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NEW PROGRAM PROPOSAL FORM

Sponsoring Institution(s): University of Central Missouri

Program Title: Cybersecurity

Degree/Certificate: Bachelor of Science

Options: None

Delivery Site(s): Warrensburg, Missouri

CIP Classification: 11.1003

Implementation Date: Fall 2015

Cooperative Partners: None

AUTHORIZATION:

Michael J Grelle 2-18-2015

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

Name/Title of Institutional Officer | Signature | Date

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Person to Contact for More Information | Telephone

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STUDENT ENROLLMENT PROJECTIONS

Year	1	2	3	4	5
Full Time	15	25	40	55	70
Part Time	0	0	5	5	5
Total	**15**	**25**	**45**	**60**	**75**

Please provide a rationale regarding how student enrollment projections were calculated:

Due to the high market demand in the region and an insufficient number of Cybersecurity professionals available to fill the open positions, the program is expected to grow and achieve the above projections. Enrollment in the Cybersecurity program at Southeast Missouri State University grew to 100 students in three years since it started. We expect similar enrollment projections in this part of Missouri.

Provide a rationale for proposing this program, including evidence of market demand and societal need supported by research:

Background

The Cyberspace Policy Review [1], published in 2009, argued for a national strategy to develop a cybersecurity workforce adequate in numbers and expertise to secure the United States in cyberspace. The latest undergraduate curriculum guidance on computer science (CS2013) [2] prepared for institutions of higher education by the Association for Computing Machinery (ACM) Education Board and the Institute of Electrical and Electronics Engineers (IEEE) Computer Society includes information assurance and security as a key body of knowledge in the computer science undergraduate curriculum. The information assurance and security knowledge area has organized topics vital to cybersecurity. CS2013 also embedded many cybersecurity topics in other key knowledge areas in computer science such as software engineering, software development fundamentals, system fundamentals, programming languages, parallel and distributed computing, networks and communications, and operating systems.

As a result, the Department of Mathematics and Computer Science at the University of Central Missouri (UCM) is requesting approval for a new program, a B.S. in Cybersecurity degree. The proposed addition is important to the UCM Department of Mathematics and Computer Science's continuing efforts to enhance its contributions to prepare the 21st century technical workforce in a STEM field of national interest.

Market Demand

This program will be the first of its kind in Central and Western Missouri to cater to the growing market demand of skilled cybersecurity professionals. A quick job search on October 22nd on *indeed.com* for cybersecurity returned 55 different positions in Missouri just for the month of October alone, many of which are in the Kansas City area [3]. Many such positions remain unfilled for a long time due to a shortage of skilled manpower in cybersecurity. Cybersecurity jobs are no longer only in highly specialized niche organizations. Instead, these jobs now span all sectors from defense, homeland security, and financial institutions to healthcare, law enforcement, and education. According to the Bureau of Labor Statistics [4], the outlook for cybersecurity jobs (a typical position is information security analyst) is very positive.

Information Security Analysts	
2012 Median Pay	$86,170 per year
Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	Less than 5 years
On-the-job Training	None
Number of Jobs, 2012	75,100
Job Outlook, 2012-22	37% (Much faster than average)
Employment Change, 2012-22	27,400

According to another Bureau of Labor Statistics data reported by www.careerinfonet.org, cybersecurity is the second fastest growing occupation in the United States with a projected growth rate of 37% over the next decade [5].

Top 10 Fastest-Growing Occupations in US

#	Occupation	Employment 2012	Employment 2022	Percent * Change	Earnings	Typical Education
1	Interpreters and Translators	63,600	92,900	46%		Bachelor's degree
2	Information Security Analysts	75,100	102,500	37%		Bachelor's degree

#	Occupation	Employment 2012	Employment 2022	Percent * Change	Earnings	Typical Education
3	Meeting, Convention, and Event Planners	94,200	125,400	33%		Bachelor's degree
4	Market Research Analysts and Marketing Specialists	415,700	547,200	32%		Bachelor's degree
5	Geographers	1,700	2,200	29%		Bachelor's degree
6	Personal Financial Advisors	223,400	283,700	27%		Bachelor's degree
7	Operations Research Analysts	73,200	92,700	27%		Bachelor's degree
8	Biomedical Engineers	19,400	24,600	27%		Bachelor's degree
9	Cost Estimators	202,200	255,200	26%		Bachelor's degree
10	Actuaries	24,300	30,600	26%		Bachelor's degree

Many defense contractors located in Missouri hire cybersecurity professionals in various roles like information security analyst, security engineers, security architect, security administrator, and cryptographer. In Missouri, cybersecurity is the third fastest growing occupation with a projected growth rate of 28% over the next decade [5].

Top 10 Fastest-Growing Occupations in Missouri

#	Occupation	Employment 2012	Employment 2022	Percent * Change
1	Interpreters and Translators	960	1,270	33%
2	Food Scientists and Technologists	630	820	30%
3	Information Security Analysts	1,490	1,910	28%
4	Meeting, Convention, and Event Planners	2,020	2,580	28%
5	Operations Research Analysts	910	1,150	27%
6	Market Research Analysts and Marketing Specialists	6,520	8,240	26%
7	Logisticians	2,240	2,790	25%
8	Geographers	30	40	24%
9	Cost Estimators	5,010	6,190	23%
10	Actuaries	610	750	23%

USNews has ranked Cybersecurity fifth in the list of top college majors that lead to jobs [6]. In an article in Washington Post, Tom Kellerman, a former member of the President's cybersecurity

commission was quoted "The government needs to hire at least 10,000 experts in the near future and the private sector needs four times that number" [7]. A survey reported by CIO revealed that Cybersecurity salaries are three times the national average [8].

Student Demand

There are currently 181 schools spanning 43 states that have been designated by the National Security Agency as National Centers of Academic Excellence in Information Assurance Education [9]. This designation is given to schools offering cybersecurity programs that meet certain program quality requirements and help the country meet its demand of cybersecurity professionals. In addition there are 44 schools as of 2012 that have been designated by the National Security Agency as National Centers of Academic Excellence in Information Assurance/Cyber Defense [10]. Many of the designated schools are regional universities and 2-year colleges. Most designated institutions have seen a growth in enrollments in their cybersecurity programs in the last 5 years and this growth is expected to continue given the strong student interest and demand and a strong market demand. The total number of designated institutions reflects a growing popularity of cybersecurity as a major among students.

A significant percentage of graduates with cybersecurity skills are nonresident aliens who are unlikely to be given security clearances required for many cybersecurity jobs [11]. The undergraduate programs attract more domestic students compared to graduate programs. Our program expects to contribute towards filling this void of skilled cybersecurity workers that are also US citizens.

We have received many inquiries from our undergraduates about specializing in cybersecurity. We also receive numerous inquiries from military personnel stationed at Whiteman AFB about cybersecurity offerings from our department. We feel that cybersecurity as a discipline has grown and evolved to a level where a course or two on security aspects of computer science can not provide a broad perspective of various aspects of cybersecurity. An entire program with a right mix and balance of courses on cybersecurity is the right approach to provide a strong foundation for cybersecurity skills in the 21st century. The program will cater to student demands to learn popular topics like countering hacking, protecting software from reverse engineering, computer virus detection, cryptographic security of online transactions, preventing network intrusions, etc.

Societal Need

Recent cyber attacks on large retailers like Target [12] and large banks like JP Morgan Chase [13] again highlighted the need for increased cybersecurity education and training of the existing workforce and preparing a new generation of cybersecurity workers ready for securing our cyberspace from intruders and attackers. The Federal government has recognized the importance of cybersecurity at all levels and a Comprehensive National Cybersecurity Initiative (CNCI) was established by President George W. Bush in 2008 and continued by President Obama [14]. CNCI Initiative#8 puts emphasis on expanding Cyber Education "to develop a technologically-skilled and cyber-savvy workforce with the right knowledge and skills". This led National Institute of Standards and Technology (NIST) to start the National Initiative for Cybersecurity Education (NICE) that involves Department of Homeland Security (DHS), National Science Foundation (NSF), and Department of Education (DoE) [15]. These federal agencies have started programs to help increase the skilled cybersecurity workforce. One of these programs is the designation of

institutions as National Centers of Academic Excellence in Information Assurance and Cyber Defense by the National Security Agency (NSA) [16].

With the establishment of the United States Cyber Command in 2009, more military personnel require cybersecurity training and education. Our program can support this need of the military given the proximity to Whiteman AFB. Many officers have contacted us recently inquiring about cybersecurity offerings at UCM. A full-fledged undergraduate program on cybersecurity will show our commitment and give us visibility among the military.

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?

Given the University of Central Missouri's statewide mission in applied sciences and technology programs, UCM is in some way a natural home for the proposed B.S. in Cybersecurity program. Two universities in Missouri are currently offering undergraduate programs in Cybersecurity: Lindenwood University and Southeast Missouri State University. Due to geographically unbalanced locations of undergraduate Cybersecurity programs (Both existing programs are located in the east half of the state), the closest institution offering a undergraduate Cybersecurity program is approximately 200 miles away from Warrensburg. On the other hand, a clear majority of UCM students 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. 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 undergraduate study in Cybersecurity within reasonable driving distance.

Does delivery of the program involve a collaborative effort with any external institution or organization? If yes, please complete Form CL.

No. The current Computer Science faculty members at UCM are qualified and sufficient to handle the new program. Delivering the program will not involve collaborative efforts with any external institution or organization.

References:

1. Cyberspace Policy Review. On the Internet at http://www.whitehouse.gov/assets/documents/Cyberspace_Policy_Review_final.pdf(visited October 22, 2014.
2. Computer Science 2013: Curriculum Guidelines for Undergraduate Programs in Computer Science. On the Internet at http://www.acm.org/education/curricula-recommendations(visited October 22, 2014
3. On the Internet at http://www.indeed.com/jobs?q=cybersecurity&l=Missouri(visited October 22, 2014).

4. Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2014-15 Edition, Information Security Analysts, on the Internet at http://www.bls.gov/ooh/computer-and-information-technology/information-security-analysts.htm (visited October 22, 2014).
5. On the Internet at http://www.careerinfonet.org/oview1.asp?next=oview1&Level=edu3&optstatus=&jobfam=&id=1&nodeid=3&soccode=&stfips=&ShowAll=(visited October 22, 2014).
6. "Discover 11 Hot College Majors That Lead to Jobs" by Cathie Gandel. USNews, Sept 10, 2013. On the Internet at http://www.usnews.com/education/best-colleges/articles/2013/09/10/discover-11-hot-college-majors-that-lead-to-jobs(visited October 22, 2014).
7. "Cybersecurity experts needed to meet growing demand" by Alexander Fitzpatrick. *Washington Post*, May 29, 2012. On the Internet at http://www.washingtonpost.com/business/economy/cybersecurity-experts-needed-to-meet-growing-demand/2012/05/29/gJQAtev1yU_story.html(visited October 22, 2014).
8. "Cybersecurity Pros in High Demand, Highly Paid and Highly Selective" by Kenneth Corbin. CIO, Aug 8th, 2013. On the Internet at http://www.cio.com/article/2383451/careers-staffing/cybersecurity-pros-in-high-demand--highly-paid-and-highly-selective.html(visited October 23, 2014).
9. National Centers of Academic Excellence in Information Assurance (IA)/Cyber Defense (CD), on the Internet at https://www.nsa.gov/ia/academic_outreach/nat_cae/(visited October 22, 2014).
10. "2013 National Centers of Academic Excellence in Information Assurance Designees Announced". National security Agency, Dec 1, 2013. On the Internet at https://www.nsa.gov/public_info/press_room/2013/academic_excellence_designees.shtml(visited October 23, 2014).
11. "Towards Curricular Guidelines for Cybersecurity: Report of a Workshop on Cybersecurity Education and Training" by Andrew McGettrick. Association for Computing Machinery (ACM), Aug 30, 2013. Available on Internet at http://www.acm.org/education/TowardCurricularGuidelinesCybersec.pdf(visited October 23, 2014).
12. "Missed Alarms and 40 Million Stolen Credit Card Numbers: How Target Blew It" by Michael Riley, Ben Elgin, Dune Lawrence, and Carol Matlack. Businessweek, March 13, 2014. On the Internet at http://www.businessweek.com/articles/2014-03-13/target-missed-alarms-in-epic-hack-of-credit-card-data(visited October 23, 2014).
13. "JPMorgan: 76 million customers hacked" by James O'Toole. CNN Money, Oct 3, 2014. On the Internet at http://money.cnn.com/2014/10/02/technology/security/jpmorgan-hack/(visited October 23, 2014).
14. The Comprehensive National Cybersecurity Initiative, on the Internet at http://www.whitehouse.gov/issues/foreign-policy/cybersecurity/national-initiative(visited October 22, 2014).
15. National Initiative For Cybersecurity Education (NICE), on the Internet at http://csrc.nist.gov/nice/about.html(visited October 22, 2014).
16. National Centers of Academic Excellence in Information Assurance (IA)/Cyber Defense (CD). National security Agency. On the Internet at https://www.nsa.gov/ia/academic_outreach/nat_cae/(visited October 23, 2014).

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PROGRAM STRUCTURE

A. **Total credits required for graduation:** 120

B. **Residency requirements, if any:** 30

C. **General education:** Total credits: 42

Courses (specific courses OR distribution area and credits):

Course Number	Credits	Course Title
CS 1000	3	Computers and Modern Society
CTE 3060	3	Technical Writing
ACST 1300	3	Basic Statistics
CJ 1000	3	Intro to Criminal Justice
COMM 1000/1050	3	Public Speaking/Foundation of Oral Communication Competency
CS 1030/MATH 1131	3	Intro to Computer Programming/Applied Calculus
Areas/Category	**Credits**	**Notes**
Writing I	3	
Managing Info.	2	
Literature	3	
Fine Arts	3	
Knowledge Area I	3	Choose a course from Literature/Fine Arts or Languages/Humanities
Science with Lab	4	
History	3	
Social Sciences	3	

D. **Major requirements:** Total credits: 70

Core Courses (52 credits):

Course Number	Credits	Course Title
CS 1000	3	Computer Programming I

CS 1110	3	Computer Programming II
CS 2200	3	Intro to Computer Organization
CS 2300	3	Data Structures
CS 2400	3	Discrete Structures
CS 3130	3	Secure Programming
CS 3300	3	Intro to Cryptography
CS 3500	3	C and UNIX Environment
CS 4300	3	Algorithm Design and Analysis
CS 4500	3	Operating Systems
CS 4600	3	Database Theory and Applications
CS 4800	3	Computer Networking
CS 4820	3	Computer Security
CS 4920	3	Senior Project
NET 1060	3	Intro to Networks
NET 1061	3	Routing and Switching Essentials
NET 3068	4	Network Security I

Electives Group I (9-12 credits):

Course Number	Credits	Course Title
CS 4010	3	Special Problems in Cybersecurity
CS 4610	3	Intro to Cloud Computing
CS 4620	3	Big Data Systems
CJ 3450	3	Intro to Computer Forensics

Electives Group II (6-9 credits):

Course Number	Credits	Course Title
CS 4020	3	Internship in CS
CS 3110	3	Application Programming with C# and .NET
CS 3120	3	Web Programming
CS 3200	3	Computer Architecture
CS 4110	3	Mobile App. Programming with Android

CS 4120	3	Advanced App. Programming with Java
CS 4510	3	Intro to Distributed Systems
CS 4700	3	Artificial Intelligence
CS 3800	3	App. Development with VB.NET
CS 4910	3	Software Development
NET 2060	3	Scaling Networks
NET 2061	3	Connecting Networks

E. Free elective credits:

8

(Sum of C, D, and E should equal A.)

F. Requirements for thesis, internship or other capstone experience:

CS 4920 Senior Project serves as a capstone course for the program which is required. Internship (CS 4020 Internship in CS) is optional to the students.

G. Any unique features such as interdepartmental cooperation:

N/A

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PROGRAM CHARACTERISTICS AND PERFORMANCE GOALS

Institution Name: University of Central Missouri
Program Name: Bachelor of Science in Cybersecurity
Date: Fall 2015

(Although all of the following guidelines may not be applicable to the proposed program, please carefully consider the elements in each area and respond as completely as possible in the format below. Quantification of performance goals should be included wherever possible.)

1. 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.

  No special admission procedures or student qualifications required. The proposed program will adopt the same admission criteria for undergraduate students at UCM.

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

  N/A

2. 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 area required for tenure track faculty.
  M.S. in Computer Science or a closely related area required for non-tenure track faculty.

- 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 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 be involved in other related professional activities. Faculty are expected to continue improving their teaching by keeping up to date on material or pedagogy.

3. Enrollment Projections

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

  75 students

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

  94% full time, 6% part time

4. 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 with a Bachelor of Science degree in Cybersecurity will demonstrate the following specific student outcomes:

  - An ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline.
  - An ability to analyze a problem, and identify and define the required cybersecurity components appropriate to its solution.
  - An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
  - An ability to function effectively on teams to accomplish a common goal.
  - An understanding of professional, ethical, legal, security and social issues and responsibilities.
  - An ability to communicate effectively with a range of audiences.
  - An ability to analyze the local and global impact of computing on individuals, organizations, and society.
  - Recognition of the need for and an ability to engage in continuing professional development.
  - An ability to use current techniques, skills, and tools necessary for securing the cyberspace.

- 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 Cybersecurity related fields, 5% in other fields, 0% unemployed

- Transfer rates, continuous study.

  N/A

5. Program Accreditation

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

  The program will seek ABET accreditation. UCM will also seek recognition as a National Security Agency (NSA) designated Center for Academic Excellence (CAE) in Information Assurance/Cyber Defense (IA/CD) two years after the program starts. An institution is eligible to apply for CAE IA/CD designation only after the IA/CD program (Cybersecurity) has been in effect for two years.

6. Alumni and Employer Survey

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

  Around 90% satisfaction. 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.

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

  Around 90% satisfaction. Survey will be sent to employer(s) every three years requesting their input on quality of the program and its graduates. Data from the survey will be compiled and analyzed to improve the quality of the program. The UCM Cybersecurity Advisory Board, which meets once per year, will also provide input during the meeting.

7. Institutional Characteristics

- Characteristics demonstrating why your institution is particularly well equipped to support the 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 undergraduate class size is 24. UCM's six-month job-placement rate for undergraduates is 92 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.