Form NP: NEW PROGRAM PROPOSAL FORM

Sponsoring Institution(s): University of Central Missouri

Program Title: Computer Science

Degree/Certificate: Master of Science

Options: None

Delivery Site(s): University of Central Missouri main campus in Warrensburg, Missouri

CIP Classification: 11.0701

Implementation Date: Fall 2010

Cooperative Partners: None

Expected Date of First Graduation: May 2012

AUTHORIZATION

Dr. Michael J. Grelle, Associate Provost for Academic Programs and Services

Name/Title of Institutional Officer Signature Date

Dr. Ed Davenport, davenport@ucmo.edu, 660-543-4930

Person to Contact for More Information Telephone

Form SE: STUDENT ENROLLMENT PROJECTIONS

2. Need:
A. Student Demand:

Estimated enrollment each year for the first five years for full-time and part-time students (Please complete Form SE.)

Year	1	2	3	4	5
Full Time	5	10	15	20	25
Part Time	5	5	5	5	5
Total	10	15	20	25	30

A recent survey was given to our current computer science students in the Fall of 2009. Out of the 97 students who responded to the survey, 20 students (21%) indicated that they were strongly interested in the proposed M.S. in Computer Science program and another 36 students (37%) indicated that they were

moderately interested. Furthermore, the UCM International Center receives many inquiries annually from all over the world regarding the offering of an M.S. in Computer Science at UCM. Students often ask specifically for Computer Science since their government or sponsor will not support other degrees. The degree has to be in Computer Science.

Let us consider the student demand for an M.S. in Computer Science with respect to the national scene. According to the most recent survey conducted by the National Science Foundation Division of Science Resources Statistics [1][2], the graduate enrollment in Computer Science is the third largest among all sciences (including social sciences) and engineering fields with a total of 48,959 students in 2007, only behind Biological Sciences and Psychology. This number also represents a 2.7 % increase compared to 2006. The first-time and full-time graduate enrollment for Computer Science in 2007 is 9,352 students, a 4.1% increase from 2006. Again, the same pattern follows, Computer Science has the third largest first-time and full-time graduate enrollment among all sciences (including social sciences) and engineering fields, following only Biological Sciences and Psychology. The average annual percentage change for the first-time and full-time graduate enrollment for Computer Science from 1999 to 2007 is 4.77%. These figures demonstrate that Computer Science is a very popular and viable graduate program in the US which has a very strong, consistent and increasing student demand.

According to the newest Graduate Enrollment and Degrees report released in September 2009 by the Council of Graduate Schools [3], the first-time graduate enrollment for Computer and Information Sciences in Fall 2008 is 11,874 students, a 9.5% increase from 2007. The average annual percentage change for the first-time graduate enrollment for Computer and Information Sciences from 2003 to 2008 is 2.1% and the average annual percentage change from 1998 to 2008 is 4.6%. The enrollment figure places Computer and Information Sciences 7th among 44 fine fields in Biological and Agricultural Sciences, Physical Sciences, Health Sciences, Engineering, Social and Behavioral Sciences, Arts and Humanities, Education, Business, Public Administration and Services and Other Fields in terms of first-time graduate enrollment, only behind Biological Sciences, Health and Medical Sciences, Psychology, Education Administration, Business Administration and Management, and Social Works. Again, these figures show that Computer Science is a very popular and viable graduate program in the US which has a very strong, consistent and increasing student demand.

Will enrollment be capped in the future?

There is no expectation of a cap being needed on enrollment.

B. Market Demand:

National, state, regional, or local assessment of labor need for citizens with these skills

Computer Science is an applied science discipline. The proposed Master of Science in Computer Science supports the goals of University of Central Missouri's Mission statement to provide advanced graduate studies and research in areas of particular strength and need. Furthermore, the University of Central Missouri has a statewide mission in professional applied sciences and technology programs. Offering an M.S. in Computer Science advances our university’s statewide mission.

The demand for quality employees in the field of computing remains strong. This trend is shown to be solid and still growing. The following quote appeared in the January 2008 issue of the *CIO Insight* [4], based on the employment statistics the government released in January 2008. “The number of employed computer professionals is growing at a faster rate than the overall business-tech workforce. That has pushed IT unemployment to a decade low, with no signs of relief on the hiring front anytime soon. A

record 3.76 million workers in the U.S. held IT jobs last year, according to a CIO Insight analysis of Bureau of Labor Statistics (BLS) data. That's a whopping 8.5 percent increase from 2006. The rapid growth in employment lowered last year's IT unemployment rate to 2.1 percent, from 2.5 percent in 2006, the lowest level recorded since the government redefined IT occupations in 2000. As a comparison, overall unemployment in the U.S. in 2007 stood at 4.6 percent, unchanged from 2006."

In spite of the recent down turn in the economy, IT employment remains robust as unemployment rises in most other job categories. According to the July 2008 issue of the *CIO Insight* [5], "The size of the IT workforce in the United States has topped 4 million workers for the first time last quarter, according to CIO Insight's analysis of U.S. Bureau of Labor Statistics data. And the number of employed IT pros reached 3,956,000 in the second quarter of 2008, also a record high. Another sign of a strong IT economy: the number of workers employed by IT services firms rose by 56,100 this past year to 1,414,400, a 4.1 percent increase, according to last month's BLS establishment survey of some 160,000 businesses and government agencies covering about 400,000 worksites. The active sample includes about one-third of all nonfarm payroll workers." Another article in the September 2008 issue of the *CIO Insight* [6] shows IT services payrolls growth buck national employment trends. "While all nonfarm businesses shed 84,000 jobs last month, one sector showed strong employment growth: IT services. Last month's payroll gain within IT services tops the average monthly increase of 5,240 the sector has experienced in the past year. IT services firms employ 62,900 more workers than they did a year earlier, a 4.6 percent increase. That contrasts with an overall payroll drop of 283,000, or 0.2 percent, among all nonfarm employers." According to another article in the October 2008 issue of the *CIO insight* [7], "IT joblessness remains near record lows and way below overall unemployment rate. The IT unemployment rate—as calculated by CIO Insight—inched up one-tenth of a percentage point to 2.4 percent in the third quarter. September's unemployment rate for all occupations stood at a five-year high of 6.1 percent, unchanged from August. (Third-quarter 2008 overall joblessness averaged 6 percent.) ". The newest data further confirms the strong employment trend in computer industry. The November 2008 statistics from the BLS shows a jump of 2.7% in computer systems design and related services employment while U.S. employers laid off 533,000 employees in November.

The US Bureau of Labor Statistics provides the data illustrated in Table 1 regarding the top fastest growing career fields, requiring a bachelor's degree or higher, during the 2006-2016 time period. 5 out of the top 15 fastest growing occupations in the US through 2016 are computer related. The Bureau of Labor Statistics also projects that 854,000 new jobs will be created in the computer industry through 2016 representing a 24.1% increase from 2006.

Table 1 - Fastest Growing Occupations in the United States that Require a Bachelor's Degree or Higher

#	Occupation	Employment 2006	Employment 2016	Percent Change *
1	Network systems and data communications analysts	261,800	401,600	53%
2	Computer software engineers, applications	506,800	732,500	45%
3	Personal financial advisors	176,200	248,400	41%
4	Veterinarians	62,200	84,000	35%

#	Occupation	Employment 2006	Employment 2016	Percent Change *
5	Substance abuse and behavioral disorder counselors	83,300	112,000	34%
6	Financial analysts	220,600	295,200	34%
7	Forensic science technicians	13,100	17,100	31%
8	Mental health counselors	99,800	129,800	30%
9	Mental health and substance abuse social workers	122,300	158,800	30%
10	Marriage and family therapists	24,700	32,100	30%
11	Computer systems analysts	503,600	649,600	29%
12	Database administrators	119,400	153,500	29%
13	Computer software engineers, systems software	350,000	448,700	28%
14	Physical therapists	172,900	219,800	27%
15	Physician assistants	65,600	83,400	27%

Source: http://www.acinet.org/acinet/oview1.asp?soccode=&stfips=&from=National&Level=BAplus&x=32&y=14 (original source: Department of Labor Bureau of Labor Statistics, Office of Employment Projections.)

Similar to the national trend, 5 out of the top 15 fastest growing occupations in Missouri that requires a Bachelor's degree or higher are computer related.

Table 2 - Fastest Growing Occupations in Missouri that Require a Bachelor's Degree or Higher

	Occupation	Employment 2006	Employment 2016	Percent Change *
1	Network systems and data communications analysts	5,090	7,360	45%
2	Computer software engineers, applications	7,040	9,410	34%
3	Medical scientists, except epidemiologists	1,490	1,980	33%
4	Animal scientists	100	130	32%
5	Biochemists and biophysicists	80	110	29%
6	Computer software engineers, systems software	5,600	7,130	27%
7	Forensic science technicians	200	250	26%
8	Veterinarians	1,480	1,850	25%
9	Microbiologists	240	300	25%
10	Substance abuse and behavioral disorder counselors	1,740	2,170	25%
11	Marriage and family therapists	250	320	24%
12	Food scientists and technologists	460	570	23%
13	Pharmacists	4,860	5,910	22%

	Occupation	Employment 2006	Employment 2016	Percent Change *
14	Database administrators	2,750	3,330	21%
15	Network and computer systems administrators	7,860	9,520	21%

Source: http://www.acinet.org/acinet/oview1.asp?soccode=&stfips=29&from=State&Level=BAplus&x=40&y=8 (original data from Missouri Department of Economic Development, Missouri Economic Research and Information Center)

According to the US Bureau of Labor Statistics 2006 Occupational Employment Statistics Survey, the St. Louis and Kansas City metropolitan areas are ranked 16th and 27th, respectively among 100 US metropolitan areas in terms of the number of employment in science and engineering occupations. The share of science and engineering employment in the workforce is 4.3% and 4.7% for St. Louis and Kansas City, respectively.

According to the Science and Engineering Indicators 2008 published by the National Science Board, the computer specialists share of the workforce in Missouri is 2.12% in 2006, which is the second largest among 16 neighboring states or states in the Midwest region.

The Missouri Job Vacancy Survey (JVS), developed by the Missouri Department of Economic Development's Division of Workforce Development (DWD), and Missouri Economic Research and Information Center (MERIC) shows that 42% of METS (Mathematics, Engineering, Technology and Science) job vacancies in Missouri are in computer science. Let us consider the job vacancies in METS-related occupations with respect to different regions in Missouri. Occupations with the most vacancies in Kansas City and also in the Central region of Missouri are Computer Support Specialists. In St. Louis, Computer Systems Analysts have the third largest number of vacancies.

Finally, in a Missouri CBHE official document titled "Clarifying Comments on CBHE Policies and Procedures for the Review of Academic Program Proposals" [8], Computer Science belongs to one of the four categories identified as a field representing needs. In fact, Missouri employers can not find enough computer science graduates to fill the vacancies. According to the Missouri Job Vacancy Survey mentioned above, employers indicated they had either "some" or "great difficulty" filling the opening for 47% of the vacancies in computer science or engineering disciplines. In other words, the current existing Computer Science programs can not produce enough graduates to meet the workforce needs of our state.

C. Societal Need: General needs which are not directly related to employment

The computer industry is one of the fastest growing segments of our economy and that growth promises to continue. Today, computers are used in almost every aspect of our lives: from desktops at home and work to mainframe computers in government and industry to supercomputers expanding the frontiers of science and technology.

To maintain a competitive edge, industry and commerce must continue to make creative scientific and engineering advances as well as produce high quality products. More than ever, there is a demand for a prepared work force with the scientific and technical training necessary to perform effectively on the job.

Advances in computer technology are being made daily. These computing-related advancements continue to distribute themselves throughout the U.S. economy at great speed in the forms of computers, communications equipment, software, and other application products. These technological advancements continue to transform our economy, our society, and our day-to-day lives. Individuals are becoming reliant on these technologies as over 60 percent of the U.S. uses computers and over 50 percent use the Internet [9].

According to the Science and Engineering Indicators 2008 published by the National Science Board, Missouri only has 9.6 science and engineering graduate students per 1,000 individuals 25-34 years old in 2005. This places Missouri 12th among 16 neighboring states or states in the Midwest region.

According to the Educational Needs Index Project Sponsored by the Tennessee Higher Education Commission, 16 out of UCM 21 service counties have educational needs index in the most critical or critical category.

According to the US Bureau of Census, the average poverty rate for the UCM service area is above the state figure, and the average median household income is significantly below the state figure. At the same time, a clear majority (73%) of UCM students are from our 21 service counties according to the most recent report released by the UCM Office of Institutional Research in the Fall of 2009. As a comprehensive regional university with a statewide mission in applied sciences and technology programs, it is our mission to provide Missouri citizens in our own service region and/or beyond the access to affordable graduate study in Computer Science with reasonable cost and driving distance.

Table 3 – Average Percent of Poverty and Average Median Household Income

Area	Average Percent of Poverty (2007)	Average Median Household Income (2007)
UCM service area (21 counties)	14.9%	$40,099
State of Missouri	13.3%	$45,012

D. Methodology used to determine "B" and "C" above.

Data in this proposal is mainly derived from reliable Internet sources such as: National Science Foundation, Council of Graduate Schools, Department of Labor Bureau of Labor Statistics, Office of Employment Projections, Missouri Department of Economic Development, Missouri Economic Research and Information Center, Missouri Department of Higher Education, CIO Insight online and some professional journals. The specific references are listed at the end of this proposal.

3. Duplication and Collaboration: If similar programs currently exist in Missouri, what makes the proposed program necessary and/or distinct from the others at public institutions, area vocational technical schools, and private career schools? Does delivery of the program involve a collaborative effort with any external institution or organization? If yes, please complete Form CL.

Given the University of Central Missouri's statewide mission in applied sciences and technology programs, UCM is in some ways a natural home for the proposed M.S. in Computer Science program. The following universities in Missouri are currently offering master programs in Computer Science. UM-Columbia, UMKC, UMSTL, MST, Northwest Missouri State University, Washington University, and Webster University. As our state's research campuses, the graduate programs in UMC, UMKC, UMSTL, MST and Washington University are mainly designed to train students in independent research skills and prepare them to continue on doctoral program in a specific emphasis area. Accordingly, all of their programs offer a thesis option which emphasizes independent research, and some of their programs offer two or three specific concentration areas (e.g., bioinformatics, networking/telecommunications, software engineering, etc.). On the other hand, the proposed program is designed to produce senior computer professionals in the computer related industry, and its focus is on the application of technology to solve a variety of practical problems and to prepare students to enter a competitive job market by increasing their skills in high-demand areas and emerging technologies. It is not mainly designed to prepare students to pursue a doctoral degree. As a result, the proposed program provides a project option instead of a thesis option which emphasizes applying the knowledge learned from the program to solve practical problems. Our curriculum is also generally based without a concentration area. Furthermore, our university's student population is quite different from these research campuses in terms of their career goals, academic preparations and/or geographic locations. As a result, there will not be duplication with these institutions.

Northwest Missouri State University's graduate program has a fixed 33 credit hour curriculum (no elective courses are available) while the proposed program has an 18 credit hour core and a 15 credit hour in electives which provides more flexibility for the students. As a result, there is no duplication with Northwest Missouri State University. Webster University offers a master program with emphasis in Distributed Systems. Since our curriculum is more generally based, there is no duplication with Webster University as well.

Due to geographically unbalanced locations of graduate Computer Science programs (5 out of 7 programs are located in the east half of the state among which 3 programs are located in St. Louis), the closest institution offering a graduate Computer Science program is approximately 58 miles away from Warrensburg. A clear majority of UCM students (73%) are from our traditional 21 service counties and are tied to this area by jobs and/or family responsibilities. Many of the students have circumstances making going elsewhere to college impossible. The options available to them are largely determined by the options provided at UCM. Furthermore, there are family concerns requiring entry into the selected program as fast as feasible for financial reasons. This situation is further exacerbated by the continuing deteriorating economic conditions of the university's service region. As shown in Table 3 in Form SE, the average poverty rate for the UCM service area is above the state figure, and the average median household income is significantly below the state figure. Furthermore, according to Educational Needs Index project sponsored by the Tennessee Higher Education Commission, 16 out of UCM 21 service counties have educational needs index in the most critical or critical category. As a comprehensive regional university with a statewide mission in applied sciences and technology programs, it is our

mission to provide Missouri citizens in our service region and/or beyond more access to affordable graduate study in Computer Science within reasonable driving distance.

Finally, Computer Science belongs to one of the four categories identified by the Missouri CBHE as a field representing needs [8] (http://www.dhe.mo.gov/clarifyingcomments.shtml). In fact, Missouri employers can not find enough computer science graduates to fill the vacancies. According to the Missouri Job Vacancy Survey, developed by the Missouri Department of Economic Development's Division of Workforce Development, and Missouri Economic Research and Information Center, employers indicated they had either "some" or "great difficulty" filling the opening for 47% of the vacancies in computer science or engineering disciplines. In other words, the current existing Computer Science programs can not produce enough graduates to meet the workforce needs of our state. Creating a new program in M.S. in Computer Science at UCM should help expand and sustain a quality workforce in Missouri. Furthermore, as a comprehensive regional university with a statewide mission in applied sciences and technology programs, offering an M.S. in Computer Science advances our university's statewide mission.

The current Computer Science faculty members are qualified and sufficient to handle the new program. Delivering the program will not involve collaborative efforts with any external institution or organization.

Form PS: Program Structure

4. Program Structure

A. Total credits required for graduation: 33

B. Residency requirements, if any: N/A

C. Courses and credits required for general education: 0

D. Courses and credits required for the major: 33

Core Courses: 18 cr

CS 5300 Advanced Algorithms and Data Structures 3 cr.
CS 5500 Advanced Operating Systems 3 cr.
CS 5600 Advanced Database Systems 3 cr.
CS 5800 Advanced Computer Networking and Security 3 cr.
CS 5900 Compiler Design and Construction 3 cr.
CS 5910 Advanced Software Engineering 3 cr.

Students must choose from Plan A or Plan B: 15 cr

Plan A: Master Project

CS 5040 Master Project 6 cr
Elective Courses 9 cr
CS 5000 Special Topics in Computer Science 3 cr

CS 5020 Internship in Computer Science 3 cr
CS 5030 Readings in Computer Science 3 cr
CS 5310 Theory of Computation 3 cr
CS 4420 Systems Simulation and Modeling 3 cr
CS 5430 Numerical Analysis 3 cr
CS 4700 Artificial Intelligence 3 cr
CS 4810 Computer Graphics 3 cr
MATH 4450 Intro. to Graph Theory 3 cr

Plan B: Comprehensive Examination

Elective Courses 15 cr
CS 5000 Special Topics in Computer Science 3 cr
CS 5020 Internship in Computer Science 3 cr
CS 5030 Readings in Computer Science 3 cr
CS 5310 Theory of Computation 3 cr
CS 4420 Systems Simulation and Modeling 3 cr
CS 5430 Numerical Analysis 3 cr
CS 4700 Artificial Intelligence 3 cr
CS 4810 Computer Graphics 3 cr
MATH 4450 Intro. to Graph Theory 3 cr

E. Number of free elective credits remaining (Sum of C, D, and E should equal A): 0

F. Requirements for thesis, internship, or other capstone experiences

Thesis option is not available in this program. Instead, a student must either pass a comprehensive examination or complete and successfully defend a master project before graduation. Internship is also optional to the students.

G. Any unique features, for example, interdepartmental cooperation: N/A

Form FP: Financial Projections (deleted)

Form PG: Program Characteristics and Performance Goals

6. Program Characteristics and Performance Goals: See the recommended format and issues to be addressed (Form PG). For collaborative programs, responsibility for program evaluation and assessment rests with the institution(s) granting the degree(s).

PROGRAM CHARACTERISTICS AND PERFORMANCE GOALS

Institution Name: University of Central Missouri

Program Name: Master of Science in Computer Science

Date: December 2009

Student Preparation

- **Any special admissions procedures or student qualifications required for this program which exceed regular university admissions, standards, e.g., ACT score, completion of core curriculum, portfolio, personal interview, etc. Please note if no special preparation will be required.**

  Students entering this program are expected to have an undergraduate major in a computing related discipline. Candidates must complete the Graduate Record Examination (GRE) with a minimum combined score of 1000 in Verbal and Quantitative reasoning, and a minimum score of 4.0 in Analytical Writing.

- **Characteristics of a specific population to be served, if applicable.**

  Students entering this program are expected to have an undergraduate major in a computing related discipline. This program is designed to produce senior computer professionals in the computer related industry, and its focus is on the application of technology to solve a variety of practical problems.

Faculty Characteristics

- **Any special requirements (degree status, training, etc.) for assignment of teaching for this degree/certificate.**

  Ph.D. in Computer Science or a closely related field

- **Estimated percentage of credit hours that will be assigned to full time faculty. Please use the term "full time faculty" (and not FTE) in your descriptions here.**

  All courses will be taught 100% by full-time faculty

- **Expectations for professional activities, special student contact, teaching/learning innovation.**

  Faculty teaching in this program will be expected to be professionally active, as evidenced by peer reviewed publications and/or externally funded grants. Faculty will also be expected to attend and/or present at professional meetings, participate in workshops/seminars in areas related to their specialties and involve in other related professional activities (e.g. editor of a professional journal, referee for peer reviewed journals and conference proceedings, hold an office in a regional, national or international organization, etc.)

  Besides class meeting times, faculty are required to hold regular office hours each week. Faculty advisers will have a high degree of interaction with the students who choose the master project option. Faculty are expected to continue improving their teaching by keeping up to date on material or pedagogy.

Enrollment Projections

- **Student FTE majoring in program by the end of five years.**

30 students

- **Percent of full time and part time enrollment by the end of five years.**

  85% full time, 15% part time

Student and Program Outcomes

- **Number of graduates per annum at three and five years after implementation.**

  Three years: 10, five years: 15

- **Special skills specific to the program.**

  Graduates of this program will have special skills and advanced knowledge in algorithms and data structures, programming languages, database systems, operating systems, computer architecture, software engineering, computer networks and security, etc. Students will also be able to address the needs of society with a sense of professionalism and adapt to a dynamic multidisciplinary technological environment through teamwork, ethical concerns, and effective communication.

- **Proportion of students who will achieve licensing, certification, or registration.**

  N/A

- **Performance on national and/or local assessments, e.g., percent of students scoring above the 50th percentile on normed tests; percent of students achieving minimal cut-scores on criterion-referenced tests. Include expected results on assessments of general education and on exit assessments in a particular discipline as well as the name of any nationally recognized assessments used.**

  None available

- **Placement rates in related fields, in other fields, unemployed.**

  95% in computing related fields, 5% in other fields, 0% unemployed

- **Transfer rates, continuous study.**

  5% transfer rates, 5% continuous study in graduate school

Program Accreditation

- **Institutional plans for accreditation, if applicable, including accrediting agency and timeline. If there are no plans to seek specialized accreditation, please provide reasons.**

  No accreditation body exists for this program at this time.

Alumni and Employer Survey

- **Expected satisfaction rates for alumni, including timing and method of surveys**

  Around 90% satisfaction. A paper survey will be sent to graduates at periods of one and three years after their graduation to gauge how the program has prepared them for their careers. Data from the survey will be compiled and analyzed to improve the quality of the program. An electronic version of the survey will also be available on the department website. Graduating students will be given an exit interview with the Graduate Committee.

- **Expected satisfaction rates for employers, including timing and method of surveys**

  Around 90% satisfaction. Survey will be sent to employer(s) every summer. Data from the survey will be compiled and analyzed to improve the quality of the program. An electronic version of the survey will also be available on the department website.

7. Accreditation: If accreditation is not a goal for this program, provide a brief rationale for your decision. If the institution is seeking program accreditation, provide any additional information that supports your program.

No accreditation body exists for this program at this time.

8. Institutional Characteristics: Please describe succinctly why your institution is particularly well equipped or well suited to support the proposed program.

Founded as a teacher's college in 1871, the University of Central Missouri has maintained its commitment to excellent teaching. UCM has a statewide mission in applied sciences and technology programs. Our average class size is 23. UCM's six-month job-placement rate for undergraduates is 94 percent, and, reflecting our excellent financial support packages, our students benefit from one of the lowest student-debt ratios in the state. Publicly supported, richly diverse in our people and programs, UCM offers a remarkable educational experience. Of recent University of Central Missouri graduates:

- 90% were satisfied with the quality of education they received.
- 84% were satisfied with the quality of education in their major.
- 91% rated the practical experience in their courses as excellent or good.
- 89% indicated the quality of education they received at UCM increased their confidence in their knowledge and abilities.
- 85% rated the quality of academic advice they received from faculty as excellent or good.
- 86% felt faculty care about their academic success and welfare.
- 93% would recommend UCM to a family member or friend considering college.

9. Any Other Relevant Information: N/A

References

1. Laura Burns, Peter Einaudi and Patricia Green, “S&E Graduate Enrollments Accelerate in 2007; Enrollments of Foreign Students Reach New High,” National Science Foundation, May 2009.

2. Julia Oliver, “Graduate Students and Postdoctorates in Science and Engineering: Fall 2006,” National Science Foundation, April 2008.

3. Nathan Bell, “First-Time and Total Graduate Enrollment by Fine Field: 1998 to 2008,” Council of Graduate Schools, September 2009.

4. Eric Chabrow, “The New IT Worker Shortage,” CIO Insight, January 2008. http://www.cioinsight.com/c/a/Trends/The-New-IT-Worker-Shortage/

5. Eric Chabrow, “Computer Jobs Hit Record High,” CIO Insight, July 2008. http://www.cioinsight.com/c/a/Workplace/Computer-Jobs-Hit-Record-High/

6. Eric Chabrow, “IT Services Buck Gloomy Jobs Trend,” CIO Insight, September 2008. http://www.cioinsight.com/c/a/Workplace/IT-Services-Buck-Gloomy-Jobs-Trend/

7. Eric Chabrow, “IT Employment, Workforce Reach Record Highs,” CIO Insight, October 2008. http://www.cioinsight.com/c/a/Workplace/IT-Employment-Workforce-Reach-Record-Highs/

8. “Clarifying Comments on CBHE Policies and Procedures for the Review of Academic Program Proposals,” Missouri Department of Higher Education, February 2003. http://www.dhe.mo.gov/clarifyingcomments.shtml

9. Schwarzkopf, A.B., Mejias, R.J., Jasperson, J., Saunders, C.S. & Gruenwald, H, “Effective practices for IT skills staffing,” Communications of the ACM, 47(1), January 2004.