

**BUSINESS INFORMATION SYSTEMS (BIS) – OFFERED BY THE MANAGEMENT,  
MARKETING, AND LOGISTICS DEPARTMENT**

**COMPUTER INFORMATION SYSTEMS (CIS) – OFFERED BY THE MATHEMATICS  
AND COMPUTER SCIENCE DEPARTMENT**

The faculties of the Mathematics and Computer Science Department and the Management, Marketing, and Logistics Department have worked jointly over the past one and a half years to develop two complementary information systems majors. Consideration was initially given to creating a single, joint major. This option was determined to be infeasible because there are two distinct customer bases that will be served by two majors.

The CIS major is designed to meet the needs of students wanting a significant emphasis on computer science, but with a more applied approach than the current computer science major provides. These students are expected to come largely from the pool of students that currently either major in computer sciences or start as computer science majors and then switch to another major.

The BIS major is designed to meet the needs of students desiring to earn a business degree with concentrated study in information technologies. These students currently are severely limited in their course options by the combined requirements of the University Core and Business School Core. If a business major were to complete the minimum coursework required for the proposed CIS degree, that student's minimum total credit hour requirement for graduation would rise from 128 to 155. Students majoring in BIS will likely be drawn from those students who otherwise would have majored in Management, probably with a Management of Business Technology Concentration.

Countless hours were spent carefully considering what courses, currently existing or not, should be included in each major as requirements and electives. The course content of current MN and CS offerings were examined in detail with consideration for elimination of duplication and joint teaching opportunities. Based on the results of this analysis, several courses were redesigned to better meet the needs of our students and two new courses are proposed.

The faculties of both departments are pleased with the resulting proposed majors and highly recommend their approval.

Dwight Olson, MTCS Chair

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## **DOCUMENTATION OF NEED – BIS & CIS JOINTLY.**

The Business Information Systems and Computer Information Systems majors are necessary in order to remain competitive with our peer institutions. A survey of twenty-one of our peers and competitors revealed that 20 of these institutions offer a relative equivalent of an information systems major in the business school. In addition, 20 out of 21 offer the equivalent of a computer science (CS) major; and 10 of the 19 schools that offer both BIS and CS majors also offer a relative equivalent of a CIS major. Figure 1 provides a breakdown of these numbers based on a survey of the following institutions: John Carroll's EBI "Jesuit cohort" schools, John Carroll's EBI "stretch cohort" schools, the U.S. News top five Midwest region schools in the same category as John Carroll, and the five largest schools in northeast Ohio.

The importance of remaining competitive in the information systems field is underscored by the ongoing trends in computer-related occupations. ACINet (America's Career InfoNet) analyzed Ohio Labor Market Information and the Bureau of Labor Statistics' (BLS) Occupational Employment Statistics Survey data and reported that for the state of Ohio, for jobs requiring a bachelor's degree, Systems Analysts are the second fastest growing occupation and have the fourth highest number of job openings. At the national level, BLS data show numerous computer-related occupations – occupations that would be served by both BIS and CIS majors – to be in the top ten of openings and growth (see Figures 2 and 3). The BIS/CIS majors will meet the occupational and academic interests of prospective students, and the establishment of both BIS and CIS programs will enhance the visibility of John Carroll not only with respect to students, but also with respect to employers.

Beyond the statistics, the relevance of both the BIS and CIS majors are supported by various experts and organizations. The aforementioned U.S. News surveys provide separate rankings of universities based on business school majors, including "Management Information Systems" (MIS). In addition, the aforementioned BLS survey provides a related Occupational Outlook Handbook that places MIS programs as a source for recruiting systems analysts and other information systems professionals:

For systems analyst, programmer-analyst, as well as database administrator positions, many employers seek applicants who have a bachelor's degree in computer science, information science, or management information systems (MIS). MIS programs usually are part of the business school or college. These programs differ considerably from computer science programs, emphasizing business and management-oriented coursework and business computing courses. Many employers increasingly seek individuals with a master's degree in business administration (MBA) with a concentration in information systems, as more firms move their business to the Internet.

## **BUSINESS INFORMATION SYSTEMS (BIS) MAJOR**

### **INTRODUCTION.**

This major is designed for students who wish to begin their careers in the broadly defined area of business information systems. This area includes responsibilities such as systems design and management, operations management, and business process analysis. In today's dynamic business environment, customer expectations, competition, globalization, and technology have combined to produce a powerful effect on the process of delivering goods and services to the marketplace. In order to succeed, a manufacturing or service process analyst must be able to understand business decisions as well as technology decisions. Increasingly, businesses are seeing themselves as a collection of processes of various types. Business Information Systems (BIS) majors will be ideally suited to capitalize on this approach to business. They will be active learners, knowledgeable about current technology, and capable of high performance with the goals of supporting:

The enhancement of business performance using technology.

The integrated flow of materials/information in manufacturing and service organizations.

Traditional business areas of finance, marketing, accounting and management.

Modeling and data analysis techniques for better functional decision-making.

The majority of BIS majors will likely enter the business world as business process analysts, systems analysts, or change agents. They will be able to interact with technology in significant ways to solve organizational problems. Listed below are some examples of the context-specific jobs in which the technology management role might be filled by a BIS major:

Design and/or manage technical operations for a computer-controlled manufacturer.

Provide technical support for a large-scale retailer and/or distributor.

Design and/or manage technology that supports banking operations.

In addition to the opportunities listed above, BIS majors are also likely to be employed in staff support/consulting jobs. Companies are increasingly out-sourcing many of their needs, including technology-related projects, to consulting agencies. Perhaps more than any other organization, systems consulting firms look for employees who understand not only the application and management of information technologies, but also the business processes and operations that are supported by those technologies.

Likewise, this equally strong background in both areas reflects the role of the typical systems analyst. As summarized in the encyclopedia at Techweb (the online portal for business technology periodicals such as *Information Week*, *Internet Week*, and *Network Computing*):

Systems analysts require a balanced mix of business and technical knowledge, interviewing and analytical skills and a good understanding of human behavior.

Ultimately, such a balance is relevant to the critical and pervasive role of today's information systems. Enterprise resource planning (ERP) software applications such as SAP that originated in the manufacturing sector now often control and support every facet of business operations and decision-making. The implementation and management of ERP applications require knowledge of the processes and operations of the functional areas of a business in addition to knowledge of information systems and technologies. At the same time, the Internet and electronic commerce have transformed business into "e-business", and the relevance of the same combination of knowledge continues to be reinforced. Furthermore, ERP and e-commerce strategies have become a catalyst in the explosion of supply chain management and customer relationship management strategies and applications. All of these strategies and their related software applications require business information systems professionals who understand business operations and the transaction processing and decision support systems that surround them.

## DOCUMENTATION OF NEED - BIS.

We currently offer a BIS-related concentration – Management of Business Technology (MBT) – within the management major. Feedback from employers (as well as the *IS 2002: An Update of the Information Systems Model Curriculum* guidelines, described below) indicates that the coursework in this concentration is insufficient preparation for many entry-level jobs in this field. At the same time, a concentration that lies within a major can be overlooked by prospective students who are searching for an information systems major in the business school. Thus, John Carroll University is at a competitive disadvantage unless and until we offer a Business Information Systems major.

The *IS 2002: An Update of the Information Systems Model Curriculum* guidelines were used to structure our proposed BIS major. *IS 2002* is sponsored by the Association of Computing Machinery (ACM), the leading professional organization in the computer science field, and created by a group of the world's top experts in information technologies. This report is available online at [http://www.spatial.maine.edu/SIEWEB/IS\\_ModelCurriculum.pdf](http://www.spatial.maine.edu/SIEWEB/IS_ModelCurriculum.pdf). Figure 4 provides a comparison of the *IS 2002* model curriculum with proposed BIS curriculum.

The document that *IS 2002* updates, *IS '97: Model Curriculum and Guidelines for Undergraduate Programs in Information Systems* (available online at <http://ids.csom.umn.edu/faculty/gdavis/curcompre.pdf>), recognizes the relevance of information systems studies that are positioned within the context of a business curriculum (from page 11 of the *IS '97* report):

Prerequisite or interleaved topics directly applicable to the IS curriculum therefore include:

...Organization functions. Students should be exposed to economics and organization functions such as accounting, distribution, finance, human resources, marketing, and production.

More specifically, *IS '97* recognizes the historical relevance of information systems studies that are positioned within the context of operational processes, decision support, and the management of corporate resources (from page 6 of the *IS '97* report):

As organizations extended the use of information technology to operational processes, decision support, and competitive strategy, the academic field also grew in scope and depth. An IS organization function emerged to manage information technology. In the same way that universities have degree programs reflecting important organizational functions, such as financial resource management, marketing resource management, and human resource management, a degree program emerged for management of information technology resources.

It is within this operational and managerial context that our BIS major has been designed. The BIS major will enable John Carroll University and the Boler School of Business to attract and keep students interested in careers in the leading edge fields of information systems and operations management. Without this major these students will likely either initially enroll in one of John Carroll University's competitor institutions or transfer out after their sophomore year.

## **MAJOR REQUIREMENTS - BIS.**

**University Core:** At least 58 credit hours.

**Business Core:** 44 credit hours listed below, excluding MN 461 (Legal Environment of Business). Overlap of 3 credit hours (EC 211 fulfills a Division III requirement in the University Core).

MN 106	Introduction to Computers and Software (2 cr.)
EC 201	Principles of Economics I
EC 202	Principles of Economics II
EC 205	Business Statistics I
EC 206	Business Statistics II
AC 201	Financial Accounting I
AC 202	Financial Accounting II
MN 202	Business Communications
MN 300	Management Information Systems
MN 325	Fundamentals of Management
MN 326	Production/Operations Management
MK 301	Introduction to Marketing
FN 312	Financial Management
MN 463	Business Law I
MN 499	Strategic Management

**Note:** AC 211, Analysis of Accounting Information, may be substituted for AC 202 with advisor approval.

**Major Requirements:** A total of at least 24 credit hours of coursework.

**Required Coursework:** 18 credit hours of required coursework as listed below.

CS 201	Introduction to Computer Science with Java I – redesigned course
MN 341	Fundamentals of Data Base Design
MN 371	Management Science
MN 383	Project Management – new course
MN 451	Systems Analysis and Design
MN 465	Legal Environment of Information Technology – new course

**Note:** MN 461, Legal Environment of Business, may be substituted for MN 465 with advisor approval.

**Elective Coursework:** At least 6 credit hours of elective coursework as indicated below.

Students interested in a production/operations management emphasis in their coursework should select at least two of the following courses:

- MN 381 Materials and Inventory Management
- MN 382 Quality Management
- MN 406 Seminar in Production/Operations Management
- MN 352 Human Resources Management
- AC 312 Cost Analysis and Budgetary Control (prerequisite of AC 303)
- LG 328 Business Logistics

Students interested in a Management Information Systems or Computer Science emphasis in their coursework should select at least two of the following courses (at least one must be a CS course):

- MN 342 Software Development for Business
- MN 407 Seminar in Information Systems
- CS 202 Introduction to Computer Science with Java II
- CS 309 Web Design and Programming I
- CS 310 Web Design and Programming II
- CS 320 GUI Programming
- CS 455 Computer Communications and Networking
- AC 341 Accounting Information Systems (prerequisite of AC 303)
- LG 440 Supply Chain Systems Management (prerequisite of MN 328)
- MK 310 Customer Relationship Management (prerequisite of MK 302)

**Note:** Students will be strongly encouraged to take MN 342 as one of their electives.

**New Courses:** Two new courses have been developed to meet the needs of this new major (MN 383 and MN 465) and two have been substantially redesigned (CS 201 and CS 202 – described under the CIS new courses). Their proposed *2003-2005 Undergraduate Bulletin* descriptions are listed below:

**MN 383 Project Management 3 cr.**

Prerequisites: MN 300 and MN 326. Principles and methods useful for planning and controlling a project, including development of a project plan, budgeting, resource planning and scheduling, and project monitoring and control. Selected computerized packages are studied, including Microsoft Project, and examples of different types of projects from manufacturing and service industries are used.

**MN 465 Legal Environment of Information Technology 3 cr.**

Prerequisites: MN 463 and Senior Standing. Topics covered may include but not limited to: the Domestic and International Regulatory Environment of Information Technology including Antitrust Law, Labor Law, Administrative Law, Employment Discrimination, E-Commerce/E-Business, Intellectual Property (Copyrights, Patents, Trademarks, Trade Names, Trade Dress, Software Licensing), Torts, Jurisdictional Issues including Criminal and Civil Process and Court Systems, Statutes Relating to Electronic Transactions, and Computer and Related Crimes. Additionally, Legal and Ethical issues pertaining to Privacy will be addressed.

## **RESOURCE IMPLICATIONS - BIS.**

Resource implications are anticipated to be minimal.

Based largely on the demand for the MBT concentration over the past three years, 20 -30 BIS majors are anticipated each year.

Students taking MN 465 would, in virtually all cases, otherwise have taken MN 461. Therefore, there should be no impact on total staffing needs as a result of this course requirement.

Since most BIS majors are anticipated to be students who otherwise would have majored in Management, BIS students will essentially take MN 383 instead of MN 425 (a required course for Management majors, but not required for BIS majors). Therefore, staffing of sections of this course will, effectively, be provided by a corresponding reduction in the number of sections of MN 425 that need to be offered.

All other courses in the major are currently offered. As demand for the BIS major grows, the resources for staffing these courses will come from a reduction in the need for sections of Management major courses such as MN 395 and MN 495 (again assuming that the vast majority of BIS majors will be students who otherwise would have majored in Management).

One area where additional support would be extremely useful is the funding of several (2 or 3) student assistant positions. Given the technical nature of the major, the maintenance requirements of the University's computer systems and assistance required by the BIS students are likely to be greater than currently available.



## COMPUTER INFORMATION SYSTEMS (CIS) MAJOR

### INTRODUCTION.

Many students are interested in studying computers but do not plan on graduate study or a career involving system or application programming. These students are more interested in providing technical and software support for others and applying software rather than developing it.

The current Computer Science major does not serve these students well. Some do complete the CS major while others change majors or transfer to schools that have a major with a more suitable direction (usually CIS or BIS depending on the student's interest in business). This new major is intended to meet the needs of these students. The proposed major includes topics that are currently in great demand and, like all aspects of computer science, will be constantly updated as needed.

The CIS (and BIS) majors will enable JCU to retain those students who currently leave JCU to pursue such a degree elsewhere. The programs should also attract new students whose original interests are in this type of major.

### Alternatives considered

A student in the existing CS major takes a core of computer science courses and must elect a sequence of courses from mathematics, statistics, physics, or business to complete the major. Adding another sequence to the existing CS major would not address the problem discussed above. The core of computer science courses would have to be reduced and more courses added to the sequences, leading to essentially several very different CS majors. It was felt that a single major should have more uniformity to it.

Another plan to have one CIS major administered jointly by the Department of Mathematics and Computer Science and the Department of Management, Marketing, and Logistics was explored and abandoned. Including the Business Core, University Core, the Management courses, and the CIS courses designed for the program would increase the number of credit hours required to at least 150. Dividing the major into two tracks would have the effect of two different majors with the same name.

## **DOCUMENTATION OF NEED – CIS.**

Some of our motivation for designing the CIS major came from a skills and attributes list compiled by Experience, Inc and obtained by the Center for Career Services. The list was based upon the technical computer skills businesses nationwide wanted/expected from college graduates in computer science. The following topics from the list will be covered in the new CIS major:

1. Active Server Pages
2. ActiveX Language/Tools
3. ASP Languages/Tools
4. JavaScript Languages/Tools
5. Macromedia ColdFusion Languages/Tools
6. Perl Languages/Tools
7. XML Languages/Tools
8. Adobe Photoshop Software Packages
9. Macromedia Dreamweaver Software Packages
10. Multimedia Software Packages
11. Netscape Navigator Software Packages
12. Advanced Web Design
13. Flash Design
14. MS Access Databases
15. Oracle Databases
16. Technical Writing General Skills

Other skills on the list already incorporated into the CS major include:

1. Java Languages/Tools
2. Visual Basic Languages/Tools
3. OOA/OOD/OOP Design
4. Computer Graphics General Skills

## MAJOR REQUIREMENTS – CIS.

**University Core:** At least 58 credit hours.

**Major requirements:** A total of at least 48 credit hours of coursework.

**Required Coursework:** 42 hours

MT 122 or EC 205 Statistics  
MT 135 Calculus I  
CS 201 Intro to CS with Java I  
CS 202 Intro to CS with Java II  
CS 309 Web Design and Programming I  
CS 310 Web Design and Programming II  
CS 320 GUI Programming  
CS 431 Multi-media  
CS 451 Database Systems  
CS 455 Communications and Networking  
CS 470 Software Engineering  
CS 475 Technical Writing in Computer Science  
MN 106 Introduction to Computers and Software  
MN 300 Management Information Systems

**Elective Coursework:** Two electives chosen from the following of which at least one must be designated MN

MN 341 Fundamentals of Database Design  
MN 342 Software Development for Business  
MN 371 Management Science  
MN 407 Seminar in Information Systems  
MN 451 Systems Development  
CS 303 Procedural Programming with C  
CS 463 Graphics  
CS 467 Artificial Intelligence

**Notes:** Students will be advised to take MT 136 in their freshman year to give them the option of either the CS or the CIS major without falling behind.

It is expected that many CIS majors will choose to minor in Business.

**New Courses:** CS 201, CS 202, and CS 303 are already planned as replacements for existing courses CS 211, CS 212, and CS 327 and will be serving CS, CIS, and BIS. Thus the only additional courses to be offered are CS 309, CS 310, CS 431, and CS 475. Their proposed 2003-2005 *Undergraduate Bulletin* descriptions are listed below:

**CS201 Intro to CS with Java I 3 cr.**

Corequisite or Prerequisite: MT 134 or MT 135. Three main areas are covered: basic programming concepts, introduction to object-oriented programming, and object-oriented design. The primary basic programming concepts covered are: variables, assignments, conditionals, loops, and parameter passing. The primary concepts covered from object-oriented programming are: objects, methods, constructors, inheritance, and message-passing. And those from object-oriented design are: modularity, encapsulation, information-hiding, and connectivity.

**CS202 Intro to CS with Java II 3 cr.**

Prerequisite: CS 201 and either MT 134 or MT 135. A continuation of CS 201, this course covers more advanced concepts in object-oriented programming and design, and applies them to data structures and algorithm analysis. Topics include: O-O concepts of polymorphism, overloading, overriding, and genericity, as well as linked lists, stacks, queues, trees, recursion and algorithm comparison using order notation.

**CS303 Procedural Programming with C 3 cr.**

Prerequisite: CS 202. The course concentrates on procedural or sequential aspects of programming. Primary topics include: functions, pointers, structures, structure charts, top-down and bottom-up design, debugging techniques, separate compilation, and writing modular code without the benefit of language-supported constructs such as objects and inheritance.

**CS 309 Web Design and Programming I 3 cr.**

Prerequisite: CS 202. Principles of web page design; HTML, DHTML, XHTML, and XML; cascading style sheets; introduction to client-side and server-side programming; Javascript and Perl; integrating Java applets; Java based XML processing.

**CS 310 Web Design and Programming II 3 cr.**

Prerequisite: CS 309. Continuation of CS 309. Advanced web programming and scripting methods, including Active Server Pages, Python, PHP. Topics selected from web server administration, web agents, security, e-commerce, and others.

**CS 431 Multi-Media Programming 3 cr.**

Prerequisite: CS 310. Principles of interactive multimedia design; introduction to multimedia documents and authoring via Dreamweaver, Macromedia and Flash; introduction to interactive television and hypermedia systems, digital media, compression, and synchronization.

**CS 475 Technical Writing in Computer Science 3 cr. (Proposed Writing Intensive course)**

Prerequisite: Division I English Composition 6 cr. CS 201 & CS 202. This course focuses on written communication related to the computer science field. It will emphasize clear, concise expression of technical information. Students will explore several types of CS writing including: user's guides, help pages, tutorials, mainstream articles, and technical papers. Students will read and analyze example pieces; write, edit and revise their own; and critique other students' work.

## COMPARISON WITH EXISTING CS MAJOR - CIS.

For comparison purposes, the requirements for the CS degree, as revised for Fall 2003, are shown below.

Computer Science Major – 61 to 71 hours depending on the choice of sequence

MT 135 Calculus I  
MT 136 Calculus II  
MT 379 Mathematical Foundations of Computer Science  
EP 388, EP 388L Computer Logic Design and Microcomputers  
CS 201 Introduction to CS with Java I  
CS 202 Introduction to CS with Java II  
CS 303 Procedural Programming with C  
CS 320 GUI Programming  
CS 373 Computer Architecture and Assembly Language  
CS 470 Software Engineering  
CS 471 Algorithm Analysis

one of the following

CS 473 Language Processors  
CS 474 Operating Systems

three additional CS courses at the 400 level

one of the following support sequences

- a. MT 233, MT 341, MT 477, MT 479
- b. MT 233, MT 342, MT 420, MT 422, MT 425
- c. MT 233, PH 215-216, PH 209-210, EP 265-266
- d. AC 201, AC 202 or 211, EC 211-212, EC 205-206, MN 300, CS 203

## **RESOURCE IMPLICATIONS - CIS.**

The department is currently seeking to hire a new tenure track person in computer science and no additional staff is anticipated.

**Figure 1**  
Survey of Information Systems Programs at 21 Institutions of Higher Learning

<u>Group</u>	<u>School</u>	<u>BIS</u>	<u>CIS</u>	<u>CS</u>
<b>EBI<sup>1</sup> Jesuit Cohort:</b>	Boston College	✓ <sup>1</sup>		✓ <sup>2</sup>
	Creighton University <sup>3</sup>	✓	✓	✓
	Loyola Marymount University	✓		✓
	Marquette University	✓	✓	✓
	University of Dayton <sup>4</sup>	✓	✓	✓
	University of San Francisco			✓
	<b>EBI "Stretch" Cohort:</b>	Baylor University	✓	
Brigham Young University	✓	✓	✓	
Miami University of Ohio	✓	✓	✓	
Syracuse University	✓ <sup>5</sup>	✓ <sup>5</sup>	✓	
University of Denver	✓	✓	✓	
University of Richmond	✓		✓	
<b>US News Midwest Best:</b>	Bradley University	✓	✓	✓
	Creighton University <sup>3</sup>	✓	✓	✓
	Drake University	✓		✓
	Valpraiso University	✓		✓
	Xavier University	✓		✓
<b>Northeast Ohio Largest:</b>	Case Western Reserve	✓ <sup>6</sup>		✓
	Cleveland State University	✓	✓	✓
	Kent State University	✓		✓
	University of Akron	✓		✓
	Youngstown State University	✓	✓	✓
<b>TOTALS (counting Creighton only once):</b>		20	10	20

**Definitions of Programs Surveyed**

**BIS** (Business Information Systems) - information systems studies in a business school department

**CIS** (Computer Information Systems) - information systems studies in a computer science department (essentially an applied computer science degree)

**CS** (Computer Science) – traditional degree offered by a computer science/mathematics department

**Footnotes**

<sup>1</sup>Educational Benchmarking, Inc. (benchmarking service – [www.ebi.com](http://www.ebi.com))

<sup>2</sup>BIS and CS are concentrations in a School of Management that does not have any majors.

<sup>3</sup>Creighton University is both an EBI Jesuit Cohort and a US News Midwest Best school.

<sup>4</sup>Although Dayton is a Marist institution, it was included (by others) as an EBI Jesuit Cohort school.

<sup>5</sup>CIS is in the School of Information Studies (SIS). BIS is a dual major between School of Mgmt and SIS.

<sup>6</sup>BIS is a concentration in the Management major in a School of Management that has majors only in Accountancy, Economics, and Management.

**Figure 2**  
Occupations with the Most Openings (Requiring a Bachelors Degree or Higher)

#	Occupation	2000 Employment	Average annual job openings (due to growth and net replacements)	Earnings Quartile	Most significant source of education or training
1	<a href="#">General and operations managers</a>	2,397,600	76,680	\$\$\$\$	Bachelor's or higher degree, plus work experience
2	<a href="#">Elementary school teachers, except special education</a>	1,532,100	55,060	\$\$\$\$	Bachelor's degree
3	<a href="#">Secondary school teachers, except special and vocational education</a>	1,003,700	49,240	\$\$\$\$	Bachelor's degree
4	<a href="#">Computer software engineers, applications</a>	380,000	40,550	\$\$\$\$	Bachelor's degree
5	<a href="#">Accountants and auditors</a>	975,800	32,560	\$\$\$\$	Bachelor's degree
6	<a href="#">Computer software engineers, systems software</a>	316,900	30,560	\$\$\$\$	Bachelor's degree
7	<a href="#">Computer systems analysts</a>	431,400	29,570	\$\$\$\$	Bachelor's degree
8	<a href="#">Chief executives</a>	547,000	26,550	\$\$\$\$	Bachelor's or higher degree, plus work experience
9	<a href="#">Financial managers</a>	657,900	22,270	\$\$\$\$	Bachelor's or higher degree, plus work experience
10	<a href="#">Computer programmers</a>	585,400	21,740	\$\$\$\$	Bachelor's degree

*Source: Bureau of Labor Statistics, Office of Employment Projections  
Table reproduced from America's Career InfoNet (ACINet.com)*



**Figure 3**  
Fastest Growing Occupations (Requiring a Bachelors Degree or Higher)

#	Occupation	Employment		Percent change *	Earnings Quartile	Most significant source of education or training
		2000	2010			
1	<a href="#">Computer software engineers, applications</a>	380,000	760,100	100%	\$\$\$\$	Bachelor's degree
2	<a href="#">Computer software engineers, systems software</a>	316,900	601,200	90%	\$\$\$\$	Bachelor's degree
3	<a href="#">Network and computer systems administrators</a>	228,500	415,700	82%	\$\$\$\$	Bachelor's degree
4	<a href="#">Network systems and data communications analysts</a>	118,700	210,600	77%	\$\$\$\$	Bachelor's degree
5	<a href="#">Database administrators</a>	106,000	175,900	66%	\$\$\$\$	Bachelor's degree
6	<a href="#">Computer systems analysts</a>	431,400	689,200	60%	\$\$\$\$	Bachelor's degree
7	<a href="#">Physician assistants</a>	57,800	88,700	53%	\$\$\$\$	Bachelor's degree
8	<a href="#">Computer and information systems managers</a>	313,000	462,900	48%	\$\$\$\$	Bachelor's or higher degree, plus work experience
9	<a href="#">Audiologists</a>	12,800	18,500	45%	\$\$\$\$	Master's degree
10	<a href="#">Computer and information scientists, research</a>	28,000	39,400	40%	\$\$\$\$	Doctoral degree

*Source: Bureau of Labor Statistics, Office of Employment Projections  
Table reproduced from America's Career InfoNet (ACINet.com)*

**Figure 4**  
Comparison of IS 2002 with BIS Courses

