaton sessions utilized the same interface. Numerous customized data types were built into the data definition subsystem, and extensive integrity checking was performed upon data entry, trough a hierarchy of triggers. The database had authorization procedures and a journal.
- Programmed procedures for routine system management of VMS, such as backup, recovery, startup, shutdown, monitoring, so as to allow personnel without computer training to serve as reliable operators.
- Led an internal corporate educational program in computer literacy and served as the instructor. The participants were a group of ≈ 20 hardware technicians, business administrators, clerks, and a few experts in the domain of electric power transmission. Whereas a small number of attendants actually learned to develop programs independently, all of them became able to interact successfully with programmers involved in modeling, requirement specification, data definition, and other tasks encountered in automating of operations.
- As a senior programmer and system manager, provided perpetual ad hoc technical guidance and authoritative advice to application programmers, regarding numerous problems encountered in the development and porting of applications, such as algorithmic efficiency, numerical stability, compiler compatibility, format conversions, storage utilization, input data quality, etc.
- Reviewed and evaluated the software developed through external contracts.

Department of Electrical Engineering, University of Belgrade, 9/77 – 6/1980
Recitation Lecturer

Held problem-solving teaching sessions in theoretical electromagnetics for undergraduate students. Independently selected the content of the lectures and was fully responsible for it.

EDUCATION

Ph.D., Computer Science, University of Massachusetts at Amherst, August 1993

The studies focused on parallel architectures, graph theory, algorithms, computability, complexity, operating systems, distributed computing.

Doctoral Curriculum in Computer Science, Department of Electrical Engineering, Belgrade, 1986

Completed all Graduate Program requirements, except for the dissertation. The studies focused on operating systems, databases, contemporary microprocessor architecture, programming languages, formal denotational semantics, computability, formal languages, automata theory, concurrent programming. Completed with the average grade of 10.0, on a $5-10$ scale, where $5 \cong F$ and $9 \cong A$.

B.S., Electrical Engineering, University of Belgrade, July 1982

Comprehensive curriculum, strong in mathematics, mechanics, physics, theoretical and applied electromagnetics, electronics, computer architecture, programming, programming languages, compilers, numerical analysis. Over 40 courses, many of them full-year, were taught in the major. Completed with the average grade of 9.38, on a $5-10$ scale, where $5 \cong F$ and $9 \cong A$. The diploma thesis project included a major software package, written in the combination of MACRO-11/RT-11 assembler and FORTRAN, for supporting variable-precision arithmetic operations.

Mathematical Gymnasium, Belgrade, Jun 1975

The school was unique nation-wide in that it augmented its regular curriculum by a special university-level program in mathematics, physics, and astronomy. This program was intended for a small number of top-ranked students in the country, which were admitted after a series of entrance examinations. Completed with the highest distinctions.

AWARDS

PSC CUNY Research Award, City University of New York, academic year 1998-99,
topic: Layout area of index-shuffle graphs.

PSC CUNY Research Award, City University of New York, academic year 1996-97,
topic: Controlling the data space of tree structured computations.

PSC CUNY Research Award, City University of New York, academic year 1994-95,
topic: Properties of index-shuffle graphs.

Graduate School Fellowship Award, University of Massachusetts at Amherst, academic year 1991-92.

Student Awards
national: 1978–1980, three individual top placements in theoretical electromagnetics at annual problem-solving competitions of undergraduate EE departments; 1975, the third place in physics at the annual problem-solving competition of high-schools;
university: 1976–1977, two annual awards for performance on examinations

PUBLICATIONS

Book:

- B. Obrenić (2003): Practice Problems in Discrete Mathematics.
  Prentice-Hall, N.J., ISBN: 0-13-045803-1, 415 pages.

Refereed journals:

- B. Obrenić (2004): Approximating hypercubes by index-shuffle graphs via direct-product emulations. *Journal of Interconnection Networks 5(4)*, p. 429–473.
- I. Gottlieb and B. Obrenić (2003): Controlling the data space of tree structured computations. *Information and Computation 187*, p. 246–276.
- B. Obrenić, M.C. Herbordt, A.L. Rosenberg, C.C. Weems, (1999): Using emulations to enhance the performance of parallel architectures. *IEEE Transactions on Parallel and Distributed Systems 10(10),* p. 1067–1081.
- M. Baumslag and B. Obrenić (1997): Index-Shuffle Graphs. *International Journal of Foundations of Computer Science, Special Issue on Interconnection Networks 8(3)*, p. 289–304.
- S.N. Bhatt, F.R.K. Chung, J.-W. Hong, F.T. Leighton, B. Obrenić, A.L. Rosenberg, E.J. Schwabe (1996): Optimal emulations by butterfly-like networks. *Journal of the ACM 43*, p. 293–330.
- B. Obrenić (1994): An approach to emulating separable graphs. *Mathematical Systems Theory 27*, p. 41–63.
- B. Obrenić (1993): Embedding de Bruijn and shuffle-exchange graphs in five pages. *SIAM Journal on Discrete Mathematics 6*, p. 642–654.
- B. Obrenić, K.S. DiBella, A.S Gaylord (1993): DCE cells under Megascope: Pilgrim insight into the resource status. *Lecture Notes in Computer Science 731* (A. Schill, ed.), Springer-Verlag, N.Y., p. 162–178.

Refereed conference proceedings:

- B. Obrenić (1998): Emulating Direct Products by Index-Shuffle Graphs. *1st Merged Symposium* of *12th International Parallel Processing Symposium* and *9th IEEE Symposium on Parallel and Distributed Processing,* Delta Orlando Resort, Orlando, Florida, p. 338–344, March 30–April 3, 1998.
- M. Baumslag and B. Obrenić (1997): Index-Shuffle Graphs. *8th IEEE Symposium on Parallel and Distributed Processing,* New Orleans, Louisiana, p. 160–168, October 23-26, 1996.
- B. Obrenić (1991): Embedding de Bruijn and shuffle-exchange graphs in five pages. *3rd ACM Symposium on Parallel Algorithms and Architectures*, Hilton Head, South Carolina, p. 137–146, July 22-24, 1991.
- B. Obrenić (1991): An approach to emulating separable graphs. *3rd ACM Symposium on Parallel Algorithms and Architectures*, Hilton Head, South Carolina, p. 159–167, July 22-24, 1991.
- F.S. Annexstein, M. Baumslag, M.C. Herbordt, B. Obrenić, A.L. Rosenberg, C.C. Weems, (1990): Achieving multigauge behavior in bit-serial SIMD architectures via emulation. *3rd IEEE Symposium on Frontiers of Massively Parallel Computation*, College Park, Maryland, p. 186–195, October 8-10, 1990.

Other publications:

- B. Obrenić (2001–2004): Exercises in Databases.
  Problem compendium, Queens College, New York.
- B. Obrenić (1999–2004): Problems in Computation Theory.
  Problem compendium, Queens College, New York.
- B. Obrenić (1993): Cell graphs for managing communication in parallel computing.
  Ph.D. Dissertation, Univ. Massachusetts.
- B. Obrenić (1992): Megascope, Pilgrim Resource Monitor—Introduction.
  Project Pilgrim Document Set, Univ. Massachusetts.
- B. Obrenić (1992): Megascope, Pilgrim Resource Monitor—Sensor design note.
  Project Pilgrim Document Set, Univ. Massachusetts.

Refereeing:

- *Information and Computation*
- *Journal of Algorithms*
- *Mathematical Systems Theory*
- *Discrete Applied Mathematics*
- *Journal of Interconnection Networks*
- *IEEE Transactions on Parallel and Distributed Systems*
- *Mathematical Programming B*
- *International Journal of Parallel Programming*
- *Parallel Processing Letters*
- *Journal of Fiber and Integrated Optics*
- International Conference on High Performance Computing
- IEEE Symposium on Parallel and Distributed Processing
- International Parallel Processing Symposium
- International Parallel and Distributed Processing Symposium

CURRENT ADDRESS
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March 9, 2005

Vita

Ihsin Tsaiyun Phillips

Department of Computer Science
Queens College, the City University of New York

I. Education:

- **1984:** Ph.D. CS, University of Maryland, College Park, Maryland.
- **1981:** M.S. CS, University of Maryland, College Park, Maryland.
- **1979:** B.S. CS, University of Maryland, College Park, Maryland.

II. Faculty Appointments:

- Fall 2003 - Present: Professor, Department of Computer Science, Queens College, the City University of New York (CUNY).
- Fall 2000 - Spring 2003: Professor and Chair, Department of Computer Science, Queens College, the City University of New York (CUNY).
- Fall 1998 - Fall 2000: Thomas Bannan Endowed Chair, School of Science and Engineering, Seattle University.
- Fall 1997 - Spring 2000: Professor, Department of CS&SE, Seattle University.
- Fall 1997 - Fall 1998: Associate Chair, Department of CS&SE, Seattle University.
- Fall 1991 - Spring 1997: Tenured Associate Professor, Department of CS&SE, Seattle University.
- Fall 1993 - Spring 1995 : The director of Undergraduate Program in CS&SE, Seattle University.
- Fall 1992 - present: Graduate School representative, Univ. of Washington.
- Fall 1988 - present: Affiliate faculty, Department of Elect. Eng., Univ. of Washington.
- Fall 1985 - Spring 1991: Assistant Professor, Department of CS&SE, Seattle University.
- Fall 1984 - Spring 1985: Assistant Professor, Department of Computer Science, University of Maryland Baltimore County.
- Summers 1985, 1986, 1987: Visiting Assistant Professor, Center for Automation Research, Univ. of Maryland, College Park, Maryland.
- Fall 1984 - Spring 1985: Affiliate Faculty, National Bureau Standard, Washington D.C..

III-A. Courses Taught at Queens College:

- CSCI 323 Design and Analysis of Algorithms
- CSCI 700 Algorithm I
- CSCI 701 Software Design
- CSCI 731 Sofware Development Practicum
- CSCI 732 Research Practicum
- CSCI 780 Software Engineering

III-B. Courses Taught at Seattle University:

- CSC 150 Introduction to Computer Science
- CSC 170 Intermediate Programming with Pascal
- CSC 230 Fortran for Engineers
- CSC 235 Computer Systems and Assembly Languages
- CSC 240 Introduction to Computer Organization
- CSC 250 Data Structures
- CSC 310(old) Data Structures and Analysis of Algorithm
- CSC 310(since 1995) Design and Analysis of Algorithm
- CSC 360 Introduction to Software Engineering
- CSC 465 Computer Graphics and Image Processing
- CSC 470 Artificial Intelligence
- CSC 490 Senior Project
- CSC 491 Introduction to Image Processing
- CSC 487 Software Engineering &Project Development I
- CSC 488 Software Engineering &Project Development II
- CSC 489 Software Engineering &Project Development III
- MSE 500 Information Structures and Algorithms
- MSE 551 Distributed Computing
- MSE 564 Computer Graphics
- MSE 591C Software Literature Reviews
- MSE 585 Software Engineering Project I
- MSE 586 Software Engineering Project II

- MSE 587 Software Engineering Project III
- MSE 589 Special Topics: Software Engineering Literature Surveys

VI.1. Directed Master of Software Engineering Projects (5 to 6 students per project):

- 1997-98: Project: Internet Delivery Framework. Sponsor: Provident Ventures, Bellevue, Washington.
- 1995-96: Project: Performance Evaluation of Line-drawing Systems Sponsor: Ihsin Phillips
- 1994-95: Project: Document Image Retrieval System. Sponsor: US Department of Advance Research Project Agency.
- 1991-92: Project: Graphical Object Oriented Visual Programming Tool. Sponsor: US Department of Advance Research Project Agency.
- 1990-91: Project: Proteus Controller. Sponsor: US Naval Coastal System Center.
- 1989-90: Project: Fagan Inspection Tools. Sponsor: Boeing Computer Service.
- 1988-89: Project: Database Entry System. Sponsor: Kistler-Morse Inc.
- 1987-88: Project: Map & Graphic Image Correction. Sponsor: Boeing Aerospace.

VI.2. Computer Science Senior Software Engineering Projects(5 to 6 students per project):

- 1999-00: Project: A Graphical User Interface Tool for Hierarchical Structured Documents. Sponsor: Dr. Ihsin Phillips
- 1998-9: Project: Regence Blue Shield Database Management. Sponsor: Regence Blue Shield of Washington.
- 1996-7: Project: Graphical User's Interface for Document Classification and Management. Sponsor: Hewlett-Packard.

V. Publications:
V.1. Professional Journal Publications:

1. "Table Structure Understanding and Its Performance Evaluation" Yalin Wang, Ihsin T. Phillips and Robert M. Haralick, Pattern Recognition, 37(7), Jul. 2004, pp. 1479-1497
2. "Performance Evaluation of document structure extraction algorithms", J. Liang, Ihsin.T. Phillips, and R.M. Haralick, *the Journal of Computer Vision and Image Understanding, Special issue on Empirical Evaluation of Computer Vision Algorithms*, Vol. 84, No. 1, Oct. 2001, pp. 144-159.
3. "An Optimization Methodology for Document Image Structures Extraction on Latin Character Documents", J. Liang, Ihsin.T. Phillips, and R.M. Haralick, *the Journal of IEEE Transaction for Pattern Analysis and Machine Intelligent*, Vol. 23, Num. 7, July 2001, p. 719-734.

4. "Consistent Partition and Labeling of Text Blocks", J. Liang, Ihsin.T. Phillips, and R.M. Haralick, *the Journal of Pattern Analysis and Applications*, Vol. 3 Issue 2, 2000, pp.196-208.

5. "Empirical Performance Evaluation of Graphics Recognition Systems," Ihsin T. Phillips and Atul Chhabra, *the Journal of IEEE Transaction for Pattern Analysis and Machine Intelligent*, Vol. 21, Number 9, September, 1999, pp.849-870.

6. "Extraction of Text-lines and Text-blocks on Document Images Based on Statistical Modeling", S. Chen, R.M. Haralick, and Ihsin T. Phillips, *International Journal of Imaging Systems and Technology,* Vol. 7, 1996.

7. "Extraction of Text-words in Document Images Based on Statistical Characterization", S. Chen, R.M. Haralick, and Ihsin T. Phillips, *Journal of Electronic Imaging,* Vol. 5(1), January 1996, pp. 21-36.

8. "Non-linear Global and Local Document Degradation Models," T. Kanungo, R.M. Haralick and Ihsin T. Phillips, *International Journal of Imaging Systems and Technology*, Vol. 5, No. 4, 1994.

9. "Proteus: a Reconfigurable Computational Network for Computer Vision," R.M. Haralick, A.K. Somani, C. Wittenbrink, R. Johnson, K. Cooper, L. Shapiro, J. Hwang, Ihsin T. Phillips, *B. Daugherty, R. Lorbeski, L. Loving, T. Miller, L. Parkins, and S. Soos*, *Machine Vision and Applications*, Special Issue, 1994,

10. "Statistical Morphology," R.M. Haralick E. Dougherty, J. Ha, T. Kanungo, S. Karasu, C.K. Lee, L. Rystrom, V. Ramesh, and Ihsin T. Phillips, *Advances in Applied Statistics: Statistics & Images: 2*, (a Supplement to *Journal of Applied Statistics*, Vol. 21, Nos. 1/2, 1994), K.V. Mardia (ed.), Abingdon, Oxfordshire, UK: Carfax, 1994, 341–354.

11. "O(log n) Bimodality Analysis," I. T. Phillips, A. Rosenfeld, and A. Sher, *Journal of Pattern Recognition*, Vol. 22, No. 6, 1989, pp. 741-746.

12. "Decomposing Stacks of 2D Arrays into Ellipsoid-Like Objects," I. T. Phillips and A. Rosenfeld, *Journal of Image and Vision Computing*, Vol. 6, No. 1, 1988, pp. 33-51.

13. "An Isodata Algorithm for Straight Line Fitting," I. T. Phillips and A. Rosenfeld, *Journal of Pattern Recognition Letters 6*, 1988, pp. 291-297.

14. "A Method of Curve Partitioning Using Arc-Chord Distance," I. T. Phillips and A. Rosenfeld, *Journal of Pattern Recognition Letters 5*, 1987, pp. 285-288.

15. "Decomposition and Approximation of Three-Dimensional Solids," I. T. Phillips, R. Cannon, and A. Rosenfeld, *Journal of Computer Vision, Graphics, and Image Processing 33*, 1986, pp. 307-317.

16. "A Simplified Method of Detecting Structures in Glass Patterns," I. T. Phillips and A. Rosenfeld, *Journal of Pattern Recognition Letters 4*, 1986, pp. 213-217.

17. "A Shrinking Technique for Complex Object Decomposition," I. T. Phillips, *Journal of Pattern Recognition Letters 3*, 1985, pp. 271-277.

18. "Automatic Segmentation of Electron Micrographs of Berea Sandstone Cross-Sections," I. T. Phillips, L. Davis, and A. Rosenfeld, *Journal of Pattern Recognition*, Vol. 16, 1983, 385-400.

19. "Metric Analysis and Data Validation Across Fortran Projects," V. Basili, R. Selby, and I. T. Phillips, *Journal of IEEE Transactions on Software Engineering*, Vol. SE-9, 1983, pp. 652-664.

V.2. Book Chapters:

1. "Zone Content Classification by Using Background Analysis", Yalin Wang, Ihsin, T. Phillips, and Robert Haralick, to be published in the DAS2000 post book.

2. "The Second International Graphics Recognition Contest – Raster to Vector Conversion: A Report," A.D. Chhabra, and I. T. Phillips, Graphics Recognition – Algorithms and Systems, Karl Tombre and Atul Chhabra (Eds.), Springer Verlag, Lecture Notes in Computer Science, vol. 1389, 1998, pp. 390-410.

3. "A Performance Evaluation Protocol for Graphics Recognition Systems," I. T. Phillips, J. Liang, A.D. Chhabra, and R.M. Haralick, Graphics Recognition – Algorithms and Systems, Karl Tombre and Atul Chhabra (Eds.), Springer Verlag, Lecture Notes in Computer Science, vol. 1389, 1998, pp. 372-389.

   item "A Benchmark for Graphics Recognition Systems," A.D. Chhabra and I. T. Phillips, Empirical Evaluation Techniques in Computer Vision, K. Bowyer and P.J. Phillips, IEEE Computer Society, 1998, pp. 28-38.

4. "The Second International Graphics Recognition Contest – Raster to Vector Conversion: A Report," A Chhabra and I. T. Phillips, to be appeared as a chapter in *Graphics Recognition Methods and Application*, K. Tombre and A. Chhabra (eds.), Springer, 1998.

5. "The Representation of Document Structure: a Generic Object-Process Analysis," D. Dori, D. Doermann, C. Shin, R. Haralick, I. Phillips, M. Buckman, and D. Ross, Chapter 16, Handbook of Character Recognition and Document Image Analysis, World Scientific Publishing Company, 1997, pp.421-456.

6. "Data sets for OCR and Document Image Understanding Research," I. Guyon, R. Haralick, J. Hull, and I. T. Phillips Chapter 30, Handbook of Character Recognition and Document Image Analysis, World Scientific Publishing Company, 1997, pp.779-799.

7. "A Benchmark: Performance Evaluation of Dashed-Lind Detection Algorithms", B. Kong, I.T. Phillips, R.M. Haralick, A. Prasad, and R. Kasturi; A book chapter in *Graphics Recognition Methods and Application*, R. Kasturi and K. Tombre (eds.), Springer, 1995, pp. 270-285.

8. "Document zone hierarchy and classification", R.M. Haralick, I.T. Phillips, S. Chen, and J. Ha, *Shape, Structure and pattern Recognition*, Edited by Dov Dori and Alfred Bruckstein, World Scientific, 1995, pp. 390-415.

9. "CD-ROM Document Database Standard", I.T. Phillips, S. Chen, and R.M. Haralick; A book chapter in *Document Image Analysis*, by L. O'Gorman and R. Kasturi, Los Alamitos, CA, IEEE Computer Society Press, 1994, pp. 1998-203.

V.3. Refereed Conference/Workshop Publications:

1. " A Study on the Zone Content Classification Problem", Yalin Wang, Ihsin, T. Phillips, and Robert Haralick, has been accepted for publication in *Proceedings of the 5th IAPR International Workshop on Document Analysis Systems (DAS'2002)*, Princeton, New Jersey, August 19-21, 2002.

2. "Table Detection via Probability Optimization", Yalin Wang, Ihsin, T. Phillips, and Robert Haralick, has been accepted for publication in *Proceedings of the 5th IAPR International Workshop on Document Analysis Systems (DAS'2002)*, Princeton, New Jersey, August 19-21, 2002.

3. "A Theoretical Foundation for Table Detection and Analysis Algorithms", Howard Wasserman, Keitaro Yukawa, Bon Sy, Kui-Lam Kwok, and Ihsin T. Phillips, has been accepted for publication in *Proceedings of the 5th IAPR International Workshop on Document Analysis Systems (DAS'2002)*, Princeton, New Jersey, August 19-21, 2002.

4. "Document Zone Content Classification Using Decision Tree and HMM", has been accepted for publication in *Proceedings of International Conference on Pattern Recognition*, Quebec City Convention Center, Quebec, Canada, August 11-15, 2002.

5. "Automatic Table Ground Truth Generation and A Background-analysis-based Table Structure Extraction Method", Yalin Wang, Ihsin T. Phillips and Robert Haralick, *Sixth International Conference on Document Analysis and Recognition*, Seattle, Washington, U.S.A. Sept. 10-13, 2001, p. 528–532.

6. "Zone Content Classification and Its Performance Evaluation", Yalin Wang, Robert Haralick and Ihsin T. Phillips, *Sixth International Conference on Document Analysis and Recognition* , Seattle, Washington, U.S.A. Sept. 10-13, 2001, p. 540–544.

7. "Using Area Voronoi Tessellation to Segment Characters Connected to Graphics", Yalin Wang, Ihsin T. Phillips and Robert Haralick, *Workshop on Graphics Recognition (GREC2001)*, Kingston, Ontario, Canada. Sept. 2001

8. "Random Table and Its Ground Truth Automatic Generation: A Tool for Table Understanding Research", Yalin Wang, Ihsin T. Phillips and Robert Haralick, *Workshop on Document Layout Interpretation and its Applications (DLIA2001)*, Seattle, Washington, U.S.A. Sept. 2001

9. "Performance Evaluation and Improvements," Yalin Wang, Robert M. Haralick, and Ihsin. T. Phillips, *Proceedings of the 4th IAPR International Workshop on Document Analysis Systems (DAS'2000)*, Rio de Janeiro, December 10-13, 2000, p.429-438.

10. "Statistical-based Approach to Word Segmentation," Yalin Wang, Ihsin. T. Phillips, Robert M. Haralick, and Jisheng Liang, *Proceedings of the 15th International Conference on Pattern Recognition(ICPR2000)*, Barcelona, Span, September 3-7, 2000, p.555-558 .

11. "Methodology for Special Symbol Recognition," Jisheng Liang, Ihsin. T. Phillips, Robert M. Haralick, and Jisheng Liang, *Proceedings of the 15th International Conference on Pattern Recognition(ICPR2000)*, Barcelona, Span, September 3-7, 2000, p.11-14.

12. "Performance Evaluation of Line-drawing Systems," Atul Chhabra and Ihsin. T. Phillips, *Proceedings of the 15th International Conference on Pattern Recognition(ICPR2000)*, Barcelona, Span, September 3-7, 2000, p.864-867

13. "How to Extend and Bootstrap an Existing Data Set with Real-life Degraded Images," Ihsin. T. Phillips, *Proceedings of the 5th International Conference on Document Analysis and Recognition (ICDAR99)*, Bangalore, India, September 20-22, 1999, p. 689-692.

7

14. "A Statistically Based, Highly Accurate Text-line Segmentation Method," Jisheng Liang, Ihsin. T. Phillips, and Robert.M. Haralick, *Proceedings of the 5th International Conference on Document Analysis and Recognition (ICDAR99)*, Bangalore, India, September 20-22, 1999, pp. 551-554.

15. "From Image to SGML/XML Representation: One Method," Yalin Wang, Ihsin. T. Phillips, and Robert.M. Haralick, *Document Layout Interpretation and its Application: A Workshop at the 5th International Conference on Document Analysis and Recognition (ICDAR99)*, Bangalore, India, September 18, 1999.

16. "A Unified Methodology for Document Structure Analysis," Jisheng Liang, Ihsin. T. Phillips, and Robert.M. Haralick, *Document Layout Interpretation and its Application: A Workshop at the 5th International Conference on Document Analysis and Recognition (ICDAR99)*, Bangalore, India, September 18, 1999.

17. "A Methodology for Special Symbol Recognitions," Jisheng Liang, Ihsin. T. Phillips, and Robert.M. Haralick, *Proceedings of the 3nd International Workshop on Graphics Recognition (GREC99)*, Jaipur, India, September 26-27, 1999.

18. "A Unified Approach for Document Structure Analysis and its Application to Text-line Extraction," Jisheng Liang, Ihsin. T. Phillips, and Robert.M. Haralick, *Proceedings of 1999 Symposium on Document Image Understanding Technology* Annapolis, Maryland, April 14-16, 1999, pp,32-41.

19. "A Benchmark for Raster to Vector Conversion Systems," I. T. Phillips and A.D. Chhabra, Proceedings of the Joint IAPR International Workshops SSPR'98 and SPR'98, Sydney, Australia, August 11-13, 1998, pp.242-251.

20. "A Methodology of Using the UW Image Databases for OCR and Document Image Document Understanding Systems," I.T. Phillips, *Proceeding of Electronic Imaging 98*, Document Recognition IV, Vol. 3027, Feb. 27-30, 1998, San Jose, California.

21. "Performance Evaluation for Line-drawing Recognition Systems," I.T. Phillips, F. Chang, K. Chang, B. Duggirala, M. Logan, J. Loughry and *Proceeding of Electronic Imaging 97, Document Recognition IV*, Vol. 3027, Feb. 20-24, 1997, San Jose, California, pp 136-148.

22. "A Performance Evaluation of Document Layout Analysis Algorithms on the UW Data Set," J. Liang, I.T. Phillips, and R.M. Haralick, *Proceeding of Electronic Imaging 97*, Document Recognition IV, Vol. 3027, Feb. 20-24, 1997, San Jose, California, pp149-160.

23. "Evaluation Criteria for Engineering Drawing Detection Algorithms," I.T. Phillips and J. Liang, presented in the Poster Session, 1997 Symposium on Document Image Understanding Technology, Annapolis, Maryland, April 30-May 2, 1997.

24. "The ISL Document Image Understanding Toolbox and Font Attribute Recognition," R. Rogers, J. Liang, I.T. Phillips, and R.M. Haralick, IEEE Document Image Analysis Workshop, Puerto Rico, June 20, 1997, pp18-25.

25. "Image Understanding Analysis Toolbox: An Experimental Environment," J. Liang, R. Rogers, I.T. Phillips, and R.M. Haralick, Fourth International Conference on Document Analysis and Recognition, August 18-20, 1997, Ulm, Germany, pp.984-988.

26. "A Performance Evaluation Protocol for Engineering-drawing Recognition Systems," I.T. Phillips, J. Liang, and R.M. Haralick, Proceedings of the 2nd International IAPR Workshop on Graphics Recognition, August 22-23, 1997, INRIA Lorraine & CRIN/CNRS, Nancy, France, pp.333-346.

27. "The Prototype of a Complete Document Image Understanding System," J. Liang, J. Ha, R. Rogers, I.T. Phillips, R.M. Haralick, and B. Chanda, *Proceedings of International Association of Pattern Recognition Workshop on Document Analysis Systems*, Malvern, Pennsylvania, Oct. 14-16, 1996, pp 131-154.

28. "Semiautomatic Production of Highly Accurate Word Bounding Boxes Ground Truth," R. Rogers, I.T. Phillips, and R.M. Haralick, *Proceedings of International Association of Pattern Recognition Workshop on Document Analysis Systems*, Malvern, Pennsylvania, Oct. 14-16, 1996, pp 375-387.

29. "Zone Classification in a Document using the Method of Feature Vector Generation," Ramaswamy S, I. T. Phillips, J. Ha, and R.M. Haralick, *Proceedings of the 3rd International Conference on Document Analysis and Recognition*, August 14-16, 1995, Montrael, Canada, Volume II, 541-544.

30. "Simultaneous Word Segmentation from Document Images Using Recursive Morphological Closing Transform," S. Chen, R.M. Haralick, and I. T. Phillips, *Proceedings of the 3rd International Conference on Document Analysis and Recognition*, August 14-16, 1995, Montrael, Canada, Volume II, 761-764.

31. "Recursive X-Y Cut Using Bounding Boxes of Connected Components," J. Ha, I. T. Phillips, and R.M. Haralick, *Proceedings of the 3rd International Conference on Document Analysis and Recognition*, August 14-16, 1995, Montrael, Canada, Volume II, 952-955.

32. "Understanding Mathematical Expressions from Document Images," J. Ha, I. T. Phillips, and R.M. Haralick, *Proceedings of the 3rd International Conference on Document Analysis and Recognition*, August 14-16, 1995, Montrael, Canada, Volume II, 956-959.

33. "Document Page Decomposition by the Bounding-Box Projection Technique," J. Ha, I. T. Phillips, and R.M. Haralick, *Proceedings of the 3rd International Conference on Document Analysis and Recognition*, August 14-16, 1995, Montrael, Canada, Volume II, 1119-1122.

34. "Automatic Text Skew Estimation in Document Images," S. Chen, R.M. Haralick, and I.T. Phillips, *Proceedings of the 3rd International Conference on Document Analysis and Recognition*, August 14-16, 1995, Montrael, Canada, Volume II, 1153-1156.

35. "Perfect Document Layout Ground Truth Generation Using DVI Files and Simultaneous Word Segmentation From Document Images," S. Chen, R.M. Haralick, and I.T. Phillips, *Proceedings of the Fourth Annual Symposium on Document Analysis and Information Retrieval*, April 24-26, 1995, Las Vegas, Nevada, 229-247.

36. "Extraction of Text Layout Structures on Document Images Based on Statistical Characterization," S. Chen, R.M. Haralick, and I.T. Phillips, *Proceedings of Electronic Imaging 95, Document Recognition II*, February 6-7, 1995, San Jose, California, 128-139.

37. "Document Page Decomposition using Bounding Boxes of Connected Components of Black Pixels," J. Ha, I.T. Phillips, and R.M. Haralick, *Proceedings of Electronic Imaging 95, Document Recognition II*, February 6-7, 1995, San Jose, California, 140-151.

38. "Automatic Line Detection in Document Images using Recursive Morphological Transforms" Bin Kong, S. Chen, R.M. Haralick, and I.T. Phillips, *Proceeding of Electronic Imaging 95, Document Recognition II*, February 6-7, 1995, San Jose, California, 163-174.

39. "Performance Evaluation of Two OCR Systems," S. Chen, S. Subramaniam, I.T. Phillips, and R.M Haralick, *Proceedings of the Third Annual Symposium on Document Analysis and Information Retrieval*, University of Nevada, Las Vegas, NV, April 11–13, 1994, 299–317.

40. "Estimating Errors in Document Databases," J. Ha, S. Chen, I.T. Phillips, and R.M. Haralick, *Proceedings of the Third Annual Symposium on Document Analysis and Information Retrieval*, University of Nevada, Las Vegas, NV, April 11–13, 1994, 435–459.

41. "Bayesian Corner Detector," R.M. Haralick X. Zhang, V. Ramesh, A. Bedekar, and I.T.Phillips, *ICIP-94, IEEE International Conference on Image Processing*, Austin, TX, November 13–16, 1994, 282-286.

42. "English Document Database Design and Implementation Methodology," I.T. Phillips, S. Chen, J. Ha, R. M. Haralick, *the Second Annual Symposium on Document Analysis and Information Retrieval*, April 26-28, 1993, pp. 65-104.

43. "Implementation Methodology and Error Analysis for the English Document Database-I," I.T. Phillips, J. Ha, S. Chen, and R.M. Haralick. An invited paper, *Proceedings of the 22nd AIPR Workshop*, Oct. 13-15, 1993, Washington D.C..

44. "Global and Local Degradation Model for Document Images," T. Kanungo, R.M. Haralick, I.T. Phillips, *Proceedings of the International Conference on Document Analysis and Retrieval*, October 20-22, 1993, Tsukuba, Japan, pp 730-734.

45. "CD-ROM Document Database Standard'," I.T. Phillips, S. Chen, and R.M. Haralick, *Proceedings of the International Conference on Document Analysis and Retrieval (ICDAR 93)*, Oct. 20-22, 1993, Tsukuba, Japan, pp 478-483.

46. "The Implementation Methodology for the CD-ROM English Document Database," I.T. Phillips, J. Ha, R.M. Haralick, D. Dori, *Proceedings of the International Conference on Document Analysis and Retrieval*, Oct. 20-22, 1993, Tsukuba, Japan, pp 484-487.

47. "Proteus: a reconfigurable computational network for computer vision," R.M. Haralick, A.K. Somani, C. Wittenbrink, R. Johnson, K. Cooper, L. Shapiro, J. Hwang, I.T. Phillips, *B. Daugherty, R. Lorbeski, L. Loving, T. Miller, L. Parkins, and S. Soos*, *Proceedings, 11th IAPR International Conference on Pattern Recognition*, The Hague, The Netherlands, August 30–September 3, 1992, Vol. IV, 43–57.

48. "Subpixel Precision Corner Detection and Localization," I. T. Phillips and R. Haralick, *Proceedings of Electronic Imaging 90 West*, Pasadena, California, February 26-March 1, 1990.

49. "Image Segmentation Using the Morphological Pyramid," C. Lee, R. Haralick, and I. T. Phillips, *Proceeding of Electronic Imaging 89*, Orlando, FL, March, 1989, pp. 108-221.

50. "Experiments in Affine Invariant Matching," M. Costa, I. T. Phillips, L. Shapiro, and R. Haralick, *Proceeding of Electronic Imaging 89*, Orlando, FL, March, 1989, pp. 108-221.

51. "Digital Realization of the Labeled Discrete Voronoi Diagram and its Application to Closed Boundary Detection," T. Matsuyama and I. T. Phillips, *Proceedings of the Seventh International Conference on Pattern Recognition*, Montreal, Canada, 1983.

52. "Evaluating and Comparing the Software Metric in the Software Engineering Laboratory," V. Basili and I. T. Phillips, *Proceedings of the ACM Sigmetrics*, March 1981, 195-206.

V.4. Non-refereed Publications:

1. "The Design and Implementation of the Third English Technical Document Image Database-III: Reference Manual," I.T. Phillips, *UW-CDROM database-III*,August, 1996, 67 pages.

2. "The Design and Implementation of the Second English/Japanese Technical Document Image Database-II: Reference Manual," *Bruce Stone*, I.T. Phillips, R.M. Haralick, *UW-CDROM database-II*, issumed in July, 1995, 84 pages.

3. "Requirements: CD-ROM English Document Database," I.T. Phillips, S. Chen, and R.M. Haralick, *Technical Report, Intelligent System Laboratory, University of Washington* (25 pages), presented to the Technical Committee 11, IAPR, September, 1992.

4. "Extracting the Medial Axis from the Voronoi Diagram of Boundary Segments: An Alternative Method for Closed Boundary Detection," T. Matsuyama and I. T. Phillips, *Tech. Report CS-TR-1261*, Center for Automation Research, University of Maryland, April 1983.

5. "The Labeled Discrete Voronoi Diagram," I. T. Phillips and T. Matsuyama, *Tech. Report CS-TR-1278*, Center for Automation Research, University of Maryland, August 1983.

VI. Research Grant:

- **:** PSC-CUNY Research Award for the year of 2001-2, $3,314.
- **:** PSC-CUNY Research Award for the year of 2002-3, $3,352.
- **:** PSC-CUNY Research Award for the year of 2004-5, for a course release.
- **:** $64,000, research/development grant from the Texterity Inc. (with Prof. Robert Haralick).
- **1998-2000:** $64,000, research/development grant from the Texterity Inc. (with Prof. Robert Haralick).
- **1994 - 1996:** $400,000, research grant from the Department of Advance Research Programs Agency (with Prof. Robert Haralick).
- **1993 - 1994:** $300,000, research grant from the Department of Advance Research Programs Agency (with Prof. Robert Haralick).
- **1992 - 1993:** $300,000, research grant from the Department of Advance Research Programs Agency (with Prof. Robert Haralick).
- **1990:** $18,500, summer research support from the U.S. Naval Coastal Systems Center.

- **1989:** $14,000, summer research support from the National Science Foundation.
- **1988:** $14,000, summer research support from the Washington Technology Center, University of Washington.
- **1987** $14,000, Summer research grant from the National Science Foundation.
- **1986** $12,000, Summer research grant from the National Science Foundation.
- **Summers 1985** $12,000, Summer research grant from the National Science Foundation.

VII. Service at Queens College:

- Chair of the Department of Computer Science, Fall 2000-Spring 2003.
- Member of the College P&B Committee, Fall 2000-Spring 2003
- An alternative voting member to the College P&B Executive Committee, Fall 2000.
- Member of the Mathematics and Natural Sciences Division P&B Committee, Fall 2000-Spring 2003.
- Member of CS P&B Committee, Fall 2000-Spring 2003.
- Member of CS Undergraduate Curriculum Committee, Fall 2000-2001.
- Member of CS Graduate Curriculum Committee, Fall 2000-2001.
- Member of the faculty Search Committee, Fall 2000.
- Chair of the faculty Search Committee, Fall 2001.

VII. Service at Seattle University:

- Member of School Curriculum Committee, the School of Science and Engineering, 1999-2000.
- Faculty senate, 1988-89, and 1997-2000.
- Member of Faculty Development Committee, the School of Science and Engineering, 1994, and 1997-2000.
- Faculty Handbook Revision Committee, Fall 1997 to 1999.
- Member of the Grievance Committee, the School of Science and Engineering, 1996-1998.
- Member of the CSSE Departmental Personnel Committee, 1991-2000, (chair, 1998-99).
- Associate Chair of Computer Science/Software Engineering (CSSE), Fall 1997 to 1998.
- Director, Undergraduate Program in (CSSE), from 1993 to 1995.
- Chair, the CSSE Undergraduate Curriculum Committee, 1993-1998.
- Member of CSSE Undergraduate Curriculum Committee, since 1986.
- CSSE undergraduate student advisor, since 1986.

- MSE student advisor, CSSE, 1987-1991.
- Served on most of the CSSE Undergraduate and MSE Faculty Search Committee since 1987.
- Member of the CSSE Chair Search Committee, 1990, 1996, and 1997.
- Member of the CSSE Departmental Personnel Committee, since 1991.
- Member of the CSSE Departmental Strategic Committee, since 1995.
- Colloquium organizer for the school of Science and Engineering, 1994-5.
- Member of Research/Scholarship Committee, the School of Science and Engineering, since 1995.
- Participated in University open-houses, 1986-1988.
- Participated in most of the new/transfer student orientations, since 1989. These events are sponsored by the University.
- Participated in the summer *Step Head* advising program, since 1994. The program is sponsored by the University.

VIII. Professional Service:

- IAPR (international Association on Pattern Recognition) TC 11 Chair, 1999-2000.
- Local co-chair and a program committee, the six-th International Conference on Document Analysis and Recognition (ICDAR'01), 2001, September 20-22, Seattle, Washington, USA.
- A program committee, the fifth International Conference on Document Analysis and Recognition (ICDAR'99), 1999, September 20-22, Bangalore, India.
- A conference session chair, at the fifth International Conference on Document Analysis and Recognition (ICDAR'99), 1999, September 21, Bangalore, India.
- A panel co-chair, at the fifth International Conference on Document Analysis and Recognition (ICDAR'99), 1999, September 22, Bangalore, India.
- A conference session chair, at the Document Recognition II, SPIE 1998, February, 1998, San Jose, California.
- A co-organizer of the Engineering-drawing Recognition Competition, The competition was held on August 22-23, 1997, at INRIA Lorraine & CRIN/CNRS, Nancy, France. I was responsible for the Engineering-drawing detection performance evaluation, including writing the performance evaluation protocol and implementing the evaluation software.
- A member of the Dashed-line Recognition Competition Committee. The competition was held on August 9, 1995, at the Pennsylvania State University, University Park, Pennsylvania. I was responsible for the dashed-line detection performance evaluation, including writing the evaluation protocol and the summary.
- A member of the local arrangement committee for the International Workshop on Structural and Syntactic Pattern Recognition, June 14, 1994, Westin Hotel, Seattle, Washington.

- The workshop Co-Chair for the Workshop on Designing Databases for the Evaluation of Optical Character Recognition (OCR) and Document Image Understanding Algorithms, January 28-29, 1993, Seattle, Washington.

- Members of the Master and Ph.D. Supervisory Committees for the following students of the Department of Electrical Engineering at University of Washington:

  - Mr. Jisheng Liang: Ph.D. dissertation defense in 1999.
  - Mr. Su Chen: Ph.D. Preliminary Exam in 1994 and Ph.D defense in 1996.
  - Mr. Jaekyu Ha: Ph.D. Preliminary Exam in 1995.
  - Mr. Tapas Kunungo: Ph.D. Preliminary Exam in 1994 and Ph.D defense in 1996.
  - Mr. Jisheng Liang: Ph.D. Preliminary Exam in 1996.
  - Mr. Jing-Quang Zhu: Master defense exam in 1996.

  My service within each of the above committees included supervising the students' research activities during their studies, reading their theses and dissertation drafts and final versions, making comments, and attending the exams.

- Graduate School representative (UW) of the Ph.D General and Final Exam Committee for Mr. Kingsum (CS)– Ph.D. Preliminary Exam in 1994 and Ph.D defense in 1996. My service on this committee included reading the student's thesis proposal, the Ph.D. thesis and dissertation draft and final version, making comments, and attending the exams.

- Review papers for several journals and numerous conferences and workshops.

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PROFESSIONAL EXPERIENCE

- Assistant Professor of Bioinformatics, in Silico Drug Design, Computer Science Department, Queens College of City University New York. (sept 2005 – present).
- Associate Research Scientist, Bioinformatics, Digital Technology Center, University of Minnesota. (July 2003 – Aug 2005)
- Assistant Research Scientist, Integrative Bioscience, San Diego Supercomputer Center, University of California, San Diego (UCSD). (April, 2001- June, 2003)
- Visiting Scientist, National Partnership for Advanced Computational Infrastructure - Integrative Bioscience, San Diego Supercomputer Center, University of California, San Diego. (1998-2001)
- Staff Scientist GrIV(3), Center for Cellular and Molecular Biology, Hyderabad, India. (1993-1998)
- Visiting Research Fellow, Berkbeck College, University of London, UK. (1991-1993)
- Staff Scientist GrIV(2) Center for Cellular and Molecular Biology, Hyderabad, India. (1988-1993)
- Research Associate, Department of Zoology, University of Pune, India. (1987-1988)

EDUCATION

- Post Doc., Prof. Sir. Tom Blundell(F.R.S)'s Lab. Berkbeck College, University of London, UK. (1991-1993).
- Ph.D., Life Sciences, University of Hyderabad & Centre for Cellular and Molecular Biology, Hyderabad, India. (1988) Thesis Title: "*DNA sequence data analysis some structural and Biological Implications".*
- M.Sc., Life Sciences, Jawaharlal Nehru University, New Delhi, India. (1982)
- B.Sc. (Math, Physics, Chemistry), Osmania University, Hyderabad, India. (1980)

AWARDS & HONORS

- Indian National Science Academy – British Royal Society exchange award. (1997)
- Visiting Scientist, European Bioinformatics Institute, Hinxton, Cambridge, U.K. (August, 1997)
- Visiting Scientist, Department of Biochemistry, University of Cambridge, U.K. (July, 1997)
- European Economic Commission Bursary award. (1992-93)
- Department of Biotechnology, Govt. of India, Overseas Associate award. (1991-1992)
- Council of Scientific and Industrial Research National Merit Scholarship, Ph.D. (1982-1988)
- Merit Scholarship, Jawaharlal Nehru University, New Delhi, India, M.Sc. (1980-1982)

RESEARCH GRANTS

- Philip E. Bourne (PI), Mauricio S Montal (co-PI) & **Boojala V. B. Reddy (co-PI)** (DBI-0111709 Dated Sept. 13,2001: $240,001) Awarded by National Science Foundation USA. "Voltage-gated ion channel protein resource database".
- **Boojala V. B. Reddy (PI)** . (SP/SO/D-01/95 Dated: June 21,1996: INR 1,367,470) award by Department of Science and Technology, Ministry of Science and Technology, Govrnment of India. (1996-1999) "Analysis of Packing Relations of Secondary Structures in Proteins".

COMPUTATIONAL EXPERIENCE

- FORTRAN, C/C++ , PERL, JAVA extensively used for software development.
- Several Sequence and structural data analysis software tools (Modeler, Composer, Swiss-Model, PC_GENE, GCG, etc.)
- Accelrys Software InsightII, (Biopolymer, Discover, Dock, Homology, Ludi etc.) and FRODO.
- Computers: SGI, DEC-alpha, SUN, VAX, PDP-11, Evans & Sutherland, convex., PC.
- Operating systems: UNIX/IRIX, DOS, VMS, OSF, LINUX.

TEACHING / SUPERVISING

- DNA and Protein sequence data analysis tools to graduate researchers at CCMB.
- UCSD-Bioscience Extension Classes to Industry Professionals.
  - Protein Sequence and structural data analysis. (2000-01)
  - Comparative Protein Modeling Principles and Practice. (2001-02)
  - Advanced tools and Algorithms in Bioinformatics. (2001-02)
  - Principles of Protein Structure and Comparative Modeling. (2002-2003)

  U of MN Bioinformatics Workshop: "Perl for Bioinformatics".
- Supervised 4 postgraduate researchers and 3 technical assistants, 3 summer interns

CONSULTING EXPERIENCE

- Senior Consultant for Identification of Peptidomimetics by Knowledge-based modeling for Reddy US therapeutics, GA (2002).
- Senior Consultant on the project for Identification of Peptidomimetics by Knowledge-based modeling for Angion Biomedica, NY. Lead products have been tested to be promising (2001).

MANUSCRIPT REVIEWER

- Bioinformatics
- Journal of Biosciences
- Biophysical Journal
- Genes
- Journal of Biomolecular Structure and Dynamics
- Proteins: structure, function and bioinformatics
- Indian Journal of Biochemistry & Biophysics
- Protein Engineering Design and Selection

MEMBERSHIP TO PROFESSIONAL SOCITIES

- Member American Association for Advancement of Science (AAAS)
- Elected Member American Chemical Society (ACS)
- Member International Society for Computational Biology (ISCB)
- Member Protein Society (PS)
- Life Member Indian Biophysical Society (IBS)
- Life Member Society of Biological Chemists, India (SBCI)

RESEARCH PUBLICATIONS (*Communicating author**)**

- **Reddy BVB**, Kaznessis Y (2005) A Quantitative analysis of amino acid position conservation in interface regions of protein-protein hetrocomplexes. *Journal of Bioinformatics and Computational Biology* 3(5): 1137 - 1150.
- Duan, Y. **Reddy BVB**, Kaznessis Y (2005) Physicochemical and residue conservation calculations to improve the ranking of protein-protein docking solutions. *Protein Science* 14: 316 - 328.
- Vicatos S, **Reddy BVB**, Kaznessis, Y. (2005) Prediction of distant residue contacts with the use of evolutionary information from PFAM database. *Proteins: Struct. Func. and Bioinfo* 58: 935 - 949.
- **Reddy BVB**, Li WW, Bourne P. (2002) Use of Conserved Key Amino Acid Positions to Morph Protein Folds. *Biopolymers*. 64: 139 – 145.
- Li WW, **Reddy BVB**, Tate J, Shindyal I, Bourne P (2002) CKAAPs: A Conserved Key Amino Acid Positions DataBase. *Nucleic Acids Research.* 30: 409 - 411.
- Li WW, **Reddy BVB**, Shindyal I, Bourne P (2001) CKAAPs: A Conserved Key Amino Acid Positions DataBase. *Nucleic Acids Research.* 29: 329-31.
- **Reddy BVB**, Li WW, Shindyal I, Bourne P (2001) Conserved Key amino acid Positions

(CKAAPs) derived from analysis of common substructures in proteins. *Proteins: Struct. Func. and Genetics*. 42: 148-63.

- Nagarajaram HA, **Reddy BVB**, Blundell TL (1999) Analysis and prediction of inter-strand packing distances between beta-sheets of globular proteins. *Protein Engng* 12(12): 1055-1062.
- Burke DF, Deane CM, Nagarajaram HA, Campillo N, Martinez MM, Mends J, Molina F, Perry J, **Reddy BVB**, Soares CM, Steward RE, Williams M, Carrondo MA, Blundell TL, Mizyguchi K (1999) An iterative structure-assisted approach to sequence alignment and comparative modelling. *Proteins: Struct. Func. and Genetics.* Supplement 3, 55-60.
- **Reddy BVB**, Nagarajaram HA, Blundell TL (1999) Analysis of interactive packing of secondary structural elements in a/b units. *Protein Science* 8, 573-586.
- Tiwari S, **Reddy BVB*** (1999) A statistical analytical approach to predict secondary structure of protein from amino acid sequence information. *Theoretical Chemistry Accounts* 101, 41-45.
- **Reddy BVB***, Datta S, Tiwari S (1998) Use of structural environment of amino acids to study effect of substitution mutations on protein stability. *Protein Engng.* 11, 1137-1145.
- **Reddy BVB***, Ramesh P, Tiwari S (1998) MICPS: substitution mutations to engineer intracellular protein stability. *Bioinformatics* 14, 225 - 226.
- **Reddy BVB**, Gopal V, Chatterji D (1997) Recognition of promoter DNA by subdomain 4.2 of *Escherichia coli* sigma-70: A knowledge based model of -35 hexamer interaction with 4.2 helix-turn-helix motif. *J. Biomol. Str. Dyn.* 14, 407 - 419.
- **Reddy BVB*** (1996) Structural distribution of di-peptides that are identified to be determinants of intracellular protein stability. *J. Biomol. Str. Dyn.* 14, 201 - 210.
- Kolaskar AS, Joshi B, **Reddy BVB** (1995) Contextual constraints in the choice of synonymous codons *Indian J. Biochem. Biophy*. 32, 417 - 423.
- **Reddy BVB***, Pandit MW (1995) A statistical analytical approach to decipher information from biological sequences: Application to murine splice-site analysis and prediction *J. Biomol. Str. Dyn.* 12, 785 - 801.
- Rajendrakumar CSV, **Reddy BVB**, Reddy AR (1994) Proline - protein interactions: Protection of structural and functional integrity of M4 lactate dehydrogenase. *Biochem. Biophy. Res. Com.* 201, 957 - 963.
- **Reddy BVB**, Blundell TL (1993) Packing of secondary structural elements in proteins: Analysis and prediction of inter-helix distances. *J. Mol. Biol.,* 233, 464-479.
- Guruprasad K, **Reddy BVB**, Pandit MW (1990) Correlation between Stability of a Protein and its Di-peptide Composition: A Novel Approach for Predicting in vivo Stability of a Protein from its Primary Sequence. *Protein Engng.* 4, 155-161.
- Kolaskar AS, **Reddy BVB** (1986) Contextual Constraints on Codon Pair Usage Structural and Biological Implications. *J. Biomol. Struc. Dyn.* 3, 725-738.
- Kolaskar AS, **Reddy BVB** (1985) Complementary DNA Sequence Data Analysis of Prokaryotic Systems. *J. Biosci.* 7, 45-59.
- Kolaskar AS, **Reddy BVB** (1985) A method to locate Protein Coding Sequences in DNA of prokaryotic systems. *Nucleic Acids Res.* 13, 185-194.

CHAPTERS IN BOOKS

- **Reddy BVB***, Bourne P. (2002) Chapter 12: Protein Structure Evolution and the SCOP database in *Structural Bioinformatics* – John Wiley & Sons Publication. (Edt. Phil E. Bourne, Helge Weissig) 239 – 248.
- **Reddy BVB*** (2002) Chapter 2: Secondary Structural packing in proteins in *Protein Folding Stability and Design* (Edt: Machael Gromiha , S. Seljaraj) 25 - 36.
- **Reddy BVB***, Deshpande M, Pandit MW (1991) "Computer Prediction of Splice Sites in Human Genome in *Computers in Bio-medicine* - Computational Mechanics Publications (Edt: K D Held, C A Brebbia and R D Ciskowski) 47 - 60.

PUBLISHED RESEARCH SUMMARIES/ABSTRACTS

- Duan, Y., **Reddy, BVB,** Breslauer, D, Kaznessis Y. (2004) An Efficient Docking Method to Study Protein Interactions. *Biophysical Journal* (Suppliment) 86(1): pp267a
- David A. Chalton, **Reddy, BVB.**, Murray-Rust, J (2002) Catalysis and regulation: Proteins - Web alert, *Current Opinion in Structural Biology.* 12: 693-694.
- Lakey JH, **Reddy BVB**, Murray-Rust, J (2001) Macromolecular assemblages Theory and simulation - Web alert. *Current Opinion in Structural Biology.* 11: 139-40.
- **Reddy, BVB.**, Nair,T M., Li, WW., Shindyalov, IN. and Bourne, PE. (2000) Conserved Amino Acid Positions (CKAAPs) in Proteins: Implications in Protein stability and structural integrity *Protein Science* l9(suppl.1),78
- **Reddy BVB**, Datta S (1997) Analysis of structural environment of amino acids that alter in vitro protein stability. *J. Biomol. Str. Dyn.* 14(6), pp772.
- **Reddy BVB**, Blundell TL (1993) Proximal distance between two interacting helices and a volume dependent parameter of the residues in packing interface - a useful correlation for protein modelling. *Protein Engineering.* 6 (Supplement), pp 123.
- **Reddy BVB** (1993) Correlation Between Stability of a Protein and its Di-peptide Composition: Studies on the Structural and Biological Implications. *Protein Eng.* 6 (Supplement), pp24.
- Nagarajaram HA, **Reddy BVB**, Blundell TL (1997) Packing of secondary structural elements in proteins - An analysis. *Protein Science.* 6: pp87.

INVITED TALKS (SELECTED**)**

- Department of Biotechnology, University de Montreal, Canada. “Conserved key amino acids: implications to protein folding, function and protein-protein interactions” (Dec, 2003).
- Department of Biology, University of Alaska, Fairbanks. “Use of Conserved Key Amino Acid Positions to morph protein folds” (July, 2003).
- Epimmune, San Diego, California. “Correlation between Stability of a Protein and its Di-peptide Composition: A Novel Approach for Predicting In vivo Stability of a Proteins from its Primary Sequence”. (2002)
- Keck Graduate Institute, Claremont, California. “Use of Conserved Key Amino Acid Positions (CKAAPs) for Fold Recognition in Protein Modeling”. (2000)
- The Burnham Institute, La Jolla, California. “Comparative Protein Modeling Principles and Practice”. (2000)
- EMBL Heidelberg, Germany. “Theoretical Studies on Protein Stability and its Di-peptide Composition”. (1992)
- First International Meeting, Young Perspectives in Molecular Biotechnology, at Maxplank's Institute, Gottingen, Germany. “Synonymous Codon Choice - Possible Relevance to Protein Folding”. (1992)

OVER 30 PRESENTATIONS IN CONFERENCES AND MEETINGS

CURRICULUM VITAE

Alexander J. E. RYBA

Electronic Mail	ryba@sylow.cs.qc.edu
Address	Department of Computer Science, Queens College, Flushing, NY 11367
Telephone	718 997 3488 Fax 718 997 3513

Academic Positions

1998–present	**Queens College and Graduate Center, CUNY, New York**
January 2005	Tenured Professor, Computer Science, (2005 - present)
September 2000	Tenured Associate Professor, Computer Science, (2000 - 2004)
September 1998	Visiting Associate Professor, Mathematics, (Fall 1998, and 1999-2000)
1997–1998	**Visiting Associate Professor, University of Michigan, Ann Arbor**
1990–2000	**Marquette University, Milwaukee, Wisconsin** **Department of Mathematics, Statistics, and Computer Science**
September 1995	Tenured Associate Professor (1995 – 2000)
September 1990	Tenure Track Assistant Professor (1990 – 1995)
1987–1990	**Assistant Professor, University of Michigan, Ann Arbor**
Spring 1987	Visiting Assistant Professor, University of Illinois, Chicago, Illinois
1986	Postdoctoral Research Fellow, Carleton University, Ottawa, Ontario
Fall 1985	Visiting Research Associate, University of Oregon, Eugene, Oregon

University Education

1981–1985	**Ph.D., University of Cambridge.**
Thesis Title	Algebras Related to Some Sporadic Simple Groups
Advisor	Professor J. G. Thompson
1977–1981	**Trinity College, University of Cambridge**
1981	Certificate of Advanced Study in Mathematics (with Distinction)
1980	B.A. with First Class Honours in Mathematics

Fellowships, Prizes and Awards

2004–2005	PSC-CUNY Research Grant
1998 and 1999	Gorenstein Professorship, Queens College, CUNY
1997 and 1998	NSA Summer Research Grant
Summer 1996	Summer Faculty Fellowship, Marquette University
Summer 1988	Horace H. Rackham Faculty Fellowship, University of Michigan
1977–1984	Scholarships at Trinity College Cambridge
1976	Member of British team at the International Math Olympiad
1976 and 1977	Third place in the British Mathematics Olympiad

Research Publications

1. A new construction of the O'Nan simple group, J. Algebra, 112, 173–197, 1988. MR#89b:20045

2. Calculation of the 7−modular characters of the Held group. J. Algebra, 117, 240–255, 1988. MR#89g:20026

3. Matrix generators for the Held group, pages 135–141 in Computers in Algebra, Marcel Dekker, New York, 1988. MR#91k:20024

4. Some Projective Modules Determined by Sporadic Geometries (with Stephen D. Smith and Satoshi Yoshiara), J. Algebra, 129, 279–311, 1990. MR#91a:20019

5. A new doubly-infinite class of factorial rings (with Piotr Blass, K.J. Horadam and Peter B. Kleidman), pages 43–44 in Group Actions and Invariant Theory, CMS Conference Proceedings, Volume 10.

6. Condensation programs and their application to the decomposition of modular representations, J. Symbolic Comput., 9, 591–600, 1990. MR#91j:20002

7. Kostant's Conjecture Holds for $E_7 : L_2(37) < E_7(C)$ (with Peter B. Kleidman), J. Algebra, 161, 535–540, 1993. MR#94k:20025

8. Embeddings of $U_3(8)$, $Sz(8)$ and the Rudvalis group in algebraic groups of type E_7 (with Robert L. Griess), Inventiones Mathematicae, 116, 215–241, 1994. MR#94k:20024

9. Matrix Generators for the Harada-Norton group (with Robert A. Wilson), Experimental Math., 3, 137–145, 1994. MR#95k:20017

10. A natural invariant algebra for the Harada-Norton group, Math. Proc. Cambridge Philos. Soc., 119, 597–614, 1996. MR#96k:20029

11. Fibonacci representations of the symmetric groups, J. Algebra, 170, 678–686, 1994. MR#96b:20014

12. Modular Moonshine?, In, *Moonshine, the Monster, and Related Topics* ed. Dong and Mason, Contemporary Mathematics, 193, 307–336, 1995. MR#97c:20022

13. Modular Moonshine II (with Richard E. Borcherds), Duke Math. J., 83, 435–459, 1996. MR#98b:17030

14. Embeddings of $PSL(2,31)$ and $SL(2,32)$ in $E_8(C)$, (with Robert L. Griess, and with appendices by Michael Larsen and J-P. Serre), Duke Math. J., 94, 181–212, 1998. MR#2000a:20106

15. $HS < E_7(5)$ (with Peter B. Kleidman and U. Meierfrankenfeld), J. Lond. Math. Soc. (2), 60 no. 1, 95–107, 1999. MR#2001b:20026

16. Embeddings of $PSL(2,41)$ and $PSL(2,49)$ in $E_8(C)$, (with Robert L. Griess), J. Symbolic Comput., 31 no. 1 –2, 211–227, 2001. MR#2001k:20104

17. Finite Simple Groups which projectively embed in an exceptional Lie group are classified. (with Robert L. Griess), Bull. Amer. Math. Soc. (N.S.), 36, no. 1, 75–93, 1999. MR#99g:20085 (Featured Review)

18. Embeddings of $Sz(8)$ in $E_8(C)$, (with R. L. Griess), J. Reine Angew. Math., 523, 55–68, 2000. MR#2001f:20034

19. Rank one lattice type vertex operator algebras and their automorphism groups, II: E-series, (with R. L. Griess and Chongying Dong), J. Algebra, 217, no. 2, 701–710, 1999. MR#2000j:17033

20. $Ru < E_7(5)$ (with Peter B. Kleidman and U. Meierfrankenfeld), Comm. Algebra, 28 no. 8, 3555– 3583, 2000. MR#2001c:20029

21. Inversion and Neighborhood Inversion in Graphs. (with Robert Cowen, Stephen H. Hechler, and John W. Kennedy) Graph Theory Notes of New York, 37, 37–41, 1999.

22. The hexad game, (with Joseph Kahane). Electron. J. Combin., 8 no. 2, 9pp (electronic), 2001. MR#2002h:91031

23. Condensation of symmetrized tensor powers of matrix representations, Jour. Symbol. Comput., 32 no. 3, 273–289, 2001. MR#2002e:20020

24. Short proofs of embeddings into exceptional groups of Lie type. J. Algebra 249, no. 2, 402–418, 2002. MR#2003i:20081

25. Embeddings of $SL(2,27)$ in complex algebraic groups, (with R. L. Griess), Michigan Math. J. 50 no. 1, 89–99, 2002. MR#2003e:20052

26. Classification of finite quasisimple groups which embed in exceptional algebraic groups, (with R. L. Griess), J. Group Theory, 5 no. 1, 1–39, 2002. MR#2002j:20091

27. Identification of matrix generators of a Chevalley group. Submitted to J. Algebra, December 2004, 15 pages.

28. Constructive membership testing in black-box groups, (with P. E. Holmes, S. A. Linton, E. A. O'Brien, and R. A. Wilson), Submitted to J. Group Theory, November 2004, 20 pages.

29. A natural invariant algebra for the Baby Monster group. Submitted to J. Group Theory, November 2004, 18 pages.

30. Computer Construction of split Cartan subalgebras. Submitted to J. Algebra, January 2005, 41 pages.

Textbook Publications

Data Structures and Program Design in C++ (with Robert L. Kruse), Prentice-Hall, 1998.

Christopher Vickery
Curriculum Vitae

Home: 86-24 Palo Alto Street
Holliswood, NY 11423
(718) 479-1903

Work: Computer Science Department
Queens College of CUNY
Flushing, NY 11367-0904
(718) 997-3508
vickery@babbage.cs.qc.edu
http://babbage.cs.qc.edu

Employment

1993 - present	Professor of Computer Science, Queens College of CUNY
1976 - 1993	Associate Professor of Computer Science, Queens College of CUNY
1979 - 1980	Visiting Associate Professor of Computer Science, SUNY at Stony Brook
1971 - 1976	Assistant Professor of Computer Science, Queens College of CUNY
1970 - 1971	Instructor, Queens College of CUNY

Education

1971	Ph.D. City University of New York
1966	MA Columbia University
1964	BA Hamilton College
1964 - present	Various courses offered by MIT, The University of Pennsylvania, IBM, and Intel Corporation.

Grants And Awards

2004	PSC-CUNY Research Award, “PAL Interfaces for Inexpensive FPGA Kits.”
2003	PSC-CUNY Research Award, “Persistent Java Virtual Machine Debugging Interface.”
2001	CUNY Institute for Software Design “Design and Development of a Persistent Java Virtual Machine (PJVM).”
1999	NSF Instrumentation and Laboratory Improvement Program, “A Laboratory for Computer Organization and Architecture” with S. Goodman.
1991	NSF Instrumentation and Laboratory Improvement Program, “A Raster Environment for Computer Graphics” with Z. Xiang.
1988	PSC-CUNY Research Award
1987	PSC-CUNY Research Award
1985	PSC-CUNY Research Award
1985	Queens College Faculty in Residence Award
1983	AMI “Gate Array Contest,” second place
1981	PSC-CUNY Research Award
1978	CCP Certificate in Data Processing
1977	NSF Instructional Scientific Equipment Program

Professional Organizations

ACM
IEEE
Sigma Xi

Professional Activities

Editorial Board, *FORTH Journal of Application and Research*
Manuscript Reviewer for IEEE *Computer* magazine, McGraw-Hill, SIGARCH Conference, PSC-CUNY Research Award Program.
Reviewer for ACM *Computing Reviews*

College and University Committee Service

Academic Senate Technology and Library Committee (2002-present)
Chair, Search Committee for CS Faculty (2000-2001)
Chair, Search Committee for CS Dept Chair (1999-2000)
Academic Senate Nominating Committee (1999 to present; chair 2005-present)
QC Instructional Technology Task Force (1999-2002)
Chair, Search Committee for CS Dept Higher Education Associate
Chair, Search Committee for QC Assistant Vice-President for Information Technology (1997-98)
QC Computer and Communication Planning Committee, later OIT User's Committee (1989-)
CS Dept Personnel and Budget Committee (1974 - 1979; 1987 - present)
CS Dept Graduate Curriculum Committee (1987 - present)
CS Dept Undergraduate Curriculum Committee (1972 - 1987)
CUNY Task Force on Teacher Preparation (1988-89)
CS Dept CLT search committee (1988)
QC Academic Computer Center Director search committee (1986)
Computer Science Liason, CUNY Committee on Research (1976 - 79)
Science Sunday at The College (several)

Invited Presentations

Queens College Digital Design Laboratory. New York City College of Technology, March 11, 2004.
Leveraging CS Software Skills in the Digital Design Process. CUNY Computer Science Discipline Council, October 3, 2003.
Laboratory Options for Computer Science Majors. With Tamara Blain. 2003 Workshop on Computer Architecture Education (WCAE), San Diego, June 8, 2003.
The Persistent Java Virtual Machine (PJVM). With Eric Shamow. Queens College Computer Science Department, February 25, 2002.
Keynote speaker, 1993 iRUG Conference, Portland OR.
Real-Time Multitasking CPU Design. Presented at IBM Thomas J. Watson Research Center, Hawthorne, NY, July 1987.
FORTH Machine Design Considerations. Presented at the Rochester FORTH Conference, Rochester, NY, June, 1984.

Publications

Configware in the Computer Science Curriculum, Workshop on Reconfigurable Computing Education, Karlsruhe, 2006.

Laboratory Options for Computer Science Majors. Workshop on Computer Science Education, San Diego, 2003. With Tamara Blain.

UNIX Shell Programmer's Interactive Workbook. Prentice Hall, 1999.

RMXEMB: Simulation of the Intel386EX Microprocessor. Software system developed for Intel Corporation, 1994.

Real-Time and Systems Programming Using the iRMX for Windows Operating System. McGraw-Hill, 1993.

qCLI: A New CLI for iRMX. 1992 iRUG Conference, New Orleans. 186-211.

Loadable Device Drivers for iRMX. A three-part article in the iRUG Newsletter, 1991 **2**(1-3)

Real-Time X: BSD Sockets. 1990 iRUG Conference, St. Louis. 387-420.

QFORTH: A Multitasking FORTH language processor. *Journal of FORTH Application and Research.* 1984, **2**(1), 65-76.

FORTH as the Machine: A Computer for Software Engineering. Presented at The Fourth Jerusalem Conference on Information Technology, May, 1984. (with G. Berkeley)

A hardware/Software Interface Between Animal Test Chambers and a PDP-11/34 Processor Running RSX-11M. Technical Report for New York Psychiatric Institute, 1980.

A Microprogram Design Laboratory. *Proceedings of the ACM SIGMINI/SIGPLAN Interface Meeting*, New Orleans, 1976, 117-118. Reprinted in *ACM SIGMICRO Newsletter*, March 1976.

Software Aids for Microprogramming. *ACM Seventh Annual Workshop on Microprogramming.* Palo Alto, 1974. 208-211

Co-author of one journal article and one book in experimental psychology.

Curriculum Vitae

Jerry Waxman
(718) 575-4048
waxman@aleph.cs.qc.edu

Current Position: Professor of Computer Science, Queens College - CUNY

Other Academic Positions: Chair, Department of Computer Science, Queens College 2000-2001
Visiting Prof. of Computer Science – Hebrew University, Jerusalem, 1995 – 1996
Visiting Prof. of Computer Science – Jerusalem College of Technology, Jerusalem, 1995 – 1996
Visiting Prof. of Computer Science – International School of Business – Jerusalem, 1995 – 1996
Adjunct Professor of Computer Science – Yeshiva University, 1999- present

Education:

PhD. Oct. 1973 New York University, N.Y., N.Y.
Computer Science
M.S. Jan. 1972 New York University, N.Y., N.Y.
Operations Research
M.S. Jan. 1972 Yeshiva University, N.Y., N.Y.
Philosophy
B.A. June 1969 Yeshiva University, N.Y., N.Y.
Mathematics

Honors:

Founders' Day Award, New York University, 1973
Professor of the Year Award - Queens College, 1986
National Silver Medal Award, 1986 (Council for the Support and Advancement of Education)
Fellow, International Combinatorics Association - ICA, Elected 1994

Current Research Interests: Algorithms, Theory of Computation, Programming Methodology and Software Engineering, Computer Science Education.

Recent Editorships and Conference Activity

Guest Editor*: Mathematics and Computer Education* Journal. Three special journal issues to be published over the next two years. The themes of these issues fall under the general heading of "Trends in Mathematics Education" (TIME) but concentrate specifically on the area of Developmental Mathematics.

Session Chair: "Comprehensive Program (CP3): Reforming Developmental Mathematics," FIPSE/LAAP, San Diego, November 2001.

Selected Recent Publications and Presentations:

Waxman, J., R. Goldberg, and J. Shapiro, "Network Modeling Using Level Graphs," Mathematical Modeling and Scientific Computing, Vol. 6, 1996.

Waxman, J., A Second Course in Computing for Non-Computer Science Majors, WebTech '96, San Francisco, CA, Oct. 1996.

Waxman, J., R. Goldberg and Jacob Shapiro, "Approximation Algorithm for the Optimal Partition Problem," Congressus Numerantium, Vol. 124, pp. 197-210, 1997.

Waxman, J., Robert Goldberg and Jacob Shapiro, "Error Metrics for the Optimal Partition Problem," abstracted in the Proceedings of the 11th International Conference on Mathematical and Computer Modeling (ICMCM) Conference, Boston, Massachusetts, November, 1997.

Waxman, J., Robert Goldberg and Jacob Shapiro, "Different Measures for Evaluating Quality of a Partition," abstracted in the Proceedings of the Twenty-Eighth International Conference on Combinatorics, Graph Theory and Computing, Boca Raton, Florida, February 1997.

Waxman, J., Robert Goldberg and Jacob Shapiro, "Shortest Path Heuristics Under Heavy Traffic Conditions," abstracted in the Proceedings of the Twenty-Eighth International Conference on Combinatorics, Graph Theory and Computing, Boca Raton, Florida, February 1997.

Waxman, J., R. Goldberg and J. Shapiro, New Shortest Path Heuristics for Heavy Network Traffic Conditions, 27th Southeasters International Conference on Graph Theory and Computing, Boca Raton, Fl, Feb. 1997.

Waxman, J., R. Goldberg and J. Shapiro, Measuring the Quality of a Partition, 27th Southeasters International Conference on Graph Theory and Computing, Boca Raton, Fl, Feb. 1997.

Waxman, J., R. Goldberg and J. Shapiro, Error Metrics for the Optimal Partition Problem, Proceedings of the Eleventh International Conference on Mathematical and Computer Modeling, Washington, D.C., May 1997.

Waxman, J., Robert Goldberg and Jacob Shapiro, "Analysis of Partition Variance for the Number Partition Problem," Congressus Numerantium, Vol. 130, pp. 29-46, 1998.

Waxman, Jerry, "Error Analysis of Scheduling in an Ideal Situation," 12th International Conference for Mathematical and Computer Modeling, Chicago, Illinois, August, 1999.

Waxman, Jerry, "Theoretical Analysis of Scheduling Algorithms," 12th International Conference for Mathematical and Computer Modeling, Chicago, Illinois, August 1999.

Waxman, J., "Theoretical Analysis of Scheduling Algorithms," abstracted in the Proceedings of the 12th International Conference on Mathematical and Computer Modeling (ICMCM) Conference, Chicago, Illinois, July 1999.

Waxman, J., "Experimental Analysis of Schedule Algorithms," abstracted in the Proceedings of the INFORMS Annual Meeting, Fall 1999, Philadelphia, Pennsylvania, November 1999.

Robert Goldberg and Jerry Waxman, "Issues in a Large Format Introductory rogramming Course," in Tony Greening, Editor: Java in the Computer Science Curriculum, Springer-Verlag Monographs in Computer Science Series, 2000.

Robert R. Goldberg, Jacob Shapiro and Jerry Waxman, "Scheduling with Minimum Overloading," submitted to Journal of Algorithms, 2001.

Robert Goldberg, Ronald R. Kelly, Mark Shore, Selina Vasquez, Jerry Waxman, "Comprehensive Program (CP3): Reforming Developmental Mathematics," FIPSE/LAAP, San Diego November 2001.

Robert Goldberg, Ronald R. Kelly, Mark Shore, Selina Vasquez, Jerry Waxman, "Reforming Developmental Mathematics Cluster," Twenty-Sixth Annual Conference of the National Association For Developmental Education (NADE), Orlando, Florida, March 2002.

Robert Goldberg, Ronald R. Kelly, Mark Shore, Selina Vasquez, Jerry Waxman, "In Pursuit of Quality Mathematics Learning for Diverse Student Populations," Thirteenth International Conference on College Teaching and Learning, Jacksonville, Florida, April 2002. (Invited)

Jerry Waxman and Robert Goldberg, "Exploring Quantitative Relationships (EQR)," Mathematics and Computer Education (MACE) Journal Special Issue on Innovative Approaches to Developmental Mathematics. Jan 2003

Jerry Waxman, "Dealing with Quantiphobia: Lessons from Sesame Street and Blue's Clues" ,RUME 2005. Feb 2005. (MAA - The SIGMAA on Research in Undergraduate Mathematics Education)

Other Publications and Presentations:

1. "Modeling Layered Networks" (with R. Goldberg and J. Shapiro), Tenth International Conference on Mathematical and Computer Modeling and Scientific Computing, Boston, MA, July 1995.

2. "Equivalences for Neural Nets and Fuzzy Systems", (with A. Rybalow), Tenth International Conference on Mathematical and Computer Modeling and Scientific Computing, Boston, MA, July 1995.

3. "Identification of Critical points in a Network Topology", (with R. Goldberg), Congressus Numerantium Vol. 101, 1994, pp 129-150.

4. "Path Quality of Level Graph Searches", (with R. Goldberg and J. Shapiro), Congressus Numerantium, Vol. 102, 1994, pp 13-28.

5. "Analytic Results Regarding the Asymptotic Behavior of Level Graph Algorithms", (with R. Goldberg and J. Shapiro), Twenty-Fifth Southeastern International Conference on Combinatorics, Graph Theory and Computing, Boca Raton, FL, March 1994.

6. "To Break a Graph into Pieces", (with R. Goldberg), Twenty-Fifth Southeastern International Conference on Combinatorics, Graph Theory and Computing, Boca Raton, FL, March 1994.

7. "On the Equivalence of Critical and Articulation Points in Directed Graphs", (with R. Goldberg), Technical Report 94-001, Department of Computer Science, Queens College, CS94-001, 1994.

8. "Analytical Results Regarding the Path Quality of Level Graph Searches", (with R. Goldberg and J. Shapiro), Technical Report 94-003, Department of Computer Science, Queens College, CS94-003, 1994.

9. "Wormholes in the Search Space" (with J. Shapiro), Third International Symposium on Artificial Intelligence and Mathematics, Jan 1994.

10. "Parallel Decision Procedures for Finite State Automata" (with R. Goldberg)to appear in the Journal of Computer and Information Technology 1994.

11. "A Syntactic Model for Enforcing Semantic Database Constraints" (with R. Goldberg and J. Shapiro), Journal of Computer and Information Technology Vol 1, No. 2, pp 111-121, 1993.

12. "Skeletal Graphs and Structural Properties of Languages" (with Robert Goldberg), Congressus Numerantium December, 1993.

13. "Experimental Analysis of Three Level Graph Algorithms: Computational Efficiency v.s. Path Optimality", (with J. Shapiro) Congress Numerantium, Dec, 1993.

14. "Computer Literacy for Non-Majors: Design and Implementation Issues for Depth and Breadth" (with Theresa Austin), Proceedings of FIE '93 , Frontiers in Education 1993, Johns Hopkins University, October, 1993.

15. "Philosophical Foundations of Artificial Intelligence", AOJS Conference, Spring Glenn N.Y., August 1993 (Invited Talk).

16. "Hypertextual Systems: Antecedents and Implications", AOJS Conference, Spring Glenn N.Y., August 1993 (Invited Talk).

17. "A Constructive Proof for Scherk's Theorem on the Representation of Primes", (with J. Shapiro) International Journal of Computer Mathematics, Vol. 48, no. 1,2, 1993.

18. "Experimental Study of a New Class of Algorithms for Efficient Network Routing", Proceedings of the Second International Conference on Computer Communications and Networks (IC^3N), San Diego, California, 431-438, June 1993.

19. "Toward a Categorical Theory of Natural Language Semantics: Application to the Understanding of Text and Metaphor" (with A. Rybalow) Technical Report 93-001, Department of Computer Science, Queens College, April, 1993.

20. "Experimental Analysis of the Complexity of Level Graph Heuristics" (with J. Shapiro), Twenty-Fourth Southeastern International Conference on Combinatorics, Graph Theory and Computing, Boca Raton, FL, Feb. 1993.

21. "A Graph Theoretic Approach to the Classification Problem for Finite State Automata" (with R. Goldberg) Twenty-Fourth Southeastern International Conference on Combinatorics, Graph Theory and Computing, Boca Raton, FL, Feb. 1993.

22. "Computing for Non-majors: Laboratory Manual", C.P.I. Microtech, N.Y., N.Y., August 1992, 180 pages.

23. "An Enriched Laboratory-Based Non-Majors' Introduction to Computers", Creativity: Proceedings of the ASEE Conference, Toledo, pp 520-523, June 1992.

24."Enriching the Non-Majors's Introductory Computer Science Course", Conference on Computers Across the Curriculum, N.Y., N.Y., May 1992.

25. "LEO: Software for Teaching Spanish Reading" (with T. Austin), Conference on Computers Across the Curriculum, N.Y., N.Y., May 1992.

26. "Level Graphs and Approximate Shortest Path Algorithms,"(with J. Shapiro, J. Waxman and D. Nir) Networks, Vol. 22, pp 691-717, 1992.

27. "Near Point Heuristics for Rank Constrained Level Graphs" (with J. Shapiro, and K. Chen), Congressus Numerantium, Vol. 89 pp 15-32, 1992.

28. "Near Point Optimality in Rank Constrained Level Graphs" (with J. Shapiro), Twenty-Third Southeastern International Conference on Combinatorics, Graph Theory and Computing, Boca Raton, FL, Feb. 1992.

29. "Rank Constrained Level Graphs,"(with J. Shapiro) Congressus Numerantium, Vol. 84, pp 9-20, 1991.

30. "Design of an Intelligent Reading Tutor" (with T. Austin), M.L.A. National Conference, San Francisco, CA, December, 1991.

31. "Constraining Level Graphs" (with J. Shapiro), Twenty-Second Southeastern International Conference on Combinatorics, Graph Theory and Computing, Baton Rouge, LA, Feb. 1991.

32. "Introduction to Level Graphs," Technical Report 91-001 - Queens College, Dept. of Computer Science,1991.

33. "Lattice Structured Level Graphs," Technical Report 91-002 - Queens College, Dept. of Computer Science, 1991.

34. "Survey of Computer Science," Software Advantage Press, 1989 (200 pp.)

35. "Programming in Pascal," Queens College Press 1985 (185 pp.)

36. "Programming in Fortran," Queens College Press 1982 (185 pp.)

Papers Under Review:

1. Optimal k-Partitions (with R. Goldberg, and J. Shapiro)

2. Parameterized Level Graphs (with R. Goldberg, and J. Shapiro)

Work in Progress

"Fully Dynamic Algorithms for Level Graphs," supported by a grant from PSC-CUNY

"Routing in Multi layer networks," Jerry Waxman, supported by a grant from PSC-CUNY

"Genetic Algorithms for Shortest Path Algorithms," supported by a grant from PSC-CUNY

Mentoring

Recently mentored Simina Fluture for PhD in Computer Science at CUNY, "A New Approach to Automated Lung Segmentation and Emphysema Quantification Analysis", Completed Fall 2004.

Committee Work

I have served on numerous committees on the departmental, College, and University levels.

Grants:

Over $1 million dollars in funded research from agencies such as National Science Foundation, US Department of Education, US Department of Defense, The Ford Foundation and CUNY.

Most Recent:

PSC-CUNY: To start July 2005.

NYC City Council, "A Laboratory Facility for Informal Multimedia Education" Co-PI with Mitchell Shur of Hillel Foundation at Queens College – Funded for $180,000. The funds are for the construction of a laboratory to be located at Hillel in the Student Union. (Fall 2004)

Jennifer Whitehead

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EDUCATION

Ph. D. Mathematics, University of Warwick, 1975.
M. S. Mathematics, University of Warwick, 1972.
B. S. Mathematics, First Class Honors, University of London, 1971.

PROFESSIONAL EXPERIENCE

Professor, Computer Science Department, Queens College, January 2005 - present.

Associate Professor, Computer Science Department, Queens College, January 1989 – December 2004.

Assistant Professor, Computer Science Department, Queens College, September 1980 - December 1988.

Lecturer, Mathematics Department, Northwestern University, September 1979 - August 1980.

Assistant Professor, Mathematics Department, Texas A&M University, September 1975 - August 1979.

RESEARCH INTERESTS

Continuous computational complexity, p-adic computing, real-time scheduling, file transfer scheduling.

PUBLICATIONS

Residuals of the join of ascendant subgroups. *Can. J. Math.* **29** 1066-68 (1977).

On certain properties of subnormal subgroups. *Can. J. Math.* **30** 573-582 (1978).

Subnormality and ascendancy in soluble groups of finite rank. *Archiv der Math* **34** 10-14 (1980).

On the complexity of fixed-priority scheduling of periodic real-time tasks, (with J. Y-T Leung). *Proc. 18th Allerton Conference on Communication, Control, and Computing* (1980).

PUBLICATIONS CONT.

Hypercentral residuals of a join of subnormal subgroups. *Proc. Amer. Math. Soc.* **85** 15-18 (1982).

On the complexity of fixed-priority scheduling of periodic real-time tasks (with J. Y-T Leung). *Performance Evaluation* **2** 237-250 (1982).

Virtual permutations of $Z[Z^n]$-complexes (with M. Maller). *Proc. Amer. Math. Soc.* **90** 162-166 (1984).

On the group SSF(G), G a cyclic group of prime order (with M. Maller). *Trans. Amer. Math. Soc.* **290** 725-733 (1985).

The complexity of file transfer scheduling with forwarding, *SIAM J. Comput*., **19**, 222-245 (1990).

Computational complexity over the 2-adic numbers (with M. Maller). *American Math Society Lectures in Applied Mathematics* **32,** 513-521 (1996).

Computational complexity over the p-adic numbers (with M. Maller). *Journal of Complexity* **13,** 195-207 (1997).

Efficient p-adic cell decompositions for univariate polynomials (with M. Maller). *Journal of Complexity* **15**, 513-525 (1999).

P $\neq$ **NC** over the p-adic numbers (with M. Maller). *Journal of Complexity* **19,** 125-131 (2003).

A single-variable sign consistency algorithm over the p-adic numbers (with M. Maller). *To be submitted.*

p-adic dynamics and the squaring map. (with M. Maller). *In preparation.*

PH. D. THESES SUPERVISED

Kenneth Lord, "File Forwarding Approximation Algorithms" (CUNY) 1995.

COURSES TAUGHT

Operating systems, advanced operating systems, distributed systems, discrete structures, theory of computation.

GRANTS

"Investigations in p-adic complexity theory" (with M. Maller). PSC-CUNY Research Award 63452-00 32 (2001-2002).

"Investigations in p-adic and parallel complexity theory" (with M. Maller). PSC-CUNY Research Award 64476-00 33 (2002-2003)

"Algorithms, cell decompositions and complexity over the p-adic numbers" (with M.Maller). PSC-CUNY Research Award 65450-00 34 (2003-2004)

"Investigations in padic complexity" (with M. Maller). PSC-CUNY Research Award 66514-00 35 (2004-2005)

DEPARMENTAL SERVICE

Department Chair 2003 - present
Departmental P&B 1988 – present
Faculty Search Committee 2002 - 2003
Undergraduate Curriculum Committee 1985 - present
Undergraduate Adviser 1985 - 2001

PROFESSIONAL SOCIETIES

Association for Computing Machinery
Institute for Electrical and Electronics Engineers, Computer Society

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OFFICE ADDRESS

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EDUCATION

Year	Degree	Field	Institution
1988	Ph.D.	Computer Science	State University of New York at Buffalo
1984	M.S.	Computer Science	State University of New York at Buffalo
1982	B.S.	Computer Science and Engineering	Beijing Polytechnic University

ACADEMIC POSITIONS

Year	Title	Department	Institution
1997 – present	Associate Professor	Computer Science	Queens College
1991 – present	Doctoral Faculty	Computer Science	CUNY Graduate School and University Center
1988 – 1996	Assistant Professor	Computer Science	Queens College
1987 Summer	Instructor	Computer Science	SUNY at Buffalo
1986 – 1988	Programmer	Biophysical Sciences	SUNY at Buffalo
1984 – 1988	Graduate Research Assistant	Computer Science	SUNY at Buffalo
1982 – 1984	Graduate Teaching Assistant	Computer Science	SUNY at Buffalo

ADMINISTRATIVE POSITIONS

Year	Title	Department	Institution
2003 – present	Deputy Chair	Computer Science	Queens College
2003 – present	Curriculum Committee Chair	Computer Science	Queens College
2003 – present	Personnel & Budget Committee Member	Computer Science	Queens College
2001 – 2003	Curriculum Committee Co-Chair	Computer Science	Queens College
1991 – 1999	Graduate Admissions Officer	Computer Science	Queens College
1989 – 2001	Undergraduate Curriculum Comm. Member	Computer Science	Queens College

COURSES TAUGHT

Level	Course Title
Graduate	Computer Graphics, Artificial Intelligence, Compiler Construction Program Development and Verification
Senior	Computer Graphics, Compilers, Database Systems
Junior	Data Structures, Discrete Structures
Sophomore	Computers and Programming, Computer Organization and Assembly Language
Freshman	Introduction to Computer Science

BOOKS/BOOK CHAPTERS

[1] J. Neil, Z. Xiang and A. Auerbach, List-Oriented Analysis of Single-Channel Data, in P. M. Conn (ed.), *Electrophysiology and Microinjection: Methods in Neurosciences* **4**, Academic Press, San Diego, CA, ISBN 0-12-185258-X, 1991, 474-490.

[2]* Z. Xiang and R. Plastock, *Schaum's Outline of Theory and Problems of Computer Graphics*, 2nd ed., McGraw-Hill, New York, ISBN 0-07-135781-5, 2000.

[3] Z. Xiang, *Computer Graphics with OpenGL*, Tsinghua University Press, Beijing, China (in press).

[4] Z. Xiang, Color Quantization, in T. Gonzalez, *Handbook on Approximation Algorithms and Metaheuristics*, Taylor and Francis, Boca Raton, FL, (in press).

* Has been translated to Chinese (ISBN 7-111-10822-1, 2002) and German (ISBN 3-8266-0908-5, 2003).

JOURNAL ARTICLES

[1] Z. Xiang, J. G. Chutkow, S. C. Shapiro and S. N. Srihari, Computerized Neurological Diagnosis: A Paradigm of Modeling and Reasoning, *Health Care Instrumentation* **1(3)**, 1986, 90-105.

[2] Z. Xiang and S. N. Srihari, Diagnosis Based on Empirical and Model Knowledge, *IEEE Software* **3(2)**, March 1986, 50-51.

[3] S. N. Srihari and Z. Xiang, Spatial Knowledge Representation, *International Journal of Pattern Recognition and Artificial Intelligence* **3(1)**, March 1989, 67-84.

[4] N. Schaller, A. Bunschaft, T. Howard, W. LaLonde, D. Schwertzer, C. Wasikowski and Z. Xiang, Graphics Education for Computer Science, *Computer Graphics* **26(2)**, July 1992, 410-411.

[5] N. Schaller, D. Higgins, T. Howard, W. LaLonde, D. Schwertzer, Z. Xiang and C. Wasikowski, Graphics Education for Computer Science – Panel Report, *Computer Graphics* **27(1)**, Jan. 1993, 6-10.

[6] G. Joy and Z. Xiang, Center-cut for Color Image Quantization, *The Visual Computer* **10(1)**, Oct. 1993, 62-66.

[7] Z. Xiang and G. Joy, Color Image Quantization by Agglomerative Clustering, *IEEE Computer Graphics and Applications* **14(3)**, May 1994, 44-48.

[8] Z. Xiang, A Nontraditional Computer Graphics Course for Computer Science Students, *Computer Graphics* **28(3)**, Aug. 1994, 186-188.

[9] G. Joy and Z. Xiang, Reducing False Contours in Quantized Color Images, *Computers & Graphics* **20(2)**, March/April 1996, 231-242.

[10] E. Jeng and Z. Xiang, Moving Cursor Plane for Interactive Sculpting, *ACM Transactions on Graphics* **15(3)**, July 1996, 211-222.

[11] Z. Xiang, Color Image Quantization by Minimizing the Maximum Intercluster Distance, *ACM Transactions on Graphics* **16(3)**, July 1997, 260-276.

[12] Z. Xiang, A Tri-plane Cursor, *Journal of Graphics Tools* **2(3)**, July 1998, 37-43.

REFEREED PAPERS

[1] Z. Xiang, S. N. Srihari, S. C. Shapiro and J. G. Chutkow, Analogical and Propositional Representations of Structure in Neurological Diagnosis, *Proc. First Conference on Artificial Intelligence Applications*, IEEE Comp. Soc., Denver, CO, Dec. 1984, 127-132.

[2] Z. Xiang and S. N. Srihari, Representation of Structure in Neurological Diagnosis, *Proc. International Conference on Computers, Systems and Signal Processing*, IEEE, Bangalore, India, Dec. 1984, 1166-1169.

[3] Z. Xiang and S. N. Srihari, Graphics Interfaces to a Neurological Diagnosis System, *Proc. Sixth Annual Conference and Exposition* **3**, NCGA, Dallas, TX, April 1985, 215-222.

[4] Z. Xiang and S. N. Srihari, Spatial Structure and Function Representation in Diagnostic Expert Systems, *Proc. of the Fifth International Workshop on Expert Systems and Their Applications*, Agence de l'Informatique, Avignon, France, May 1985, 191-206.

[5] Z. Xiang, S. N. Srihari, S. C. Shapiro and J. G. Chutkow, A Modeling Scheme for Diagnosis, *Proc. Expert Systems in Government Symposium*, IEEE Comp. Soc., McLean, VA, Oct. 1985, 538-547.

[6] Z. Xiang, J. G. Chutkow, S. C. Shapiro and S. N. Srihari, Representation of Spatial Structure and Function in Diagnosis, *Proc. Second Conference on Artificial Intelligence Applications*, IEEE Comp. Soc., Miami Beach, FL, Dec. 1985, 223-228.

[7] Z. Xiang and S. N. Srihari, A Strategy for Diagnosis Based on Empirical and Model Knowledge, *Proc. Sixth International Workshop on Expert Systems and Their Applications*, Agence de l'Informatique, Avignon, France, April 1986, 835-848.

[8] Z. Xiang and S. N. Srihari, Diagnosis Using Multi-level Reasoning, *Proc. Expert Systems in Government Symposium*, IEEE Comp. Soc., McLean, VA, Oct. 1986, 151-158.

[9] Z. Xiang, Fault Localization Using Physical and Logical Models, *Proc. Third International Symposium on Expert Systems – Theory and Applications*, IASTED, Los Angeles, CA, Dec. 1988, 165-168.

[10] Z. Xiang, A Dual-Level Differentiation Strategy for Fault Localization, in G. X. Ritter (ed.), *Information Processing 89: Proceedings of the IFIP 11th World Computer Congress*, North-Holland, Amsterdam, The Netherlands, 1989, 687-692.

[11] Z. Xiang and G. Joy, Feedback-based Quantization of Color Images, *Proc. SPIE 2182: Image and Video Processing II*, IS&T/SPIE, San Jose, CA, Feb. 1994, 34-42.

[12] E. Jeng and Z. Xiang, Priority Point Lists for Point Based Object Rendering, *Proc. Fifth International Conference on Computer Graphics and Imaging*, IASTED, Kaua'i, HI, Aug. 2002, 79-84.

[13] E. Jeng and Z. Xiang, Fast Soft Shadow Visualization for Deformable Moving Light Sources Using Adaptively Sampled Light Field Shadow Maps, *Proc. 10th Pacific Conference on Computer Graphics and Applications*, IEEE Comp. Soc., Beijing, China, Oct. 2002, 426-428.

[14] E. Jeng and Z. Xiang, Forward Area Light Map Projection, *Proc. 2nd International Conference on Computer Graphics, Virtual Reality, Visualization and Interaction in Africa*, ACM SIGGRAPH and EUROGRAPHICS, Cape Town, South Africa, Feb. 2003, 79-86, 186.

GRANTS

Year	Title	Sponsor	Amount
1991	SIGGRAPH '91 Conference Grant	ACM SIGGRAPH	$1,000
1991	Development of Undergraduate Graphics Laboratory with Raster Environment at CUNY Queens College	National Science Foundation	$81,065
1992	Exploration and Reduction of Visible Distortion in Quantized Color Images	CUNY Research Foundation	$2,743
1994	Feedback-based Quantization of Color Images	CUNY Research Foundation	$3,899

AWARDS

Year	Title	Sponsor/Institution	Place
1982	Graduate with Honors	Beijing Polytechnic University	Beijing, China
1986	Best Paper	The Sixth International Workshop on Expert Systems and Their Applications	Avignon, France

PROFESSIONAL SERVICE

Year	Work Description
1988	Reviewer for *IEEE Expert*

1993 – 1994	CS Panel of the University Committee on Research Awards, CUNY Graduate Center
1994	Reviewer for *IEEE Computer Graphics and Applications*
1996	Reviewer for *IEEE Transactions on Fuzzy Systems*
2002	Reviewer for *Journal of Graphics Tools*
2003	Reviewer for *Data Structures and the Java Collections Framework*, McGraw-Hill
2003 – present	Faculty Admissions Committee, Ph.D. Program in CS, CUNY Graduate Center
2004 – present	Graduate Scholastic Standards Committee, Academic Senate, Queens College

Curriculum Vitae

Keitaro Yukawa
Assistant Professor
Department of Computer Science
Queens College of the City University of New York

PERSONAL DATA

Home address:
85 E 12th St.
Huntington Station, NY 11746

Mailing address:
Department of Computer Science
Queens College
65-30 Kissena Boulevard
Flushing, NY 11367
Phone: (718) 997-3500
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TITLE

Assistant Professor of Computer Science (with tenure)
Queens College of the City University of New York

EDUCATION

Jan/83–Sep/87: Ph.D. (Computer Science)
University of Waterloo
Waterloo, Ontario, Canada

May/81–Dec/82: M.Math. (Computer Science)
University of Waterloo
Waterloo, Ontario, Canada

Apr/76–Mar/80: B.Eng. (Information Engineering)
University of Gunma
Kiryu, Gunma, Japan

EMPLOYMENT HISTORY

Sep/88–Present: Assistant Professor of Computer Science at the Queens College of the City University of New York.

Oct/87–June/88: Postdoctoral Fellow in the Department of Computer Science at the University of Victoria, B.C., Canada.

PUBLICATIONS

1. K. Yukawa, *Amalgamating Functional and Relational Programming through the Use of Equality Axioms*, Ph.D. dissertation, University of Waterloo, September, 1987. Dissertation supervisor: Prof. M.H. van Emden. Also appeared as Technical Report CS-87-61, Department of Computer Science, University of Waterloo, October, 1987.

2. M.H. van Emden and K. Yukawa, Logic Programming with Equations, *Journal of Logic Programming*, 4(4):265-288, 1987.

3. M.H.M. Cheng and K. Yukawa, AP: An Assertional Programming System, in *Advances in Logic Programming and Automated Reasoning*, R.W. Wilkerson, ed., Ablex Publishing Corporation, New Jersey, 1992, pp. 120-134.

4. H.C. Wasserman, K. Yukawa, and Z. Shen, The Essential Inadequacy of Deduction in Logic Programming, *Bulletin of the Interest Group in Pure and Applied Logics*, 3(1):107-110, 1995. (An extended abstract of this paper appears in *Proceedings of the 1993 International Logic Programming Symposium*, D. Miller, ed., The MIT Press, Massachusetts, 1993, p. 644.)

5. H.C. Wasserman, K. Yukawa, and Z. Shen, An Alternative Transformation Rule for Logic Programs, in *Proceedings of the 1995 ACM Symposium on Applied Computing*, ACM Press, 1995, pp. 364-368.

6. H.C. Wasserman, K. Yukawa, and Z. Shen, On Quantitative Measurement of Negation in Logic Programming, in *Proceedings of the 1996 ACM Symposium on Applied Computing*, ACM Press, 1996, pp. 58-62.

7. H.C. Wasserman, K. Yukawa, B. Sy, K.L. Kowk, and I.T. Phillips, A Theoretical Foundation and a Method for Document Table Structure Extraction and Decomposition, in *Proceedings of the 5th IAPR International Workshop on Document Analysis Systems*, Springer Lecture Notes in Computer Science 2423, 2002, pp. 291-294.

GRANTS

Funded

1. CUNY Institute for Software Design and Development (with I.T. Phillips, K.L. Kwok, B. Sy, and H. Wasserman).
Title: Methods for Document Table Structure Extraction and Decomposition.
Amount: $4,000.
Funded in May 2001.

2. PSC-CUNY 33 Research Award (with Howard Wasserman, Co-PI).
Title: A Method of Document Table Region Detection.
Grant Number: 64414-00 33.

Amount: $3,352.
Period: 7/1/02–6/30/03.

3. PSC-CUNY Research Award
Title: Conceptual Modeling of Music Structures as Composite Objects for Database Systems
Period: 7/1/05–6/30/06.

Submitted

1. Central Intelligence Agency (with I.T. Phillips, K.L. Kwok, B. Sy, and H. Wasserman).
Title: Methods for Document Table Structure Extraction and Decomposition.
Amount: $110,000.
Submitted in May 2001.

2. National Science Foundation (with B. Sy (PI), D. Salane, and M. Lu).
Title: Pattern-Based Approach for Integrating Research into the Undergraduate Curriculum.
Amount: $498,404.
Submitted in November 2002.

ADMINISTRATIVE ACTIVITIES

1990–2001: Member of Graduate Curriculum Committee.
1999–2001: Chair of Graduate Curriculum Committee.
2001–2003: Co-Chair of Curriculum Committee.
2003–Present: Member of Curriculum Committee.
2001–Present: Assistant Chair for CS Graduate Studies.
1992–2000, 2002–2003: Member of Graduate Admissions Committee.
2002–2003: Coordinator for Discrete Mathematics Portion of Departmental Proficiency Test.

SOCIETIES

Association for Computing Machinery.
IEEE Computer Society.

AWARDS

Queens College Faculty-in-Residence award for 1989-90.

CURRENT RESEARCH

- Database systems and data modeling, especially object-oriented databases.
- Music data modeling; computational music.

PAST RESEARCH

Functional and logic programming. Theories of logic programming. Semantics of programming languages and formal specification. Document processing; especially detection, extraction, and processing of table structures in documents.

TEACHING

Recent
Principles of Programming Languages (undergraduate)
Object-Oriented Databases (undergraduate and graduate)

Past
Data Structures (undergraduate)
C/C++ Programming (undergraduate)
Formal Languages (undergraduate)
Design and Analysis of Algorithms (undergraduate and graduate)
Database Systems (graduate)
Functional Programming (graduate)

MISCELLANEOUS ACTIVITIES

- Have developed an undergraduate/graduate course in object-oriented database systems over the past few years; a textbook in object-oriented database systems is in preparation.
- Jointly with a student, designed and implemented a Wed-based graduate admissions database using the JASMINE object database system. This database has been in use for Departmental graduate admissions and advisement.

Jun Zheng

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Flushing, NY 11355
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E-mail: zheng@cs.qc.edu

EDUCATION

Ph.D., Computer Engineering, Department of Electrical and Computer Engineering, University of Nevada, Las Vegas, Las Vegas, NV, **Summer 2005 (**GPA 3.9/4.0**) (**Advisor: Dr. Emma Regentova**)**

M.S.E., Biomedical Engineering, Department of Biomedical, Industrial and Human Factor Engineering, Wright State University, Dayton, OH, **2001 (**GPA 3.9/4.0**)** (Advisor: Dr. Ping He)

M.S., Electrical Engineering, Department of Electrical Engineering, Chongqing University, Chongqing, China, **1996 (**GPA 3.5/4.0**)**

B.S., Electrical Engineering, Department of Electrical Engineering, Chongqing University, Chongqing, China, **1993 (**GPA 3.5/4.0**)**

TEACHING EXPERIENCE

Assistant Professor, Department of Computer Science, Queens College – City University of New York, 2005 – present
Fall 2005:
CSCI 240 – Computer Organization and Assembly Languages
Spring 2006:
CSCI 240 – Computer Organization and Assembly Languages
CSCI 3813/780 – Mobile Computing

Teaching Assistant, Department of Electrical and Computer Engineering, University of Nevada, Las Vegas, 2002-2005
Teach ECG100L-Digital Logic Lab, ECG200L-Computer Logic Design Lab, ECG300L-Digital Systems Design Lab, ECG321L Engineering Electronics Lab, ECG420L Engineering Electronics II Lab. Grader for ECG100-Digital Logic, ECG200-Computer Logic Design, ECG360-Signals and Systems I.

Guest Lecturer, Department of Electrical and Computer Engineering, University of Nevada, Las Vegas, 2002 - 2005
ECG200 Computer Logic Design, ECG300 Digital System Design, ECG682 Introduction to Biomedical Signals and Systems, ECG695 Information Coding, ECG695 Modern Processor Architecture, ECG700 Advanced Computer System Architecture.

INDUSTRY WORK EXPERIENCE

Internship as **Hardware Design Engineer**, Statistical Software and Analysts, Inc., Las Vegas, NV, May 2004 – Aug. 2004
Implement MPEG-4 Encoder using FPGA for real-time video compression in video surveillance system.

Algorithmic Engineer, Teranex Inc., Orlando, FL, Feb. 2001 – Oct. 2001
Development of video image processing algorithms implemented on SIMD parallel processor architecture. Algorithms include interlace-to-progressive video conversion, compression, decompression, noise reduction, scratch removal, color manipulation, detail enhancement, and other quality improvement techniques.

RESEARCH INTERESTS

- Wireless networking and mobile computing
- Computer architectures, reconfigurable systems, digital design
- Interconnection networks, fault tolerant computing.
- Medial image processing, Medical decision support system, pattern recognition

PUBLICATIONS

REFEREED JOURNAL PUBLICATIONS:

- **Jun Zheng**, Yan Zhang, Emma Regentova, "Virtual guard channel for handoff calls in integrated voice/data wireless networks," accepted by ***IEEE Communications Letters***.
- Hongmei Yan, Yingtao Jiang, **Jun Zheng**, Chenglin Peng, Qinghui Li, "A Multilayer Perceptron-Based Medical Decision Support System for Heart Disease Diagnosis," ***Expert Systems With Applications***, vol. 30(2), pp. 272-281, Feb. 2006.
- **Jun Zheng**, Shahram Latifi, Emma Regentova, Xiaolong Wu, Kai Luo, "Diagnosability of star graphs under the comparison diagnosis model," ***Information Processing Letters***, vol. 93(1), pp. 29-36, Jan. 2005.
- **Jun Zheng,** Emma Regentova, "Hybrid location update scheme for future PCS networks," ***IEICE Trans. on Communications***, vol. E88-B(1), pp. 388-391, Jan. 2005.
- **Jun Zheng,** Emma Regentova, "Performance analysis of channel de-allocation schemes for dynamic resource allocation in GSM/GPRS networks," ***IEE Electronics Letters***, vol. 40(24), pp. 1544-1545, Nov. 2004.
- **Jun Zheng,** Emma Regentova, "EDBLU - Enhanced Direction-based Location Update Scheme for PCS Networks," ***IEE Electronics Letters***, vol. 40(15), pp. 946-948, July 2004.
- Hongmei Yan, Yingtao Jiang, **Jun Zheng**, Bingmei Fu, Shouzhong Xiao, Chenglin Peng, "The Internet-based Knowledge Acquisition and Management Method to Construct Large-Scale Distributed Medical Expert Systems," ***Computer Methods and Programs in Biomedicine***, vol. 74(1), pp. 1-10, April 2004.

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HONORS, AWARDS AND SCHOLARSHIPS

Graduate Teaching Assistantship, University of Nevada, Las Vegas, 2002 Fall-present
Graduate Research Assistantship, University of Nevada, Las Vegas, 2002 Spring
Graduate Research Training Assistantship, Graduate College of UNLV, 2003, 2005
Conference Travel Grant, UNLV Graduate and Professional Student Association, Summer 2004
Graduate Research Assistantship, Wright State University, 1998 – 2000
Dayton Area Graduate Studies Institute (DAGSI) Tuition Scholarship, 1999-2000

PROFESSIONAL ACTIVITIES

Membership:

- IEEE Member (1998 – Present)
- IEICE Member (2004 – Present)

Conference Activities:

- Program committee of International Conference on Information Technology: Coding and Computing (ITCC 2005) Track "Data coding and compression".
- Session co-chair of International Conference on Information technology – Next Generations (ITNG 2006), Track "High performance computing architectures".
- Program committee of International Workshop on Data Mining in Security Control, 2006.

Technical Referee:

- IEE Electronic Letters 2005, 2006
- International Journal of Network Security 2006
- IEEE International Conference on Information Technology: Coding and Computing (ITCC) 2005
- IEEE Global Telecommunications Conference (Globecom) 2005
- IEEE International Conference on Communications (ICC) 2006
- International Conference on Information technology – Next Generations (ITNG 2006)

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Appendix C: Student-Alumni Survey

1. Please start by telling us your relationship to the department. If more than one category describes you, you may take the survey multiple times. Or just pick the best category now.

		Response Percent	Response Total
Current Undergraduate Student		**54.5%**	**158**
Current Graduate Student		14.1%	41
Undergraduate Program Alumnus		13.4%	39
Graduate Program Alumnus		5.9%	17
None of the above		12.1%	35
		Total Respondents	**290**
		(skipped this question)	**0**

2. What major and degree are you working toward?

		Response Percent	Response Total
CS Major BA Degree		28.3%	34
CS Major BS Degree		**56.7%**	**68**
CS Minor General		0.8%	1
CS Minor IT Track		0.8%	1
Multiple Majors, including CS		4.2%	5
Some major(s) other than CS		5%	6
Undecided		1.7%	2
Not matriculated for any degree		2.5%	3
		Total Respondents	**120**
		(skipped this question)	**170**

3. When did you start taking classes at Queens College?

		Response Percent	Response Total
1998 or earlier		10%	12
1999		3.3%	4
2000		6.7%	8
2001		17.5%	21
2002		**26.7%**	**32**
2003		25%	30
2004		5%	6
2005		5.8%	7
	Total Respondents		**120**
	(skipped this question)		**170**

4. What is your class standing?

		Response Percent	Response Total
Freshman (0 to 30 credits completed).		2.5%	3
Sophomore (31 to 60 credits completed).		9.2%	11
Junior (61 to 90 credits completed).		30.3%	36
Senior (Over 90 credits completed).		**58%**	**69**
	Total Respondents		**119**
	(skipped this question)		**171**

5. When do you expect to graduate?			
		Response Percent	**Response Total**
2005		27.7%	33
2006		**45.4**%	**54**
2007		17.6%	21
2008		6.7%	8
2009		0.8%	1
2010		0%	0
2011		0%	0
2012 or Later		1.7%	2
	Total Respondents		**119**
	(skipped this question)		**171**

6. If you are a transfer student, please tell which school you transferred from. Otherwise, leave this blank.	
Total Respondents	**61**
(skipped this question)	**229**

7. If you have a job, how many hours a week do you work? (Check zero if you don't have a job.)			
		Response Percent	**Response Total**
Zero		**31.9**%	**38**
Less than 10		8.4%	10
10-20		21.8%	26
21-40		21.8%	26
Over 40		16%	19
	Total Respondents		**119**
	(skipped this question)		**171**

8. What do you think is a reasonable amount of time to spend on a 3 to 4 credit course *per week* in addition to time spent in class?

		Response Percent	Response Total
0		0%	0
Less than one hour		4.2%	5
One to two hours		17.6%	21
Two to four hours		**29.4**%	**35**
Four to six hours		27.7%	33
Six to eight hours		13.4%	16
Eight to ten hours		5%	6
More than ten hours		2.5%	3
		Total Respondents	**119**
		(skipped this question)	**171**

9. Realistically, how much time per week do you spend outside class, on average, preparing for a typical 3-4 credit course?

		Response Percent	Response Total
0		0.8%	1
Less than one hour		14.3%	17
One to two hours		21.8%	26
Two to four hours		**27.7**%	**33**
Four to six hours		19.3%	23
Six to eight hours		7.6%	9
Eight to ten hours		5%	6
More than ten hours		3.4%	4
		Total Respondents	**119**
		(skipped this question)	**171**

10. Please indicate how strongly you agree with the following statements about the Computer Science Department.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A	Response Average
Courses are relevant to my interests.	2% (2)	13% (15)	22% (26)	**47% (56)**	17% (20)	0% (0)	**3.65**
Time demands for courses are reasonable.	6% (7)	19% (23)	30% (36)	**38% (45)**	5% (6)	2% (2)	**3.17**
There is a good choice of courses.	6% (7)	15% (18)	29% (34)	**41% (49)**	9% (11)	0% (0)	**3.33**
The curriculum provides good preparation for work after graduation.	12% (14)	13% (16)	**29% (34)**	27% (32)	7% (8)	13% (15)	**3.04**
The curriculum provides good preparation for graduate study.	5% (6)	3% (4)	**35% (42)**	33% (39)	8% (10)	15% (18)	**3.43**
Computing resources provided by the college are good.	8% (10)	6% (7)	18% (21)	**47% (56)**	18% (22)	3% (3)	**3.63**
Library resources provided by the college are good.	7% (8)	4% (5)	25% (30)	**43% (51)**	17% (20)	4% (5)	**3.61**
Computing and laboratory resources provided by the department are good.	6% (7)	9% (11)	27% (32)	**37% (44)**	16% (19)	5% (6)	**3.50**
Faculty members know the subject matter they teach well.	8% (9)	11% (13)	22% (26)	**44% (52)**	13% (15)	3% (4)	**3.44**
The number of courses taught by adjuncts rather than full-time faculty is good.	8% (9)	13% (15)	**33% (39)**	32% (38)	8% (9)	8% (9)	**3.21**
Instructors are readily available outside of class.	5% (6)	10% (12)	34% (40)	**44% (52)**	3% (3)	5% (6)	**3.30**
Advisement is good.	6% (7)	10% (12)	**42% (50)**	30% (36)	8% (10)	3% (4)	**3.26**
Courses are taught well.	6% (7)	10% (12)	36% (43)	**41% (49)**	5% (6)	2% (2)	**3.30**
Grading is fair.	6% (7)	8% (10)	29% (35)	**49% (58)**	6% (7)	2% (2)	**3.41**
There are good opportunities for internships.	9% (11)	9% (11)	29% (34)	**31% (37)**	12% (14)	10% (12)	**3.30**
The department is responsive to student needs.	8% (9)	11% (13)	**34% (41)**	29% (35)	12% (14)	6% (7)	**3.29**
						Total Respondents	**119**
						(skipped this question)	**171**

11. Please indicate the time demands for each of the following courses that you have taken. Some of the course titles have changed over the past few years; pick the ones you have taken by number.
Use N/A for courses you haven't taken or don't want to rate.

	Light	Medium	Heavy	Too heavy!	N/A	Response Average
095 Introduction to Programming (before 2002)	6% (7)	11% (13)	5% (6)	1% (1)	**77% (92)**	**2.04**
101 Introduction to Computer Science (before 2002)	5% (6)	10% (12)	5% (6)	5% (6)	**75% (89)**	**2.40**
111 Algorithmic Problem Solving	3% (3)	32% (38)	29% (35)	3% (4)	**33% (39)**	**2.50**
141 Computer Structures & Assember (before 2002)	1% (1)	8% (9)	12% (14)	3% (3)	**77% (92)**	**2.70**
203 Data Structures (before 2002)	2% (2)	10% (12)	9% (11)	4% (5)	**75% (89)**	**2.63**
211 OOP in C++	5% (6)	18% (21)	30% (36)	10% (12)	**37% (44)**	**2.72**
212 OOP in Java	2% (2)	8% (9)	5% (6)	5% (6)	**81% (96)**	**2.70**
220 Discrete Structures	6% (7)	**36% (43)**	26% (31)	8% (10)	24% (28)	**2.48**
240 Computer Org. and Assembly Language	8% (10)	**34% (41)**	19% (23)	5% (6)	33% (39)	**2.31**
241 Operating Systems (before 2002)	1% (1)	8% (9)	8% (10)	3% (4)	**80% (95)**	**2.71**
300 Programming Languages	0% (0)	9% (11)	13% (16)	4% (5)	**73% (87)**	**2.81**
313 Data Structures	3% (4)	18% (21)	24% (28)	20% (24)	**35% (42)**	**2.94**
316 Programming Languages	1% (1)	16% (19)	14% (17)	8% (9)	**61% (73)**	**2.74**
320 Theory of Computation	3% (3)	17% (20)	28% (33)	16% (19)	**37% (44)**	**2.91**
323 Analysis of Algorithms	2% (2)	18% (21)	24% (28)	3% (4)	**54% (64)**	**2.62**
331 Database	7% (8)	25% (30)	12% (14)	5% (6)	**51% (61)**	**2.31**
340 Operating Systems	4% (5)	18% (21)	23% (27)	9% (11)	**46% (55)**	**2.69**
341 Computer Organization	1% (1)	5% (6)	4% (5)	5% (6)	**85% (101)**	**2.89**
343 Computer Architecture	8% (9)	22% (26)	22% (26)	5% (6)	**44% (52)**	**2.43**
350 Parallel and Distributed Systems	0% (0)	3% (3)	5% (6)	6% (7)	**87% (103)**	**3.25**
370 Software Engineering	3% (4)	9% (11)	13% (15)	9% (11)	**66% (78)**	**2.80**
					Total Respondents	**119**
					(skipped this question)	**171**

12. What are two most important things you think the Computer Science Department should do in order to improve?	
Total Respondents	**78**
(skipped this question)	**212**

13. When did you start taking graduate courses in the CS Department?			
		Response Percent	**Response Total**
2001 or earlier		5.3%	2
2002		18.4%	7
2003		10.5%	4
2004		**39.5%**	**15**
2005		26.3%	10
Total Respondents			**38**
(skipped this question)			**253**

14. Where did you complete your undergraduate degree?			
		Response Percent	**Response Total**
Queens College BS		**40.5%**	**15**
Queens College BA		10.8%	4
Other CUNY college		13.5%	5
Other (please specify)		35.1%	13
Total Respondents			**37**
(skipped this question)			**253**

15. What was your undergraduate major?

		Response Percent	Response Total
Computer Science		**73%**	**27**
Computer Engineering		0%	0
Software Engineering		0%	0
Information Technology		2.7%	1
Mathematics		2.7%	1
Other Engineering		2.7%	1
Other Science		0%	0
Other (please specify)		18.9%	7
		Total Respondents	**37**
		(skipped this question)	**253**

16. How many credits have you completed in the master's program so far?

		Response Percent	Response Total
0 to 9		**47.4%**	**18**
10 to 19		26.3%	10
20 or more		26.3%	10
		Total Respondents	**38**
		(skipped this question)	**253**

17. When do you plan to complete your master's degree?

		Response Percent	Response Total
2005		28.9%	11
2006		**42.1**%	**16**
2007		18.4%	7
2008		0%	0
2009 or later		10.5%	4
	Total Respondents		**38**
	(skipped this question)		**253**

18. Please indicate whether you agree with the following statements about the Computer Science Department or not.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A	Response Average
Courses are relevant to my interests.	5% (2)	8% (3)	26% (10)	**37% (14)**	11% (4)	13% (5)	**3.45**
There is a good choice of courses.	13% (5)	21% (8)	18% (7)	**32% (12)**	3% (1)	13% (5)	**2.88**
The curriculum provides good preparation for work after graduation.	18% (7)	18% (7)	16% (6)	**26% (10)**	3% (1)	18% (7)	**2.71**
The curriculum provides good preparation for further graduate study.	8% (3)	3% (1)	21% (8)	**47% (18)**	5% (2)	16% (6)	**3.47**
Computing resources provided by the college are good.	5% (2)	16% (6)	18% (7)	**34% (13)**	13% (5)	13% (5)	**3.39**
Library resources provided by the college are good.	5% (2)	16% (6)	18% (7)	**29% (11)**	16% (6)	16% (6)	**3.41**
Computing and laboratory resources provided by the department are good.	5% (2)	21% (8)	11% (4)	**32% (12)**	13% (5)	18% (7)	**3.32**
Faculty members know the subject matter they teach well.	5% (2)	16% (6)	13% (5)	**42% (16)**	5% (2)	18% (7)	**3.32**
The number of courses taught by adjuncts rather than full-time faculty is good.	8% (3)	11% (4)	**37% (14)**	16% (6)	5% (2)	24% (9)	**3.00**
Instructors are readily available outside of class.	16% (6)	8% (3)	18% (7)	**42% (16)**	0% (0)	16% (6)	**3.03**
Advisement is good.	11% (4)	16% (6)	18% (7)	**26% (10)**	5% (2)	24% (9)	**3.00**
Courses are taught well.	8% (3)	8% (3)	24% (9)	**45% (17)**	0% (0)	16% (6)	**3.25**
Grading is fair.	5% (2)	5% (2)	26% (10)	**37% (14)**	11% (4)	16% (6)	**3.50**
There are good opportunities for internships.	16% (6)	18% (7)	16% (6)	**24% (9)**	5% (2)	21% (8)	**2.80**
The department is responsive to student needs.	13% (5)	16% (6)	**32% (12)**	24% (9)	3% (1)	13% (5)	**2.85**

Total Respondents	**37**
(skipped this question)	**253**

19. What are two most important things you think the Computer Science Department should do in order to improve our master's degree program?

Total Respondents	**26**
(skipped this question)	**264**

20. When did you graduate from Queens College?

		Response Percent	Response Total
Before 1980		2.6%	1
Between 1980 and 1990		2.6%	1
Between 1991 and 1995		0%	0
Between 1996 and 2000		10.3%	4
After 2000		**84.6%**	**33**
	Total Respondents		**39**
	(skipped this question)		**251**

21. What formal education have you pursued since receiving your undergraduate degree?

		Response Percent	Response Total
None		**64.1%**	**25**
I have partially completed a master's degree in a computer related field.		25.6%	10
I have partially completed a master's degree in another field.		2.6%	1
I have completed a master's degree in a computer related field.		5.1%	2
I have completed a master's degree in another field.		2.6%	1
I have partially completed a Ph.D. in a computer related field.		0%	0
I have partially completed a Ph.D. in another field.		0%	0
I completed a Ph.D. in a computer related field.		0%	0
I have completed a Ph.D. in another field.		0%	0
	Total Respondents		**39**

(skipped this question)	**251**

22. Which of the following describes your employment since graduation?

		Response Percent	Response Total
I have been regularly employed, and my jobs have been related to computing.		**51.3%**	**20**
I have been regularly employed, but my jobs have not been related to computing.		20.5%	8
I have had multiple jobs. Some have been computing related and some have not.		20.5%	8
I have not been employed since graduation.		7.7%	3
	Total Respondents		**39**
	(skipped this question)		**251**

23. Please tell how strongly you agree with the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A	Response Average
My computer science major provided me with a good preparation for work.	18% (7)	18% (7)	26% (10)	**28% (11)**	5% (2)	5% (2)	**2.84**
My computer science major provided me with a good preparation for graduate study.	8% (3)	8% (3)	**28% (11)**	**28% (11)**	8% (3)	21% (8)	**3.26**
The time I spent at Queens College was rewarding and enjoyable.	13% (5)	10% (4)	26% (10)	**33% (13)**	13% (5)	5% (2)	**3.24**
					Total Respondents		**39**
					(skipped this question)		**251**

24. What two things should the **Computer Science Department** do improve the undergraduate program?

Total Respondents	**20**
(skipped this question)	**270**

25. What two things should **Queens College** do to improve its undergraduate program?

Total Respondents	**15**
(skipped this question)	**275**

26. When did you graduate with an MA in Computer Science?			
		Response Percent	**Response Total**
Before 1980		0%	0
Between 1980 and 1990		0%	0
Between 1991 and 1995		0%	0
Between 1996 and 2000		0%	0
After 2000		0%	0
		Total Respondents	**0**
		(skipped this question)	**290**

27. What further education have you pursued since receiving your master's degree in Computer Science from Queens College?			
		Response Percent	**Response Total**
None		0%	0
I have partially completed another master's degree in a computer related field.		0%	0
I have partially completed another master's degree in another field.		0%	0
I have completed another master's degree in a computer related field.		0%	0
I have completed another master's degree in another field.		0%	0
I have partially completed a Ph.D. in a computer related field.		0%	0
I have partially completed a Ph.D. in another field.		0%	0
I completed a Ph.D. in a computer related field.		0%	0
I have completed a Ph.D. in another field.		0%	0
		Total Respondents	**0**
		(skipped this question)	**290**

28. Which of the following describes your employment since receiving your master's degree in Computer Science from Queens College?

		Response Percent	Response Total
I have been regularly employed, and my jobs have been related to computing.		0%	0
I have been regularly employed, but my jobs have not been related to computing.		0%	0
I have had multiple jobs. Some have been computing related and some have not.		0%	0
I have not been employed since getting my degree.		0%	0
	Total Respondents		**0**
	(skipped this question)		**290**

29. Please tell how strongly you agree with the following statements.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Response Average
My Queens College Master's in Computer Science provided me with a good preparation for work.	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	**0.00**
My Queens College Master's in Computer Science provided me with a good preparation for further graduate study.	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	**0.00**
The time I spent working on my Master's degree at Queens College was rewarding and enjoyable.	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	**0.00**
				Total Respondents		**0**
				(skipped this question)		**290**

30. What two things should the **Computer Science Department** do improve the Master's program?

Total Respondents	**0**
(skipped this question)	**290**

31. What two things should **Queens College** do to improve the Master's program?

Total Respondents	**0**
(skipped this question)	**290**