

Prospects for Information Technology Jobs in New York's Finance Sector

**Prepared for the CUNY Institute for Software Design and
Development through a Project Funded by the Alfred P. Sloan
Foundation**

by the

Fiscal Policy Institute

One Lear Jet Lane
Latham, NY 12110
518-786-3156

11 Park Place, Suite 701
New York, NY 10007
212-414-9001

www.fiscalpolicy.org

June, 2005

About the Fiscal Policy Institute

The Fiscal Policy Institute (FPI) regularly monitors economic and labor market conditions and their effect on working people and their families in New York City and New York State. FPI biennially publishes **The State of Working New York** report and has produced a series of labor market profiles for the New York City Employment and Training Coalition. After September 11, FPI conducted extensive analysis of the impact of the terrorist attacks on New York City's economy and labor force. In 2004, FPI released four studies on various aspects of minimum wage employment in New York. FPI has also prepared in-depth studies on several important sectors of the New York City economy, including the securities, tourism, non-profit social services, laundry, building service, apparel manufacturing, and construction industries. This report is the latest in this series designed to improve labor market opportunities for New York City residents. These publications are available on FPI's website: www.fiscalpolicy.org.

The Fiscal Policy Institute is a nonpartisan research and education organization that focuses on the broad range of tax, budget, economic and related public policy issues that affect the quality of life and the economic well-being of New York State residents. Founded in 1991, FPI's work is intended to further the development and implementation of public policies that create a strong, sustainable economy in which prosperity is broadly shared by all New Yorkers. FPI has offices in Albany and New York City.

Executive Summary

This report is part of a joint project of the Fiscal Policy Institute and the City University of New York Institute for Software Design and Development (CISDD), for the CUNY Computer Science Discipline Council. The purpose of this project was to create an ongoing dialog with IT representatives from the financial services industry to develop appropriate modifications to CUNY's undergraduate computer science major, if necessary and to increase the placement of CUNY graduates in New York's finance industry. Substantive input for the project was provided by two groups, a CISDD Financial Services Industry Advisory Committee, and an ad-hoc computer science faculty curriculum committee. The CISDD-FPI project was funded by the Alfred P. Sloan Foundation.

There are roughly 100,000 workers in computer-related occupations in New York City. New York information technology (IT) employment is closely tied to the City's finance sector. A little over one-quarter (26%) of workers in computer related occupations in New York City are employed in the finance sector (banking and securities). In specific occupations -- computer scientists and system analysts, programmers, and database administrators -- over 30% of those employed in the city worked in the financial sector.

For most of the last five years, computer related employment has been in a slump. The dot-com and telecom bust, the conclusion of the Y2K problem, the recession and the Wall Street crash all contributed to the worst downturn ever experienced in the computer field. Conditions now seem to point to a turnaround. Employment in computer services in New York City increased by 5.3 percent in the first half of 2005, and computer-related hiring is almost certainly taking place in the finance sector. Employment in New York City's securities industry has been on the upswing for the past year and Wall Street spending on data processing is rising again (up 5% in 2004). Constantly changing business information processing and communications requirements will fuel renewed hiring. Nationally, reports indicate that the job market is improving for computer science graduates for the first time in recent years. Job vacancy data also point to a turnaround. In the first half of 2005 the number of IT vacancies in New York City has increased dramatically. Based on estimates by the New York State Department of Economic Development, the average number of vacancies in the first six months of 2005 was over 60% higher than in the first half of 2004.

The State Labor Department projects that computer-related jobs in New York City are likely to increase by over 22% over the decade from 2002 to 2012. This represents an increase of over 20,000 jobs. Newly created jobs and the replacement of workers leaving through retirement and other reasons will lead to about 3,500 job openings annually.

In addition to cyclical swings, a number of factors have influenced the IT labor market resulting in changed demand for various IT occupations. New technologies, cost cutting at firms--which has led to outsourcing— and increased integration of IT functions with the business side within firms, have altered the occupational characteristics of the IT labor

market. Although the computer programmer occupation is still an important segment of the IT industry, it is projected to grow slowly in the future. In contrast, the demand for software engineers (applications and systems), computer support specialists, computer systems analysts, database administrators and network systems and data communications analysts is likely to grow.

As a result of the decline in demand for computer professionals early in this decade, enrollment in computer science undergraduate programs nationally fell by over 60% between 2000 and 2004. However, this trend is likely to reverse as the industry begins to upgrade and develop new IT applications. Recent news reports suggest that there is a growing shortage of IT workers in many parts of the country.

Finance industry IT officials report that computer professionals with skills that support IT infrastructure, security, database management, helpdesks, applications development, web services and project management are expected to be in demand. Information security and seamless redundant systems, always a concern to financial firms, have become more urgent after 9/11. Demand for individuals with skills in these areas will persist in the future. "Network vulnerability", virus protection, and "intrusion detection" are some of the areas of concern. Project management skills, particularly in the finance sector, are in demand to manage outsourced projects.

In addition to expert technical skills, finance industry IT officials look for individuals with a broad knowledge of computer technology and strong analytical skills. Potential employees need to have knowledge of the finance business and must possess "soft-skills." The latter include: communications and inter-personal skills, knowledge of business ethics and a capacity to work under pressure. Internships often enhance job prospects and most managers find new employees through their network of contacts.

CUNY is well-positioned to provide IT workers for New York's finance sector. There are over 9,000 students in computer science or computer science related degree programs at CUNY colleges developing a broad range of skills essential to the finance sector. CUNY colleges offer a broad range of computer related training relevant to the industry including computer science (CS), software engineering (SE), information technology (IT) and information systems (IS). Collectively, CUNY schools represent one of the largest university computer programs in the country. In 2003, CUNY awarded nearly 1,860 Bachelors, Masters, and Ph.D., degrees in computer related disciplines. In 2001, the latest year for which national data are available, CUNY accounted for 3.5% of the nation's Bachelor's degrees awarded in computer science.

Over the past two years, CUNY's Institute for Software Design and Development (CISDD) has begun to engage the finance sector in discussions to adapt curricula to meet industry needs. One course that was created led to an initiative that engaged students in two industry related projects which were completed successfully in the spring of 2005.

In responding to changing technology and industry needs, CUNY's Computer Science Discipline Council should consider establishing a permanent industry related Computer Science Faculty Curriculum Committee that would review current industry needs and advise computer science departments at CUNY on adapting current curriculum to meet industry requirements. New York's finance industry should collaborate with the Discipline Council in this process, expand internship opportunities for CUNY students and more systematically consider CUNY computer science graduates in filling their IT staffing needs.

Prospects for Information Technology Jobs in New York's Financial Sector

I. Preface

This report is part of a joint project of the Fiscal Policy Institute and the CUNY Institute for Software Design and Development (CISDD). The purpose of this project was to develop modifications in the curricula of CUNY's computer science departments to better meet the needs of the finance industry and to increase the placement of CUNY graduates in New York's finance industry. Substantive input for the project was provided by two groups, a CISDD Financial Services Industry Advisory Committee, and a CISDD formed Computer Science faculty curriculum committee. This report was funded by the Alfred P. Sloan Foundation.

This report is an analysis of Information Technology (IT) job prospects in the financial industry in New York and follows an earlier report by the Fiscal Policy Institute entitled "*Labor Market Trends and Issues in the New York City Securities Industry*". The earlier report was prepared for the Institute for Business Trends Analysis at the Borough of Manhattan Community College (BMCC) in 2002. In the earlier report, FPI recommended that CUNY develop cooperative programs with industry and adapt academic programs at CUNY to meet industry needs.

II. Information Technology Jobs in the Finance Industry

In addition to IT jobs found in the computer industry, in New York City there are significant numbers of IT jobs in the finance sector (banking and securities). IT employment in New York City is closely tied to economic trends in the finance sector. In fact, the presence of computer design/software sector in New York City is in large part attributable to the demand for products and services emanating from the City's finance sector.

Because of the method by which employment data are gathered, it is difficult to precisely pin-point on a continuing basis the number of people who work in IT related jobs in New York City. However, occupational data from the 2000 Census provide essential information that reflects the magnitude of employment of IT workers by industry as of 2000.

In 2000, about 26.3% (29,049) workers in computer related occupations in New York City were employed in the finance sector (banking and securities). The total number of workers in computer-related occupations in New York City was slightly over 110,000. In specific occupations—computer scientists and system analysts, programmers, database administrators—over 30% of those employed worked for the financial sector.(See Table 1.)

Table 1
Computer-related Occupations in the Finance Sector
New York City

	NAICS	NAICS	Total	All
	521,522	523,525	Finance	Industries
Computer Scientists and Systems Analysts	3,180	5,099	8,279	26,780
Computer Programmers	3,559	5,652	9,211	29,735
Computer Software Engineers	1,514	2,852	4,366	15,775
Computer Support Specialists	804	1,315	2,119	9,900
Database Administrators	420	434	854	2,810
Network and Computer Systems Administrators	629	985	1,614	6,825
Network Systems and Data Communications Analysts	654	1,284	1,938	15,055
Operations Research Analysts	260	408	668	3,455
Total of these occupations	11,020	18,029	29,049	110,335
Finance sector as fraction of occupational employment:				
Computer Scientists and Systems Analysts	11.9%	19.0%	30.9%	
Computer Programmers	12.0%	19.0%	31.0%	
Computer Software Engineers	9.6%	18.1%	27.7%	
Computer Support Specialists	8.1%	13.3%	21.4%	
Database Administrators	14.9%	15.4%	30.4%	
Network and Computer Systems Administrators	9.2%	14.4%	23.6%	
Network Systems and Data Communications Analysts	4.3%	8.5%	12.9%	
Operations Research Analysts	7.5%	11.8%	19.3%	
Total of these occupations	10.0%	16.3%	26.3%	

Note: NAICS 521, 522 are banking, credit and related activities. NAICS 523 and 525 include Securities, Commodities, Funds, Trusts and other financial investments and related activities.

Source: U. S. Census Bureau, 2000 Census.

An approximation of the change in IT employment in New York City since 2000 is presented in Table 2, which is based on U.S. Bureau of Labor Statistics data. In 2003, a total of 92,280 jobs were in the computer and related occupational categories in New York City. These data show an overall decline between 2000 and 2003 in computer-related occupations due to the recession, 9/11 and the end of Y2K. However, there were also gains during this period in some occupational segments. There was a sharp decline in demand for computer programmers, computer support specialists, computer systems analysts and database administrators. In contrast, there was a steep increase in demand for computer software engineers and network systems and data communications analysts.

Table 2

NYC Trends in Computer Related Occupations 2000 and 2003.

SOC Codes	Occupation Title	Emp.2000	Emp. 2003	#Chg.	%Chg	Annual Sal
15-0000	Computer-related Occupations	101,060	92,280	-8,780	-8.7%	\$72,910
15-1011	Computer and Information Scientists, Research	NA	410	NA	NA	\$75,000
15-1021	Computer Programmers	24,220	19,490	-4,730	-19.5%	\$74,590
15-1031	Computer Software Engineers, Applications	8,570	11,600	3,030	35.4%	\$83,540
15-1032	Computer Software Engineers, Systems Software	6,130	7,360	1,230	20.1%	\$79,780
15-1041	Computer Support Specialists	18,190	14,680	-3,510	-19.3%	\$55,660
15-1051	Computer Systems Analysts	17,620	14,790	-2,830	-16.1%	\$72,940
15-1061	Database Administrators	5,690	4,080	-1,610	-28.3%	\$78,350
15-1071	Network and Computer Systems Administrators	7,700	7,630	-70	-0.9%	\$76,650
15-1081	Network Systems and Data Communications Analysts	5,090	7,550	2,460	48.3%	\$69,540
15-2031	Operations Research Analysts	1,230	850	-380	-30.9%	\$67,550

Source: U.S. Bureau of Labor Statistics

Note: The employment numbers and occupational titles do not match in Table 2 and 3 because they were derived through different methodologies.

Table 3 provides occupational projections from the New York State Labor Department through 2012. These projections clearly show a steady increase in demand for IT workers in the future. Overall, by 2012 computer-related occupations are likely to increase by 22.4% or over 20,000 jobs. The total annual average openings are likely to be close to 3,500 over the next several years. Major growth is forecast for software engineers, software developers, database administrators, computer systems analysts, and communications analysts. Although, the number of computer programmers is expected to remain stable and large in New York City, the growth in demand for computer programmers and operation research analysts is likely to be low.

Table 3

**Occupational Outlook in Computer-related Occupations,
New York City, 2002-2012**

SOC Code	Title	Employment		Change		Annual Average Openings		
		2002	2012	Level	Percent	Total	Growth	Replacement
15-1011	Computer and Information Scientists, Research	250	290	40	16	10	0	0
15-1021	Computer Programmers	20,060	20,520	460	2.3	520	50	470
15-1031	Computer Software Engineers, Applications	11,480	14,740	3,260	28.4	440	330	110
15-1032	Computer Software Engineers, Systems Software	7,440	10,380	2,940	39.5	370	290	70
15-1041	Computer Support Specialists	14,950	18,130	3,180	21.3	500	320	180
15-1051	Computer Systems Analysts	16,610	21,390	4,780	28.8	670	480	190
15-1061	Database Administrators	4,700	6,200	1,500	31.9	200	150	50
15-1071	Network and Computer Systems Administrators	7,320	9,230	1,910	26.1	270	190	80
15-1081	Network Systems and Data Communications Analysts	6,680	9,480	2,800	41.9	360	280	80
15-2031	Operations Research Analysts	990	1,050	60	6.1	30	10	20

Source: New York State Department of Labor, Occupational Employment Statistics Survey

III. Findings: Industry Trends

Employment prospects for IT workers are improving

General industry employment data for the computer and finance industries, both of which account for a large share of IT jobs, show steep declines since the early 2000s. However, both these industries appear to be inching back from the recession, although it is likely that IT employment, in the short run, will remain significantly below earlier employment levels which occurred as a result of the anxiety over the Y2K problem in addition to workers that were hired during the dot-com boom.

While these conditions no longer exist, over the long haul, continued technological innovation in IT applications and network engineering will add IT jobs in the financial industry and internet commerce.

Industry sources suggest that the finance industry has again begun hiring workers in IT occupations. While it is difficult to quantify the number of IT workers being hired within the finance sector because IT related employment is not classified separately in the monthly establishment survey, employment data for the IT industry reflects what may be happening in IT related finance employment. Wall Street spending on data processing increased by 5% in 2004, following two years of steep cost-cutting.

Employment in New York City's computer systems design and related services industry had been fairly stable at around 33,000 in 2003 and 2004. This is slightly above the level that existed in the city in 1997 before the dot-com boom and the burst of hiring related to the Y2K computer problem. Computer employment in New York City surged to 50,000 in January of 2001 during that boom period, and then declined steadily throughout 2001 and 2002. From December 2004 to June 2005, computer industry employment in New York City increased by 5.3 percent to 34,100.

New York's financial industry, which accounts for a substantial number of IT workers, shows recent gains that may enhance employment opportunities in the sector. From the December 2000 peak, employment in banking and securities dropped by almost 47,000 jobs (15.7%) through May of 2004. During the last year, however, employment in banking and securities grew by 2.1%. The job growth in securities was particularly strong, increasing by 3.6% or nearly 6,000 jobs.

As a result of the decline in demand for computer professionals, enrollment in computer science undergraduate programs fell by over 60% nationally between 2000 and 2004. However, this trend is likely to reverse as industry begins to upgrade and develop new IT applications. Recent news reports suggest that there is a growing shortage of IT workers in many parts of the country.¹

¹ Jay Vegso "Interest in CS as a Major Drops Among Incoming Freshman" Computer Research News, May, 2005. Michael Kan, "IT Field Now Faces Worker Shortage", Richmond Times-Dispatch, June 27, 2005.

Chart 1

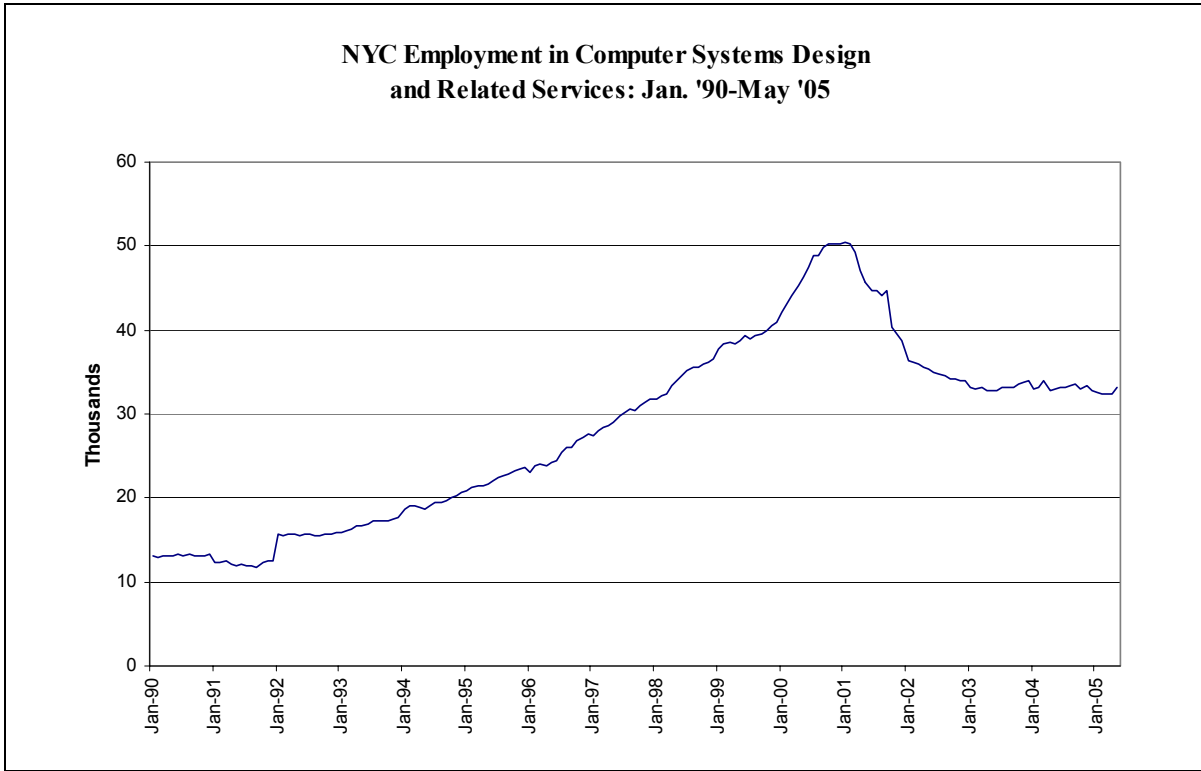
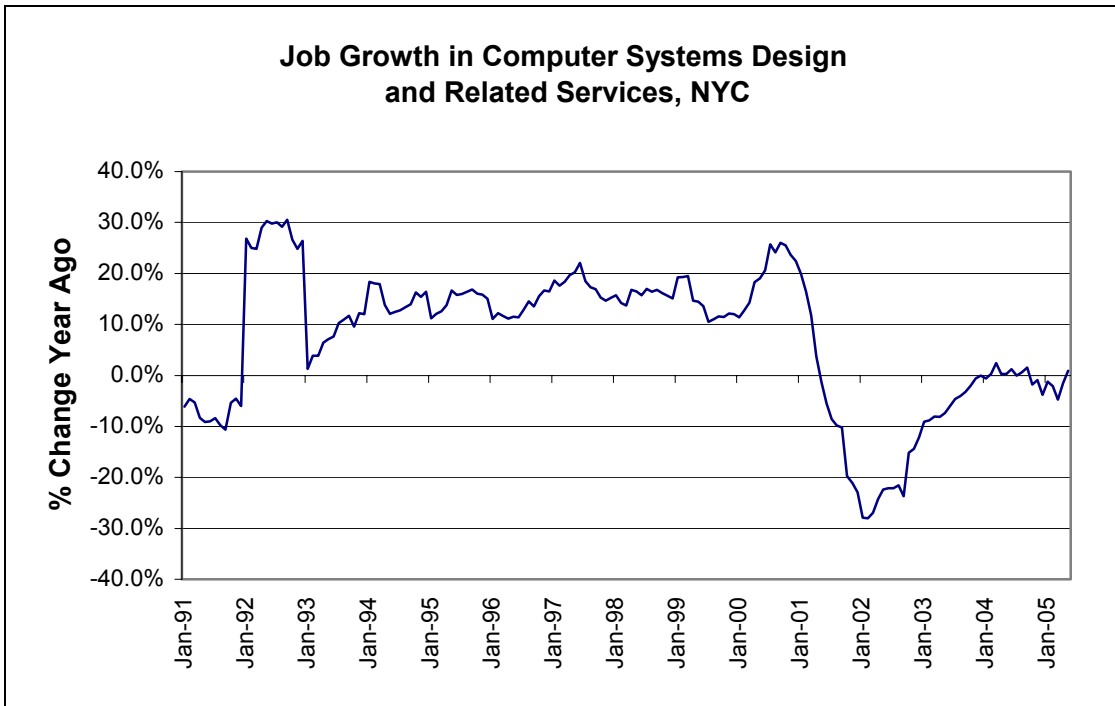


Chart 2

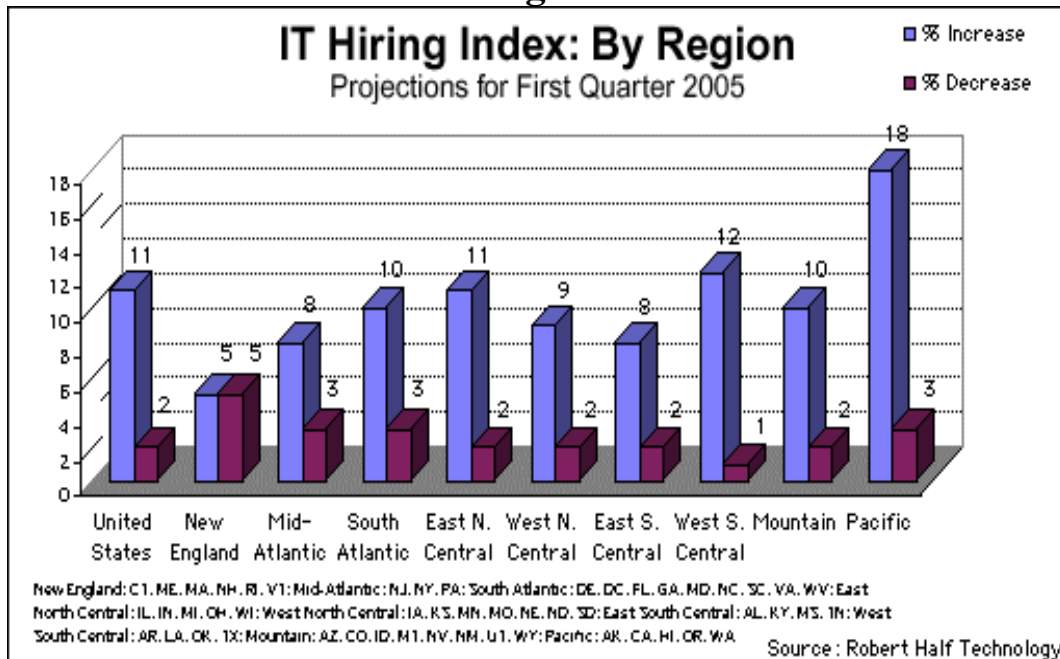


IT-related jobs are opening up for New Yorkers

Discussions with industry personnel and a review of trade literature suggest that computer related jobs are opening up for New Yorkers in the finance industry. An annual industry report by Robert Half Technology suggests that the massive reductions in IT occupations has slowed and is gradually reversing.² There is also an increase in technology spending reported to us by IT managers and confirmed by industry activity reported by Robert Half Technology. Increases in technology spending suggest an increased need for IT workers.³ This inference is confirmed by a BLS occupational forecast for computer related workers and employment increases in the computer industry over the next several years.

More importantly, the finance sector leads other sectors in IT hiring nationally. More survey respondents reported an increase in hiring than decreases in hiring of IT professionals. (Charts 3 & 4)

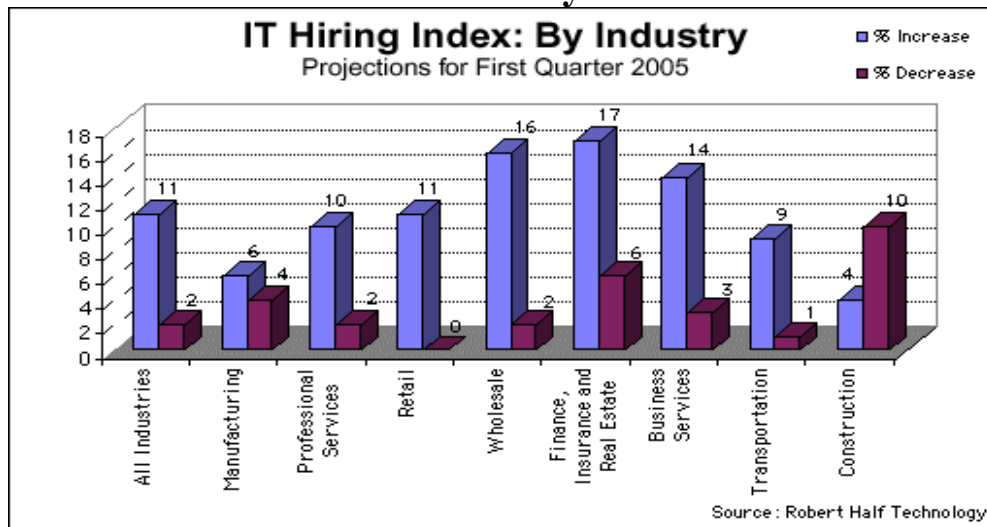
Chart 3
Robert Half Technology Analysis of IT Worker Demand by Region



² Robert Half Technology, *2004 Salary Guide*, Robert Half Technology Company, 2004.

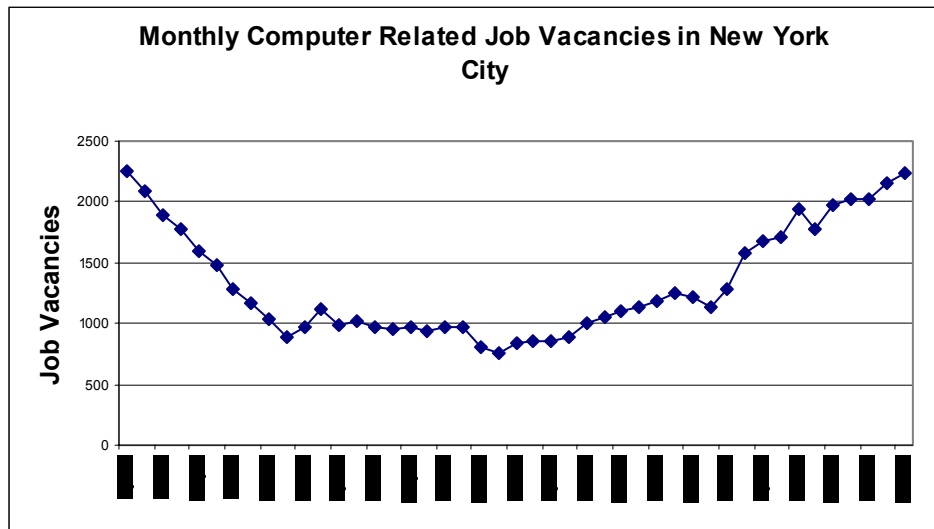
³ http://www4.gartner.com/press_releases/asset_64773_11.html http://www.gartner.com/1_researchanalysis/Monthly_Tech_Demand_Index.jsp, June 2005

Chart 4 Robert Half Technology Analysis of IT Worker Demand by Industry



New York City specific data, based on an analysis of Monster.com vacancy listings by New York State Empire State Development, confirm the recent growth trend in IT job opportunities. Although there have been decreases in job listings since the upward trend began, the overall trend is up. In the first half of 2005 the number of IT vacancies in New York City has increased dramatically. Based on estimates by the New York State Empire State Development, the average number of vacancies in the first six months of 2005 was over 60% higher than in the first half of 2004. These vacancy listings are for computer hardware, computer software, general IT, internet and e-commerce personnel.

Chart 5



Source: NYS Empire State Development compilation of Monster.com job vacancy listings.

IV. Findings: Jobs and Skills

The following findings of IT professional demand in the financial industry are based on discussions with industry professionals, a review of industry literature, occupational projections by the Bureau of Labor Statistics and the New York State Department of Labor, and information published by Robert Half Technology in its *2004 Salary Guide* and on the organization's website (www.roberthalftechnology.com).

- *IT infrastructure (Networking)* Demand for individuals to support the IT infrastructure will remain stable. In infrastructure, personnel do not necessarily need to be knowledgeable about the finance industry. Security issues and communication with new technologies (e.g., wireless) are becoming increasingly important.
- *Project Management.* In finance in particular, there appears to be an increase in demand for individuals in project management. A key reason for this is the outsourcing of work previously done within the firm. Firms need individuals to manage these projects from both the client and vendor perspectives. In addition to technical skills, potential employers look for leadership and more generally “soft skills”, described below.
- *Information security/assurance.* Information security, always a concern to financial firms, has become more urgent after 9/11. Demand for individuals with skills in the area will persist in the future. “Network vulnerability,” virus protection, and “intrusion detection” are some of the areas of concern to firms.
- *Database management/Administration/Developer.* Always important to a financial firm, the demand for database management skills has grown following deregulation of the industry as client and potential client databases become an even more important business tool.
- *Technical (Help Desk and/or End-user support).* While some of the development activity in the area will be outsourced, increased online access will require support from within the firm.
- *Applications Development.* More and more applications are likely to be outsourced, but there still is potential for client oriented applications development.
- *Web services.* Intranet and extranet (systems to share information with external suppliers/clients).

The IT environment in the finance sector is dynamic and requires a diverse and constantly upgraded skill set

The IT environment in the financial sector is dynamic. IT managers lay out targets for system changes over an eighteen month period and as a result there is constant change and thus pressure to offer the best service and tools to keep up with competition.

In-house IT entities do not have a lock on internal business solutions and must be willing to provide IT services that are equal to that available externally. In addition to coping with competitive forces, IT activities must respond to frequent evolution of SEC regulations.

Analytical skills including mathematics skills are essential

IT occupations require at least an Associates Degree, but most require a Bachelors or a Graduate degree. Most occupations require strong technical and analytical skills.

A broad knowledge of computer technology is important to long term success

A broad and deep programming background is essential for keeping up with the constant change that occurs in the IT environment. In addition to specialty skills, IT candidates must have knowledge of network engineering and basic security. Advanced knowledge of specific skills can only be acquired in the workplace and generally cannot be taught as part of a college curriculum.

A basic knowledge of business is important to success in industry

Knowledge of the business aspects of the firm is essential to success in the industry. Business components of the firm demand the best IT solutions to compete in the market place, and knowledge of the business enhances the ability to provide the IT solutions to these groups.

“Soft skills” have become very important as IT departments work more with other internal and external organizations

Because there is now a need for IT professional to deal with outside entities, “soft-skills”, i.e., non-technical skills, are considered very important. These include: the ability to communicate (verbal, writing, presentation), interpersonal skills, capacity to respond to the office environment (dress code, office protocols), knowledge of business ethics (very important now in the securities industry), capacity to work under pressure, ability to project a professional image, and business “savvy” are considered a must for IT professionals working in the financial industry today.

Demand for software engineers over the next several years is expected to grow

Software engineers usually have multi-disciplinary backgrounds and belong to two related but distinct occupations. ***Applications software engineers*** work with general software applications. They are responsible for developing, creating, and modifying software to optimize efficiency for clients. They may also be responsible for designing databases in an organization working individually or in teams. Software engineering application jobs involve creating and developing software solutions. Software engineers require knowledge of hardware (chips, circuit boards, etc.) and software including applications and programming. It may also require a practical knowledge of engineering science, telecommunications, and design. In addition to technical skills, a strong command of written English--both grammar and vocabulary—is essential. The occupation typically requires a Bachelor’s degree and often some post-graduate training. Work experiences enhance skills and many in this occupation have several years of work experience.

Software engineers dealing with systems software are further up the skills stream, researching, designing, developing and testing systems level software, compilers and other systems software including network related resources. They determine and formulate software requirements using principles from disciplines related to computer science, engineering, and mathematics. In addition to skills summarized for application engineers, this occupation requires practical knowledge of engineering science and technology. In addition, because they must design and build from the “ground up”, they require knowledge of principles and processes related to customer needs. Since this occupation often involves training of groups and individuals, organizations often look for individuals who have knowledge of principles and methods for curriculum development and training of groups and individuals. Many in this occupation have Bachelor’s and Master’s degrees and often substantial work experience.⁴

Internships can go a long way in enhancing job prospects

Major IT departments have structured summer internships and are able to make job offers to students in their senior year. Through internships students are able to acquire advanced skills that make them more marketable within the firm and even in the industry. IT departments frequently review part-time and summer jobs when assessing potential candidates. IT managers suggest that internships and training programs allow new employees to “hit the ground running.”

⁴ Occupational Information Network, <http://online.onetcenter.org/>
<http://online.onetcenter.org/link/summary/15-1031.00>
<http://online.onetcenter.org/link/summary/15-1032.00>

Managers hire new employees mostly through their network of contacts (employees, colleagues, etc)

Firms utilize diverse methods for recruiting new employees. These include: campus fairs, newspaper ads, online resources such as “Monster.com,” internship programs, and through the employee and collegial networks. The latter appears to be the most important source for recruitment of new employees in the industry.

Outsourcing and off-shoring may dampen IT employment growth

Outsourcing, i.e., companies moving computer-related work outside of the firm, has picked up momentum in the last several years. Earlier, companies outsourced to vendors locally or within the United States. Increasingly though, vendors or the principal companies themselves are establishing off-shore facilities for IT-related work to support business process functions, i.e., payroll, accounting and other activities that are not related to the firm’s main business. Internally supported computer applications for business centers within financial firms are being outsourced to vendors who are, in turn, off-shoring the work to facilities abroad. Interviews with information officers in financial firms confirm the phenomena within New York’s financial industry. Activities being outsourced include work of Business Support Units, including, Desktop, Help desks, and higher end applications such as systems and applications development.

Out-sourcing began several years ago to cut costs, but, today, the lack of relevant skills within firms requires out-sourcing. Firms have not been able to hold on to highly skilled personnel within IT Departments.

V. CUNY Institute for Software Design and Development Initiatives

CUNY is well-positioned to provide IT workers for New York's finance sector. There are more than 9,000 students in computer sciences and closely related disciplines at CUNY institutions developing a broad range of skills essential to the finance sector. CUNY offers a broad range of computer related training relevant to the industry including software engineering (SE), information technology (IT) and information systems (IS). Collectively, CUNY schools represent one of the largest university computer programs in the country. In 2003, CUNY awarded nearly 1,860 Bachelors, Masters, and Ph.D., degrees in computer related disciplines. In 2001, for which comparable data are available, CUNY accounted for 3.5% of the nation's Bachelor's degrees awarded in computer science.

In responding to the changing composition of IT occupations, CUNY's Computer Science Discipline Council should, using the offices of CISDD, consider establishing a permanent industry related Computer Science Faculty Curriculum Committee that would review current industry needs and advise computer science departments at CUNY on adapting current curriculum to meet industry requirements. New York's finance industry should collaborate with CISDD in this process, expand internship opportunities for CUNY students and more systematically consider CUNY computer science graduates in filling their IT staffing needs.

As part of its effort to analyze industry trends in order to respond to industry needs the CUNY Institute for Software Design and Development two undertook two major initiatives that are described below.

Financial Services Industry Undergraduate Curriculum Advisory Committee.

Industry developments, including technological change, security concerns, and out-sourcing, among others, will influence industry demand and thus curricula development.

Joint meetings with representatives from CUNY Computer Science Departments and IT representatives from the finance industry were held to discuss IT needs of the finance sector. Overall, there was a consensus on the reduced demand for "back room" programmers largely because of off-shoring and increased integration of IT functions within firms with their business operations. In response, some computing curricula are beginning to deemphasize new software development and instead are beginning to focus more on teaching use of existing technologies to meet firm-level goals. Other recommendations and conclusions arising from these meetings are included in Section IV.: Findings: Jobs and Skills.

This trend is corroborated in a recent report on computer science curricula by a joint task force of three leading national organizations of IT professionals.⁵

The national joint task force report on computer science curricula lists five undergraduate majors, some recent, dealing with computing. Computer Science remains the major that deals with theoretical issues of computing and the creation of new software. Software Engineering, a degree that is an outgrowth of computer science, deals with the creation and maintenance of large computer programs. Information Technology and Information Systems, both growing fields, are aligned with existing computing needs of organizations and are often housed within a business or business technology school. Information Technology generally deals with integration in a business with products and systems out in the marketplace. Information Systems roles have computing concerns at higher levels of an organization. The fifth major mentioned in the report, Computer Engineering, deals with networks and device hardware (and the software to drive them).

Business organizations that would previously have hired computer science majors are instead hiring SE, IT and IS majors, reducing the perceived need for computer science majors.

Complete Software Development Life-cycle Course Initiative

To enhance the exposure of CUNY students with industry practices, CISDD initiated a non-credit course involving faculty, students and industry (UBS and Credit Suisse/First Boston).

The course was designed to familiarize students with the IT development process within each of these firms, including: requirements gathering and problem domain analysis; the need for quality assurance beyond developer testing; and source code management and version control systems.

Students selected for the course were screened by faculty for their technical skills and compatibility with specific projects in each of these firms. A total of eleven students were selected for the course and then for work on three projects—a team of three or four students for each project.

Students were introduced to techniques common to object oriented analysis and design methodologies. IT representatives from UBS made a presentation of the development methodology for their project. The two completed projects were:

⁵ Joint Task Force for Computing Curricula 2004, Computing Curricula 2004, (The Association for Computing (ACM), The Association for Information Systems (AIS), The Computer Society (IEEE-CS), November 2004. http://www.acm.org/education/Overview_Draft_11-22-04.pdf

A Quality Assurance reporting system at UBS was adapted to enhance migration from open source platforms to the standard UBS data base structures such as Oracle. The system was integrated with Actuate Reports to provide a better system for QA project tracking and outward management reporting.

A risk metrics evaluation system at Credit Suisse/First Boston to allow structured description of risk factors related to specific IT resources.

Many discussions with the Computer Science Curriculum Advisory Committee revealed that any projects that help students understand the complexity of working in the real world, and also give them new skills are the most ideal projects for a course of this kind. CUNY hopes to continue courses of this kind that actively bring together industry IT officials, faculty and students.

Occupation Descriptions

15-0000 COMPUTER AND MATHEMATICAL SCIENCE OCCUPATIONS

15-1011.00 Computer and Information Scientists, Research

Conduct research into fundamental computer and information science as theorists, designers, or inventors. Solve or develop solutions to problems in the field of computer hardware and software.

15-1021.00 Computer Programmers

Convert project specifications and statements of problems and procedures to detailed logical flow charts for coding into computer language. Develop and write computer programs to store, locate, and retrieve specific documents, data, and information. May program web sites.

15-1031.00 Computer Software Engineers, Applications

Develop, create, and modify general computer applications software or specialized utility programs. Analyze user needs and develop software solutions. Design software or customize software for client use with the aim of optimizing operational efficiency. May analyze and design databases within an application area, working individually or coordinating database development as part of a team.

15-1032.00 Computer Software Engineers, Systems Software

Research, design, develop, and test operating systems-level software, compilers, and network distribution software for medical, industrial, military, communications, aerospace, business, scientific, and general computing applications. Set operational specifications and formulate and analyze software requirements. Apply principles and techniques of computer science, engineering, and mathematical analysis.

15-1041.00 Computer Support Specialists

Provide technical assistance to computer system users. Answer questions or resolve computer problems for clients in person, via telephone or from remote location. May provide assistance concerning the use of computer hardware and software, including printing, installation, word processing, electronic mail, and operating systems.

15-1051.00 Computer Systems Analysts

Analyze science, engineering, business, and all other data processing problems for application to electronic data processing systems. Analyze user requirements, procedures, and problems to automate or improve existing systems and review computer system capabilities, workflow, and scheduling limitations. May analyze or recommend commercially available software. May supervise computer programmers.

15-1061.00 Database Administrators

Coordinate changes to computer databases, test and implement the database applying knowledge of database management systems. May plan, coordinate, and implement security measures to safeguard computer databases.

15-1071.00 Network and Computer Systems Administrators¹

Install, configure, and support an organization's local area network (LAN), wide area network (WAN), and Internet system or a segment of a network system. Maintain network hardware and software. Monitor network to ensure network availability to all system users and perform necessary maintenance to support network availability. May supervise other network support and client server specialists and plan, coordinate, and implement network security measures.

15-1071.01 Computer Security Specialists

Plan, coordinate, and implement security measures for information systems to regulate access to computer data files and prevent unauthorized modification, destruction, or disclosure of information.

15-1081.00 Network Systems and Data Communications Analysts

Analyze, design, test, and evaluate network systems, such as local area networks (LAN), wide area networks (WAN), Internet, intranet, and other data communications systems. Perform network modeling, analysis, and planning. Research and recommend network and data communications hardware and software. Includes telecommunications specialists who deal with the interfacing of computer and communications equipment. May supervise computer programmers.

¹ O*NET data not collected at this level. See more detailed O*NET 3.1 occupation(s) below.

² Residual or "All Other" occupation. O*NET data not collected.

³ O*NET data from incumbents will be collected for this occupation and not for the detailed O*NET 3.1 occupation below.

⁴ Military-Specific Occupation. O*NET data not collected.

References

Discussions/presentations

Meeting with IT managers of the Securities Industries Technology Committee, Securities Industry Association, April 4, 2004.

Presentations by members of the Industrial Advisory Committee for CUNY Institute for Software Design & Development (CISDD)

Interviews with senior finance industry IT managers and a business development manager in a financial firm.

Data sources

Robert Half Technology in its *2004 Salary Guide*, Robert Half Technology.

U. S. Bureau of Labor Statistics, November 2003, National, State, and Metropolitan Area Occupational Employment and Wage Estimates,
http://www.bls.gov/oes/current/oes_5600.htm#b15-0000

New York State Department of Labor, *Occupational Employment Statistical Survey, 2004*

Joint Task Force for Computing Curricula 2004, Computing Curricula 2004, (The Association for Computing (ACM), The Association for Information Systems (AIS), The Computer Society (IEEE-CS), November 2004.
http://www.acm.org/education/Overview_Draft_11-22-04.pdf