

Computer Information Systems

APRC 2005-2006

Section 1 of 2

APRC Questions for CIS PRP

I. Program Overview

1. How will accreditation for the College Business affect the CIS program?

The faculty believe accreditation for the College of Business will have an impact on the flexibility of the CIS curriculum. The one-hundred twenty hour limitation reduces the number of CIS courses that can be required in the program.

The drive to become accredited under Option A required that new faculty have a PhD or earn a PhD within five years. CIS professionals who have relevant experience in the IT field AND who have earned a PhD are in high demand and short supply. The hiring criterion of relevant experience is more important to the CIS program than the requirement to have earned a PhD. Since no new faculty have been hired since the new accreditation guidelines have been adopted, the CIS faculty do not know the impact of the new requirements on hiring.

2. According to the data in Section I-4, student satisfaction seems to decline as students get further into the program. How is this interpreted and what is the program doing about it?

Class	Incorrect Percentage % with 4 or 5	# with 4 or 5	Total in class	Correct Percentage % with 4 or 5
Freshman	100%	4	4	100%
Sophomore	36%	9	11	82%
Junior	42%	7	12	58%
Senior	23%	9	26	35%

The CIS faculty were surprised at these findings and have had little time to digest or discuss the results of the Student Satisfaction Survey. The initial interpretations of the decline in student satisfaction may be due, in part, to negative impressions upper level students have concerning the IT field and employment prospects, in general. The CIS program is difficult and high grades are not easy to attain. The faculty believe that students need to understand the qualifications for and role of an IT professional. In the past many opportunities existed for students to learn about IT careers and professional responsibilities from alumni, employers, guest speakers, as well as faculty. The College of Business had BAD Tuesday (Business Alumni Day) and the Distinguished Business Lecture, both of which informed students about professional responsibilities from a practitioner's perspective. These events have been discontinued. The CIS faculty need to seek replacement opportunities for these types of interactions so CIS majors can learn that the program requirements are relevant and meaningful. Membership in the student chapter of AITP and required internships will help improve student satisfaction. Also, the planned central advising event (see question 4 below) is an opportunity to meet with students in a "fun-filled" environment and discuss the curriculum, expectations, the IT job outlook and other topics that don't fit neatly into a course syllabus. The CIS faculty will continue to access and discuss student satisfaction to remedy any problems in this area.

APRC Questions for CIS PRP

3. Recruiting steps are mentioned in both Sections I & III. Which are in process, and which are planned but not yet implemented?

The CIS program plans a fun and informative “central advising” event where students will meet with the CIS faculty to learn about the curriculum (CIS core, business core, General Education requirements). At this venue faculty advisors will meet with students individually for academic advising and to discuss topics of concern. DAWG Days are scheduled. The CIS section of the College of Business Web site is continually improved. Brochures are available for distribution at College Nights and other scheduled recruitment events.

4. In Section I-5, it says that some courses are not taught in a lab environment because no lab is available. In III-10-3-G, it says that since 2002, courses needing a hands-on environment have been placed computer labs. Please clarify.

After careful review of course sections times and locations, it was discovered that currently ALL CIS courses are taught in a lab setting. Section I – Page 5 is incorrect when it states that “no lab is available.”

II. Collection of Perceptions

1. Please supply graduate survey results if they are available.

Responses from CIS graduates are still being collected.

2. Regarding the employer survey—how many employers responded? Please supply a copy of the instrument.

The CIS program faculty continually evaluate employment opportunities for CIS students. We talk to employers of CIS students, the CIS advisory board members, and people we meet at professional meetings. We also conducted detailed studies of employment Web sites in the analysis that led to our revised CIS curriculum. No survey instrument has been used to collect this data. Most responses were anecdotal.

3. What changes do CIS faculty want to make based on the results of the student survey?

Please refer to response to 1.3 above.

4. What is the CIS faculty’s plan for faculty development?

Based on responses from the Faculty Survey, it is clear that professional development is a critical need for CIS faculty. A cohesive plan for professional development for the CIS program as a whole does not exist at this time. CIS faculty members believe an over-arching plan with resources to support it should be developed. Currently, the Post-Tenure Review process is in place to describe individual faculty member’s professional development goals.

APRC Questions for CIS PRP

III. Program Profile

1. When CIS students attrit, where do they attrit to? Other universities, other FSU colleges? Other COB programs?

We are still trying to gather this information.

2. A capacity figure of 180 is given. Is this an on-campus full-time figure, or does it include both on and off-campus students?

The capacity figure is 180 includes BOTH on and off-campus students.

3. How long does it take students to finish the CIS program?

We are still trying to gather this information. We believe that, in the past, it took CIS students 4.5 to 5 years to complete the program, on average. The new curriculum with its reduced number of credit hours should take less than 5 years to complete.

4. We are unsure of the meaning of the table on III-6. Please clarify.

We used data from two sources provided by Institutional Research and Testing (See Handout). The table in our original report came from Retention and Graduation Rates of Full-Time FTIAC Students – By Major, Official 4th Day Counts, Page 23. This IR&T document shows Persisters and Non-Persisters.

The data shown below is from the Administrative Program Review and includes both on and off-campus students. Attrition is calculated by subtracting the student count for year 2 from the student count for year 1 and dividing by the student count for year 1. For example, Year 1 (2000) Freshmen count – 91. Year 2 (2001) Freshmen count = 62.

- i. $91 - 62 = 29$
- ii. $29 / 91 = 32\%$ attrition.

	2000	Attrit %	2001	Attrit %	2002	Attrit %	2003	Attrit %	2004
Freshmen	91		79		27		18		17
Sophomore	68	32%	62	37%	50	-22%	33	0%	18
Junior	78	-21%	82	-6%	66	2%	49	-55%	51
Senior	135	-83%	143	-56%	128	-108%	137	-100%	98
Total	372		366		271		237		184

From Administrative Program Review: 7th/4th Day Counts IR&T, 1/26/2005, Page 122

This data suggests that the CIS program has a fairly significant attrition rate between the Freshman and Sophomore years. After that, attrition rates are difficult to ascertain using this data.

V. Facilities and Equipment

1. If ATS technicians maintain computer lab and faculty computers, why don't they also maintain program servers and CIS networking labs?

APRC Questions for CIS PRP

The ATS technicians do not, as a general rule, have the expertise to manage Internet and database servers. Also, their workload rules would not allow them to maintain the servers and network labs.

Other

1. Please supply the names of the PRP panel members.

Program Review Panel:

Chair:	Carole Kosanovich
Computer Information Systems Faculty:	
Amy Buse	Jon Huhtala
Clyde Hardman	Jay Hettiarachchy
Dick Hewer	Warner Myntti
Dale Hobart	Hal Palmer
College of Business faculty:	Michael Cooper
Faculty member outside COB:	Robert Vonderosten (College of Arts and Science)
Advisory Committee Member and Alumnus:	Bryan Blackburn
CIS Department Head:	Jim Woolen

2. Please supply some sample syllabi.

These will be provided.

Computer Information Systems Program

Academic Program Review

Table of Contents

Section 1 – Program Overview

- A. Program Goals Section 1 – Page 1
- B. Program Visibility and Distinctiveness Section 1 – Page 2
- C. Program Relevance Section 1 – Page 3
- D. Program Value Section 1 – Page 5

Section 2 – Collection of Perceptions

- A. Graduate Follow-Up Study Section 2 – Page 1
- B. Employer Follow-Up Study Section 2 – Page 8
- C. Graduate Exit Survey Section 2 – Page 9
- D. Student Program Evaluation Section 2 – Page 10
- E. Faculty Perceptions Section 2 – Page 13
- F. Advisory Committee Perceptions Section 2 – Page 15

Section 3 – Program Profile

- A. Profile of Students Section 3 – Page 1
- B. Enrollment Section 3 – Page 4
- C. Program Capacity Section 3 – Page 6
- D. Retention and Graduation Section 3 – Page 6
- E. Access Section 3 – Page 7
- F. Curriculum Section 3 – Page 9
- G. Quality of Instruction Section 3 – Page 10
- H. Composition and Quality of Faculty Section 3 – Page 12
- I. Service to Non-Majors Section 3 – Page 14
- J. Degree Program Cost and Productivity Data Section 3 – Page 15
- K. Assessment and Evaluation Section 3 – Page 15
- L. Administrative Effectiveness Section 3 – Page 17

Section 4 – Facilities and Equipment

- A. Instructional Environment Section 4 – Page 1
- B. Computer Access and Availability Section 4 – Page 2
- C. Other Instructional Technology Section 4 – Page 3
- D. Library Resources Section 4 – Page 4

Section 5 – Conclusions

- A. Relationship to FSU Mission Section 5 – Page 1
- B. Program Visibility and Distinctiveness Section 5 – Page 1
- C. Program Value Section 5 – Page 1
- D. Enrollment Section 5 – Page 2
- E. Characteristics, Quality and Employability of Students Section 5 – Page 2
- F. Quality of Curriculum and Instruction Section 5 – Page 3
- G. Composition and Quality of Faculty Section 5 – Page 3

Appendices

- A. Evaluation of Facilities and Equipment Appendix A
- B. Student Survey Appendix B
- C. Curriculum Review Appendix C
- D. Labor Market Analysis Appendix D
- E. Degree Program Cost and Productivity Data Appendix E

A. PROGRAM GOALS.**1. State the goals of the program.**

The mission of the CIS department at Ferris State University is to provide an outstanding, flexible, supportive learning environment for students preparing for careers in information technology services. The goals of the CIS program are to provide a solid foundation in:

- Analytical and critical thinking skills
(organizational problem solving; ethics and professionalism; creativity);
- Business fundamentals
(business models; functional business areas; evaluation of business performance);
- Interpersonal, communication and team skills
(interpersonal relationships; team work; leadership; communication);
- Technology
(application development; internet systems architecture and development; database design and administration; systems infrastructure and integration);
- Information systems and technology-enabled business development
(systems analysis and design; business process design; systems implementation; IS project management).

2. Explain how and by whom the goals were established.

These goals were established by Ferris State University's CIS department faculty when the CIS curriculum was reengineered in 2004. CIS faculty agreed upon the revised curriculum and thus the program goals.

3. How do the goals apply to preparing students for careers in and meeting employer needs in the community/region/marketplace?

The revised CIS curriculum was aligned to the nationally recognized IS 2002 model curriculum that was designed by the Association for Computing Machinery (ACM), Association of Information Technology Professionals (AITP) and Association for Information Systems (AIS) professional societies. IS 2002 was based on an IT market skills survey of thousands of jobs across the country. The Ferris CIS adoption of this model included input from the CIS Advisory Board on skills needed in the Michigan and regional workplace.

4. Have the goals changed since the last program review? If so, why and how? If not, why not?

The goals changed due to IT market needs. The former emphasis on programming was reduced to a two course sequence that will instill concepts for programming. Additional courses in database design, implementation and administration were added to strengthen the program. Project management was added as a requirement in the CIS core, and an ethics course and a logic course were added as required General Education courses. Additional networking courses were added to the curriculum. Finally, starting Fall 2005 all CIS students will be required to have an internship.

5. Describe the relationship of the program goals to the University's mission, and the departmental, college and divisional strategic plans.

Ferris State University's mission statement is

"Ferris State University will be a national leader in providing opportunities for innovative teaching and learning in career-oriented, technological and professional education."

The Ferris vision is to be a national leader in career-oriented and professional education, and the CIS program's alignment to a national model (and subsequent national assessment) fulfills that mission. It also meets goals 1 & 2 for the College of Business. Lastly, it meets departmental goals of providing current and relevant skills for the market place.

B. PROGRAM VISIBILITY AND DISTINCTIVENESS

1. Describe any unique features or components of the program.

The CIS program has several unique features and components which are described below.

- The CIS program has a strong advisory Board with whom we meet annually.
- An internship is required for all CIS students beginning Fall 2005.
- Students receive "hands-on" instruction using experiential learning methodology.
- The CIS program has three (3) courses that provide an integrated framework for application design and implementation. Typically CIS programs across the country have one or two systems analysis and design courses. Employers indicate that they hire our graduates because of their strong background in this area.

"What we are always looking for is the solid business systems analysis and business systems development training that students receive at Ferris."

Doug Wenger, SVP & CIO, OMNOVA Solutions Inc.

2. Describe and assess the program's ability to attract quality students.

The CIS program had more majors participating in the University Honors program than any other COB program in academic year 2003-2004. According to CIS faculty, the quality of our students is increasing each year.

The CIS program continues to suffer from declining enrollments consistent with national CIS enrollment experience. Actions to attract additional numbers of quality students include:

- Continue to utilize recently developed marketing materials (brochure, Web card, Web site, flash e-mail) for recruitment, distribute at various recruitment events, and mail to prospective students.
- Continue to build relationships with community colleges and career tech centers.
- Begin visiting selected high schools for recruitment.
- Reach beyond the borders of Michigan to adjacent states to recruit from large high schools, career centers, etc. Find external funding since there are no available internal funds for this activity.
- Continue annual CIS summer computer camp for recruitment and image building.
- Continue to work with IS/IT department leaders across Michigan.
- In partnership with other academic units across campus, create blended degrees that fill a market gap and provides much needed skills for the workplace.
- Create and offer a summer academy for K-12 teachers to provide computing skills that can help in their recertification process.

3. Identify the institutions that are the main competitors for prospective students in this program.

Competitors that offer bachelor's degrees similar to the CIS degree include CMU, EMU, GVSU, WMU, Oakland, Wayne State, and NMU.

Community colleges have also become a competitor for prospective students. For economic reasons, more students stay at home and attend community college for a year or two after high school graduation. In recent years, more community colleges have begun to offer programs in computer technologies. In the past, computer programs were very expensive, but, with the advent of microcomputers and the Internet, equipment costs have decreased.

A. How are these programs similar and different from the FSU program?

- Similarities:

Most of these programs are housed in a College of Business, with the notable exception of GVSU.

All of these programs have suffered a similar significant enrollment decline during the national down turn. One program is being subsumed by another department and the department chair position was eliminated.

- Differences:

Those institutions with AACSB accreditation cannot be as flexible as Ferris in providing a broader depth of an information systems curriculum.

B. What can be learned from them that would improve the program at Ferris?

By collaborating with the Great Lakes CIS Leaders group and leaders at other institutions, including other state universities, the University of Toledo (Ohio), and the University of Windsor (Canada), the CIS program faculty and administration can find ways to:

- increase enrollment
- review curriculum needs in the industry
- share course materials and content
- enhance the economy of Michigan through partnerships.

C. PROGRAM RELEVANCE.

1. Provide a labor market demand analysis:

Included in the APR is a Labor market Analysis (See Appendix D). In summary, career fields in Information Technology (specifically, Computer Support Specialists and Systems Administrators, Computer Software Engineers, and Computer Systems Analysts, Database Administrators, and Computer Scientists) are among the fastest growing occupations from 2002 – 2012. Employers will continue to seek computer professionals with strong programming, systems analysis, interpersonal, and business skills.

Four career fields requiring a Bachelor’s degree in Computer Information Systems for entry into the career fields were carefully analyzed for the APR using the 2004-05 edition of the Occupational Outlook Handbook published by the Bureau of Labor Statistics of the U.S. Department of Labor. These careers are among the fastest growing occupations through 2012.

The career fields analyzed included:

- Computer Programmer
- Computer Support Specialists and Systems Administrators
- Computer Software Engineers
- Computer Systems Analysts, Database Administrators, and Computer Scientists

Career Field	Description	Salary Range
Computer Programmers	Write and maintain computer programs using variety of programming languages	\$45,000
Computer Support Specialists and Systems Administrators	Network Administration and Security	\$27,500 – \$70,000
Computer Software Engineers	Develop Internet, intranet, WWW and Mobile applications. Responsible for System Security	\$47,000 – \$51,000
Computer Systems Analysts, Database Administrators, and Computer Scientists	Responsible for system security, database design and implementation, Wi-Fi access, etc.	\$38,000 – \$45,000

The Michigan Critical Occupations list includes the following with above average growth rates for 1998-2008:

Rank	Description	Hourly Rate
1	Computer Systems Analysts	\$27.47
2	Computer & Information Systems Managers	\$36.86
3	Computer Hardware Engineers	\$35.23
3	Computer Software Engineers, Applications	\$30.76
3	Computer Software Engineers, Systems Software	\$33.78
5	Computer Support Specialists	\$19.28
6	Computer Programmers	\$26.61

2. Describe and assess how the program responds to emerging issues in the discipline, changes in the labor force, changes in employer needs, changes in student needs, and other forces of change.

The CIS program monitors and responds to market changes via participation in nationally-recognized academic forums, collaboration with peer institutions in Michigan and the region, use of facilitation to arrive at consensus on curriculum design, and participation in professional societies. Data from the U.S. Bureau of Labor Statistics, state agencies, and industry are used to help assess the IT/IS market directions.

The Computer Information Systems program responds to emerging issues in the discipline by performing the following assessments and studies.

- Each year the Advisory Board of the CIS program meets with faculty and administration of the program and advises on topics including: curriculum enhancements to align the CIS program with changes in the IT industry, successes of graduates and suggestions for improvement, labor force projections from companies represented by Advisory Board members and the IT industry as a whole, and changes in employer needs. Input from the CIS Advisory Board has been used to make sure the program is relevant and current to the market needs of the IT industry.
- The Computer Information Systems faculty members studied and redesigned the CIS program curriculum during the 2002-03 and 2003-04 academic years. A new program with revised degree requirements was implemented Fall semester 2004. The Curriculum Review Committee that was charged with the major overhaul of the program is a standing committee comprised of content area experts. The Curriculum Review Committee continuously reviews and evaluates the CIS program to maintain a strong, relevant program that serves both students and employers. The Advisory Board for the CIS program carefully reviewed the suggested curriculum during their annual meeting during the 2002-03 academic year and made recommendations for improvement. The Advisory Board approved the revised CIS program during their 2003-04 meeting.
- The CIS faculty the IS 2002 model curriculum for Information Technology programs. Broad topic areas from the IS 2002 model curriculum were incorporated into the CIS program curriculum.

3. Assess why students come to FSU for the program. Summarize the results of the graduate exit survey and the student program evaluation.

a. How well does the program meet student expectations?

The tables below show the analysis of specific questions which were included on the student survey instrument. Each table will be discussed independently.

Q25: CIS program has met my expectations			
Class	% with 4 or 5	# with 4 or 5	Total in class
Freshman	100%	4	4
Sophomore	36%	9	11
Junior	42%	7	12
Senior	23%	9	26

When you look at the overall satisfaction of the students it consistently drops from the freshman year to the senior year.

These are the mean scores by class			
Class	Q21: read technical material	Q22: feel prepared	Q23: communication skills
Freshman	4.25	4.33	4.00
Sophomore	3.73	3.55	3.82
Junior	3.08	2.92	3.92
Senior	3.04	3.19	3.88

The scores in the table above were surprising when compared to some of the others, and again indicative of the fact that faculty and administration of the CIS program don't let students know what the marketplace expects. Employers continue to say that

communication skills are weak while students view their communication skills as above average.

b. How is student sentiment measured?

Student sentiment is measured with the SAI (Student Assessment of Instruction) system, the EBI student satisfaction surveys, and departmental surveys.

D. PROGRAM VALUE. Please refer to the faculty survey.

1. Describe the benefit of the program, facilities, and personnel to the University.

The faculty of the CIS program in the COB believes that the CIS program is valuable to Ferris State University, the state and society. All efforts should be made to maintain the program in our rapidly changing technologically oriented society.

Some of the positive elements suggested by the CIS faculty in dealing with the business core include suggestions that the core curriculum become more focused on the importance of the integration of business disciplines. The current COB capstone course already addresses this problem to some degree, but there are other opportunities available. The ISYS 321 class was designed to illustrate the importance of information integration for decision making within the environment of business applications. It is hoped that as the core continues to evolve students will achieve a better understanding of the importance of integration to the successful operation of the enterprise.

2. Describe the benefit of the program facilities, and personnel to the students enrolled in the program.

The faculty perceives the preparation of students to be adequate, but that the program needs to continue to evolve. In order to accomplish this task, the curriculum will need to be continuously modified and faculty must be exposed to the current trends in technological advancement. It would certainly help, if faculty were given more opportunity to engage in content oriented professional development, in addition to the pedagogical development opportunities that exist. . A strong professional development plan for the program as a whole and for each individual faculty member must be implemented. Post-tenure review plays a role in this plan, but program faculty and administrators need to work together consistently and constantly to fund, monitor, and implement this plan.

The CIS faculty felt that the advising process within the program was average at best. Steps have already been taken to require students to meet with their advisor once a year to ensure that they are following the correct curricular path. Because of the continuous change within the information systems discipline, it is rare for the CIS curriculum to remain unchanged from one year to the next. Hence, students are often faced with the dilemma of needing a course that will not be offered because of low enrollment. Substitute courses are developed, but unless the student meets with his or her advisor there is no way that they will be able understand which class they are to take. If the curriculum is allowed to stabilize, faculty should be better able to guide students as to the correct classes to take and the proper sequence in which they should take them.

The facilities during the first two years are adequate to fulfill the needs of the students, but during the last two years the hardware available for the networking and hardware classes is very antiquated. Also, because of the number of courses many courses that should be taught in a computer lab environment are not because no lab is available

3. What is the assessment of program personnel of the value of the program to employers? Explain how is this value is determined.

Just last year the CIS faculty made extensive changes to the curriculum that follow the IS 2002 guidelines. The key component to these changes was a core of 10 IS classes. It is anticipated that this structure, following the national guidelines, will better prepare our students for the challenges in the rapidly changing discipline.

In making these changes it was acknowledged that the Ferris State University CIS program would become more consistent with other IS programs in the country. College of Business accreditation concerns, specifically the reduced number of credit hours in the program core,

influenced the CIS program in adopting IS 2002 guidelines. CIS faculty expressed many ideas, concerns, and diverse opinions concerning the appropriateness of our curricular exercises.

4. ***Describe the benefit of the program, faculty, staff and facilities to entities external to the University (services that faculty have provided to accreditation bodies, and regional, state, and national professional associations; manuscript reviewing; service on editorial boards; use of facilities for meetings, etc.).***

Members of the faculty and administrators belong to a variety of professional organizations. Recently, the CIS department head, Jim Woolen, participated as a panelist during a 60-minute session on implementing the IS 2002 model curriculum at the 2004 Information Systems Education Conference (ISECON). Faculty members have frequently given presentations at state conferences, such as MACUL and IBEA conferences.

5. ***What services for extra-University general public groups (e.g., presentations in schools or to community organizations) have faculty, staff or students provided? Describe how these services benefit students, program, and community.***

- One faculty member was asked to join the first Faculty Learning Community initiative.
- CIS faculty and administrators make presentations to civic organizations, SIGs, high school and community college students. CIS faculty and administrators continue to build relationships with community colleges, career tech centers, and will visit selected high schools for recruitment. CIS plans to work with other IS/IT department leaders across Michigan and partner with other academic units across campus to create blended degrees.
- CIS faculty and administrators will reach beyond the borders of Michigan to adjacent states to recruit from large high schools, career centers, etc. External funding for these recruitment activities must be sought.
- A CIS summer computer camp for high school students has been successful.
- The CIS program should recreate and offer a summer academy for K-12 teachers to provide computing skills that can help in their recertification process.

The benefits of these types of outreach programs are:

- Participants are made aware of Ferris State University's CIS program.
- The image of Ferris State University's CIS program is enhanced.
- K-12 teachers suggest Ferris State University's CIS program to their students.
- Technological education is provided for other units on the campus of Ferris State University.

A. Graduate follow-up survey:

The Graduate Follow-up survey was designed and developed in the CIS capstone class during Fall semester 2004. Students in Dr. Hettiarachchy's ISYS 488 (Systems Design and Implementation) and ISYS 489 (Advanced Systems Design and Implementation) worked in teams to develop online surveying systems for use by Ferris State University for the purpose of self-study, Academic Program Review, accreditation, certification, etc.

The students presented the systems to College of Business faculty and administrators who, then, evaluated the systems and selected the best system for implementation.

Once the online survey computer application was completed in April of 2005, it was ready to be made available electronically for Computer Information Systems graduates to fill-in. Due to miscommunication concerning who was responsible for emailing the survey instrument URL to graduates, the graduate survey was not made available to CIS alumni until Fall semester 2005. The CIS department is in the process of completing the Graduate Follow-up Survey for use in the Academic Program Review and to access Alumni perceptions and improve CIS program quality. As soon as the final survey results and analysis are completed, they will be made available to the CIS faculty and administration and the APRC.

The survey instrument is shown on the following pages.

Graduate follow-up survey

As a part of the Computer Information Systems (CIS) Academic Program Review process we are assessing alumni perceptions of the program.

0%

100%

CIS Alumni Survey

In our ongoing effort to improve the Computer Information Systems program at Ferris State University, we ask that you take a few moments to complete this survey.

The survey is divided into two sections. Section 1 includes questions regarding your general preparedness for work following your graduation from the CIS program and your recommendations for improvement of the program. Section 2 asks questions of a more personal nature. Your anonymity and confidentiality is guaranteed.

Section 1 - Continuous Quality Improvement

Please rate the importance for entering CIS professionals in each of the following areas.

1 =Not important to 5 = most important

	1	2	3	4	5
Word Processing/ PC Data base	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Marketing Presentation Skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Java Language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Visual Basic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
C or C++	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
COBOL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
RPG	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Network Configuration/ Modification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Systems Analysis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Systems Design and Development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Systems Implementation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Managing Employees	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Selling Services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Professional responsibility and ethics	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to adapt and learn new concepts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Database Design	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Understand Functional area of business	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case Tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Graduate follow-up survey

Web page design /HTML	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Communication Skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Team Work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please rate the instruction you received at Ferris from the CIS faculty and how that instruction prepared your for entry into the CIS profession?
1 = Not prepared to 5 = Well Prepared

	1	2	3	4	5
Word Processing/ PC Database	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Marketing Presentation Skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Java Language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Visual Basic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
C OR C++	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
COBOL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
RPG	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Network Configuration/Modification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Systems Analysis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Systems Design and development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Systems Implementation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Managing Employees	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Selling Services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Professional Responsibility/ Ethics	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to adapt and learn new concepts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Database design	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Understanding of functional areas of business	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CASE Tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Object Oriented design Methods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Web page design/ HTML	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Project Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CIS Program Overall	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please rate the following characteristics regarding the CIS faculty.
1 = Inadequate to 5 = Excellent

	1	2	3	4	5
CIS Professor's Teaching Methods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CIS Professor's knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Graduate follow-up survey

CIS Program- Prepare you for work

What could be done to make this program more effective in preparing students for future trends in the CIS profession?

Empty response box for the question above.

Please describe what you think are the most important trends for future CIS graduates.

Empty response box for the question above.

Section 2 - Information about CIS graduates.
Your anonymity and confidentiality is guaranteed.

What year did you graduate

- 1999 or before
- 2000
- 2001
- 2002
- 2003
- 2004

What is the primary area(s) of your job responsibility?

Check all Primary Areas that apply

- Applications Programmer/ Analyst
- Data Communications/ LAN Specialist
- Systems Analyst
-

Graduate follow-up survey

- Systems Manager
- Database Manager
- Manager of Systems Programming
- Internet Specialist
- Manager Data Communications/LAN
- Senior Analyst/Project Leader
- Programming Manager
- Data Base Analyst
- Systems Programmer
- IT or CIS Manager

Other: _____

What are your primary area(s) of responsibility?

Check all areas that apply

- Financial/Accounting Systems
- Process Control Systems
- Marketing/Sales Systems
- Engineering/Research Systems
- Network Systems Software/Hardware
- Manufacturing Systems
- Manufacturing Systems
- Systems Software
- Order/Distribution Systems
- Human Resources Systems
- Help Desk / Call Center
- Technical Support
- Other _____

What is the primary Hardware environment(s) at your job site?

Check all that apply

Main

Frame, Brand, Model, Operating System _____

Mid Range:

Brand, Model, Operating System _____

Microcomputer:

Brand, Model, Operating System _____

Network:

Brand, Model, Operating System _____

Graduate follow-up survey

What was your initial salary in Information Technology after graduation?

- Less than \$30,000
- \$30,000 to under \$40,000
- \$40,000 to under \$50,000
- \$50,000 to under \$60,000
- \$60,000 to under \$70,000
- \$70,000 to under \$80,000
- \$80,000 to under \$90,000
- Over \$90,000

What is your current annual salary?

- Less than \$30,000
- \$30,000 to \$40,000
- \$40,000 to \$50,000
- \$50,000 to \$60,000
- \$60,000 to \$70,000
- \$70,000 to \$80,000
- \$80,000 to \$90,000
- Over \$90,000

Indicate the total number of promotions and job changes you have received since graduation.

- None
- One
- Two
- Three
- Four
- Five
- Six or More..

In a typical month, rate each of the following skills.

1 = Never Used to 5 = Use Everyday

	1	2	3	4	5
Word Processing/ PC data base	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Marketing Presentation Skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Java Language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Visual Basic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
COBOL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
RPG	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Network Configuration/ Modification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Graduate follow-up survey

	Systems Analysis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
	Systems Design/Development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
	Systems Implementation/Modification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
	Managing Employees	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
	Selling Services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
	Communication Skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
	Team Building Skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
	Network & Data Security	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
	Other:	<input type="text"/>						
<p><< <u>prev</u> <u>last</u> >> [Exit and Clear Survey]</p>								

B. Employer follow-up survey:

Feedback from employers is an ongoing process in the CIS program Quality Improvement cycle. The faculty and administration are continuously surveying employers, who may be Advisory Board members or Alumni, concerning the employability and promotability of CIS program graduates. Employers are also asked why they hire Ferris CIS graduates, where else they recruit potential employees, what do they like and dislike about graduates of different CIS programs, what can be done to improve a Ferris CIS graduates success in the IT marketplace, and what emerging IT topics should be included in the CIS curriculum.

During the re-design of the CIS program curriculum, thousands of job postings from past, current, and potential employers of CIS graduates were carefully evaluated. The CIS faculty wished to make sure the CIS curriculum contained courses that would give CIS graduates a strong background in information systems fundamentals as well as the necessary skills to be successful in the very competitive market for IT jobs.

Employers continue to emphasize the importance of excellent communication skills, both written and oral. IT professionals must communicate and serve as liaisons between IT departments and business units.

Required technical skills are ever-changing, so employers believe a strong background in the fundamentals of information technology are necessary for success in the workplace. They would like the graduates they hire to be enthusiastic and eager to engage in life-long learning as the IT field progresses and evolves.

Employers believe a strong business background is essential for success and advancement as an IT professional. Technical skills are and may continue to be out-sourced. Therefore, for success in the workplace a strong business background with excellent communication skills as well as strong technical fundamentals are required.

C. Graduating student exit survey

Graduating students are surveyed every year on an ongoing basis to obtain information regarding quality of instruction, relevance of courses, and satisfaction with program outcomes based on their own expectations. The survey must seek student suggestions on ways to improve the effectiveness of the program and to enhance the fulfillment of their expectations. This survey is mandatory for all program graduates.

There was not specific graduating survey completed, but the Student Satisfaction Survey showed for almost all questions that the satisfaction drops in the junior and senior years. Question 10 asks how prepared the student feels. Of the seniors, only 9/26 or 34.6% responded with a 4 or 5. (1 senior said they strongly agreed, 8 agreed). Sixty-five percent did not believe they were well-prepared to enter the workplace.

Faculty, administrators, employers, alumni, and the CIS Advisory Board need to do a better job informing the students of expectations and how well CIS graduates are meeting those expectations.

D. Student program evaluation: (Refer to Appendix B for survey instrument and results)

Current students are surveyed to obtain information regarding quality of instruction, relevance of courses, and satisfaction with program outcomes based on their own expectations. The survey must seek student suggestions on ways to improve the effectiveness of the program and to enhance the fulfillment of their expectations. This survey should be conducted during the year before the PRP report is submitted.

Fifty-three CIS students were surveyed.

Freshman	4	Transfers students	14
Sophomore	11	Bachelors	46
Junior	12	Associates	5
Senior	26	Majors	42
		Minors	11

Quality of Instruction

Questions 1-8 on the survey were directly related to quality of instruction.

Below is the table when combining all 8 questions:

Mean	3.68	Answered 5
Median	4	
Mode	4	

Ways to improve

The students were given an open ended question asking for what significant changes would make the most improvement. The responses can be summarized best by the following.

Significant Changes that would make the most improvement		
Comment	Number of students with comment	Percentage
The program needs more networking classes	2	3.77%
We need to update the program	1	1.89%
The program needs better equipment. This includes hardware and software.	10	18.87%
Bring in IT Reps to talk with students or have more field trips	2	3.77%
Teach programming classes in a lab	3	5.66%
Raise standards	5	9.43%
Faculty are not knowledgeable, up-to-date, don't help much	20	37.74%
More employers at job fair or for internships	2	3.77%
Don't change the check so much	4	7.55%
More hands-on	3	5.66%
irrelevant courses	5	9.43%
Would a more diverse program with more web design, or more networking, or more choices in general	3	5.66%

When you look at these results, there are three main areas of concern. First, as a program, CIS does not let its students see the big picture. This is demonstrated by the statements about the wrong software, irrelevant courses, more hands-on learning, and wanting a more diverse program.

We have some students that want to graduate and be able to have very specific technical skills. While technical skills are very important, what they have not learned is that technical skills change so quickly, it is more important to learn the overarching concepts. One student in the "don't change" section stated the step-by-step books. While the mechanics are good, they are not everything. Our program trains the students to be managers of technical services, and we are not cohesive in letting the students understand that goal, or why we have chosen the classes that we have chosen.

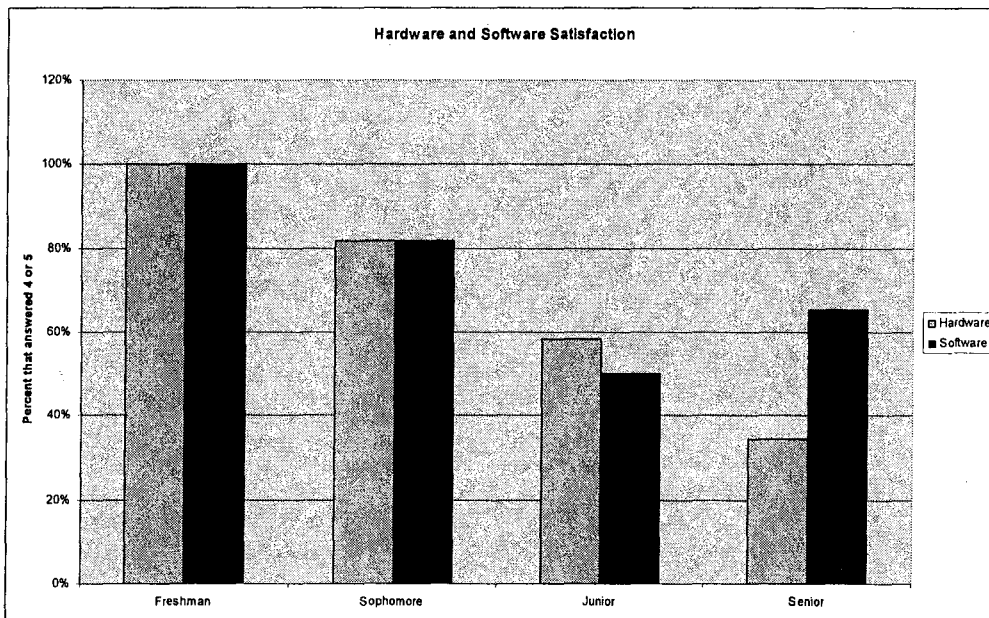
Second, the opinion of the students is that the CIS faculty are not current. Training for technical skills is very expensive and there are not enough dollars to allow all faculty to obtain training every year.

In the past the program was heavily geared to programming and system design. Today's students may not be interested in that. We have not made connections with them to allow them to understand that importance.

Networking is growing industry and we have not responded with the technical skills or the course work to support this potential area of growth.

And the third area of concern is the equipment. The underclassmen feel that the equipment is adequate, but the upperclassmen do not. This makes sense because the underclassmen have classes that meet mostly in the labs and those are updated on a regular basis. The upperclassmen have classes in the more specialized classrooms. The equipment in the labs used by many of the upperclassmen is at least 4-9 years old.

Class	Hardware (total ratings of 4 or 5)	Software (total ratings of 4 or 5)
Freshman	4/4 100%	4/4 100%
Sophomore	9/11 81.8%	9/11 81.8%
Junior	7/12 58.3%	6/12 50%
Senior	9/26 34.6%	17/26 65.4%



Things not to change

Don't change - They have served me well

Comment	Number of students with comment	Percentage
Practical Examples, hands-on work	4	7.55%
Good faculty, especially Bandstra and Hobart	6	11.32%
Equipment is good, hardware and software	3	5.66%
SQL and server administration classes	3	5.66%
The choice of classes was very good	3	5.66%

There isn't a strong pattern in the items that students feel we do well. We don't have one thing that seems to be our niche.

Note: The survey instrument used for this study along with student comments is included in Appendix B.

E. Faculty perceptions:

The faculty of the CIS program in the COB believe that the program is valuable to Ferris State University, the state and society. All efforts should be made to maintain the program in our rapidly changing technologically oriented society.

The faculty perceive the preparation of students to be adequate, but that the program needs to continue to evolve. In order to accomplish this task, the curriculum will need to be continuously modified and faculty must be exposed to the current trends in technological advancement. It would certainly help, if faculty were given more opportunity to engage in content oriented professional development, in addition to the pedagogical development opportunities that exist. The atmosphere that currently exists within in the college does not encourage this development. There are no rewards associated with faculty research, workshop attendance or conference presentations. A strong professional development plan for the program as a whole and for each individual faculty member must be implemented. Post-tenure review plays a role in this plan, but program faculty and administrators need to work together consistently and constantly to fund, monitor, and implement this plan.

The CIS faculty felt that the advising process within the program was average at best. Steps have already been taken to require students to meet with their advisor once a year to ensure that they are following the correct curricular path. Because of the continuous change within the information systems discipline, it is rare for the CIS curriculum to remain unchanged from one year to the next. Hence, students are often faced with the dilemma of needing a course that will not be offered because of low enrollment. Substitute courses are developed, but unless the student meets with his or her advisor there is no way that they will be able understand which class they are to take. If the curriculum is allowed to stabilize, faculty should be better able to guide students as to the correct classes to take and the proper sequence in which they should take them. Just last year the CIS faculty made extensive changes to the curriculum that follow the IS 2002 guidelines. The key component to these changes was a core of 10 IS classes. It is anticipated that this structure, following the national guidelines, will better prepare our students for the challenges in the rapidly changing discipline. In making these changes it was acknowledged that the Ferris State University CIS program would abandon its traditional course of independence and become like other programs in the country. These changes were made primarily for reasons of College of Business accreditation concerns. There seems to be quite a variance of opinions among faculty members at this time, as to the appropriateness of our curricular exercises.

Some of the positive elements suggested by the CIS faculty in dealing with the business core include suggestions that the core curriculum become more focused on the importance of the integration of business disciplines. The current COB capstone course already addresses this problem to some degree, but there are other opportunities available. The ISYS 321 class was designed to illustrate the importance of information integration for decision making within the environment of business applications. It is hoped that as the core continues to evolve students will achieve a better understanding of the importance of integration to the successful operation of the enterprise.

The majority of CIS faculty felt that a need exists for new faculty with current work experience. Since the COB decided to become a candidate for ACBSP accreditation, new faculty must have a terminal degree. It is very difficult to find faculty who have current work experience in the discipline as well as a Ph.D. Since 2000 the CIS department has lost at least five faculty members. None have been replaced. This fact has burdened the remaining faculty with the requirement that they cover all areas of the curriculum in addition to trying to stay abreast of current trends within the discipline. It is true that since 2001 enrollment within the CIS program has been reduced drastically, as have other programs in the country. One wonders if the decrease in enrollment has been caused by the same reasons as other schools or because of the make-up of the faculty within the current program. New faculty have been hired in the graduate program, but this department is considered a separate department and there is very little cross utilization between the departments.

The CIS faculty unanimously agreed that the computer and network facilities within the COB should be upgraded, if the program is to continue to be viable. An interesting study could be undertaken to compare the COB facilities to facilities at the other state universities. Some ideas for

improving these facilities include; searching for a network or classroom sponsor within the private sector, obtaining grant money to upgrade network facilities, and becoming part of a certification program that would allow private funds to be used for network facilities.

It appears that most of the CIS faculty lack of confidence in the COB leadership. They felt that present leadership is aloof, non-communicative, not faculty centered, that they do not lead and have become too autocratic, leading to a lack of respect between the faculty and administration. For example, a total reorganization of the COB was executed in the spring of 2005 without any faculty being consulted. While this may have been an efficient means of changing the organizational structure, it left many faculty feeling that their opinions were not valued and any feeling of collegiality that might have existed was destroyed. This problem can be addressed by a change in leadership style exhibiting some of the following characteristics: openness, interest in faculty concerns, more collaboration in the decision making process and becoming less autocratic.

The faculty also identified problems with departmental leadership. Most faculty felt that professional development was not encouraged. It is paramount that faculty within the discipline maintain current technological knowledge in order to bring the newest techniques to the classroom. Faculty felt that they were required to develop their new courses with little support from the administration. There are many ways that development opportunities can be fostered. For example, being given release time from classroom instruction to engage in consulting opportunities within private industry, encouraging research, attending workshops and conferences. At present faculty are expected to partially self-fund these activities and find replacement faculty for any classes missed. The primary concern of the administration within the COB seems to be increased enrollment. While being an admirable goal, at some point quality opportunities for learning should overcome the need for greater numbers and increased credit/hour production.

Before becoming interested in ACBSP accreditation, development activities were encouraged. Since these types of activities are stressed as a major component of accreditation by ACBSP, it seems logical that faculty development opportunities should be made easier by the administrators within the college.

The CIS faculty listed as strengths of the program the following; the departmental secretary and certain elements of the curriculum. As of August 19th the department secretary has been promoted and moved to another college. Obviously there is room for improvement within the program.

Major concerns include; the age of the faculty, the need for professional development, lack of current discipline knowledge, and the need to market the program. As far as marketing is concerned a better product needs to be developed before it can be successfully marketed.

After the last program review cycle for the CIS program, it was determined that the program needed to be enhanced, as at that time we had the equivalent of seven full-time faculty members covered by adjunct instructors. This enhancement never occurred and the program has been allowed to wither. Justification for replacement of faculty that retired, died or left the university was prepared, but subsequently denied. Pleas for additional tenure-track faculty who are experienced in current information systems technology have largely been ignored by the administration and resources have been shifted to the fledgling graduate program. If the CIS program is expected to continue to be a viable program within the COB these concerns must be addressed.

F. Advisory committee perceptions:

The Advisory Board for the CIS Program met most recently on October 21st, 2004.

Thirteen (13) of the twenty-seven (27) member Advisory Board attended the day-long event held at the Applied Technology Center in Grand Rapids.

Representatives for the College of Business included Dean David Nicol, Associate Dean Van Edgerton, CIS Department Head Jim Woolen, Internships Coordinator Brenda McCarthy, and Department Secretary Deb Ducat. For the first time, faculty were not allowed to cancel classes to attend the Advisory Board meeting so faculty representation was limited to Trudy Borst and Dale Hobart.

The Dean of the College of Business, Dr. David Nicol, addressed the group and discussed employment concerns with the CIS program. The Dean reported that changes in the IT industry following 9/11 and the ending of the dot.com era have impacted student perceptions of IT careers. He indicated that it is difficult to convince students that there are jobs in the CIS field and that the CIS program is still viable.

Advisory Board members were told that, as in the new CIS curriculum, students are currently strongly encouraged to undertake at least one internship to gain experience in the field, obtain knowledge on how information technology functions in the real world, and to make themselves more marketable for job opportunities.

The members of the advisory board approved the CIS program curriculum change that recommends an internship experience. They believe internships are a needed reality and believe the CIS program should move toward making internships a requirement of the CIS program.

The Advisory Board indicated that outcomes need to be assessed better, allowing us to measure our efforts for results.

One member of the Advisory Board, who is also a program alumnus, gave the following testimonial to be placed on the CIS program Web site.

Bryan Blackburn '90

General Manager
SourcIT Technology Services
Grand Rapids, Mich.

After graduating from Ferris State University in 1990 with a business degree with a CIS emphasis, Bryan Blackburn headed to Florida for an IT job with Dataflex Company. Now back in Michigan, he has 15 years experience in IT including a stint as vice president for Cybernet Engineering and branch manager for Robert Half International in Grand Rapids before joining SourcIT. Blackburn said that technology often drives technicians to take on new roles with different companies.

Blackburn adds Ferris' business and technical courses helped him in his career. He chose Ferris because of the real world and hands-on training offered by the University. He chose the computer field because he saw it as an up and coming industry with a need for students trained in IT.

In his leadership role with SourcIT one of his biggest challenges is making sure he has the top IT talent at the optimal time - making hiring decisions not too soon but not too late. He enjoys working with a diverse group of clients, mostly small to medium-sized businesses, and helping them identify and make the best use of technology with the most return on investment. Most of SourcIT's clients support up to a few hundred personal computers.

"We specialize in the design, implementation and support of computer networks," Blackburn says. SourcIT is heavily involved in wireless technology, wireless Internet connection including a lot of work for condominiums and apartment complexes. SourcIT also provides Web hosting and Web design and development as well as application development. Six employees currently report to Blackburn.

Blackburn's advice to current and future CIS students at Ferris is to get involved in organizations outside of the classroom. He highly recommends the Association of Information Technology Professionals (AITP), which has a student chapter at Ferris. He also highly suggests internships to students. He said that business and communications

courses are also beneficial as the most sought after candidates in the job market are those with a combination of business and technology skills.

"The days of a programmers sitting in a basement banging out code are gone," Blackburn says.

John Manilla, a CIS graduate and Advisory Board member, gave a presentation his company, Nutech. Dr. Woolen presented enrollment statistics and described what the CIS program is doing to promote itself. Actions to reverse the declining enrollment trends included:

- Re-Engineering of CIS curriculum
- Redesign of CIS Program Web site.
- Creation of professional brochure for CIS program
- Creation of professional Web card for CIS program
- Mailing from FSU Office of Admissions to 1000 highly prospective students.
- Creation of CIS Summer Camp during summer of 2004
- Presentation of CIS program to teachers at Educator Academy and Educator Externship Program
- Presentations to Bay Arenac and Cedar Springs students.
- Completion of a 3 + 1 transfer agreement with Mid-Michigan Community College

Suggestions for Advisory Board assistance to reverse the declining enrollment trends include:

- Creation of a scholarship fund
- Recruitment efforts and or testimonials
- Help with creating industry partnerships
- Suggestions for increasing majors
- Fund raising efforts
- Facilitation of recruitment efforts at high schools, career days, etc.

Student leaders of the AITP organization gave information concerning the activities of the student chapter.

A. PROFILE OF STUDENTS.

1. Student Demographic Profile.

a. Gender, race/ethnicity, age (use annual institutional data).

	Age	Sex		Ethnicity						
		M	F	Blank	Black	Hispanic	Indian/Alaskan	Asian/Pac	White	Foreign
2000F	24.5	151	127	20	52	6	2	4	274	20
		0.54	0.46	0.05	0.14	0.02	0.01	0.01	0.72	0.05
2001F	23.6	266	120	23	55	4	2	7	269	26
		0.69	0.31	0.06	0.14	0.01	0.01	0.02	0.70	0.07
2002F	24	214	79	22	43	3	1	6	196	22
		0.73	0.27	0.08	0.15	0.01	0.00	0.02	0.67	0.08
2003F	24.6	186	70	25	36	2	1	5	173	14
		0.73	0.27	0.10	0.14	0.01	0.00	0.02	0.68	0.05
2004F	24.8	159	46	25	24	1	1	4	142	8
		0.78	0.22	0.12	0.12	0.00	0.00	0.02	0.69	0.04

The female participation rate dropped from 46% to 22% over the five-year period since the last APR. A considerable amount of work will need to be done to recruit more females in a profession not seen in their traditional professional role. Research and promotional ideas will be generated from collaboration with such women's professional groups as the Association for Women in Computing.

b. In-state and out-of-state.

	In-State	Out-Of-State	Midwest Compact
2000F	346	20	12
	0.92	0.05	0.03
2001F	352	25	9
	0.91	0.06	0.02
2002F	265	23	5
	0.90	0.08	0.02
2003F	237	14	5
	0.93	0.05	0.02
2004F	190	12	2
	0.93	0.06	0.01

c. Full-time and part-time.

	Full-Time	Part-Time
2000F	281	97
	0.74	0.26
2001F	295	91
	0.76	0.24
2002F	225	68
	0.77	0.23
2003F	192	64
	0.75	0.25
2004F	144	61
	0.70	0.30

d. Attend classes during the day, in the evenings, and on weekends.

For academic year 2003-2004, the following courses were offered fully on-line or in a blended format:

- Fully On-line: ISYS 277 (4 Ferris off-campus sites)
 ISYS 304 (4 Ferris off-campus sites)
 ISYS 316 (4 Ferris off-campus sites)
- Partial Internet: ISYS 305 (1 Ferris off-campus site; 5 on-site sessions)
 ISYS 321 (2 Ferris off-campus sites; 6 on-site sessions)
 ISYS 400/470 (3 Ferris off-campus sites; 3 on-site sessions)
 ISYS 480 (4 Ferris off-campus sites) [deleted from program F05]
 ISYS 430/488 (4 Ferris off-campus sites; 3 on-campus sessions)
 ISYS 499/489 (4 Ferris off-campus sites; 3 on-campus sessions)

e. Enrolled in classes on- and off-campus.

	On-Campus *	Off-Campus *	Bachelor's Degree	Associate Degree	BS Tran	Computer Literacy	CIS/Mgt	CIS/Mkt	Acct/CIS	OC Bach	GUI Cert
2000F	342	69	302	6	1	0	11	5	17	69	0
	0.83	0.17	0.73	0.01	0.00	0.00	0.03	0.01	0.04	0.17	0.00
2001F	362	55	310	20	1	1	9	4	17	55	0
	0.87	0.13	0.74	0.05	0.00	0.00	0.02	0.01	0.04	0.13	0.00
2002F	264	58	224	22	1	0	3	1	13	46	12
	0.82	0.18	0.70	0.07	0.00	0.00	0.01	0.00	0.04	0.14	0.04
2003F	217	52	186	19	0	0	2	1	9	208	9
	0.81	0.19	0.43	0.04	0.00	0.00	0.00	0.00	0.02	0.48	0.02
2004F	166	48	136	21	0	0	0	1	8	48	0
	0.78	0.22	0.64	0.10	0.00	0.00	0.00	0.00	0.04	0.22	0.00

* On-Campus includes Bachelor's, Associates, Computer Literacy, CIS/Mgt, CIS/Mkt, and Acct/CIS

* Off-Campus includes Off-Campus Bachelor's and GUI Certificate

f. Enrolled in 100% on-line and/or mixed delivery courses.

N/A

g. Discuss how the information presented in (a) through (f) impacts the curriculum, scheduling, and/or delivery methods in the program.

- As shown by the above data, most CIS majors are white males. The number of female CIS majors is diminishing rapidly. This is a nationwide trend that the CIS program must address.
- The number of full-time students is declining as is the number of on-campus students. More students need to work to support themselves and their families as they pursue higher education goals. The availability of Internet and Partial Internet courses, as well as economic necessity, is probably responsible for this trend.

2. Quality of Students.

a. What is the range and average GPA of all students currently enrolled in the program? ACT? Comment on this data.

	FSU GPA			ACT		
	Min	Avg	Max	Min	Avg	Max
2000F	0.7	2.906	4	11	20	32
2001F	0.506	2.88	4	11	20.2	32
2002F	1.433	2.937	4	13	20.5	32
2003F	1.329	2.971	4	12	20.6	32
2004F	0.9	2.985	4	12	20.9	32

Source: APR 00-04 Enrollment by Residency, Age, FSU GPA, and ACT: Institutional Research and Testing 2/09/2005
 Page 95 of 297

The Average GPA and ACT score of a CIS major have steadily increased since 2001 and 2000, respectively.

- b. What are the range and average GPA's of students graduating from the program? ACT? Comment on this data.**

	FSU GPA			ACT		
	Min	Avg	Max	Min	Avg	Max
2000F	2.197	3.278	4	13	17.8	27
2001F	2.253	3.283	4	7	18.2	30
2002F	2.265	3.254	4	12	21.3	32
2003F	2.171	3.254	4	12	20.3	33

Source: APR Enrolled/Graduated 00-04: Institutional Research and Testing 2/09/2005 Page 63 of 192

The Average GPA has fallen slightly in recent years. However, ACT score of CIS graduates have increased.

- c. In addition to ACT and GPA, identify and evaluate measures that are used to assess the quality of students entering the program.**

The CIS program had more majors participating in the University Honors program than any other COB program in academic year 2003-2004.

- d. Identify academic awards (e.g., scholarships or fellowships) students in the program have earned.**

- Of the forty (40) May 2004 CIS graduates receiving the BS degree, 55% graduated with academic honors.
- Two students receive scholarships each year from two CIS scholarship funds that are for academic and student achievement. These include the Stephen Edward Martin Memorial Scholarship and the Fortune/Morlock Scholarship. In addition, scholarships have been awarded to CIS majors from members of the CIS Advisory Board and CIS faculty.
- Two CIS students received academic and leadership recognition at the annual College of Business Excellence Awards Ceremony in 2004.
- More scholarships are needed to attract and retain outstanding students.

- e. What scholarly/creative activities (e.g., symposium presentations, other presentations or awards) have students in the program participated in?**

- Ferris State's student chapter of the Association of Information Technology Professionals (AITP) competed for the first time at the 2004 AITP National Collegiate Conference (NCC). The Ferris student team placed 4th of 55 in the Network Design Contest, and received an Honorable Mention.
- During the 2004 NCC, 3 Ferris students attending took and passed the nationally-recognized Associate Computer Professional (ACP) exam from the Institute for Certification of Computer Professionals (ICCP).
- Sponsored to Attend the AITP meetings in Grand Rapids.

The significance of these activities is: (1) validation/verification of their education at Ferris; (2) networking with industry professionals and fellow students across the nation; (3) external assessment of the program's outcomes.

- f. What are other accomplishments of students in the program? Comment on the significance of these accomplishments to the program and students.**

The influx of highly motivated honors students into the CIS program has been welcomed by the CIS faculty. However, in some CIS courses students fall into the categories of "Excellent" or "Poor" with few in between.

During the 2004 summer, all CIS students on Internship were offered a job at the company where they interned.

3. Employability of students.

- a. How many graduates have become employed full-time in the field within one year of receiving their degree? Comment on this data.**

A placement rate of ninety-four percent (94%) is reported by CIS graduates.

Source: 2002-2003 Graduate Follow-up Survey Summary: Institutional Research and Testing 1/18/2005

- b. What is the average starting salary of graduates who become employed full-time in the field since inception (for new programs) or the last program review? Compare with regional and national trends.**

A starting salary of \$41,005 is reported by CIS graduates. (Source: 2002-2003 Graduate Follow-up Survey Summary: Institutional Research and Testing 1/18/2005) The Labor Market Analysis completed for this APR showed average starting salaries for IT professionals in the range from \$27,500 to \$47,000.

- c. How many graduates have become employed as part-time or temporary workers in the field within one year of receiving their degree? Comment on this data.**

CIS students are highly sought as student technicians on campus while at school. Some even get hired fulltime at Ferris and then finish their degree

- d. Describe the career assistance available to the students. What is student perception of career assistance?**

Career assistance is provided by Ferris' Office of Student Employment and Career Services. They help students with goal setting, resume development, and other job searching techniques. They sponsor workshops, such as, Flex for Success and Job Fairs. Backpack to Briefcase workshops are also offered to CIS majors. Unfortunately, most CIS majors do not seek employment until after graduation and do not avail themselves of the employment services and opportunities available to them at Ferris.

The student chapter of the AITP sponsors field trips for CIS students and invites many guest speakers to AITP meeting so students can learn more about IT careers.

- e. How many graduates continue to be employed in the field? Comment on this data.**

N/A

- f. Describe and comment on the geographic distribution of employed graduates.**

N/A

- g. How many students and/or graduates go on for additional educational training? (Give annual average.) Comment on this data. N/A**

N/A

- h. Where do most students and/or graduates obtain their additional educational training? Comment on this data.**

N/A

B. ENROLLMENT.

- 1. What is the anticipated fall enrollment for the program?**

Anticipated Fall 2005 enrollment is 118 students on campus plus 45 off-campus for a total of 163.

- 2. Have enrollment and student credit hour production (SCH) increased or decreased since the last program review? Supply a table and comment on any enrollment trends.**

	Freshmen		Sophomores		Junior		Senior		Total	
	Enroll	SCH	Enroll	SCH	Enroll	SCH	Enroll	SCH	Enroll	SCH
2000	91	1223	68	919	78	884	135	1444	372	4470
2001	79	1029	62	877	82	975	143	1530	366	4411
2002	27	379	50	708	66	777	128	1469	271	3333
2003	18	257	33	425	49	637	137	1543	237	2862
2004	17	240	18	251	51	608	98	1034	184	2133

Source: Administrative Program Review 2004 7th/4th Day Counts: Institutional Research and Testing 1/26/2005

According to data provided by Institutional Research and Testing, enrollment and SCH have decreased quite dramatically since the last CIS Program Review in 1999-2000. The current enrollment and SCH numbers are less than half what they were in 2000. The exception is in the numbers of off-campus juniors and seniors. Although the numbers of off-campus juniors and seniors is decreasing, the numbers are decreasing at a slower rate than among on-campus juniors and seniors. This might be due to the popularity of the 2+2 and 3+1 programs offered between Ferris State University and some community colleges.

3. Since the last program review, how many students apply to the program annually?

	Winter 2004	Winter 2005
Apps	226	150
Pending	30	27
Admit Dec	196	123
Rejects	3	1
Offers	193	122
Cancelled	1	0
Admit	192	122
Non-scheduled	13	4
Enrolled	179	118

Source: Weekly Enrollment Report: Institutional Research and Testing 12/20/2004 Page 87 of 268

4. Of those who apply, how many and what percentage are admitted?

	Apps	Offers	Percentage Enrolled
2004	226	193	79%
2005	150	122	79%

5. Of those who are admitted, how many and what percentage enroll?

	Admit	Enrolled	Percentage Enrolled
2004	193	179	93%
2005	122	118	97%

6. What are the program's current enrollment goals, strategy, and efforts to maintain/increase/decrease the number of students in the program? Please explain.

Department goals are to increase enrollment slowly, but steadily. Frequent trips to off-campus sites to council students about pre-requisites and program requirements occur. Trips to Michigan high schools and career centers to present information about CIS careers and the CIS program at Ferris State University are planned. Plans to provide improved information on the CIS Program Web site concerning the program and career opportunities are underway.

The following excerpt from the Perceptions of Faculty Study conducted for this APR states, "The majority of CIS faculty felt that a need exists for new faculty with current work experience. Since the COB decided to become a candidate for ACBSP accreditation, new faculty must have a terminal degree. It is very difficult to find faculty who have current work experience in the discipline as well as a Ph.D. Since 2000 the CIS department has lost at least five faculty members. None have been replaced. This fact has burdened the remaining faculty with the requirement that they cover all areas of the curriculum in addition to trying to stay abreast of current trends within the discipline. It is true that since 2001 enrollment within the CIS program has been reduced drastically, as have other programs in the country. One wonders if the decrease in enrollment has been caused by the same reasons as other schools or because of the make-up of the faculty within the current program. New faculty have been hired in the graduate program, but this department is considered a separate department and there is very little cross utilization between the departments."

The following excerpt from the Administrative Program Review states,

Incorrect public perceptions that most IS jobs are being outsourced, the impact of the "dot com" implosion, and the demise of Y2K outrageous salaries have all adversely affected enrollments in all IS programs (Ferris, state, regional, and national). Our CIS program continues to suffer from declining enrollments.

PROPOSED ACTIONS:

- Continue to utilize recently developed marketing materials (brochure, Web card, Web site) for recruitment, distribute at various recruitment events, and mail to prospective students. (...Department faculty and administrators will participate in Community College events to meet parents and students.)
- Continue to build relationships with community colleges, career tech centers, and begin visiting selected high schools for recruitment.
- Reach beyond the borders of Michigan to adjacent states to recruit from large high schools, career centers, etc. Find external funding since there are no available internal funds for this activity.
- Continue annual CIS summer computer camp for recruitment and image building.
- Continue to work with other IS/IT department leaders across Michigan.
- In partnership with other academic units across campus, create blended degrees that fill a market gap and provides much needed skills for the workplace.
- Create and offer a summer academy for K-12 teachers to provide computing skills that can help in their recertification process.

C. PROGRAM CAPACITY

- 1. What is the appropriate program enrollment capacity, given the available faculty, physical resources, funding, accreditation requirements, state and federal regulations, and other factors? Which of these items limits program enrollment capacity? Please explain any difference between capacity and current enrollment.**

Enrollment for the CIS Fall 2005 is 118 on-campus and 45 off-campus students. All 11.5 FTE faculty have been assigned full loads. Prior to final registration 83% of all available seats in ISYS classes are full. It is estimated that after final registration more than 90% of the classroom seats will be filled. Based on this information, the estimated capacity for the CIS program is approximately 180 majors.

The service load for the CIS faculty has risen to more than seventy-five percent (75%). The increasing service load could limit the number of sections of service courses offered in the future.

Another factor that could limit the capacity of the CIS program is the availability of computer labs in the College of Business. Both classroom labs in the College of Business are now operating at over 95% capacity.

D. RETENTION AND GRADUATION

- 1. Give the annual attrition rate (number and percent of students) in the program.**

	2000F	2001F	2002F	2003F	2004F
2000F Class	61	38	27	27	26
Graduates	0	0	0	1	19
Persisters	0%	A-62%	B-45%	C-45%	?-42%
2001F Class		54	27	25	23
Graduates		0	0	0	5
Persisters		0%	A-50%	B-46%	C-42%
2002F Class			14	10	8
Graduates			0	0	0
Persisters			0%	A-71%	B-57%
2003F Class				12	8
Graduates				0	0
Persisters				0%	A-66%

Source: Retention & Graduation Rates of Full-Time FTIAC Students – By Major: Official 4th Day Counts: Institutional Research and Testing

Freshman - Sophomore A	Sophomore – Junior B	Junior – Senior C
38%	51%	57%

Based on the information displayed in the table above, the annual attrition averages 38% between the Freshman and Sophomore years, 51% between the Sophomore and Junior years, and 57% between the Junior and Senior year.

2. What are the program's current goals, strategy and efforts to retain students in the program?

The CIS faculty and administration believe that internships will inspire students to remain in the program. When faced with real-life IT experiences, students will perceive the relevancy of the CIS curriculum. Student input via Student Assessment of Instruction evaluations (SAIs) is sought and used to improve course offerings for CIS majors. At the request of many students, a previously totally on-line course went to a blended (three live sessions, remainder Internet) instructional delivery to meet student learning needs. The CIS program also plans to retain existing students, increase enrollment, and tap new markets by implementing a pedagogically sound on-line degree offering for off-campus students. These on-line courses could also be offered to students, who are on summer internships, for faster degree completion.

3. Describe and assess trends in number of degrees awarded in the program.

	On	Off	Total
1999-2000	26	14	40
2000-2001	35	13	48
2001-2002	58	7	65
2002-2003	46	16	62
2003-2004	56	14	70

The total number of degrees awarded during the above academic years has increased steadily. This data is in contrast to the declining enrollment in the CIS program. Students who matriculated in 1999 or 2000 graduated in 2003-04 or 2004-05. We have begun to see the decline in numbers of graduates due to decreased enrollment.

4. How many students who enroll in the program graduate from it within the prescribed time? Comment on any trends.

N/A

5. On average, how long does it take a student to graduate from the program? Please comment.

N/A

E. ACCESS

1. Describe and assess the program's actions to make itself accessible to students. Use examples such as off-site courses, accelerated courses or other types of flexible learning, use of summer courses, multiple program entry points, e-learning, mixed delivery courses, scheduling.

For academic year 2003-2004, the following courses were offered fully on-line or in a blended format:

Fully On-line: ISYS 277 (4 Ferris off-campus sites)
 ISYS 304 (4 Ferris off-campus sites)
 ISYS 316 (4 Ferris off-campus sites)

Partial Internet: ISYS 305 (1 Ferris off-campus site; 5 on-site sessions)
 ISYS 321 (2 Ferris off-campus sites; 6 on-site sessions)
 ISYS 400/470 (3 Ferris off-campus sites; 3 on-site sessions)
 ISYS 480 (4 Ferris off-campus sites) [deleted from program F05]
 ISYS 430/488 (4 Ferris off-campus sites; 3 on-campus sessions)
 ISYS 499/489 (4 Ferris off-campus sites; 3 on-campus sessions)

These online courses help off-campus students. The CIS program does not enough faculty or enough students at each off-campus site to warrant a separate class each year at each site. As a result, the program offers several required courses in Fully On-line or Partial Internet formats to remain responsive to the needs of the off-campus students. The Partial Internet courses for which students must attend class in Big Rapids are scheduled in Big Rapids on Saturdays to avoid conflict with work, family, and school schedules.

Off-campus students comprise 28% of fall 2005 CIS enrollment. CIS uses a blend of mixed-delivery and Internet-based courses to serve these students and to serve working students that are registered on-campus. Independent studies are judiciously used for students as they near

their graduation and cannot find required courses due to scheduling problems or courses have been discontinued since they began their academic career.

In the summer semester, freshman and sophomore courses are offered to allow students to get ahead in their degree process. Also, we offer the COB core course ISYS 321 in the summer to provide an accelerated path for students.

2. Discuss what effects the actions described in (1) have had on the program. Use examples such as program visibility, market share, enrollment, faculty load, computer and other resources.

The major impact on the program with such flexibility has been in the number of continuing students; that is, we are graduating in excess of 65 each year because we have made it more convenient for them to complete their degrees. As for the national decline in CIS enrollment during the past several years, Ferris has also seen a significant decline over the last 4 years. Since the majority of CIS classes are based in computer labs, there is also a limitation on the number of students based on computer availability. Most labs have a capacity of 25 but the networking lab only can accommodate 18 students.

Faculty members in the CIS program are willing to support flexible course offerings. However, hardware and software resources are not always supported by the off-campus sites. Additionally, firewalls have occasionally kept off-campus students from using resources available to on-campus students. This has, at times, required that off-campus students drive to campus to use hardware and software.

As stated in the Faculty Perceptions Study,

The CIS faculty unanimously agreed that the computer and network facilities within the COB should be upgraded, if the program is to continue to be viable.

An interesting study could be undertaken to compare the COB facilities to facilities at the other state universities. Some ideas for improving these facilities include; searching for a network or classroom sponsor within the private sector, obtaining grant money to upgrade network facilities, and becoming part of a certification program that would allow private funds to be used for network facilities.

3. How do the actions described in (1) advance or hinder program goals and priorities?

There is a bit of "cannibalism" of the student count for fall classes, which creates scheduling difficulties due to lower enrollment.

F. CURRICULUM. The curriculum review section must also contain appropriate check sheets and example syllabi, which may be attached as a Appendix C.

1. Program requirements. Describe and assess the program-related courses required for graduation.

ISYS	110	Fundamentals of Computer Information Systems	3
Programming component introduces fundamental programming and development concepts, data types and variables, instruction sets, number systems, flow control and logical operations, modularity and structure, and object-oriented programming. Operating systems component contains a tour of popular operating systems, file management, file structures, and computer hardware. Internet component introduces searching the World Wide Web using an Internet browser, sending Electronic mail, moving files with FTP, and creating web pages using HTML.			
ISYS	200	Database Design & Implementation	3
Introduces database concepts, design methodologies, and implementation procedures. Stresses the importance of sound database design to insure data integrity and flexibility. Common data structures, normalization techniques, integrity constraints, security features, query and report facilities are discussed. One or more popular commercial database management systems will be used to implement the designs.			
ISYS	216	Introduction to Object-Oriented Programming	3
Introduces students to object-oriented programming using the Java platform and essentials of non-graphical Java programming. Topics include primitive data types and operations, control statements, methods, objects and classes, strings, arrays, class inheritance and interfaces, and object-oriented software development.			
ISYS	316	Advanced Object-Oriented Programming	3
Student will use Java's graphical programming and advanced features to create Object-Oriented Windows programs and applets. Topics include AWT components and layout managers, drawing, mouse and keyboard event handling, menu bars, the collections framework, exception handling, multithreading, file I/O, and client/server programming.			
ISYS	325	Networking Essentials	3
A study of networking hardware, transmission media, communication protocols, the Open System Interconnection (OSI), and distributed networking/processing. The equipment, techniques, and software utilized in networks are presented. Appropriate terminology and concepts utilized in networks are introduced. Lecture workshop experience with designing, planning, installing, and maintaining a Local Area Network.			
ISYS	330	Systems Analysis & Design	3
The first course in structured methods of identifying the requirements for a system. This includes the analysis of current business operations and definitions of specific problems or opportunities. Goals, objectives, data, process design, and performance criteria are developed for the new system. Fulfills General Education "writing intensive course" requirements.			
ISYS	371	Advanced Database Design & Implementation	3
Emphasis is placed on Entity-Relationships and Relational models, data definition languages, and manipulation languages. Structured Query Language (SQL) is used to develop database objects such as databases, logs, tables, indexes, views, constraints, defaults, roles, rules, stored procedures, and triggers. Database design is reviewed. Application development and modeling tools are discussed. Projects requiring the development of integrated databases are assigned.			
ISYS	411	Project Management	3
An in-depth study of project management techniques currently employed for business and information systems projects. Typical areas will include project organization, planning administration control and leadership. The need for accurate estimating, scheduling, communicating and reporting will be stressed through the use of several cases/projects.			
ISYS	470	Database Administration	3
Advantages and requirements of client/server computing are discussed. Methodologies for designing, developing, maintaining and disseminating client/server systems are taught. Client/server applications, connectivity issues, software development tools, and database design and implementation methodologies are topics covered. Additional topics include database administration, transaction rollback and commit, data warehousing, data mining, and database security. Projects requiring the design of a distributed data processing network are required.			
ISYS	488	Systems Design & Implementation	3
Course includes object-oriented design and ISO9000 quality standards for software development. Methods of implementation, user manuals and responsibilities, and computer operations responsibilities are included with test schedules, staffing and auditing requirements. Students will design a system for an assigned project, which incorporates the techniques of good design, and includes the following: User Manual, Data Entry Manual, Operations Manual, Auditing Manual, Conversion and Implementation Schedule and Plan, Training Outlines.			
ISYS	489	Advanced Systems Design & Implementation	3
Students will code and implement the system designed in ISYS 488 Systems Analysis and Design Class. This is a team-oriented course designed to integrate systems analysis and design with programming. A computer application project is assigned to a student team for systems analysis, design, programming, and actual or simulated implementation. Students also learn about systems project management techniques, systems implementation, maintenance, operations and support.			
ISYS	491	Internship	3
		Directed Electives	12
Suggested directed electives by employment category include, but are by no means limited to: network administration; programmer/analyst; web development; consultant (individual); systems analyst; and computer support specialist. The 5 electives allow for maximum flexibility in designing a concentration to fit most student needs. A minimum of one internship for 3 credits is strongly recommended.			

The CIS curriculum was revised in 2004 after a thorough analysis of the existing curriculum and its relevance to the changing technology needs of the employment sector. The new CIS curriculum core was aligned to a nation standard (IS 2002) produced by the ACM, AITP, and AIS professional organizations.

- a. **As part of the graduation requirements of the current program, list directed electives and directed General Education courses. Provide the rationale for these selections.**

ECNS315-Network Theory & Test	ISYS304-Advanced Visual Basic	ISYS497-Independent Study
ECNS412-Real Time Operating Systems	ISYS307-Microsoft Network Administration	MGMT310-Small Business Management
ECOM200-World of E-Commerce	ISYS310-Novell Network Administration	MGMT410-Entrepreneurship & Planning
ISYS204-Introduction to Visual Basic	ISYS340-Advanced COBOL Programming	MGMT420-Small Business Consulting – SBI
ISYS220-Introduction to COBOL	ISYS350-Telecommunications	NMPP420-World Wide Web Publishing
ISYS265-Midrange Online Program Development	ISYS422-Network Security Management	NMPP450-Internet Server Administration
ISYS270-Fundamentals of Hardware & OS	ISYS490-Special Topics (1-3 cr)	
ISYS277-Linux Network Administration	ISYS491-Internship (1-9 credits)	Other electives from: ECOM, ISYS, MISM, NMPP, VISD

- b. **Indicate any hidden prerequisites (instances where, in order to take a program-required course, the student has to take an additional course. Do not include extra courses taken for remedial purposes).**

All College of Business students must complete ISYS105 (Introduction to Microcomputer Systems and Software) or demonstrate proficiency. ISYS105 is a prerequisite to ISYS110, ISYS200, and ISYS325.

2. **Has the program been significantly revised since the last review, and if so, how?**

The CIS curriculum was significantly revised in 2004 after a thorough analysis of the existing curriculum and its relevance to the changing technology needs of the employment sector. The new CIS curriculum core was aligned to a nation standard (IS 2002) produced by the ACM, AITP, and AIS professional organizations. A CIS core of 33 hours was created from skills and attributes listed in thousands of job advertisements for IS positions. Object oriented programming, networking, database management and administration and systems design and implementation were considered as the essential components of the CIS concentration in the re-engineered curriculum.

3. **Are there any curricular or program changes currently in the review process? If so, what are they?**

This APR cycle is the CIS program's first opportunity to gather feedback regarding the new curriculum. Because the curriculum is so new, most students surveyed are following older check sheets.

4. **Are there plans to revise the current program within the next three to five years? If so, what plans are envisioned and why?**

Curriculum evaluation is a on-going process for the CIS program. The CIS program has a standing committee constantly reviewing the IT environment, job-market, and seeking input from the CIS Advisory Board, faculty, employers, and alumni regarding what topics should be added to the curriculum or dropped from the curriculum.

G. QUALITY OF INSTRUCTION

1. **Discuss student and alumni perceptions of the quality of instruction.**
2. **Discuss advisory committee and employer perceptions of the quality of instruction.**
3. **What departmental and individual efforts have been made to improve the learning environment, add and use appropriate technology, train and increase the number of undergraduate and graduate assistants, etc.?**

Since 2002, all CIS courses that needed a hands-on environment for students were permanently placed in computer labs.

4. **Describe the types of professional development have faculty participated in, in efforts to enhance the learning environment (e.g. Writing Across the Curriculum; Center for Teaching and Learning, etc.).**

- CIS faculty have received merit awards, promotions, sabbatical leaves and recognition for academic service to the university.

- CIS faculty and the department head participated in workshops offered by the Ferris Center for Teaching and Learning including an introduction to brain-based learning.
 - Faculty have participated in a week-long seminar called "Working Connections" each summer to enhance their skills in their content area.
 - A faculty member became certified by Novell to use their instructional materials in the classroom.
 - A faculty member has presented papers at the Lily Conferences and at the Annual Midwest Instruction and Computing Symposium.
 - ISYS 330 fulfills General Education "writing intensive course" requirements.
 - The CIS department head, Jim Woolen, participated as a panelist during a 60-minute session on implementing the IS 2002 model curriculum at the 2004 Information Systems Education Conference (ISECON) in Providence.
 - One faculty member, who received a promotion to full professor this year, was asked to join the first *Faculty Learning Community* initiative.
 - Most CIS faculty utilize WebCT or other Web resources to enhance their classes to allow homework postings, test taking, email communications, chat sessions, and other academic related activities. One of our faculty, who extensively uses WebCT, has provided a measure of faculty development for this tool. Three tenure-track faculty took WebCT training as part of their first year, and employ it in their classes.
- 5. What efforts have been made to increase the interaction of students with faculty and peers? Include such items as developmental activities, seminars, workshops, guest lectures, special events, and student participation in the Honors Program Symposium.**
- Welcome Back Event

An event that will welcome all CIS students back and better inform new students about the reengineered curriculum and elective choices needs to be conducted each fall semester starting fall 2005. Funds will be needed to provide refreshments and possibly pay for a suitably large enough facility on campus. CIS faculty, the COB internship coordinator, the COB dean, and others will be invited to participate.

This event will serve as a "welcome to the program" for new students, and as an update for returning students. Any curriculum changes will be highlighted for returning students. While the event will provide information to the students, it should also be a lot of fun with good food and getting to know fellow students.
 - AITP

The student professional chapter of AITP has sponsored open forums with guest presenters on such topics as interviewing, the IT job industry, etc. They also sponsored many site visitations to IT facilities to gain an enhanced awareness of their chosen field. The department head takes members from the AITP student chapter to the monthly West Michigan AITP professional chapter meeting in Grand Rapids to network and to be exposed to a variety of relevant/current educational topics from guest presenters.
- 6. Discuss the extent to which current research and practice regarding inclusive pedagogy and curriculum infuse teaching and learning in this program.**
- 7. What effects have actions described in (5) and (6) had on the quality of teaching and learning in the program?**
- The experiences of students participating in these activities go beyond the classroom and provide "real world" exposure to their chosen field. Faculty traveling with the students have seen first hand how students have matured and grown with each field experience. Faculty have incorporated "lessons learned" and real world projects into the classroom.

H. COMPOSITION AND QUALITY OF FACULTY. Describe and assess the composition of the faculty teaching courses in the program.

1. List the names of all tenured and tenure-track faculty by rank.

a. Identify their rank and qualifications.

FACULTY MEMBER	RANK	YEARS IS/IT FIELD EXPERIENCE	HIGHEST DEGREE
Bandstra, Jim	Associate	2	MS Technology of Management
Buse, Amy	Associate	8	ABD in Computer Information Systems, MS in Computer Science
Daenzer, Ron	Assistant	15	MS in Computer Information Science & ABD
Hardman, Clyde	Associate	5	BS in Computer Information Systems, MBA
Hettiarachchy, Jay	Professor	2	M.S. Computer Information Science, Ph.D. History
Hewer, Richard	Associate	16	MBA
Hobart, Dale	Associate	16	JD
Huhtala, Jon	Assistant	12	BS in mathematics
Kosanovich, Carole	Professor	3 + many years of consulting for Michigan Department of Education	M.B.A., in Financial Management, B.S. in Accountancy, B.S. in Data Processing
Myntti, Warner	Associate	6	MS in Information Systems Management, MBA
Palmer, Hal	Associate	15	MA in History, ABD in Information Systems
Suhy, Andy	Associate	5	ABD in Management & Organizational Behavior; M.Ed.

b. Indicate the number of promotions or merit awards received by program faculty since the last program review.

Bandstra, James - Merit	Hettiarachchy, Jay – Associate Professor to Professor
Buse, Amy – Assistant to Associate Professor	Kosanovich, Carole - Merit
Hardman, Clyde - Merit	Myntti, Warner - Merit
	Palmer, Harold - Merit

c. Summarize the professional activities of program faculty since inception or the last program review (attendance at professional meetings, poster or platform presentations, responsibilities in professional organizations, etc.).

Faculty members in the CIS program are members of a variety of professional organizations and frequently attend or present at conferences sponsored by these organizations. Some of the organizations include:

- AITP (Association of Information Technology Professionals)
- MACUL (Michigan Association for Computer Users in Learning)
- ACM (Association for Computing Machinery)
- PDK (Phi Delta Kappa) – International association for professional educators

CIS program faculty also participate in and contribute to a number of special interest groups regarding specialized topics in information technology, such as IBM's midrange computer user's group, Microsoft .NET user's group, network user's groups, etc.

Nearly all faculty have attended workshops, seminars or professional meetings during the past several years. Several have made presentations at regional conferences. One faculty member was chosen to participate in the initial "class" of the Ferris Learning Community.

Faculty members have attended many classes and workshops including "Working Connections", Microsoft and Novell networking, and Microsoft .NET training.

2. Workload

- a. **What is the normal, annualized teaching load in the program or department? Indicate the basis of what determines a "normal" load. On a semester-by-semester basis, how many faculty have accepted an overload assignment?**

The normal annual teaching load in the program is 24 credits. During the past three years, only one faculty has accepted an overload assignment.

All CIS courses are 3 credit hours, so each instructor teaches 4 courses per semester. Workload rules state that each faculty should have no more than three (3) preparations per semester.

- b. **List the activities for which faculty receive release time.**

Faculty have received release time to develop on-line versions of existing courses (D. Hobart ¼ time), to support hardware systems for academic classes (J. Bandstra ¼ time), and to support the transition for a new department head (H. Palmer ½ time). Faculty have undertaken sabbaticals to enhance their skills and to acquire current knowledge in the field.

- c. **Faculty members in the CIS program currently receive release time as follows:**

Amy Buse teaches ½ time and works for the College of Business as Recruiting and Retention Coordinator ½ time.

In the past, a faculty member has received ¼ release time to manage an elaborate computer system, the IBM iSeries midrange computer. However, this faculty member now volunteers his time to manage the computer system.

3. Recruitment

- a. **What is the normal recruiting process for new faculty?**

During the past 3 years, no new faculty have been hired. The normal process is to create a faculty committee plus the department head, and select the best person who matches the needs of the vacant position.

- b. **What qualifications (academic and experiential) are typically required for new faculty?**

New faculty must have an earned doctorate and several years of in-field experience. An ABD will be acceptable, but there will be a contractual requirement to complete their degree before attaining tenure.

- c. **What are the program's diversity goals for both gender and race/ethnicity in the faculty?**

The CIS program would like to employ more minority and women faculty members. When recruiting new faculty, the department leadership met with Affirmative Action personnel to discuss ways to market job postings to minority and women candidates. The department followed all Affirmative Action guidelines in an attempt to attract minority and women to the CIS faculty.

- d. **Describe and assess the efforts being made to attain goals in (c).**

See Section 3.3.c

4. Orientation. Describe and assess the orientation process for new faculty.

The orientation process for new faculty follows the format prescribed by the office of Academic Affairs. New faculty participate in new faculty orientation week, and complete the A Yearlong Transition Program for New Faculty provided by Ferris State University.

5. Reward Structure: salary, professional development funds, travel funds, UCEL & FSUGR incentive money

- a. **Describe the reward structure in the program/department/college as it relates to program faculty. Indicate the type of reward and eligibility criteria.**

The CIS program receives funding from UCEL for off-campus and summer camp offerings. This funding is made available for faculty development opportunities.

- b. **Does the existing salary structure have an impact on the program's ability to recruit and retain quality faculty?**

The salaries for CIS faculty are in-line with the IT marketplace.

- c. **Is the reward structure currently in place adequate to support faculty productivity in teaching, research, and service? If not, what recommendations would you make to correct the situation.**

N/A

- d. **Is enhancing diversity and inclusion a component of the reward structure? Please explain.**

N/A

6. Graduate Instruction (if applicable)

N/A

7. Non-Tenure-Track and Adjunct Faculty.

- a. Please provide a list for the last academic year of full-time non-tenure-track and adjunct faculty who taught courses in the program. For full-time non-tenure track faculty, indicate the length of their appointments and the number of years of service at the University. Comment on the program's ability to retain non-tenure-track faculty.**

For academic year 2004-2005, only four adjuncts were used to teach CIS courses: Laurel Nicol, John Herrick, Martin Bagaya, and Trudy Borst. Ms. Borst was the only person on full-time adjunct status and for only the fall 2004 semester. Borst, Herrick and Nicol have been CIS adjuncts for Ferris for several years. Up to this point, there has been no problem in retaining adjunct faculty for the CIS program; however, the decline in enrollment has eliminated most of the need for adjuncts at this time.

- b. What percentage of program courses is taught by the faculty in (a)? What courses are they teaching? Please comment.**

Of the 103 sections taught during F04 and W05, only 6 were taught by these adjuncts. Three of these adjuncts taught off-campus courses: Laurel Nicol, ISYS 130, Newyago ISD; John Herrick, ISYS 204, Newyago ISD; Martin Bagaya, ISYS 470, off-campus at the Muskegon CC Ferris site. Trudy Borst taught 3 sections of ISYS 105 for F04.

- c. Describe the required qualifications (academic and experiential) for faculty listed in (a). Indicate if all faculty have met the criteria, and if not, what is being done to resolve the situation?**

All adjunct faculty are required to hold a master's degree in the field. All adjunct faculty used in academic year 2004-2005 met the criteria.

- d. Does the program consider the current use of non-tenure-track faculty to be appropriate? Why or why not?**

Yes. Since the level of adjunct use was less than 1% of all sections for 2004-2005, it more than meets accrediting requirements and keeps the program integrity at a high level.

- e. If the program is accredited, what position if any does the accrediting body have regarding the use of non-tenured and adjunct faculty?**

N/A

I. SERVICE TO NON-MAJORS. Describe and assess the impact that delivery of service courses offered by the program or the department has on the program.

- a. Identify and describe the General Education service courses provided by the program faculty for other departments at FSU.**

Over 70% of SCH production by the CIS faculty is for service courses to non-majors.

The CIS program is discussing the possibility of adding a "Computer Literacy" course to the General Education requirements for all Ferris students.

According to a recent survey by the American Society of Employers, computer skills are ranked among the top three skills required by employers across the nation. Computer skills ranked third after internship/work experience (#1) and related course work (#2). Universities across Michigan and the nation require a course in basic computer skills (productivity suite), or require demonstrated competency.

Studies have been undertaken to determine the level of competency of incoming Ferris students regarding basic computer skills. The initial findings indicate a strong need for such a Gen. Ed. Requirement.

- b. Identify and describe any non-General Education service courses or courses required for other programs. Comment on your interaction with the departments or programs for which the courses are provided.**

The CIS program provides service to many units on campus. For Fall 2004, 70% of the total student credit hours taught by CIS faculty were for non-majors. Customized versions of specific courses were created for other non-COB departments to meet their needs. The course selections provided for the CoE&HS were revised to reflect current needs.

c. Discuss the impact of the provision of General Education and non-General Education courses has on the program.

The service load for CIS provides opportunities for supporting computing needs in other disciplines and will lead to collaboration for cross-disciplinary degrees.

The General Education requirements have caused our number of transfer students to decrease.

d. Does the program plan to increase, decrease, or keep constant its level of service courses? Explain.

The CIS program plans to recommend Computer Literacy Requirements for ALL students. According to a recent survey by the American Society of Employers, computer skills are ranked among the top three skills required by employers across the nation. Computer skills ranked third after internship/work experience (#1) and related course work (#2). Universities across Michigan and the nation require a course in basic computer skills (productivity suite), or require demonstrated competency.

The service course, ISYS 105, teaches these skills using Microsoft Office suite products (Excel, Word, and PowerPoint), basic Internet usage, and basic file manipulation.

During the past two years of College of Business ISYS 105 orientation testing, the average score was 46 each year. In 2004, only 12% passed with a 70 or better. This 22-minute exam is used as a gateway for COB students to take ISYS 105.

Item analysis of the orientation test shows that certain basic questions were still missed by the majority of students.

J. DEGREE PROGRAM COST AND PRODUCTIVITY DATA.

a. Productivity Data - SCH, FTEF, and SCH/FTEF

	SCH	FTEF	SCH/FTEF
2000-2001	12399	28.16	440.37
2001-2002	12115	27.55	439.71
2002-2003	9382	22.29	420.89
2003-2004	7715	15.27	505.17

The number of SCH produced has decreased over the years since the last APR, but the number of FTEF has decreased at greater rate. Therefore, the overall productivity of CIS program faculty has increased from 440 to 505.

b. Program Cost Data

The Total Cost per SCH of the CIS program was \$193.08. The CIS program is ranked in the lower 50 percentile of programs at Ferris based on the Total Cost per SCH Ranked High to Low. Please Refer to Appendix E for more information.

K. ASSESSMENT AND EVALUATION. Describe and evaluate the program's assessment mechanisms.

1. List and describe what variables are tracked and why when assessing the effectiveness of the program (e.g. mastery of essentials of subject area, graduation rates, employment rates, pass rates on professional exams).

Starting in the fall 2005 semester, the department is proposing to utilize a direct assessment instrument from the Center for Computing Education Research (CCER) that will measure the CIS core outcomes. This test will be administered to all CIS seniors in the capstone courses.

Even with a poor economy in Michigan, the employment rate for CIS graduates has held steady at 98% since the last academic program review. Part of the reason for this high rate of employment even under a nation-wide decrease in students entering the computer field is that we have fewer students in the program competing for jobs.

According to data provided by Dr Bill Potter at a meeting in 2005, 52% of the 42 students who entered in the fall of 2000 completed their degree. Pre- and Post testing are now used for all section of ISYS 105 to determine if outcomes were achieved and the level of improvement.

Indirect assessment is realized in the double-paced CIS capstone courses (ISYS 488/489) when students have to apply a large body of knowledge to solve a complex problem for actual customers. Student teams have to apply skills learned in programming, project management,

oral and written communications, database design, Internet applications design, and many other skill areas learned throughout their CIS courses. The projects designed and developed by students require that they use the following skills:

Application Development

- Programming-principles, objects, algorithms, modules, testing
- Application development – requirements, spec's, development
- Algorithmic design, data, object, and file structures
- Client-server software development

Internet Systems Architecture and Development

- Web page development
- Web architecture design and development
- Design and development of multi-tiered architectures

Database Design and Administration

- Modeling and design, construction, schema tools, and DB Systems
- Triggers, stored procedures, design and development of audit controls
- Administration: security, safety, backup, repairs, and replicating

Systems Infrastructure and Integration

- Computer systems hardware
- Networking (LAN/WAN) and telecommunications
- LAN/WAN design and management
- Systems software
- Operating systems management
- Systems configuration, operation, and administration

Systems Analysis and Design, Business Process Design, Systems Implementation, IS Project Management

- Strategic utilization of information technology and systems
- IS planning
- IT and organizational systems
- Systems analysis
- Logical and physical design
- Design execution
- Testing
- Deployment
- Maintenance
- Use of IT
- Customer service

Program assessment also includes the periodic Academic Program Review where data is collected from alumni, students, employers, and the advisory board.

Additional direct program assessment is provided from the CIS Advisory Board members through their participation in curriculum assessment, program relevancy, and other program issues. Input from the CIS Advisory Board has been used to make sure the program is relevant and current to the market needs for specific skills.

For fall 2005 semester, the department is proposing to utilize a direct assessment instrument from the Center for Computing Education Research (CCER) that will measure the CIS core outcomes. This test will be administered to all CIS seniors in the capstone courses.

2. Provide trend data for the variables listed in (1). Compare the data to accreditation benchmark standards if applicable, or provide some other type of assessment of the data.

While we do not have a direct measurement in place at this time for the program, indirect assessment is realized in the double-paced CIS capstone courses (ISYS 488/489) when students have to apply a large body of knowledge to solve a complex problem for actual customers. Student teams have to apply skills learned in programming, project management, oral and written communications, database design, Internet applications design, and many other skill areas learned throughout their CIS courses.

Program assessment also includes the periodic Academic Program Review where data is collected from alumni, students, employers, and the advisory board. Additional direct program assessment is provided from the CIS Advisory Board members through their participation in curriculum assessment, program relevancy, and other program issues.

Computer Information Systems

APRC 2005-2006

section 2 of 2

During the fall 2004 semester, ISYS 105 pre- and post-testing data showed that the average improvement in score was 45 points. The maximum improvement was 97 and the minimum improvement was 11 points.

The College of Business has completed a multi-year pilot study regarding Education Testing Services (ETS) Major Field Tests. This assessment has been given to all COB majors during their final semester to test their understanding and comprehension of the Business core.

The AACSB/EBI Student Satisfaction Project was conducted for several semesters to discover the what are the variables that most affect student perceptions about the quality of their educational experience?

3. **Describe how the trend data in (2) is used to assess the rigor, breadth, and currency of the degree requirements and curriculum.**

N/A

4. **Describe how the trend data in (2) is used to assess the extent to which program goals are being met.**

N/A

L. ADMINISTRATION EFFECTIVENESS

1. **Discuss the adequacy of administrative and clerical support for the program.**

Based on responses from the Faculty Perceptions Study, faculty seem to want more face-to-face involvement with program and college administration. The faculty sincerely wish to provide excellent educational opportunities for CIS students. The CIS faculty strive to engage in ongoing professional development to improve their technical skill sets, which in the IT field is a constant process. More interaction among faculty, program, and college administrators should take place to discuss concerns regarding professional development opportunities and support. When possible, the CIS program would like to hire new faculty with excellent technical and pedagogical skills.

As stated in the Faculty Perceptions Study,

"The CIS faculty listed as strengths of the program the following; the departmental secretary and certain elements of the curriculum."

(As of August 19th the department secretary has been promoted and moved to another college.)

"It appears that most of the CIS faculty lack of confidence in the COB leadership.

They felt that present leadership is aloof, non-communicative, not faculty centered, that they do not lead and have become too autocratic, leading to a lack of respect between the faculty and administration."

(Read full text in Faculty Perceptions Study, Section 2.E)

The Faculty Perceptions Study was conducted immediately following the College of Business reorganization during the Spring of 2005, which may have influenced the faculty perceptions.

"The faculty also identified problems with departmental leadership. Most faculty felt that professional development was not encouraged. It is paramount that faculty within the discipline maintain current technological knowledge in order to bring the newest techniques to the classroom. Faculty felt that they were required to develop their new courses with little support from the administration."

(Read full text in Faculty Perceptions Study, Section 2.E)

"Before becoming interested in ACBSP accreditation, development activities were encouraged. Since these types of activities are stressed as a major component of accreditation by ACBSP, it seems logical that faculty development opportunities should be made easier by the administrators within the college."

In general, the faculty would like the College of Business and department leadership to be more faculty centered and inclusive.

2. **Are the program and/or department run in an efficient manner? Please explain.**

See above

3. **Are class and teaching schedules effectively and efficiently prepared? Please comment.**

No positive or negative remarks were made concerning class or teaching schedules.

4. *Are students able to take the courses they need in a timely manner? Please comment.*

Due to the decreased number of CIS majors, some higher level courses either are not offered each semester or are offered with low enrollment. Some courses with low enrollment do not provide students with many options for teamwork and group interaction. Also, the opportunity to experience diversity in the student population is diminished.

A. INSTRUCTIONAL ENVIRONMENT**1. Are current classrooms, labs, and technology (both on-campus and at off-site locations) adequate? Explain.**

The CIS faculty dedicate a great deal of their time to working with the resources that are needed to make the CIS program function. For example, most of the server machines needed to run the program are being supported by the faculty member that needs the server for their classes. (The IBM iSeries (AS/400) is solely support by Prof. James Bandstra. At one time he received one-quarter release time for this assignment. However, he has voluntarily given up the release time so FSU administration would continue to support the iSeries with upgrades and new leases for the system.) Other servers are supported by individual faculty members with no time allocated or recompense given for the support activities. Database and Internet servers have been supported by graduate assistants hired by College of Business Graduate Programs. Although the graduate assistants try to be as helpful as possible, their work hours are limited, so they are not always available when assistance is needed by the CIS faculty member.

As the program has evolved most computer classes required by CIS majors are conducted in a computer lab classroom environments, specifically rooms BUS116 and BUS118. Thus, faculty members are able to interact with students as the students work in the hands-on environment. As a result, problems have been identified in getting any of the workstation computers serviced during the week because the classroom labs are now used from 8:00am-9:00pm daily. (except Friday after 3pm) Most classes are full and we need all machines working daily.

The networking labs (rooms BUS120 and BUS126) have very slow "hand-me-down" computers that slow down the student lab work. For example, in the Microsoft server 2003 class the machines take about 5 minutes just to reboot.

Due to the fast pace of change within the computer industry, the adequacy of technology is always an issue. The CIS faculty and administrators must continually update the CIS curriculum and technology resources needed to support new frontiers in the IT field. Very limited resources slow the CIS program's advancement into the state-of-the-art of technology.

All in all, the basic resources are adequate but more support and flexibility is needed for the CIS program to evolve.

2. How does the condition of current facilities impact program delivery? Explain.

Any time servers are unavailable or computer workstations fail the delivery of the program courses is compromised and students are directly affected. If faculty discovers that necessary hardware or software does not work properly, the students become frustrated and lose confidence in the instructor's ability. The instructor ends up losing valuable time for instruction trying to work out the problems. In most cases the time lost is limited to one period, however, hardware/software failures due to hacker attacks, misapplied operating system patches, and incorrect firewall specifications have caused off-campus students to lose an entire week of instruction and access to necessary resources.

3. Describe the program's projected needs with respect to instructional facilities.

Some of the CIS program needs are listed below.

- Continued support for the iSeries server and upgrades of as needed
- More powerful Web server hardware and software
- Adequate support of Microsoft's .Net platform
- Adequate computers for faculty offices
- Support for high-end development platform consistent with what is used in business and industry
- A new networking classroom that includes the following:
 - CIS program subnet
 - Upgraded servers
 - New workstation computer and printer.

- Support for lab hardware
This lab has always worked with slow, inadequate "hand-me-down" computers from other labs. Lab computers have been support entirely by the CIS faculty.
- Wireless facilities are needed for student use.

4. Describe current plans for facilities improvements and indicate their status.

We have made proposals for a new Networking lab. The reasons given for not enhancing the current lab configuration include lack of funds.

A few CIS faculty are getting new office computers.

Ferris State University provided resources for a new upgrade for the IBM iSeries mid-range computer. However, support for the machine's hardware and software are made available from a CIS faculty member volunteering his time.

5. Describe how proposed changes or improvements to facilities would enhance program delivery.

The new networking lab would allow classroom capacity to increase from 18 to 24 seats.

The new lab would allow the flexibility to isolate the class lab from the campus network, which is highly restricted. This isolation is needed for the Networking security class.

New computers in the networking lab would speed up the lab work giving opportunity for more class instruction. Also, this lab would be a real show piece for recruiting new students.

Most CIS faculty need state-of-the-art computers for testing out the latest software trends. For example, Microsoft's .Net platform requires higher end machines.

The iSeries is a midrange system that gives the CIS program the ability to expose students to the high-end processing tools that medium to large companies are using in industry. Most of our students end up in companies that have a mix of Mainframe, Midrange, and microcomputers all networked together within their environment.

B. COMPUTER ACCESS AND AVAILABILITY

1. Outside of computers in faculty and staff offices, identify the computing resources (hardware and software) that are allocated to the program.

Hardware:

- | | |
|---|--|
| ● iSeries (AS/400) Server | ● Linux Server for ISYS277 |
| ● Classroom of 9 workstation with removable hard drives | ● Additional removable hard drives to service our ISYS305 & ISYS325 classes. |
| ● One Main Novell Server | ● Microsoft Server 2003 to service our .Net platform for ISYS204 & ISYS304 .NET VB classes |
| ● Three Novell servers for students for ISYS310 | |
| ● Microsoft Server 2003 for ISYS307 | |

Software:

- | | |
|--|--|
| ● MVS Mainframe | ● Visual Studio.NET |
| ● Mainframe COBOL | ● Visual Basic.NET |
| ● OS/400 and all iSeries software tools (Cobol, RPG, Java, Websphere, DB/2, SQL, etc.) | ● Visual Logic |
| ● Novell 6.5 | ● MS SQL Server |
| ● Microsoft Server 2003 | ● Oracle MS |
| ● Windows XP | ● MS Project |
| ● Linux | ● Visio 2003 |
| ● Novell Client 4.9.1 | ● Norton Antivirus |
| ● Microsoft Office Suite 2003 | ● Prentiss/Hall testing software for ISYS105 |
| Word, Excel, PowerPoint, Access | ● ASP/ASP.NET |
| | ● PHP |

2. Discuss how these resources are used.

All the above resources are used in various CIS classes for teaching students the needed skills for the working environment.

In addition, the Microsoft Office Suite 2003 software is used by most students for reports and presentations.

Every class taught within the department uses software and hardware resources listed above to meet learning outcomes for the courses.

3. Discuss the adequacy of these resources and identify needed additional resources.

Please refer to Section 4 A.3.

4. Does an acquisition plan to address these needs currently exist? Describe the plan. Has it been included in the department or college's planning documents?

Please refer to Section 4 A.4

5. Discuss the efficacy of online services (including WebCT) available to the program.

Most faculty use either WebCT or MYFSU for online support to get various materials, instruction, links to resources, and quizzes and tests to students. There is always room for improvement with these tools, but the institution seems to be doing a good job of continuing opportunities for faculty to use online resources.

6. Discuss the adequacy of computer support, including the support for on-line instruction if applicable.

The computer labs and faculty office computers are well supported by the ATS support group. Inadequate support exists for the various program servers and the CIS networking labs. These are supported solely by the CIS faculty. Although CIS faculty need complete control over these servers and the networking lab additional support resources must be available. If graduate assistants could be hired to manage these resources, CIS faculty could concentrate on teaching, learning, and recruiting.

C. OTHER INSTRUCTIONAL TECHNOLOGY

1. Identify other types of instructional technology resources that are allocated or available to the program.

Other resources would include the multimedia equipment and software that is available in the College of Business multimedia lab. (Scanners, cameras, color printer, multimedia software, etc.)

2. Discuss how these resources are used.

Most of these resources are used by students and faculty for preparing for classes room presentation.

3. Discuss the adequacy of these resources and identify needed additional resources.

These resources appear to be adequate at this time.

4. Does an acquisition plan to address these needs currently exist? Describe the plan.

N/A

5. Has it been included in the department or college's planning documents?

N/A

6. Discuss the impact of adequacy of other types of instructional technology resources and support of these resources on the program.

N/A

D. LIBRARY RESOURCES

1. Discuss the adequacy of the print and electronic and other resources available through FLITE for the program.

Due to the rapid changes in technology, books become out of date quickly. Periodicals are more helpful to CIS majors. Only a few of the information technology periodicals are of value for most students and the Library. Professional journals are of lesser value to our students. The general business references have proven to be adequate. What is most beneficial is access to the Internet.

2. Discuss the service and instruction availability provided by the Library faculty and staff with respect to the needs of the program.

The staff of FLITE has been supportive. The program does not make very much use of the services and instruction by the Library personnel. We have used the facilities at FLITE for special presentations by our graduating students. Also, the staff of FLITE has provided instruction concerning the resources available through FLITE to our off-campus students.

3. Discuss the impact of the budget allocation provided by FLITE to your program. Is the budget allocation adequate? Explain.

Although any program could use more library funds spent on materials, access to the Internet via machines in the library has been helpful to many students. Students doing group projects have the option of working in the library and often do. More microcomputers with Internet access and Microsoft Office application software installed would be welcome by all students at Ferris.

A. RELATIONSHIP TO FSU MISSION

Ferris State University's mission statement is

"Ferris State University will be a national leader in providing opportunities for innovative teaching and learning in career-oriented, technological and professional education."

The CIS program has prided itself on following the stated mission. Recently, the CIS faculty established revised goals and adopted a new curriculum that follows the IS 2002 standards. The revisions of program goals and curriculum were necessitated by changing needs in the Information Technology field.

The new curriculum still provides for building strong technological, business and professional skills, but now is aligned with National Standards. The new curriculum also provides more flexibility for CIS students by allowing them to customize their programs with the selection of 15 electives. Three (3) credit hours of the 15 should be used to provide the student with an internship opportunity.

The goals of the CIS program are to provide a solid foundation in:

- Analytical and critical thinking skills
- Business fundamentals
- Interpersonal, communication and team skills
- Technology
- Information systems and technology-enabled business development

B. PROGRAM VISIBILITY AND DISTINCTIVENESS

The CIS program has several unique features and components including a strong advisory Board, an internship for all CIS students, "hands-on" instruction using experiential learning methodology, and an intense integrated framework for application design and implementation.

Although enrollment has declined in the CIS program at Ferris State University, the program continues to attract quality students. Admission standards have been raised and the CIS program had more majors participating in the University Honors program than any other COB program in academic year 2003-2004.

All CIS programs have suffered a similar significant enrollment decline during the national down-turn. Some believe this is due to 9/11, the dot.com bust, and the overall malaise of the national economy.

C. PROGRAM VALUE

The faculty of the CIS program in the COB believes that the CIS program is valuable to Ferris State University, the state and society. All efforts should be made to maintain the program in our rapidly changing technologically oriented society.

Some of the positive elements suggested by the CIS faculty in dealing with the business core include suggestions that the business core curriculum become more focused on the importance of the integration of business disciplines. The ISYS 321 class was designed for the College of Business core to illustrate the importance of information integration for decision making within the environment of business applications

The CIS faculty perceives the preparation of students to be adequate, but that the program needs to continue to evolve. In order to accomplish this task, the curriculum will need to be continuously modified and faculty must be exposed to the current trends in technological advancement. Faculty should be given more opportunity to engage in content oriented professional development.

The CIS faculty felt that the advising process within the program should be improved. Steps have already been taken to require students to meet with their advisor once a year to ensure that they are following the correct curricular path. Because of the continuous change within the information systems discipline, it is rare for the CIS curriculum to remain unchanged from one year to the next. Hence, students are often faced with the dilemma of needing a course that will not be offered because of low enrollment.

The CIS program is valuable, not only to students but to the larger community of IT professionals. Members of the faculty and administrators belong to a variety of professional organizations. Faculty and administrators participate in professional conferences and workshops. CIS faculty and administrators provide services to schools and community organizations including presentations to civic organizations, SIGs, high school, career/tech and community college students. The CIS department conducts a summer computer camp for high school students which has been successful. In the past the CIS department hosted K-12 teachers in summer technology training sessions. The CIS program should recreate and offer a summer academy for K-12 teachers to provide computing skills that can help in their recertification process.

The benefits of these types of outreach programs included improved awareness of Ferris State University's CIS program, enhanced image of Ferris State University's CIS program.

D. ENROLLMENT

For Fall 2005, enrollment is approximately 118 students on campus plus 45 off-campus for a total of 163. The current capacity of the program is estimated to be 180 students given the number of computer labs and workstations available for CIS majors.

Incorrect public perceptions that most IS jobs are being outsourced, the impact of the "dot com" implosion, and the demise of Y2K outrageous salaries have all adversely affected enrollments in all IS programs (Ferris, state, regional, and national). Our CIS program continues to suffer from declining enrollments. The current enrollment and SCH numbers are less than half what they were in 2000. This decline in enrollment is indicative of a nationwide trend in CIS programs.

Although the number of applications has decreased, a high percentage of students who apply to the program are subsequently enrolled.

Almost all positions of faculty members who have left the department have been eliminated. When the CIS program has had the charge of replacing a faculty member the task of attracting and hiring qualified faculty members is difficult. The pool of potential faculty members who have current work experience in the discipline as well as a Ph.D. is small. This fact has burdened the remaining faculty with the requirement that they cover all areas of the curriculum in addition to trying to stay abreast of current trends within the discipline.

E. CHARACTERISTICS, QUALITY AND EMPLOYABILITY OF STUDENTS

The typical CIS student is a white male, approximately 24 years old. The percentage and number of female students has decreased dramatically over the last 4 years. The ethnic diversity of CIS students has remained relatively constant over the past for years.

Most CIS majors are from the state of Michigan. More students are electing to attend school part-time than in the past and the numbers of off-campus students are increasing. Our advising of off-campus students is excellent.

CIS majors are typically good students. The average GPA for a CIS major is 2.985 and the average ACT score is 20.9. The average GPA for a CIS graduate is 3.254 and the average ACT score is 20.3. Most successful CIS graduates are diligent in their work ethic.

Fifty-five percent (55%) of the May 2004 CIS graduates received academic honors. CIS majors receive scholarships and College of Business Excellence Awards. Ferris State's student chapter of the Association of Information Technology Professionals (AITP) competed for the first time at the 2004 AITP National Collegiate Conference (NCC) and placed 4th of 55 in the Network Design Contest. During the 2004 NCC, 3 Ferris students attending took and passed the nationally-recognized Associate Computer Professional (ACP) exam from the Institute for Certification of Computer Professionals (ICCP).

A placement rate of ninety-four percent (94%) is reported by CIS graduates. A starting salary of \$41,005 is reported by CIS graduates as compared with average starting salaries for IT professionals in the range from \$27,500 to \$47,000.

F. QUALITY OF CURRICULUM AND INSTRUCTION

The CIS curriculum was significantly revised in 2004 after a thorough analysis of the existing curriculum and its relevance to the changing technology needs of the employment sector. The new CIS curriculum core was aligned to a nation standard (IS 2002) produced by the ACM, AITP, and AIS professional organizations.

A CIS core of 33 hours was created from skills and attributes listed in thousands of job advertisements for IS positions. Object oriented programming, networking, database management and administration and systems design and implementation were considered as the essential components of the CIS concentration in the re-engineered curriculum.

This APR cycle is the CIS program's first opportunity to gather feedback regarding the new curriculum. Because the curriculum is so new, most students surveyed are following older check sheets.

Curriculum evaluation is a on-going process for the CIS program. The CIS program has a standing committee constantly reviewing the IT environment, job-market, and seeking input from the CIS Advisory Board, faculty, employers, and alumni regarding what topics should be added to the curriculum or dropped from the curriculum.

CIS faculty are constantly striving to improve the quality of the educational experience for each CIS student. The faculty work to improve instructional facilities including classroom and lab space, hardware, and software. Faculty work to improve their body of knowledge by all professional development opportunities at their disposal including self-study, university-sponsored classes and workshops, graduate courses, sabbatical leave opportunities, workshops sponsored by professional organizations and special interest groups (SIGS). Improved advising is a goal of the CIS program. Students need advising on curriculum matters, but they also need advice concerning the IT field. The CIS program will implement a "Welcome Back" advising session Fall semester 2005. The student AITP chapter is strongly encouraged to schedule guest speakers from the IT industry to advise students concerning relevant information technology topics.

G. COMPOSITION AND QUALITY OF THE FACULTY

The CIS program has twelve (12) faculty members. One faculty member serves as the College of Business Recruiting and Retention Coordinator one-half time, so the CIS program has 11.5 FTE faculty members.

Although the curriculum was revised recently to meet evolving needs in the IT marketplace and to align with national standards, the faculty perceive that the program needs to continue to evolve. In order to accomplish this task, the curriculum will need to be continuously modified and faculty must be exposed to the current trends in technological advancement.

Faculty must be given more opportunity to engage in content oriented professional development, in addition to the pedagogical development opportunities that exist.

New faculty must be hired to replace faculty members as they leave Ferris. The new faculty members must be well-versed in new methodologies, pedagogies, and technological advancements in the IT field.

**COMPUTER INFORMATION SYSTEM
ACADEMIC PROGRAM REVIEW
EVALUATION OF FACILITIES AND EQUIPMENT**

Question #1: What equipment used by CIS major is under your control? List

- IBM iSeries (AS400)
- Novell Server for ISYS 310, several hard drives, several hubs, a switch, Linux servers, and 3 additional Novell servers for ISYS 310 for students to install and use.
- Microsoft Windows 2003 for ISYS307
- Office computer, printer, classroom and lab teacher workstations
- COBNT1 for Oracle and student files
- COBNT3 for SQL Server and ASP.NET.

Question #2: What software used by CIS majors do you control?

- OS/400 and all software supplied by IBM on the iSeries.
- Netware 6.5
- Visio 2003
- Antivirus
- Linux
- Novell Client 4.9.1
- Windows XP
- Office 2003
- PHIT / ISYS 105 Office testing software
- VisualBasic.NET
- Visual Logic
- Windows Web server
- MS SQL Server
- Oracle MS
- Visual Studio.NET
- MS Project
- Visio
- Various operating systems.
- Microsoft 2003 Server Software

Question #3: Describe problems associated with the hardware and software used by CIS majors.

- None on the iSeries, but other servers are not as reliable as the iSeries. It takes a lot of time to get the equipment working and to set-up the labs and make sure the equipment and software runs.
- The CIS program needs web server(s) that run PHP, MySQL, Microsoft's .NET framework, Microsoft's IIS, SQL Server, Oracle. These server(s) should be maintained a service.
- The CIS faculty and students experience problems with Internet connections through the labs and availability of software in other labs across campus and off-campus.
- The CIS faculty and students have experienced problems connecting to web server(s) with Visual Studio.NET.
- The CIS faculty and students have experienced problems connecting to SQL Server.
- For ISYS 488 and ISYS 489 platform and development software and client software is a problem. SW/HW requirements are not standardized by the CIS program. Some faculty use ASP/ASP.NET, Visual Basic, SQL Server, and Notepad, while other faculty use other software configurations.
- Current server is slow and some workstation hard drives are very slow

Question #4: What, in your estimation, are the future needs of hardware and software for the CIS program?

- Continued support for the iSeries and upgrades of microcomputers in faculty offices and labs.
- A private subnet for CIS majors which requires a switch/router, a new networking classroom, new computers for the students, and new printers.
- Computers with USB connection and computers with a CD burner.
- Load the complete .NET application, not just parts of it.
- WI-FI for students and classrooms for notebooks.
- Need a bigger web server box. We need debug mode for Web page ASP.NET.
- CIS program needs high-end development platform consistent with what is used in business and industry. I have used HW/SW supported by graduate programs and graduate assistants. I believe supporting another platform in-house by CIS faculty is burdensome.
- Wireless network facility
- Software to control stations in the lab.
- Upgrade the network lab!

Question #5: What maintenance arrangements does the University have for computer hardware and software?

- On the iSeries, the first year of hardware support is free. We have an agreement of support on an hourly basis.
- Three years on-site for hardware from Dell.
- Novell software support is through a site license.
- Microsoft support is through a site license.
- CIS has a Microsoft Development Network (MSDN) license for other Microsoft products.
- Antivirus protections is through a site license.
- Rent service for Web service (24 hour access).
- No direct support for Windows 2003 hardware or software. Dependent on master program for some needed hardware.
- None for Microsoft server!

Question #6: What budget concerns do you have which involve computer hardware and software for the CIS program?

- Continued funding for the iSeries.
- We don't have a budget that lets us be able to plan, we are always planning.
- Web service, PHP need, My SQL, Java Server Pages, J2EE, need a wireless router.
- No support for equipment and support of that equipment.
- Question 3 and Question 4 above, my office computer is obsolete and is slated to be replaced soon.
- See Question #4.
- Never enough money.
- Main problem is the lack of support to improve the network lab

Question #7: Other comments and concerns for now or the future?

- I feel that others should share interest in using the iSeries in classes. I am not willing to cram it down people's throat.
- Training needs are constant. Our field changes daily and we need to know we can go training.
- Need to create a new product for CIS for: Webmaster, DBA, and Web System Designer
- Support, Support, Support
- More leadership needs to take place to establish real direction that the CIS program needs to take.
- The CIS program lacks real recruiting and retention ideas to bring new student to campus. Need to identify a Niche of what we do best and identify resources needed to best meet this Niche.

**Computer Information System Program Review
Student Evaluation Survey**

Spring 2005

0-N/A, 1-strongly agree, 2-disagree, 3-neutral, 4-agree, 5-strongly agree

Section I: This section is about the quality of teaching within the CIS department.

1. The CIS faculty are helpful when students have difficulty.

1's	3	Freshman	4.25
2's	7	Sophomore	4.09
3's	7	Junior	3.33
4's	23	Senior	3.38
5's	12		
N/A's	1		
Total			
Answered	53		
Mean	3.58		
Median	4		
Mode	4		

2. The CIS faculty treat students with respect.

1's	1	Freshman	4.25
2's	5	Sophomore	4.45
3's	7	Junior	3.50
4's	26	Senior	3.58
5's	13		
N/A's	1		
Total			
Answered	53		
Mean	3.79		
Median	4		
Mode	4		

3. The CIS faculty are fair and impartial in their dealings with the students.

1's	1	Freshman	4.50
2's	3	Sophomore	3.91
3's	14	Junior	3.08
4's	23	Senior	3.77
5's	11		
N/A's	1		
Total			
Answered	53		
Mean	3.70		
Median	4		
Mode	4		

4. The CIS faculty make the students feel free to ask questions, disagree, express ideas, etc.

1's	2	Freshman	4.75
2's	5	Sophomore	4.18
3's	9	Junior	3.50
4's	19	Senior	3.58
5's	17		
N/A's	1		
Total			
Answered	53		
Mean	3.77		
Median	4		
Mode	4		

5. The CIS faculty exhibit enthusiasm for the subject.

1's	1	Freshman	4.50
2's	4	Sophomore	4.18
3's	9	Junior	3.73
4's	27	Senior	3.62
5's	11		
N/A's	0		
Total			
Answered	52		
Mean	3.83		
Median	4		
Mode	4		

6. The CIS faculty are knowledgeable about the material they teach.

1's	6	Freshman	4.75
2's	6	Sophomore	3.45
3's	7	Junior	3.42
4's	24	Senior	3.35
5's	10		
N/A's	0		
Total			
Answered	53		
Mean	3.49		
Median	4		
Mode	4		

7. The CIS faculty clarify the objectives of the course.

1's	1	Freshman	4.75
2's	4	Sophomore	3.73
3's	12	Junior	3.58
4's	28	Senior	3.62
5's	8		
N/A's	0		
Total			
Answered	53		
Mean	3.72		
Median	4		
Mode	4		

8. The CIS faculty are capable of teaching the material.

1's	1	Freshman	4.75
2's	9	Sophomore	3.64
3's	13	Junior	3.25
4's	20	Senior	3.46
5's	10		
N/A's	0		
Total			
Answered	53		
Mean	3.55		
Median	4		
Mode	4		

Section II: This section is about the CIS program as a whole.

9. The expectations for the level of performance are consistent among the classes within the CIS department.

1's	2	Freshman	4.25
2's	10	Sophomore	3.18
3's	13	Junior	3.42
4's	22	Senior	3.17
5's	4		
N/A's	0		
Total			
Answered	51		
Mean	3.31		
Median	4		
Mode	4		

10. I believe that the CIS curriculum will/has prepare me for a job.

1's	7	Freshman	4.25
2's	6	Sophomore	3.45
3's	17	Junior	3.08
4's	16	Senior	2.96
5's	7		
N/A's	0		
Total			
Answered	53		
Mean	3.19		
Median	3		
Mode	3		

11. I believe that an internship during my studies is a valuable experience and should be required of all students.

1's	2	Freshman	3.25
2's	3	Sophomore	3.73
3's	11	Junior	3.33
4's	16	Senior	3.31
5's	15		
N/A's	6		
Total			
Answered	53		
Mean	3.40		
Median	4		
Mode	4		

12. I have participated in the internship program during my studies at Ferris.

1's	9	Freshman	0.75
2's	5	Sophomore	1.55
3's	6	Junior	0.42
4's	5	Senior	1.81
5's	3		
N/A's	25		
Total			
Answered	53		
Mean	1.36		
Median	1		
Mode	0		

13. The CIS program has challenged me to think in new ways and think like a CIS professional.

1's	6	Freshman	4.00
2's	11	Sophomore	3.00
3's	16	Junior	2.75
4's	16	Senior	3.00
5's	4		
N/A's	0		
Total			
Answered	53		
Mean	3.02		
Median	3		
Mode	4		

14. I know who my CIS advisor is.

1's	2	Freshman	3.75
2's	3	Sophomore	4.00
3's	3	Junior	3.50
4's	18	Senior	3.81
5's	21		
N/A's	5		
Total			
Answered	52		
Mean	3.77		
Median	4		
Mode	5		

15. I have received good advising from my CIS advisor.

1's	3	Freshman	3.50
2's	9	Sophomore	3.00
3's	7	Junior	2.33
4's	14	Senior	2.81
5's	10		
N/A's	10		
Total			
Answered	53		
Mean	2.79		
Median	3		
Mode	4		

16. I understand the value of the CIS degree including business related courses.

1's	3	Freshman	4.25
2's	2	Sophomore	3.36
3's	11	Junior	3.75
4's	26	Senior	3.65
5's	10		
N/A's	1		
Total			
Answered	53		
Mean	3.66		
Median	4		
Mode	4		

17. The support given from the department is helpful.

1's	3	Freshman	4.00
2's	1	Sophomore	3.18
3's	20	Junior	3.25
4's	19	Senior	3.50
5's	8		
N/A's	2		
Total			
Answered	53		
Mean	3.42		
Median	4		
Mode	3		

18. I feel that the content in the CIS curriculum lends itself to being taught via the Internet

1's	3	Freshman	4.00
2's	7	Sophomore	3.36
3's	21	Junior	2.67
4's	17	Senior	3.00
5's	3		
N/A's	2		
Total			
Answered	53		
Mean	3.08		
Median	3		
Mode	3		

19. I feel that WebCT adds to the overall learning experience.

1's	6	Freshman	4.00
2's	10	Sophomore	3.64
3's	8	Junior	3.33
4's	21	Senior	3.00
5's	8		
N/A's	0		
Total			
Answered	53		
Mean	3.28		
Median	4		
Mode	4		

20. I felt prepared coming into the CIS curriculum.

1's	1	Freshman	3.75
2's	6	Sophomore	3.64
3's	13	Junior	3.92
4's	18	Senior	3.48
5's	13		
N/A's	1		
Total			
Answered	52		
Mean	3.63		
Median	4		
Mode	4		

21. The CIS curriculum has enhanced my ability to read technical information and to learn on my own.

1's	7	Freshman	4.25
2's	6	Sophomore	3.73
3's	11	Junior	3.08
4's	21	Senior	3.04
5's	7		
N/A's	0		
Total			
Answered	52		
Mean	3.29		
Median	4		
Mode	4		

22. I feel that the CIS degree that I will/have earn(ed), has prepared me for a variety of job opportunities in business career.

1's	3	Freshman	4.33
2's	9	Sophomore	3.55
3's	12	Junior	2.92
4's	22	Senior	3.19
5's	5		
N/A's	1		
Total			
Answered	52		
Mean	3.27		
Median	4		
Mode	4		

23. I feel that I have the communications skills necessary to be successful on the job.

1's	0	Freshman	4.00
2's	3	Sophomore	3.82
3's	12	Junior	3.92
4's	26	Senior	3.88
5's	12		
N/A's	0		
Total			
Answered	53		
Mean	3.89		
Median	4		
Mode	4		

24. Overall, I am satisfied with the CIS program.

1's	8	Freshman	4.00
2's	7	Sophomore	3.18
3's	17	Junior	3.17
4's	19	Senior	2.69
5's	2		
N/A's	0		
Total			
Answered	53		
Mean	3.00		
Median	3		
Mode	4		

25. The CIS program has my met expectations.

1's	8	Freshman	4.25
2's	11	Sophomore	2.82
3's	15	Junior	3.00
4's	16	Senior	2.69
5's	3		
N/A's	0		
Total			
Answered	53		
Mean	2.91		
Median	3		
Mode	4		

Section III: This section is about the resources available.

26. I believe the hardware available for use in the CIS courses is adequate.

1's	7	Freshman	4.25
2's	6	Sophomore	4.00
3's	11	Junior	3.42
4's	24	Senior	2.73
5's	5		
N/A's	0		
Total			
Answered	53		
Mean	3.26		
Median	4		
Mode	4		

27. I believe the software available for use in the CIS courses is adequate.

1's	3	Freshman	4.25
2's	6	Sophomore	3.91
3's	8	Junior	3.17
4's	29	Senior	3.54
5's	7		
N/A's	0		
Total			
Answered	53		
Mean	3.58		
Median	4		
Mode	4		

28. I have taken advantage of the MSDN software agreement that the CIS department has with Microsoft.

1's	3	Freshman	3.00
2's	3	Sophomore	2.91
3's	8	Junior	3.08
4's	23	Senior	3.62
5's	10		
N/A's	6		
Total			
Answered	53		
Mean	3.30		
Median	4		
Mode	4		

Section IV: This section is to gather demographic information.

29. I am a: freshman sophomore junior senior

Freshman	4
Sophomore	11
Junior	12
Senior	26

30. I am earning a(n): bachelors degree associates degree

Bachelors	46
Associates	5

31. I am earning a CIS: minor major

Bachelors	46
Associates	5

32. I am a transfer student: YES NO

Transfer	14
----------	----

Section V: Open ended questions:**33. Think of the CIS program. What two (or three) significant changes in the CIS program would make the most improvement?**

1. More e-business courses
2. more networking related courses
3. Update it! And keep away from so much Microsoft. Put more emphasis on networking, provide alternatives to VN, Java, more Web design, DB's, and networking together. Drop pointless classes like 330 and have projects that last more than a semester.
4. Try to keep up with technology and spend more money to provide students with the proper software and hardware it takes to be competitive. Also, the CIS program should bring in IT reps from industry and plans trips available to all CIS students.
5. That all allowance programming classes should be taught in lab, not just one day. We are paying for this education and I think we should get what we are paying for. And also the lab fee charges that we pay and now we have to pay for print out in class.
6. more outside help
7. better courses
8. More independent projects; see the smart kids carrying the less knowledgeable ones in groups. Make the classes more challenging ISYS classes were way too easy. Get some young, knowledgeable profs. In there from the workplace and give us some real knowledge. ISYS 321 should not be required for us. It is a total review. Besides that, I love the Dept.
9. Dumb teachers without certs. In the field they teach if they don't have a PHD
10. Stop teachers from stereo typing student's intelligence based in their own personal ideas of how one should act, Appearance, etc.
11. I think the most important thing is to keep up with the most current technology.
12. Better faculty
13. With a couple exceptions the entire CIS teaching faculty are incompetent.
14. Provide practical implementation widely over campus
15. More perspective employers. Internship department here is weak. We need more companies at our job fair. Sticker grading. I feel too many people slide by, steal code and worm their way through it. Please make sure that the ISYS 488 and 489 have their own choice on projects and I feel we were able to learn on our own. Do not allow student to make web page surveys. Coding is very important and many of my fellow classmates could not make a program without extensive help.
16. More availability or help (I understand there are tutors in the help center, but they are less that adequate to put it nicely).
17. Knowledge of professors, classes, and department
18. Better profs with a better structure to their class Our own computer lab. VISD has their own and new Mac G5's. We have to share a lab with the whole campus with the old computers that don't even have the right software half of the time. Stop changing the check sheet every semester.
19. Don't teach of power point
20. More hardware/software for students, more networking course, and more variety of programming options
21. Some teachers need to be more involved in the class
22. We should be able to get more back for our books
23. Faculty that don't understand what they are teaching, Faculty that answer student questions with real answers, quit changing the check sheet, out own CIS lab.
24. Stop changing check sheet, give us our own lab
25. I think they rely to heavily on Microsoft. I would like to see more on php.
26. Less teachers reading out of book, more hands on work
27. More teachers have worked in the field they have teaching less from classes, all ones have taken done nothing but hurt my grade.

28. Course that focus on actual information that will be used in the workplace, computers in some of the labs are Pentium III's
 29. Not making students take so many humanities classes, they have nothing to do with CIS.
 30. Actually having class or a curriculum based around web design. That's why I came here and I have only seen one web design class and it was a 100 level.
 31. All the software in the Bus lab should be in the library. Bus lab doesn't stay open as late as the library and you can't have labs in Bus lab
 32. Not having every project be a group project. I don't learn as much with a group as I do individually.
 33. Smaller class sizes I some courses. It is important especially in CIS to have more attention given to students individually. Some courses such as humanities should not be required
 34. Hire new instructors who have recent experience in the industry and are COMPETENT in the subjects that they teach. I don't think that retraining existing staff would be beneficial enough.
 35. Heighten expectations. The CIS courses are so ridiculously lax that I can't believe it. I can only assume this is a result of the majority of the teachers not knowing their subjects well enough.
 36. The CIS department needs to be more interested in the advancement of the student's education.
 37. Get CIS Faculty that know what they are talking about and that know current technology. I have found that many of them don't know what they are talking about, or they don't know what is happening today.
 38. Don't put holds on our account without notifying us and Jim prior to registration.
 39. For lab classes such as Networking bring in equipment that will allow us to engage in hands on experiences
 40. Prof. who know their stuff and can relay that info to students.
 41. Possibly work with CNS faculty when it comes to more of the hardware aspects.
 42. Better equipment
 43. I feel that some of the classes that are offered reg one out of date and should not only be optional, but maybe even removed all together. For example, the classes on UNIX, COPOL, RPG, and possibly others should be taken out of the curriculum. These are of the least use to me. If I planned on getting a job on some ancient layout program, then I'd pursue those courses, but they were a waste if time and money. To sum it up- at Ferris I've learned a little bit about everything, but not anything about one particular subject. I am more qualified now then I was four years ago.
 44. Change or lose ethics. The class is irrelevant to any students provided today. I'd like to see a business ethics, however. Find a better way to introduce new classes. I got bumped from VB6 to VB NET Advanced and learned nothing because I had no background in the .NEY environment. I'd like to see a few new professors that know what they're doing in different important, yet not shown as such classes such as Linux, Microsoft, UNIX, etc.
 45. All programming classes should be held in an environment (classroom) where computers are available. I have had an advanced class where we had to leave the classroom daily to perform the requirements that should not happen. Le teacher presentations and more hands on training. Was very disappointed with the software class. Only hardware we saw were old PC parts. We should do a PC from scratch.
 46. Faster, more stable computers.
 47. Give this survey every year
 48. Replace Buse, Daenzer, Suhy, Hewer at least. Teach a real class on Linux and an advanced one. Fire Buse. Fire her again. Teach classes on newer technology. Impose the network classes, except JAVA. Get faculty members who know the material. Too often faculty are out of touch with the industry and for the matter reality.
- Reduce frequency of Check sheet changes. Entrance exam. It shouldn't be the program's responsibility to teach these kid's everything about computers.
Exit Exam. Don't let the stupid ones get out. They can skate through without learning anything now. Fire Suhy and Buse again.

34. Think about the CIS program. Please list the top two (or three) aspects of the program that you would not want to see changed because they have served you well.

1. Practical Examples
2. SQL, web design
3. hardware
4. Marketing 321
5. I liked taking Novell Admin and Ms 2003 Server Admin. And ISYS 470
6. Change all
7. Hands on experience
8. Hands on experience
9. Flexible programs (Network administrative, web dev.,etc).
10. Bandstra
11. I enjoyed the option to choose advanced programming language. We have op-notch faculty who care and would do anything to help us. Please keep the high level ENGL 325 writing. It is important.
12. WE have good hardware, good software, and good professors
13. Bandstra is the man! Give him a raise!
14. SQL class, the Server Admin. Class
15. Teachers keep up about there teaching to help us
16. The teachers are being kept up with new information which is good
17. WE should be able to return computer books back to the bookstore.
18. The amount of business classes that are needed for the real world.
19. The broad range of ISYS classes required to open student's eyes on what's out there. The computers are kept up to date pretty regularly.
20. Use WEBct calendar and assignments but lose the webct email.
21. The best thing about the CIS program so far has been Dale Hobart. Every one of the CIS teachers should strive to teach like him and hold standards as high as he does. The computer labs are nice.
22. I like the different choices of paths within CIS, but classes don't always line up with that path.
23. I want to see more along the lines of modern day software such as anything; Net, PHP, and more hardware knowledge
24. I do like the internship program though awfully tedious. The requirements of the HTML landed me a temp well paid job. More languages!
25. Labs. Step by Step book
26. Har, Har

Curriculum Evaluation

The Bachelor of Science degree in Computer Information Systems, offered through the Ferris State University College of Business prepares students to be Information systems specialists by providing programming, systems analysis, network administration, and database management skills. Entry-level positions include such jobs as: systems analyst; systems integrator; systems architect; network administrator; applications programmer/analyst; software developer; computer support specialist; systems administrator; systems programmer; project leader; database administrator; and, business analyst.

The CIS program has close relationships with industry through a) an industry advisory board b) active involvement with Association of Information Technology Professionals, and c) industry internships as a practical hands-on experience. The hands-on approach in the bachelor's degree gives graduates a real-world look at their field.

CIS degree is also available in several dual-major formats (CIS-Accountancy, CIS-Management, and CIS-Marketing) as well as in an accelerated three-year format. By requiring courses in the College of Business core (Accounting, Business Information systems, Financial Management, Marketing, Statistics and Operations management) the CIS program provides students with essential business knowledge, experience, and skills for immediate employment for advancement to management positions.

The program provides hands-on experience on mainframe, midrange, and client/server platforms thereby providing a wide range of employment opportunities to graduates.

The CIS program was recently revised to provide maximum flexibility for students, and to easily change with the market place. The new curriculum core was aligned to a national standard (IS 2002) which was produced by the ACM, AITP, and AIS professional societies. This core of 33 hours was created from skills and attributes listed in thousands of job advertisements for IS positions.

The CIS curriculum provides students with a broad understanding of core business functions, competency in computer programming, knowledge of information technology infrastructure, and a sound foundation in systems analysis and design. Furthermore, this curriculum provides the necessary related business skills for immediate employment in information systems and for advancement to management positions.

Ferris State University - College of Business
BACHELOR OF SCIENCE DEGREE IN COMPUTER INFORMATION SYSTEMS 126 credits

NAME: _____

Student ID# _____

Page 2

Required	Course Title - Prerequisites Shown in Brackets ()	Crs	Gr	Gr Pt
COMMUNICATION COMPETENCE - 15 CR REQUIRED				
COMM	121 Fundamentals Of Public Speaking (none)	3		
COMM	336 Technical and Professional Communication (COMM 121)	3		
ENGL	150 English 1 (none)	3		
ENGL	250 English 2 (ENGL 150 or equivalent)	3		
ENGL	325 Advanced Business Writing – (ENGL 250)	3		
SCIENTIFIC UNDERSTANDING – 7 Credits Required				
Consult the Ferris website: www.ferris.edu/html/academic/academic/courses.html for approved courses.				
	Scientific Understanding with Lab with Lab	4		
	Scientific Understanding	3		
QUANTITATIVE SKILLS – 3 Credits Required				
MATH	115* Interm Algebra (MATH 110) if MATH ACT score 24+, sub Gen Ed elec.	3		
*Must pass with a C or better before enrolling in ISYS 216				
CULTURAL ENRICHMENT – 9 Credits Required**				
Consult the Ferris website: www.ferris.edu/html/academic/academic/courses.html for approved courses.				
HUMN	216 Introduction to Ethics (second semester sophomore standing)	3		
	Cultural Enrichment Elective	3		
	Cultural Enrichment Elective	3		
SOCIAL AWARENESS – 9 Credits Required				
Consult the Ferris website: www.ferris.edu/html/academic/academic/courses.html for approved courses				
REMAINDER OF SOCIAL AWARENESS CREDITS SATISFIED WITH RELATED COURSES				
	Social Awareness Elective	3		
ADDITIONAL GENERAL EDUCATION – 5 Credits Required**				
Consult the Ferris website: www.ferris.edu/html/academic/academic/courses.html for approved courses				
HUMN	217 Introduction to Logic	3		
	Gen Ed Elective	2		
RELATED COURSES – 6 Credits Required				
ECON	221 Prin of Macroeconomics 1 (MATH 110 w/grade of C- or better or profic)	3		
ECON	222 Prin of Microeconomics 2 (ECON 221)	3		

**Global consciousness, and race ethnicity or gender requirements must be met either through Cultural Enrichment, Social Awareness or General Education courses.

Advising Notes:

FSUS 100 is satisfied by _____
 Global consciousness requirement satisfied by _____
 Race, ethnicity, gender requirement satisfied by _____

Note: CIS Students must be able to demonstrate competency in ISYS 105 topics or take ISYS 105.

NOTICE REGARDING WITHDRAWAL, RE-ADMISSION AND INTERRUPTIONS OF STUDIES

Students who return to the university after an interrupted enrollment (excluding summer) must normally meet requirements of the curriculum which are in effect at the time of their return, not the requirements which were in effect when originally admitted.
 Effective Fall 2005

BUSINESS CORE COURSES - 30 Credits Required				
REQUIRED	COURSE TITLE WITH PREREQUISITES SHOWN IN BRACKETS ()	Crs	Gr	Gr Pt
ACCT	201 Principles of Accounting 1 (Equivalent of Math 110 with C- or better)	3		
ACCT	202 Principles of Accounting 2 (ACCT 201with C- or better)	3		
STQM	260 Introduction to Statistics (MATH 115 or MATH 116 or MATH 117 or an ACT score of 24 or an SAT of 560)	3		
BLAW	321 Contracts and Sales (none)	3		
FINC	322 Financial Management 1 (ACCT 202, MATH 115 or MATH 116 or MATH 117 or MATH ACT of 24)	3		
ISYS	321 Business Information Systems (ACCT 202, MKTG 321, MGMT 301)	3		
MKTG	301 Principles of Marketing (none)	3		
MGMT	321 Applied Management (Junior standing or permission of professor)	3		
MGMT	370 Quality/Operations Management (STQM 260)	3		
BUSN	499 Interdisciplinary Integrating Experience (FINC 322, MGMT 370, MKTG 321, and senior status)	3		

COMPUTER INFORMATION SYSTEMS MAJOR – 33 Credits Required				
REQUIRED	COURSE TITLE WITH PREREQUISITES SHOWN IN BRACKETS ()	Crs	Gr	Gr Pt
ISYS	110 Fundamentals of Computer Information Systems (ISYS 105)	3		
ISYS	200 Database Design & Implementation (ISYS 105)	3		
ISYS	216 Introduction to Object-Oriented Programming	3		
ISYS	316 Advanced Object-Oriented Programming	3		
ISYS	325 Networking Essentials (ISYS 105)	3		
ISYS	330 Systems Analysis & Design (ISYS 200 & ISYS 316)	3		
ISYS	371 Adv. DB Design/Implementation (ISYS 200 ISYS 316, ISYS 330)	3		
ISYS	411 Project Management (Senior Status)	3		
ISYS	470 Database Administration (ISYS 371 & ISYS 330)	3		
ISYS	488 Systems Design & Implementation (ISYS 330 & ISYS 470)	3		
ISYS	489 Advanced Systems Design & Implementation (ISYS 488 co-req)	3		

Directed Electives – 15 Credits Required				
1. It is required that each student do an internship (ISYS 491) for at least a 3 credit experience to enhance their career opportunities.				
2. It is strongly recommended that each student obtain advisor approval before selecting elective courses to avoid possible conflicts.				
3. Example concentrations can include a mix of programming courses, network courses, transferred courses from another program or institution, another program's minor, or other related Ferris academic program courses that provide skills necessary for managing or supporting IT resources. See the CIS Electives Guidelines for recommendations.				
Course	Write Course Title	Crs	Gr	Gr Pt
ISYS	491 Internship	3		
		3		
		3		
		3		
		3		

Notice Regarding GPA Requirements
 Students must maintain a 2.00 Cumulative GPA in all FSU courses, a 2.0 GPA in the Business Core, and a 2.0 GPA in the CIS Major..

Appendix C: Curriculum Review

**FERRIS STATE UNIVERSITY -- COLLEGE OF BUSINESS
COMPUTER INFORMATION SYSTEMS MAJOR**

Electives Guidelines

1. Students wishing to complete any minor offered on campus (other than a CIS minor) may use this track to achieve this goal. Typically only one course would need to be added to complete a minor of 18 credits.
2. It is strongly recommended that you see an advisor before selecting and taking electives.
3. It is strongly recommended that an internship (3 credits) be part of the five electives to enhance your employment opportunities.
4. Transfer students would typically use these electives to fulfill elective requirements with transferred course work that may not be equivalent to Ferris courses required in the core.

SUGGESTED ELECTIVES BY SELECTED JOB CATEGORIES

TYPE OF JOB	ELECTIVE #1	ELECTIVE #2	ELECTIVE #3	ELECTIVE #4	ELECTIVE #5
Network Administration	ISYS277	ISYS307	ISYS310	ISYS 422	ISYS 270 OR ISYS 491
Programmer/Analyst	ISYS 204	ISYS 304	ISYS 220	ISYS 340	ISYS 265 OR ISYS 491
Web Development	ECOM 200	ISYS 307 OR ISYS 310	ISYS 480	NMPP 420	NMPP 450
Consultant (individual)	MGMT 310	MGMT 420	MGMT 410	ISYS 491	ISYS 491
Computer Support Specialist	ISYS 270	ISYS 277	ISYS 350	ISYS 491	ISYS 491

SUGGESTED ELECTIVES BY COURSE NUMBER & TITLE

ECNS 315 - Network Theory & Test	ISYS 340 - Advanced COBOL Programming
ECNS 412 - Real Time Operating Systems	ISYS 350 - Telecommunications
ECOM 200 - World of E-Commerce	ISYS 422 - Network Security Management
ISYS 204 - Introduction to Visual Basic	ISYS 490 - Special Topics (1-3 credits)
ISYS 220 - Introduction to COBOL Programming	ISYS 491 - Internship (1-9 credits)
ISYS 265 - Midrange Online Program Development	ISYS 497 - Independent Study
ISYS 270 - Fundamentals of Hardware & OS	MGMT 310 - Small Business Management
ISYS 277 - Linux Network Administration	MGMT 410 - Entrepreneurship & Planning
ISYS 304 - Advanced Visual Basic	MGMT 420 - Small Business Consulting - SBI
ISYS 307 - Microsoft Network Administration	NMPP 420 - World Wide Web Publishing
ISYS 310 - Novell Network Administration	NMPP 450 - Internet Server Administration

Other elective options may be selected from the following areas:

- ECOM - Electronic Commerce Marketing
- ISYS - Information Systems
- MISM - Information Systems Management
- NMPP - New Media Printing & Publishing
- VISD - Visual Communications & Design

Course Descriptions

ISYS 305 - SOFTWARE SYSTEMS: Examines the use of commercial software products to meet an organization's information systems needs. Presents a methodology for analyzing information system requirements, evaluating competing software products, selecting and installing the product, training users, and supporting the product. For non-CIS majors. Prerequisite: ISYS 105 or demonstrated competency.

ISYS 307 - MICROSOFT NETWORK ADMINISTRATION: Introduces administration of Microsoft's Server Networking operating system, and leads to knowledge needed in preparation for certification. It includes the knowledge, skills, and hands-on experience required to implement Microsoft's Server operating system. The student will have a working knowledge of Active Directory and Security including: installing server software; configuration of server software & storage; managing accounts & clients; managing groups, folders, files, and object security; managing Dfs, disk Quotas, and Software Installation; installing and managing printers; remote Access & Virtual Private Networks; and managing the Internet. Prerequisite: ISYS 105 or demonstrated competency.

ISYS 310 - NOVELL NETWORK ADMINISTRATION: Introduces administration of Novell's Networking operating system. It is designed to prepare the student for the Certified Novell Administration (CNA) exam. It includes the knowledge, skills, and hands-on experience required to implement Novell's networking services. The student will have a working knowledge of eDirectory services including installing server software, creating container objects, creating users and groups, managing trustee assignments and file attributes, login scripts, and management of printing services. Prerequisite: ISYS 105 or demonstrated competency.

ISYS 311 - INFORMATION SYSTEMS IN BUSINESS: Course is designed to acquaint the student with the various types of information and information processing that exists in a typical business or organization. Emphasis is on the functional areas of the enterprise, and the impact of electronic commerce on standard business procedures. Exposure to the basic concepts of accounting, marketing and management are highly recommended. For non-COB majors. Prerequisites: ISYS 105 or demonstrated competency, and junior standing.

ISYS 316 ADVANCED OBJECT-ORIENTED PROGRAMMING (3 credits) Students will use Java's programming and advanced features to create Object-Oriented Windows programs and applets. Topics include AWT components and layout managers, drawing, mouse and keyboard event handling, menu bars, the collections framework, exception handling, multithreading, file I/O, and client/server programming. Prereq: ISYS 216.

ISYS 321 BUSINESS INFORMATION SYSTEMS (3 credits)

Introduction to strategic information systems functions. Provides an integrating experience that enables a student to demonstrate the capacity to synthesize and apply knowledge from an organizational perspective. Included are the uses of information technology to grow, expand, and efficiently and profitably manage an organization. Of particular focus are the interrelationships between information systems. An interdisciplinary team project(s) is required. Prereq: ACCT 202, MKTG 321, MGMT 301, and BLAW 321.

ISYS 325 NETWORKING ESSENTIALS (3 credits) A study of networking hardware, transmission media, communication protocols, the Open System Interconnection model (OSI), and distributed networking/processing. The equipment, techniques, and software utilized in networks are presented. Appropriate terminology and concepts utilized in networks are introduced. Lecture workshop experience with designing, planning, installing, and maintaining a Local Area Network. Prereq: ISYS 105.

ISYS 330 SYSTEMS ANALYSIS & DESIGN (3 credits)

The first course is structured methods of identifying the requirements for a system. This includes the analysis of current business operations and definitions of specific problems or opportunities. Goals, objectives, data, process design, and performance criteria are developed for the new system. Fulfills General Education "writing intensive course" requirements. Prereq: ISYS 200 and ISYS 316.

ISYS 340 - ADVANCED COBOL PROGRAMMING:

Advanced COBOL techniques and the introduction to the development of online, interactive systems using COBOL and the system supplied terminal facilities. Students will write and test programs using COBOL and IBM CICS/VS on a mainframe computer system. Prerequisite: ISYS 220.

ISYS 350 - TELECOMMUNICATIONS:

A study of telecommunication hardware, transmission media, networks, communication protocols, the Open System Interconnection model (OSI), and distributed networking/processing. The equipment, techniques, and software utilized in telecommunication systems are presented. Appropriate terminology and concepts utilized in telecommunications are introduced. Prerequisite: ISYS 105 or demonstrated competency OR instructor approval.

ISYS 371 ADVANCED DATABASE DESIGN AND IMPLEMENTATION

(3 credits) Emphasis is placed on Entity-Relationships and Relational models, data definition languages, and manipulation languages. Structured Query Language (SQL) is used to develop database objects such as databases, logs, tables, indexes, views, constraints, defaults, roles, rules, stored procedures, and triggers. Database design is reviewed. Application development and modeling tools are discussed. Projects requiring the development of integrated databases are assigned. Prereq: ISYS 200, and ISYS 316.

Course Descriptions

ISYS 411 PROJECT MANAGEMENT (3 credits)

An in-depth study of project management techniques currently employed for business and information systems projects. Topical areas will include project organization, planning administration control and leadership. The need for accurate estimating, scheduling, communication and reporting will be stressed through the use of several cases/projects. Prereq: Senior Standing.

ISYS 422 - NETWORK SECURITY MANAGEMENT:

Provides an overview of network security management, and gives students a basic understanding of how to make a network secure. The impact of network security issues on a business and how security is meant to help a business implement a business plan is discussed. The general dimension of providing security for information processing systems, secure operating systems and applications, network security, cryptography, and security protocols are examined. Prerequisites: ISYS 307 or ISYS 310; and ISYS 325.

ISYS 470 DATABASE ADMINISTRATION (3 credits)

Advantages and requirements of client/server computing are discussed. Methodologies for designing, developing, maintaining and disseminating client/server systems are taught. Client/server applications, connectivity issues, software development tools, and database design and implementation methodologies are topics covered. Additional topics include database administration, transaction rollback and commit, data warehousing, data mining, and database security. Projects requiring the design of a distributed data processing network are required. Prereq: ISYS 371.

ISYS 480 - E-COMMERCE APPLICATION

DEVELOPMENT: Analysis and development of a commercial type Internet application including: web site/page design, communications interface, and database application. Prerequisite: ISYS 470.

ISYS 488 SYSTEMS DESIGN AND IMPLEMENTATION (3 credits)

Course includes object-oriented design and ISO9000 standards for software development. Methods of implementation, user manuals and responsibilities, and computer operations, responsibilities are included with test schedules, staffing and auditing requirements. Students will design a system for an assigned project, which incorporates the techniques of good design, and includes the following: User Manual, Data Entry Manual, Operations Manual, Auditing Manual, Conversion and Implementation Schedule and Plan, Training Outlines. Prereq: ISYS 330, ISYS 470.

ISYS 489 ADVANCED SYSTEMS DESIGN AND IMPLEMENTATION

(3 credits) Team-oriented course designed to integrate systems analysis and design with programming. A computer application project, which is sufficiently difficult to require one semester, is assigned to a student team, for systems analysis, design, programming, and actual or simulated implementation. Prereq: ISYS 488 co-req.

BUSN 499 INTERDISCIPLINARY INTEGRATING EXPERIENCE (3 credits)

Introduces the basics of business strategy and policy and moves to use of a computer simulation with students functioning in multidisciplinary teams. The teams have the challenge of developing and executing a strategy that involves production operations, procurement, distribution and marketing, pricing, research and development, employment levels and compensation, financing the operations, and other aspects of a business competing in a global environment. Prereq: FINC 322, ISYS 321, MGMT 370, MKTG 321, and senior standing.

Section 7 - LABOR MARKET ANALYSIS

The Bureau of Labor Statistics (BLS) is an agency of the U.S. Department of Labor. The BLS has published the 2004-05 edition of the *Occupational Outlook Handbook*. This publication was helpful in preparing this Labor Market Analysis.

Significant Points

- Four occupational areas within the *Occupational Outlook Handbook* indicate a Bachelor's degree in Computer Information Systems as a qualification for entry into the career field. They are:

- Computer Programmer
- Computer Support Specialists and Systems Administrators
- Computer Software Engineers
- Computer Systems Analysts, Database Administrators, and Computer Scientists

Of these, the last three are projected to be among the fastest growing occupations through 2012 and the first is expected to grow at an average rate (Refer to Table 1).

- Slower job growth due to off-shore outsourcing will be more than offset by an increased demand for information systems, the retirement of older workers, and emerging new technologies.
- Self-employment is a growing trend in these occupational areas as companies continue to outsource.
- Network and database security is the specialty in greatest demand.
- Internships are increasingly important to entry-level job seekers.

The following excerpts from the *Occupational Outlook Handbook* provide relevant, detailed information for each occupational area.

Computer Programmers

- **Job Outlook**

Employment of programmers is expected to grow about as fast as the average for all occupations through 2012. Jobs for both systems and applications programmers should be most plentiful in data processing service firms, software houses, and computer consulting businesses. These types of establishments are part of computer systems design and related services and software publishers, which are projected to be among the fastest growing industries in the economy over the 2002-12 period. As organizations attempt to control costs and keep up with changing technology, they will need programmers to assist in conversions to new computer languages and systems. In addition, numerous job openings will result from the need to replace programmers who leave the labor force or transfer to other occupations such as manager or systems analyst.

Employment of programmers, however, is expected to grow much more slowly than that of other computer specialists. With the rapid gains in technology, sophisticated computer software now has the capability to write basic code, eliminating the need for more programmers to do this routine work. The consolidation and centralization of systems and applications, developments in packaged software, advances in programming languages and tools, and the growing ability of

users to design, write, and implement more of their own programs means that more of the programming functions can be transferred from programmers to other types of workers. Furthermore, as the level of technological innovation and sophistication increases, programmers are likely to face increasing competition from programming businesses overseas, to which much routine work can be contracted out at a lower cost.

Nevertheless, employers will continue to need programmers who have strong technical skills and who understand an employer's business and its programming requirements. This means that programmers will have to keep abreast of changing programming languages and techniques. Given the importance of networking and the expansion of client/server, Web-based, and wireless environments, organizations will look for programmers who can support data communications and help to implement electronic commerce and Intranet strategies. Demand for programmers with strong object-oriented programming capabilities and technical specialization in areas such as client/server programming, wireless applications, multimedia technology, and graphic user interface (GUI) should arise from the expansion of intranets, extranets, and Internet applications. Programmers also will be needed to create and maintain expert systems and embed these technologies in more products. Finally, growing emphasis on cyber-security will lead to increased demand for programmers who are familiar with digital security issues and skilled in using appropriate security technology.

As programming tasks become increasingly sophisticated and additional levels of skill and experience are demanded by employers, graduates of 2-year programs and people with less than a 2-year degree or its equivalent in work experience should face strong competition for programming jobs. Competition for entry-level positions, however, also can affect applicants with a bachelor's degree. Prospects should be best for college graduates with knowledge of, and experience working with, a variety of programming languages and tools—including C++ and other object-oriented languages such as Java, as well as newer, domain-specific languages that apply to computer networking, database management, and Internet application development. Obtaining vendor-specific or language-specific certification also can provide a competitive edge. Because demand fluctuates with employers' needs, jobseekers should keep up to date with the latest skills and technologies. Individuals who want to become programmers can enhance their prospects by combining the appropriate formal training with practical work experience.

- **Training, Other Qualifications, and Advancement**

While there are many training paths available for programmers, mainly because employers' needs are so varied, the level of education and experience employers seek has been rising, due to the growing number of qualified applicants and the specialization involved with most programming tasks. Bachelor's degrees are commonly required, although some programmers may qualify for certain jobs with 2-year degrees or certificates. The associate degree is an increasingly attractive entry-level credential for prospective computer programmers. Most community colleges and many independent technical institutes and proprietary schools offer an associate degree in computer science or a related information technology field.

Employers are primarily interested in programming knowledge, and computer programmers can become certified in a programming language such as C++ or Java. College graduates who are interested in changing careers or developing an area of expertise also may return to a 2-year community college or technical school for additional training. In the absence of a degree, substantial specialized experience or expertise may be needed. Even when hiring programmers with a degree, employers appear to be placing more emphasis on previous experience.

Some computer programmers hold a college degree in computer science, mathematics, or information systems, whereas others have taken special courses in computer programming to

supplement their degree in a field such as accounting, inventory control, or another area of business. As the level of education and training required by employers continues to rise, the proportion of programmers with a college degree should increase in the future. As indicated by the following tabulation, 65 percent of computer programmers had a bachelor's or higher degree in 2002.

	Percent
High school graduate or equivalent or less	7.7
Some college, no degree	15.2
Associate degree	11.6
Bachelor's degree	48.6
Graduate degree	16.7

Required skills vary from job to job, but the demand for various skills generally is driven by changes in technology. Employers using computers for scientific or engineering applications usually prefer college graduates who have degrees in computer or information science, mathematics, engineering, or the physical sciences. Graduate degrees in related fields are required for some jobs. Employers who use computers for business applications prefer to hire people who have had college courses in management information systems (MIS) and business and who possess strong programming skills. Although knowledge of traditional languages still is important, employers are placing increasing emphasis on newer, object-oriented programming languages and tools, such as C++ and Java. Additionally, employers are seeking persons familiar with fourth- and fifth-generation languages that involve graphic user interface (GUI) and systems programming. Employers also prefer applicants who have general business skills and experience related to the operations of the firm. Students can improve their employment prospects by participating in a college work-study program or by undertaking an internship.

Most systems programmers hold a 4-year degree in computer science. Extensive knowledge of a variety of operating systems is essential for such workers. This includes being able to configure an operating system to work with different types of hardware and having the skills needed to adapt the operating system to best meet the needs of a particular organization. Systems programmers also must be able to work with database systems, such as DB2, Oracle, or Sybase.

When hiring programmers, employers look for people with the necessary programming skills who can think logically and pay close attention to detail. The job calls for patience, persistence, and the ability to work on exacting analytical work, especially under pressure. Ingenuity, creativity, and imagination also are particularly important when programmers design solutions and test their work for potential failures.

The ability to work with abstract concepts and to do technical analysis is especially important for systems programmers, because they work with the software that controls the computer's operation. Because programmers are expected to work in teams and interact directly with users, employers want programmers who are able to communicate with nontechnical personnel.

Entry-level or junior programmers may work alone on simple assignments after some initial instruction, or they may be assigned to work on a team with more experienced programmers. Either way, beginning programmers generally must work under close supervision. Because technology changes so rapidly, programmers must continuously update their knowledge and skills by taking courses sponsored by their employer or by software vendors, or offered through local community colleges and universities.

For skilled workers who keep up to date with the latest technology, the prospects for advancement are good. In large organizations, programmers may be promoted to lead programmer and be given supervisory responsibilities. Some applications programmers may move into systems programming after they gain experience and take courses in systems software. With general business experience, programmers may become programmer-analysts or systems analysts or be promoted to a managerial position. Other programmers, with specialized knowledge and experience with a language or operating system, may work in research and development on multimedia or Internet technology, for example. As employers increasingly contract out programming jobs, more opportunities should arise for experienced programmers with expertise in a specific area to work as consultants.

Certification is a way to demonstrate a level of competence, and may provide a jobseeker with a competitive advantage. In addition to language-specific certificates that a programmer can obtain, product vendors or software firms also offer certification and may require professionals who work with their products to be certified. Voluntary certification also is available through other various organizations.

- **Entry-level Earnings**

According to the National Association of Colleges and Employers, starting salary offers for graduates with a bachelor's degree averaged \$45,558 a year in 2003.

Computer Support Specialists and Systems Administrators

- **Job Outlook**

Employment of computer support specialist is expected to increase faster than the average for all occupations through 2012, as organizations continue to adopt and integrate increasingly sophisticated technology. Job growth will continue to be driven by the continued expansion of the computer system design and related services industry, which is projected to remain one of the fastest growing industries in the U.S. economy, despite recent job losses. Job growth will not be as explosive as growth during the previous decade as these jobs are being increasingly outsourced overseas.

Employment growth among computer support specialists reflects the rapid pace of improved technology. As computers and software become more complex, support specialists will be needed to provide technical assistance to customers and other users. New mobility technologies, such as the wireless Internet, will continue to create a demand for these workers to familiarize and educate computer users. Consulting opportunities for computer support specialists also should continue to grow as businesses increasingly need help managing, upgrading, and customizing more complex computer systems. However, growth in employment of support specialists may be tempered somewhat as firms continue to cut costs by shifting more routine work abroad to countries where workers are highly skilled but labor costs are lower. Physical location is not as important for these workers as it is for others, because computer support specialists can provide assistance remotely and support services can be provided around the clock.

Employment of systems administrators is expected to increase much faster than average as firms will continue to invest heavily in securing computer networks. Companies are looking for workers knowledgeable about the function and administration of networks. Such employees have become increasingly hard to find as systems administration has moved from being a separate function within corporations to one that forms a crucial element of business in an increasingly high-technology economy. Also, demand for computer security specialists will grow as businesses and

government continue to invest heavily in "cyber-security," protecting vital computer networks and electronic infrastructure from attack.

The growth of electronic commerce means that more establishments use the Internet to conduct their business online. This translates into a need for information technology specialists who can help organizations use technology to communicate with employees, clients, and consumers. Explosive growth in these areas also is expected to fuel demand for specialists knowledgeable about network, data, and communications security.

Job prospects should be best for college graduates who are up to date with the latest skills and technologies, particularly if they have supplemented their formal education with some relevant work experience. Employers will continue to seek computer specialists who possess a strong background in fundamental computer skills, combined with good interpersonal and communication skills. Due to the rapid growth in demand for computer support specialists and systems administrators, those who have strong computer skills but do not have a bachelor's degree should continue to qualify for some entry-level positions. However, certifications and practical experience are essential for persons without degrees.

- **Training, Other Qualifications, and Advancement**

Due to the wide range of skills required, there are many paths of entry to a job as a computer support specialist or systems administrator. While there is no universally accepted way to prepare for a job as a computer support specialist, many employers prefer to hire persons with some formal college education. A bachelor's degree in computer science or information systems is a prerequisite for some jobs; however, other jobs may require only a computer-related associate degree. For systems administrators, many employers seek applicants with bachelor's degrees, although not necessarily in a computer-related field.

Many companies are becoming more flexible about requiring a college degree for support positions because of the explosive demand for specialists. However, certification and practical experience demonstrating these skills will be essential for applicants without a degree. Completion of a certification training program, offered by a variety of vendors and product makers, may help some people to qualify for entry-level positions. Relevant computer experience may substitute for formal education.

Beginning computer support specialists usually work for organizations that deal directly with customers or in-house users. Then, they may advance into more responsible positions in which they use what they have learned from customers to improve the design and efficiency of future products. Job promotions usually depend more on performance than on formal education. Eventually, some computer support specialists become applications developers, designing products rather than assisting users. Computer support specialists at hardware and software companies often enjoy great upward mobility; advancement sometimes comes within months of initial employment.

Entry-level network and computer systems administrators are involved in routine maintenance and monitoring of computer systems, typically working behind the scenes in an organization. After gaining experience and expertise, they often are able to advance into more senior-level positions, in which they take on more responsibilities. For example, senior network and computer systems administrators may present recommendations to management on matters related to a company's network. They also may translate the needs of an organization into a set of technical requirements, based on the available technology. As with support specialists, administrators may become software engineers, actually involved in the designing of the system or network and not just the day-to-day administration.

Persons interested in becoming a computer support specialist or systems administrator must have strong problem-solving, analytical, and communication skills because troubleshooting and helping others are vital parts of the job. The constant interaction with other computer personnel, customers, and employees requires computer support specialists and systems administrators to communicate effectively on paper, via e-mail, or in person. Strong writing skills are useful when preparing manuals for employees and customers.

As technology continues to improve, computer support specialists and systems administrators must keep their skills current and acquire new ones. Many continuing education programs are offered by employers, hardware and software vendors, colleges and universities, and private training institutions. Professional development seminars offered by computing services firms also can enhance one's skills and advancement opportunities.

- **Entry-level Earnings**

According to Robert Half International, starting salaries in 2003 ranged from \$27,500 to \$56,500 for help-desk support staff, and from \$51,000 to \$67,250 for more senior technical support specialists. For systems administrators, starting salaries in 2003 ranged from \$49,000 to \$70,250.

Computer Software Engineers

- **Job Outlook**

Computer software engineers are projected to be one of the fastest growing occupations from 2002 to 2012. Rapid employment growth in the computer systems design and related services industry, which employs the greatest number of computer software engineers, should result in highly favorable opportunities for those college graduates with at least a bachelor's degree in computer engineering or computer science and practical experience working with computers. Employers will continue to seek computer professionals with strong programming, systems analysis, interpersonal, and business skills.

Despite the recent downturn in information technology, employment of computer software engineers is expected to increase much faster than the average for all occupations, as businesses and other organizations adopt and integrate new technologies and seek to maximize the efficiency of their computer systems. Job growth will not be as rapid as during the previous decade however, as the software industry begins to mature and as routine software engineering work is increasingly outsourced overseas. Competition among businesses will continue to create an incentive for increasingly sophisticated technological innovations, and organizations will need more computer software engineers to implement these changes. In addition to jobs created through employment growth, many job openings will result annually from the need to replace workers who move into managerial positions, transfer to other occupations, or leave the labor force.

Demand for computer software engineers will increase as computer networking continues to grow. For example, the expanding integration of Internet technologies and the explosive growth in electronic commerce—doing business on the Internet—have resulted in rising demand for computer software engineers who can develop Internet, intranet, and World Wide Web applications. Likewise, expanding electronic data-processing systems in business, telecommunications, government, and other settings continue to become more sophisticated and complex. Growing numbers of systems software engineers will be needed to implement, safeguard, and update systems and resolve problems. Consulting opportunities for computer

software engineers also should continue to grow as businesses seek help to manage, upgrade, and customize their increasingly complex computer systems.

New growth areas will continue to arise from rapidly evolving technologies. The increasing uses of the Internet, the proliferation of Web sites, and "mobile" technology such as the wireless Internet have created a demand for a wide variety of new products. As individuals and businesses rely more on hand-held computers and wireless networks, it will be necessary to integrate current computer systems with this new, more mobile technology. Also, information security concerns have given rise to new software needs. Concerns over "cyber security" should result in businesses and government continuing to invest heavily in security software that protects their networks and vital electronic infrastructure from attack. The expansion of this technology in the next 10 years will lead to an increased need for computer engineers to design and develop the software and systems to run these new applications and that will allow them to be integrated into older systems.

As with other information technology jobs, employment growth of computer software engineers may be tempered somewhat by an increase in contracting out of software development abroad. Firms may look to cut costs by shifting operations to foreign countries with highly educated workers who have strong technical skills.

- **Training, Other Qualifications, and Advancement**

Most employers prefer to hire persons who have at least a bachelor's degree and broad knowledge of, and experience with, a variety of computer systems and technologies. Usual degree concentrations for applications software engineers are computer science or software engineering; for systems software engineers, usual concentrations are computer science or computer information systems. Graduate degrees are preferred for some of the more complex jobs.

Academic programs in software engineering emphasize software and may be offered as a degree option or in conjunction with computer science degrees. Increasing emphasis on computer security suggests that software engineers with advanced degrees that include mathematics and systems design will be sought after by software developers, government agencies, and consulting firms specializing in information assurance and security. Students seeking software engineering jobs enhance their employment opportunities by participating in internship or co-op programs offered through their schools.

These experiences provide the students with broad knowledge and experience, making them more attractive candidates to employers. Inexperienced college graduates may be hired by large computer and consulting firms that train new hires in intensive, company-based programs. In many firms, new employees are mentored, and their mentors have an input into the new hires' evaluations.

For systems software engineering jobs that require workers who have a college degree, a bachelor's degree in computer science or computer information systems is typical. For systems engineering jobs that place less emphasis on workers having a computer-related degree, computer training programs leading to certification are offered by systems software vendors, including Microsoft, Novell, and Oracle. These programs usually last from 1 to 4 weeks, but the worker is not required to attend classes in order to sit for a certification exam; several study guides also are available to help prepare for the exams. Nonetheless, many training authorities feel that program certification alone is not sufficient for most software engineering jobs.

Professional certification is now offered by the Institute of Electrical and Electronics Engineers (IEEE) Computer Society. To be classified as a Certified Software Development Professional, individuals need a bachelor's degree and work experience that demonstrates that they have mastered a relevant body of knowledge, and must pass a written exam.

Persons interested in jobs as computer software engineers must have strong problem-solving and analytical skills. They also must be able to communicate effectively with team members, other staff, and the customers they meet. Because they often deal with a number of tasks simultaneously, they must be able to concentrate and pay close attention to detail.

As is the case with most occupations, advancement opportunities for computer software engineers increase with experience. Entry-level computer software engineers are likely to test and verify ongoing designs. As they become more experienced, computer software engineers may be involved in designing and developing software. Eventually, they may advance to become a project manager, manager of information systems, or chief information officer. Some computer software engineers with several years of experience or expertise find lucrative opportunities working as systems designers or independent consultants or starting their own computer consulting firms.

As technological advances in the computer field continue, employers demand new skills. Computer software engineers must continually strive to acquire such skills if they wish to remain in this extremely dynamic field. To help them keep up with the changing technology, continuing education and professional development seminars are offered by employers and software vendors, colleges and universities, private training institutions, and professional computing societies.

- **Entry-level Earnings**

According to the National Association of Colleges and Employers, starting salary offers for graduates with a bachelor's degree in computer engineering averaged \$51,343 in 2003, and those with a master's degree averaged \$64,200. Starting salary offers for graduates with a bachelor's degree in computer science averaged \$47,109.

Computer Systems Analysts, Database Administrators, and Computer Scientists

- **Job Outlook**

Computer systems analysts, database administrators, and computer scientists are expected to be among the fastest growing occupations through 2012. Employment of these computer specialists is expected to grow much faster than the average for all occupations as organizations continue to adopt and integrate increasingly sophisticated technologies. Job increases will be driven by very rapid growth in computer system design and related services, which is projected to be one of the fastest-growing industries in the U.S. economy. In addition, many job openings will arise annually from the need to replace workers who move into managerial positions or other occupations or who leave the labor force. Job growth will not be as rapid as during the previous decade, however, as the information technology sector begins to mature and as routine work is increasingly outsourced overseas.

Despite the recent economic downturn among information technology firms, workers in the occupation should still enjoy favorable job prospects. The demand for networking to facilitate the sharing of information, the expansion of client-server environments, and the need for computer specialists to use their knowledge and skills in a problem-solving capacity will be major factors in

the rising demand for computer systems analysts, database administrators, and computer scientists. Moreover, falling prices of computer hardware and software should continue to induce more businesses to expand their computerized operations and integrate new technologies into them. In order to maintain a competitive edge and operate more efficiently, firms will keep demanding computer specialists who are knowledgeable about the latest technologies and are able to apply them to meet the needs of businesses.

Increasingly, more sophisticated and complex technology is being implemented across all organizations, which should fuel the demand for these computer occupations. There is a growing demand for system analysts to help firms maximize their efficiency with available technology. Expansion of electronic commerce—doing business on the Internet—and the continuing need to build and maintain databases that store critical information on customers, inventory, and projects are fueling demand for database administrators familiar with the latest technology. Also, the increasing importance being placed on “cybersecurity”—the protection of electronic information—will result in a need for workers skilled in information security.

The development of new technologies usually leads to demand for various kinds of workers. The expanding integration of Internet technologies into businesses, for example, has resulted in a growing need for specialists who can develop and support Internet and intranet applications. The growth of electronic commerce means that more establishments use the Internet to conduct their business online. The introduction of the wireless Internet, known as WiFi, creates new systems to be analyzed and new data to be administered. The spread of such new technologies translates into a need for information technology professionals who can help organizations use technology to communicate with employees, clients, and consumers. Explosive growth in these areas also is expected to fuel demand for specialists who are knowledgeable about network, data, and communications security.

As technology becomes more sophisticated and complex, employers demand a higher level of skill and expertise from their employees. Individuals with an advanced degree in computer science or computer engineering or with an MBA with a concentration in information systems should enjoy highly favorable employment prospects. College graduates with a bachelor’s degree in computer science, computer engineering, information science, or MIS also should enjoy favorable prospects for employment, particularly if they have supplemented their formal education with practical experience. Because employers continue to seek computer specialists who can combine strong technical skills with good interpersonal and business skills, graduates with non-computer-science degrees, but who have had courses in computer programming, systems analysis, and other information technology areas, also should continue to find jobs in these computer fields. In fact, individuals with the right experience and training can work in these computer occupations regardless of their college major or level of formal education.

- **Training, Other Qualifications, and Advancement**

Rapidly changing technology requires an increasing level of skill and education on the part of employees. Companies look for professionals with an ever-broader background and range of skills, including not only technical knowledge, but also communication and other interpersonal skills. This shift from requiring workers to possess solely sound technical knowledge emphasizes workers who can handle various responsibilities. While there is no universally accepted way to prepare for a job as a systems analyst, computer scientist, or database administrator, most employers place a premium on some formal college education. A bachelor’s degree is a prerequisite for many jobs; however, some jobs may require only a 2-year degree. Relevant work experience also is very important. For more technically complex jobs, persons with graduate degrees are preferred.

For systems analyst, programmer-analyst, and 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 and differ considerably from computer science programs, emphasizing business and management-oriented course work and business computing courses. Employers are increasingly seeking 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. For some network systems and data communication analysts, such as webmasters, an associate's degree or certificate is sufficient, although more advanced positions might require a computer-related bachelor's degree. For computer and information scientists, a doctoral degree generally is required due to the highly technical nature of their work.

Despite employers' preference for those with technical degrees, persons with degrees in a variety of majors find employment in these computer occupations. The level of education and type of training that employers require depend on their needs. One factor affecting these needs is changes in technology.

Employers often scramble to find workers capable of implementing "hot" new technologies. Those workers with formal education or experience in information security, for example, are in demand because of the growing need for their skills and services. Another factor driving employers' needs is the timeframe during which a project must be completed.

Most community colleges and many independent technical institutes and proprietary schools offer an associate's degree in computer science or a related information technology field. Many of these programs may be more geared toward meeting the needs of local businesses and are more occupation specific than are 4-year degree programs. Some jobs may be better suited to the level of training that such programs offer. Employers usually look for people who have broad knowledge and experience related to computer systems and technologies, strong problem-solving and analytical skills, and good interpersonal skills. Courses in computer science or systems design offer good preparation for a job in these computer occupations. For jobs in a business environment, employers usually want systems analysts to have business management or closely related skills, while a background in the physical sciences, applied mathematics, or engineering is preferred for work in scientifically oriented organizations. Art or graphic design skills may be desirable for webmasters or Web developers.

Jobseekers can enhance their employment opportunities by participating in internship or co-op programs offered through their schools. Because many people develop advanced computer skills in a non-computer-related occupation and then transfer those skills to a computer occupation, a background in the industry in which the person's job is located, such as financial services, banking, or accounting, can be important. Others have taken computer science courses to supplement their study in fields such as accounting, inventory control, or other business areas. For example, a financial analyst who is proficient in computers might become a computer support specialist in financial systems development, while a computer programmer might move into a systems analyst job.

Computer systems analysts, database administrators, and computer scientists must be able to think logically and have good communication skills. Because they often deal with a number of tasks simultaneously, the ability to concentrate and pay close attention to detail is important. Although these computer specialists sometimes work independently, they frequently work in teams on large projects. They must be able to communicate effectively with computer personnel, such as programmers and managers, as well as with users or other staff who may have no technical computer background.

Computer scientists employed in private industry may advance into managerial or project leadership positions. Those employed in academic institutions can become heads of research

departments or published authorities in their field. Systems analysts may be promoted to senior or lead systems analyst. Those who show leadership ability also can become project managers or advance into management positions such as manager of information systems or chief information officer. Database administrators may advance into managerial positions, such as chief technology officer, on the basis of their experience managing data and enforcing security. Computer specialists with work experience and considerable expertise in a particular subject or a certain application may find lucrative opportunities as independent consultants or may choose to start their own computer consulting firms.

Technological advances come so rapidly in the computer field that continuous study is necessary to keep one's skills up to date. Employers, hardware and software vendors, colleges and universities, and private training institutions offer continuing education. Additional training may come from professional development seminars offered by professional computing societies.

Certification is a way to demonstrate a level of competence in a particular field. Some product vendors or software firms offer certification and require professionals who work with their products to be certified. Many employers regard these certifications as the industry standard. For example, one method of acquiring enough knowledge to get a job as a database administrator is to become certified in a specific type of database management. Voluntary certification also is available through various organizations associated with computer specialists. Professional certification may afford a jobseeker a competitive advantage.

- **Entry-level Earnings**

According to the National Association of Colleges and Employers, starting offers for graduates with a master's degree in computer science averaged \$62,806 in 2003. Starting offers averaged \$47,109 for graduates with a bachelor's degree in computer science; \$45,346 for those with a degree in computer programming; \$41,118 for those with a degree in computer systems analysis; \$40,556 for those with a degree in management information systems; and \$38,282 for those with a degree in information sciences and systems.

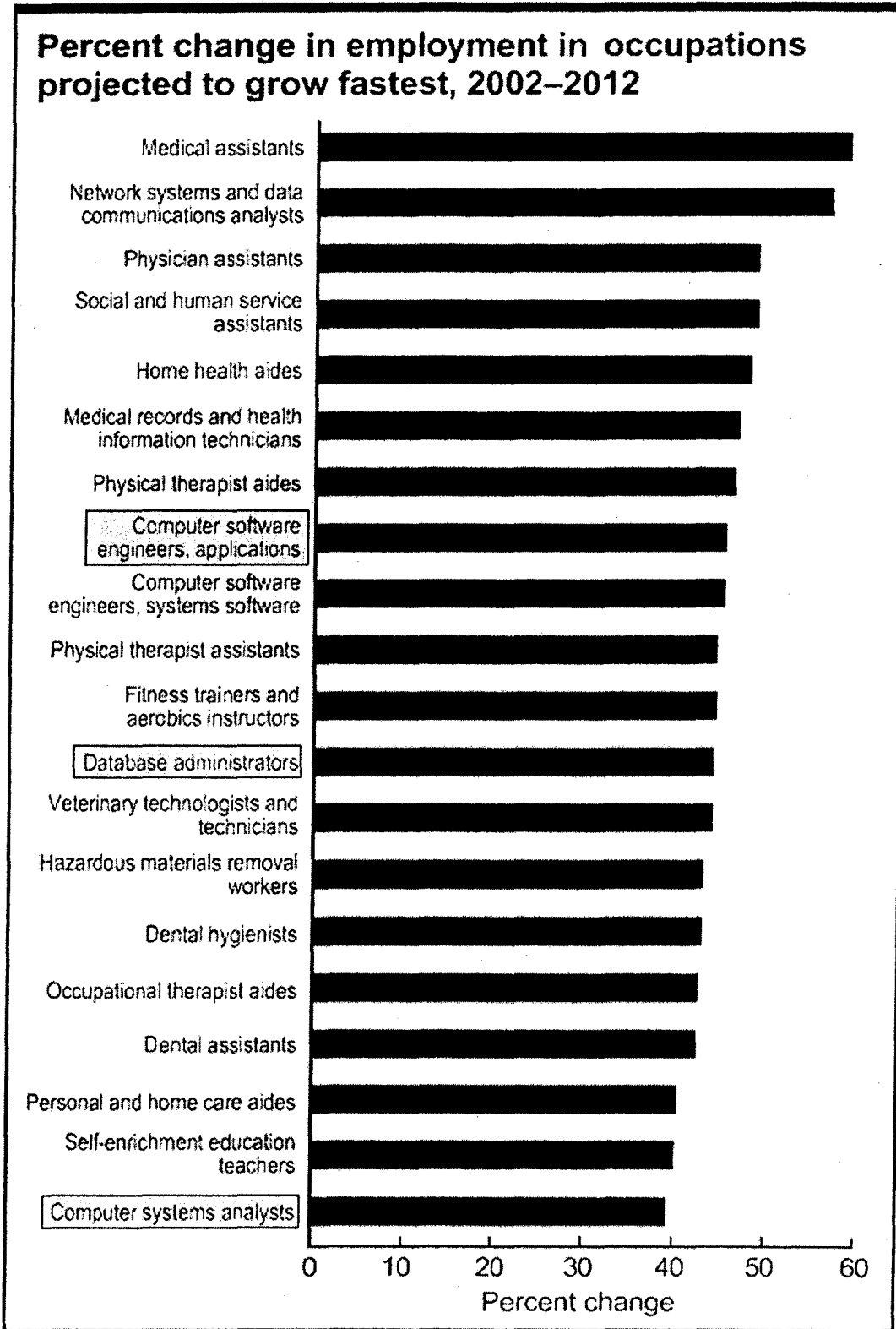
According to Robert Half International, starting salaries in 2003 ranged from \$69,750 to \$101,750 for database administrators. Salaries for networking and Internet-related occupations ranged from \$45,500 to \$65,750 for LAN administrators and from \$51,250 to \$73,750 for Intranet developers. Starting salaries for security professionals ranged from \$62,500 to \$91,750 in 2003.

Table 1. Fastest growing occupations covered in the 2004-05 *Occupational Outlook Handbook*

Table 1. Fastest growing occupations and occupations projected to have the largest numerical increases in employment between 2002 and 2012, by level of education or training (excerpt)

Education level	Fastest growing occupations	Occupations with largest numerical job growth
Bachelor's degree		
	Network systems and data communications analysts	Elementary school teachers, except special education
	Physician assistants	Accountants and auditors
	Computer software engineers, applications	Computer systems analysts
	Computer software engineers, systems software	Secondary school teachers, except special and vocational education
	Database administrators	Computer software engineers, applications
Associate degree		
	Medical records and health information technicians	Registered nurses
	Physical therapist assistants	Computer support specialists
	Veterinary technologists and technicians	Medical records and health information technicians
	Dental hygienists	Dental hygienists
	Occupational therapist assistants	Paralegals and legal assistants

Table 2. Occupations covered in the 2004-05 Occupational Outlook Handbook with the largest projected job growth



Section 7 - LABOR MARKET ANALYSIS

The Bureau of Labor Statistics (BLS) is an agency of the U.S. Department of Labor. The BLS has published the 2004-05 edition of the *Occupational Outlook Handbook*. This publication was helpful in preparing this Labor Market Analysis.

Significant Points

- Four occupational areas within the *Occupational Outlook Handbook* indicate a Bachelor's degree in Computer Information Systems as a qualification for entry into the career field. They are:

- Computer Programmer
- Computer Support Specialists and Systems Administrators
- Computer Software Engineers
- Computer Systems Analysts, Database Administrators, and Computer Scientists

Of these, the last three are projected to be among the fastest growing occupations through 2012 and the first is expected to grow at an average rate (Refer to Table 1).

- Slower job growth due to off-shore outsourcing will be more than offset by an increased demand for information systems, the retirement of older workers, and emerging new technologies.
- Self-employment is a growing trend in these occupational areas as companies continue to outsource.
- Network and database security is the specialty in greatest demand.
- Internships are increasingly important to entry-level job seekers.

The following excerpts from the *Occupational Outlook Handbook* provide relevant, detailed information for each occupational area.

Computer Programmers

- **Job Outlook**

Employment of programmers is expected to grow about as fast as the average for all occupations through 2012. Jobs for both systems and applications programmers should be most plentiful in data processing service firms, software houses, and computer consulting businesses. These types of establishments are part of computer systems design and related services and software publishers, which are projected to be among the fastest growing industries in the economy over the 2002-12 period. As organizations attempt to control costs and keep up with changing technology, they will need programmers to assist in conversions to new computer languages and systems. In addition, numerous job openings will result from the need to replace programmers who leave the labor force or transfer to other occupations such as manager or systems analyst.

Employment of programmers, however, is expected to grow much more slowly than that of other computer specialists. With the rapid gains in technology, sophisticated computer software now has the capability to write basic code, eliminating the need for more programmers to do this routine work. The consolidation and centralization of systems and applications, developments in packaged software, advances in programming languages and tools, and the growing ability of

users to design, write, and implement more of their own programs means that more of the programming functions can be transferred from programmers to other types of workers. Furthermore, as the level of technological innovation and sophistication increases, programmers are likely to face increasing competition from programming businesses overseas, to which much routine work can be contracted out at a lower cost.

Nevertheless, employers will continue to need programmers who have strong technical skills and who understand an employer's business and its programming requirements. This means that programmers will have to keep abreast of changing programming languages and techniques. Given the importance of networking and the expansion of client/server, Web-based, and wireless environments, organizations will look for programmers who can support data communications and help to implement electronic commerce and Intranet strategies. Demand for programmers with strong object-oriented programming capabilities and technical specialization in areas such as client/server programming, wireless applications, multimedia technology, and graphic user interface (GUI) should arise from the expansion of intranets, extranets, and Internet applications. Programmers also will be needed to create and maintain expert systems and embed these technologies in more products. Finally, growing emphasis on cyber-security will lead to increased demand for programmers who are familiar with digital security issues and skilled in using appropriate security technology.

As programming tasks become increasingly sophisticated and additional levels of skill and experience are demanded by employers, graduates of 2-year programs and people with less than a 2-year degree or its equivalent in work experience should face strong competition for programming jobs. Competition for entry-level positions, however, also can affect applicants with a bachelor's degree. Prospects should be best for college graduates with knowledge of, and experience working with, a variety of programming languages and tools—including C++ and other object-oriented languages such as Java, as well as newer, domain-specific languages that apply to computer networking, database management, and Internet application development. Obtaining vendor-specific or language-specific certification also can provide a competitive edge. Because demand fluctuates with employers' needs, jobseekers should keep up to date with the latest skills and technologies. Individuals who want to become programmers can enhance their prospects by combining the appropriate formal training with practical work experience.

- **Training, Other Qualifications, and Advancement**

While there are many training paths available for programmers, mainly because employers' needs are so varied, the level of education and experience employers seek has been rising, due to the growing number of qualified applicants and the specialization involved with most programming tasks. Bachelor's degrees are commonly required, although some programmers may qualify for certain jobs with 2-year degrees or certificates. The associate degree is an increasingly attractive entry-level credential for prospective computer programmers. Most community colleges and many independent technical institutes and proprietary schools offer an associate degree in computer science or a related information technology field.

Employers are primarily interested in programming knowledge, and computer programmers can become certified in a programming language such as C++ or Java. College graduates who are interested in changing careers or developing an area of expertise also may return to a 2-year community college or technical school for additional training. In the absence of a degree, substantial specialized experience or expertise may be needed. Even when hiring programmers with a degree, employers appear to be placing more emphasis on previous experience.

Some computer programmers hold a college degree in computer science, mathematics, or information systems, whereas others have taken special courses in computer programming to

supplement their degree in a field such as accounting, inventory control, or another area of business. As the level of education and training required by employers continues to rise, the proportion of programmers with a college degree should increase in the future. As indicated by the following tabulation, 65 percent of computer programmers had a bachelor's or higher degree in 2002.

	Percent
High school graduate or equivalent or less	7.7
Some college, no degree	15.2
Associate degree	11.6
Bachelor's degree	48.6
Graduate degree	16.7

Required skills vary from job to job, but the demand for various skills generally is driven by changes in technology. Employers using computers for scientific or engineering applications usually prefer college graduates who have degrees in computer or information science, mathematics, engineering, or the physical sciences. Graduate degrees in related fields are required for some jobs. Employers who use computers for business applications prefer to hire people who have had college courses in management information systems (MIS) and business and who possess strong programming skills. Although knowledge of traditional languages still is important, employers are placing increasing emphasis on newer, object-oriented programming languages and tools, such as C++ and Java. Additionally, employers are seeking persons familiar with fourth- and fifth-generation languages that involve graphic user interface (GUI) and systems programming. Employers also prefer applicants who have general business skills and experience related to the operations of the firm. Students can improve their employment prospects by participating in a college work-study program or by undertaking an internship.

Most systems programmers hold a 4-year degree in computer science. Extensive knowledge of a variety of operating systems is essential for such workers. This includes being able to configure an operating system to work with different types of hardware and having the skills needed to adapt the operating system to best meet the needs of a particular organization. Systems programmers also must be able to work with database systems, such as DB2, Oracle, or Sybase.

When hiring programmers, employers look for people with the necessary programming skills who can think logically and pay close attention to detail. The job calls for patience, persistence, and the ability to work on exacting analytical work, especially under pressure. Ingenuity, creativity, and imagination also are particularly important when programmers design solutions and test their work for potential failures.

The ability to work with abstract concepts and to do technical analysis is especially important for systems programmers, because they work with the software that controls the computer's operation. Because programmers are expected to work in teams and interact directly with users, employers want programmers who are able to communicate with nontechnical personnel.

Entry-level or junior programmers may work alone on simple assignments after some initial instruction, or they may be assigned to work on a team with more experienced programmers. Either way, beginning programmers generally must work under close supervision. Because technology changes so rapidly, programmers must continuously update their knowledge and skills by taking courses sponsored by their employer or by software vendors, or offered through local community colleges and universities.

For skilled workers who keep up to date with the latest technology, the prospects for advancement are good. In large organizations, programmers may be promoted to lead programmer and be given supervisory responsibilities. Some applications programmers may move into systems programming after they gain experience and take courses in systems software. With general business experience, programmers may become programmer-analysts or systems analysts or be promoted to a managerial position. Other programmers, with specialized knowledge and experience with a language or operating system, may work in research and development on multimedia or Internet technology, for example. As employers increasingly contract out programming jobs, more opportunities should arise for experienced programmers with expertise in a specific area to work as consultants.

Certification is a way to demonstrate a level of competence, and may provide a jobseeker with a competitive advantage. In addition to language-specific certificates that a programmer can obtain, product vendors or software firms also offer certification and may require professionals who work with their products to be certified. Voluntary certification also is available through other various organizations.

- **Entry-level Earnings**

According to the National Association of Colleges and Employers, starting salary offers for graduates with a bachelor's degree averaged \$45,558 a year in 2003.

Computer Support Specialists and Systems Administrators

- **Job Outlook**

Employment of computer support specialist is expected to increase faster than the average for all occupations through 2012, as organizations continue to adopt and integrate increasingly sophisticated technology. Job growth will continue to be driven by the continued expansion of the computer system design and related services industry, which is projected to remain one of the fastest growing industries in the U.S. economy, despite recent job losses. Job growth will not be as explosive as growth during the previous decade as these jobs are being increasingly outsourced overseas.

Employment growth among computer support specialists reflects the rapid pace of improved technology. As computers and software become more complex, support specialists will be needed to provide technical assistance to customers and other users. New mobility technologies, such as the wireless Internet, will continue to create a demand for these workers to familiarize and educate computer users. Consulting opportunities for computer support specialists also should continue to grow as businesses increasingly need help managing, upgrading, and customizing more complex computer systems. However, growth in employment of support specialists may be tempered somewhat as firms continue to cut costs by shifting more routine work abroad to countries where workers are highly skilled but labor costs are lower. Physical location is not as important for these workers as it is for others, because computer support specialists can provide assistance remotely and support services can be provided around the clock.

Employment of systems administrators is expected to increase much faster than average as firms will continue to invest heavily in securing computer networks. Companies are looking for workers knowledgeable about the function and administration of networks. Such employees have become increasingly hard to find as systems administration has moved from being a separate function within corporations to one that forms a crucial element of business in an increasingly high-technology economy. Also, demand for computer security specialists will grow as businesses and

government continue to invest heavily in "cyber-security," protecting vital computer networks and electronic infrastructure from attack.

The growth of electronic commerce means that more establishments use the Internet to conduct their business online. This translates into a need for information technology specialists who can help organizations use technology to communicate with employees, clients, and consumers. Explosive growth in these areas also is expected to fuel demand for specialists knowledgeable about network, data, and communications security.

Job prospects should be best for college graduates who are up to date with the latest skills and technologies, particularly if they have supplemented their formal education with some relevant work experience. Employers will continue to seek computer specialists who possess a strong background in fundamental computer skills, combined with good interpersonal and communication skills. Due to the rapid growth in demand for computer support specialists and systems administrators, those who have strong computer skills but do not have a bachelor's degree should continue to qualify for some entry-level positions. However, certifications and practical experience are essential for persons without degrees.

- **Training, Other Qualifications, and Advancement**

Due to the wide range of skills required, there are many paths of entry to a job as a computer support specialist or systems administrator. While there is no universally accepted way to prepare for a job as a computer support specialist, many employers prefer to hire persons with some formal college education. A bachelor's degree in computer science or information systems is a prerequisite for some jobs; however, other jobs may require only a computer-related associate degree. For systems administrators, many employers seek applicants with bachelor's degrees, although not necessarily in a computer-related field.

Many companies are becoming more flexible about requiring a college degree for support positions because of the explosive demand for specialists. However, certification and practical experience demonstrating these skills will be essential for applicants without a degree. Completion of a certification training program, offered by a variety of vendors and product makers, may help some people to qualify for entry-level positions. Relevant computer experience may substitute for formal education.

Beginning computer support specialists usually work for organizations that deal directly with customers or in-house users. Then, they may advance into more responsible positions in which they use what they have learned from customers to improve the design and efficiency of future products. Job promotions usually depend more on performance than on formal education. Eventually, some computer support specialists become applications developers, designing products rather than assisting users. Computer support specialists at hardware and software companies often enjoy great upward mobility; advancement sometimes comes within months of initial employment.

Entry-level network and computer systems administrators are involved in routine maintenance and monitoring of computer systems, typically working behind the scenes in an organization. After gaining experience and expertise, they often are able to advance into more senior-level positions, in which they take on more responsibilities. For example, senior network and computer systems administrators may present recommendations to management on matters related to a company's network. They also may translate the needs of an organization into a set of technical requirements, based on the available technology. As with support specialists, administrators may become software engineers, actually involved in the designing of the system or network and not just the day-to-day administration.

Persons interested in becoming a computer support specialist or systems administrator must have strong problem-solving, analytical, and communication skills because troubleshooting and helping others are vital parts of the job. The constant interaction with other computer personnel, customers, and employees requires computer support specialists and systems administrators to communicate effectively on paper, via e-mail, or in person. Strong writing skills are useful when preparing manuals for employees and customers.

As technology continues to improve, computer support specialists and systems administrators must keep their skills current and acquire new ones. Many continuing education programs are offered by employers, hardware and software vendors, colleges and universities, and private training institutions. Professional development seminars offered by computing services firms also can enhance one's skills and advancement opportunities.

- **Entry-level Earnings**

According to Robert Half International, starting salaries in 2003 ranged from \$27,500 to \$56,500 for help-desk support staff, and from \$51,000 to \$67,250 for more senior technical support specialists. For systems administrators, starting salaries in 2003 ranged from \$49,000 to \$70,250.

Computer Software Engineers

- **Job Outlook**

Computer software engineers are projected to be one of the fastest growing occupations from 2002 to 2012. Rapid employment growth in the computer systems design and related services industry, which employs the greatest number of computer software engineers, should result in highly favorable opportunities for those college graduates with at least a bachelor's degree in computer engineering or computer science and practical experience working with computers. Employers will continue to seek computer professionals with strong programming, systems analysis, interpersonal, and business skills.

Despite the recent downturn in information technology, employment of computer software engineers is expected to increase much faster than the average for all occupations, as businesses and other organizations adopt and integrate new technologies and seek to maximize the efficiency of their computer systems. Job growth will not be as rapid as during the previous decade however, as the software industry begins to mature and as routine software engineering work is increasingly outsourced overseas. Competition among businesses will continue to create an incentive for increasingly sophisticated technological innovations, and organizations will need more computer software engineers to implement these changes. In addition to jobs created through employment growth, many job openings will result annually from the need to replace workers who move into managerial positions, transfer to other occupations, or leave the labor force.

Demand for computer software engineers will increase as computer networking continues to grow. For example, the expanding integration of Internet technologies and the explosive growth in electronic commerce—doing business on the Internet—have resulted in rising demand for computer software engineers who can develop Internet, intranet, and World Wide Web applications. Likewise, expanding electronic data-processing systems in business, telecommunications, government, and other settings continue to become more sophisticated and complex. Growing numbers of systems software engineers will be needed to implement, safeguard, and update systems and resolve problems. Consulting opportunities for computer

software engineers also should continue to grow as businesses seek help to manage, upgrade, and customize their increasingly complex computer systems.

New growth areas will continue to arise from rapidly evolving technologies. The increasing uses of the Internet, the proliferation of Web sites, and "mobile" technology such as the wireless Internet have created a demand for a wide variety of new products. As individuals and businesses rely more on hand-held computers and wireless networks, it will be necessary to integrate current computer systems with this new, more mobile technology. Also, information security concerns have given rise to new software needs. Concerns over "cyber security" should result in businesses and government continuing to invest heavily in security software that protects their networks and vital electronic infrastructure from attack. The expansion of this technology in the next 10 years will lead to an increased need for computer engineers to design and develop the software and systems to run these new applications and that will allow them to be integrated into older systems.

As with other information technology jobs, employment growth of computer software engineers may be tempered somewhat by an increase in contracting out of software development abroad. Firms may look to cut costs by shifting operations to foreign countries with highly educated workers who have strong technical skills.

- **Training, Other Qualifications, and Advancement**

Most employers prefer to hire persons who have at least a bachelor's degree and broad knowledge of, and experience with, a variety of computer systems and technologies. Usual degree concentrations for applications software engineers are computer science or software engineering; for systems software engineers, usual concentrations are computer science or computer information systems. Graduate degrees are preferred for some of the more complex jobs.

Academic programs in software engineering emphasize software and may be offered as a degree option or in conjunction with computer science degrees. Increasing emphasis on computer security suggests that software engineers with advanced degrees that include mathematics and systems design will be sought after by software developers, government agencies, and consulting firms specializing in information assurance and security. Students seeking software engineering jobs enhance their employment opportunities by participating in internship or co-op programs offered through their schools.

These experiences provide the students with broad knowledge and experience, making them more attractive candidates to employers. Inexperienced college graduates may be hired by large computer and consulting firms that train new hires in intensive, company-based programs. In many firms, new employees are mentored, and their mentors have an input into the new hires' evaluations.

For systems software engineering jobs that require workers who have a college degree, a bachelor's degree in computer science or computer information systems is typical. For systems engineering jobs that place less emphasis on workers having a computer-related degree, computer training programs leading to certification are offered by systems software vendors, including Microsoft, Novell, and Oracle. These programs usually last from 1 to 4 weeks, but the worker is not required to attend classes in order to sit for a certification exam; several study guides also are available to help prepare for the exams. Nonetheless, many training authorities feel that program certification alone is not sufficient for most software engineering jobs.

Professional certification is now offered by the Institute of Electrical and Electronics Engineers (IEEE) Computer Society. To be classified as a Certified Software Development Professional, individuals need a bachelor's degree and work experience that demonstrates that they have mastered a relevant body of knowledge, and must pass a written exam.

Persons interested in jobs as computer software engineers must have strong problem-solving and analytical skills. They also must be able to communicate effectively with team members, other staff, and the customers they meet. Because they often deal with a number of tasks simultaneously, they must be able to concentrate and pay close attention to detail.

As is the case with most occupations, advancement opportunities for computer software engineers increase with experience. Entry-level computer software engineers are likely to test and verify ongoing designs. As they become more experienced, computer software engineers may be involved in designing and developing software. Eventually, they may advance to become a project manager, manager of information systems, or chief information officer. Some computer software engineers with several years of experience or expertise find lucrative opportunities working as systems designers or independent consultants or starting their own computer consulting firms.

As technological advances in the computer field continue, employers demand new skills. Computer software engineers must continually strive to acquire such skills if they wish to remain in this extremely dynamic field. To help them keep up with the changing technology, continuing education and professional development seminars are offered by employers and software vendors, colleges and universities, private training institutions, and professional computing societies.

- **Entry-level Earnings**

According to the National Association of Colleges and Employers, starting salary offers for graduates with a bachelor's degree in computer engineering averaged \$51,343 in 2003, and those with a master's degree averaged \$64,200. Starting salary offers for graduates with a bachelor's degree in computer science averaged \$47,109.

Computer Systems Analysts, Database Administrators, and Computer Scientists

- **Job Outlook**

Computer systems analysts, database administrators, and computer scientists are expected to be among the fastest growing occupations through 2012. Employment of these computer specialists is expected to grow much faster than the average for all occupations as organizations continue to adopt and integrate increasingly sophisticated technologies. Job increases will be driven by very rapid growth in computer system design and related services, which is projected to be one of the fastest-growing industries in the U.S. economy. In addition, many job openings will arise annually from the need to replace workers who move into managerial positions or other occupations or who leave the labor force. Job growth will not be as rapid as during the previous decade, however, as the information technology sector begins to mature and as routine work is increasingly outsourced overseas.

Despite the recent economic downturn among information technology firms, workers in the occupation should still enjoy favorable job prospects. The demand for networking to facilitate the sharing of information, the expansion of client-server environments, and the need for computer specialists to use their knowledge and skills in a problem-solving capacity will be major factors in

the rising demand for computer systems analysts, database administrators, and computer scientists. Moreover, falling prices of computer hardware and software should continue to induce more businesses to expand their computerized operations and integrate new technologies into them. In order to maintain a competitive edge and operate more efficiently, firms will keep demanding computer specialists who are knowledgeable about the latest technologies and are able to apply them to meet the needs of businesses.

Increasingly, more sophisticated and complex technology is being implemented across all organizations, which should fuel the demand for these computer occupations. There is a growing demand for system analysts to help firms maximize their efficiency with available technology. Expansion of electronic commerce—doing business on the Internet—and the continuing need to build and maintain databases that store critical information on customers, inventory, and projects are fueling demand for database administrators familiar with the latest technology. Also, the increasing importance being placed on “cybersecurity”—the protection of electronic information—will result in a need for workers skilled in information security.

The development of new technologies usually leads to demand for various kinds of workers. The expanding integration of Internet technologies into businesses, for example, has resulted in a growing need for specialists who can develop and support Internet and intranet applications. The growth of electronic commerce means that more establishments use the Internet to conduct their business online. The introduction of the wireless Internet, known as WiFi, creates new systems to be analyzed and new data to be administered. The spread of such new technologies translates into a need for information technology professionals who can help organizations use technology to communicate with employees, clients, and consumers. Explosive growth in these areas also is expected to fuel demand for specialists who are knowledgeable about network, data, and communications security.

As technology becomes more sophisticated and complex, employers demand a higher level of skill and expertise from their employees. Individuals with an advanced degree in computer science or computer engineering or with an MBA with a concentration in information systems should enjoy highly favorable employment prospects. College graduates with a bachelor’s degree in computer science, computer engineering, information science, or MIS also should enjoy favorable prospects for employment, particularly if they have supplemented their formal education with practical experience. Because employers continue to seek computer specialists who can combine strong technical skills with good interpersonal and business skills, graduates with non-computer-science degrees, but who have had courses in computer programming, systems analysis, and other information technology areas, also should continue to find jobs in these computer fields. In fact, individuals with the right experience and training can work in these computer occupations regardless of their college major or level of formal education.

- **Training, Other Qualifications, and Advancement**

Rapidly changing technology requires an increasing level of skill and education on the part of employees. Companies look for professionals with an ever-broader background and range of skills, including not only technical knowledge, but also communication and other interpersonal skills. This shift from requiring workers to possess solely sound technical knowledge emphasizes workers who can handle various responsibilities. While there is no universally accepted way to prepare for a job as a systems analyst, computer scientist, or database administrator, most employers place a premium on some formal college education. A bachelor’s degree is a prerequisite for many jobs; however, some jobs may require only a 2-year degree. Relevant work experience also is very important. For more technically complex jobs, persons with graduate degrees are preferred.

For systems analyst, programmer-analyst, and 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 and differ considerably from computer science programs, emphasizing business and management-oriented course work and business computing courses. Employers are increasingly seeking 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. For some network systems and data communication analysts, such as webmasters, an associate's degree or certificate is sufficient, although more advanced positions might require a computer-related bachelor's degree. For computer and information scientists, a doctoral degree generally is required due to the highly technical nature of their work.

Despite employers' preference for those with technical degrees, persons with degrees in a variety of majors find employment in these computer occupations. The level of education and type of training that employers require depend on their needs. One factor affecting these needs is changes in technology.

Employers often scramble to find workers capable of implementing "hot" new technologies. Those workers with formal education or experience in information security, for example, are in demand because of the growing need for their skills and services. Another factor driving employers' needs is the timeframe during which a project must be completed.

Most community colleges and many independent technical institutes and proprietary schools offer an associate's degree in computer science or a related information technology field. Many of these programs may be more geared toward meeting the needs of local businesses and are more occupation specific than are 4-year degree programs. Some jobs may be better suited to the level of training that such programs offer. Employers usually look for people who have broad knowledge and experience related to computer systems and technologies, strong problem-solving and analytical skills, and good interpersonal skills. Courses in computer science or systems design offer good preparation for a job in these computer occupations. For jobs in a business environment, employers usually want systems analysts to have business management or closely related skills, while a background in the physical sciences, applied mathematics, or engineering is preferred for work in scientifically oriented organizations. Art or graphic design skills may be desirable for webmasters or Web developers.

Jobseekers can enhance their employment opportunities by participating in internship or co-op programs offered through their schools. Because many people develop advanced computer skills in a non-computer-related occupation and then transfer those skills to a computer occupation, a background in the industry in which the person's job is located, such as financial services, banking, or accounting, can be important. Others have taken computer science courses to supplement their study in fields such as accounting, inventory control, or other business areas. For example, a financial analyst who is proficient in computers might become a computer support specialist in financial systems development, while a computer programmer might move into a systems analyst job.

Computer systems analysts, database administrators, and computer scientists must be able to think logically and have good communication skills. Because they often deal with a number of tasks simultaneously, the ability to concentrate and pay close attention to detail is important. Although these computer specialists sometimes work independently, they frequently work in teams on large projects. They must be able to communicate effectively with computer personnel, such as programmers and managers, as well as with users or other staff who may have no technical computer background.

Computer scientists employed in private industry may advance into managerial or project leadership positions. Those employed in academic institutions can become heads of research

departments or published authorities in their field. Systems analysts may be promoted to senior or lead systems analyst. Those who show leadership ability also can become project managers or advance into management positions such as manager of information systems or chief information officer. Database administrators may advance into managerial positions, such as chief technology officer, on the basis of their experience managing data and enforcing security. Computer specialists with work experience and considerable expertise in a particular subject or a certain application may find lucrative opportunities as independent consultants or may choose to start their own computer consulting firms.

Technological advances come so rapidly in the computer field that continuous study is necessary to keep one's skills up to date. Employers, hardware and software vendors, colleges and universities, and private training institutions offer continuing education. Additional training may come from professional development seminars offered by professional computing societies.

Certification is a way to demonstrate a level of competence in a particular field. Some product vendors or software firms offer certification and require professionals who work with their products to be certified. Many employers regard these certifications as the industry standard. For example, one method of acquiring enough knowledge to get a job as a database administrator is to become certified in a specific type of database management. Voluntary certification also is available through various organizations associated with computer specialists. Professional certification may afford a jobseeker a competitive advantage.

- **Entry-level Earnings**

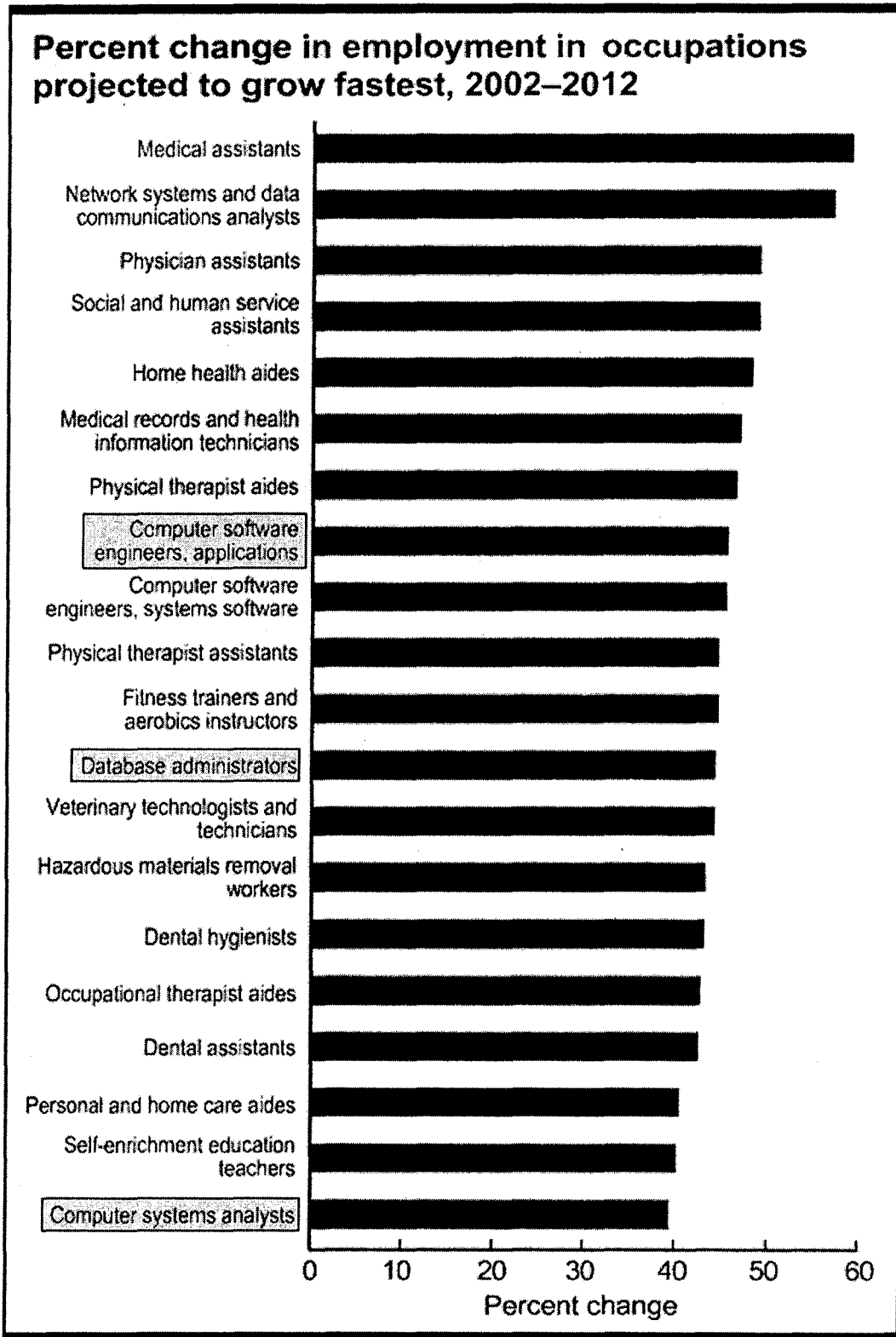
According to the National Association of Colleges and Employers, starting offers for graduates with a master's degree in computer science averaged \$62,806 in 2003. Starting offers averaged \$47,109 for graduates with a bachelor's degree in computer science; \$45,346 for those with a degree in computer programming; \$41,118 for those with a degree in computer systems analysis; \$40,556 for those with a degree in management information systems; and \$38,282 for those with a degree in information sciences and systems.

According to Robert Half International, starting salaries in 2003 ranged from \$69,750 to \$101,750 for database administrators. Salaries for networking and Internet-related occupations ranged from \$45,500 to \$65,750 for LAN administrators and from \$51,250 to \$73,750 for Intranet developers. Starting salaries for security professionals ranged from \$62,500 to \$91,750 in 2003.

Table 1. Fastest growing occupations covered in the 2004-05 *Occupational Outlook Handbook*

Table 1. Fastest growing occupations and occupations projected to have the largest numerical increases in employment between 2002 and 2012, by level of education or training (excerpt)		
Education level	Fastest growing occupations	Occupations with largest numerical job growth
Bachelor's degree		
	Network systems and data communications analysts	Elementary school teachers, except special education
	Physician assistants	Accountants and auditors
	Computer software engineers, applications	Computer systems analysts
	Computer software engineers, systems software	Secondary school teachers, except special and vocational education
	Database administrators	Computer software engineers, applications
Associate degree		
	Medical records and health information technicians	Registered nurses
	Physical therapist assistants	Computer support specialists
	Veterinary technologists and technicians	Medical records and health information technicians
	Dental hygienists	Dental hygienists
	Occupational therapist assistants	Paralegals and legal assistants

Table 2. Occupations covered in the 2004-05 Occupational Outlook Handbook with the largest projected job growth



Please review these pages from the following sources:

Degree Program Costs – 2002-2003

Institutional research & Testing, Ferris State University

Productivity Report – Fall 1999-Winter 2004

Institutional research & Testing, Ferris State University