DEGREE/PROGRAM CHANGE
FORM C
Form Number: C1178

Fields marked with * are required

Name of Initiator: Monique Marlene Morin **Email:*** morin@unm.edu **Date:*** 10-31-12

Phone Number:* 505 662-5919 Initiator's Title* Temporary Faculty: LosAlamos Branch

Associated Forms exist?* No

Faculty Contact* Monique Morin Administrative Contact* Monique Morin

Department* Computer Science Admin Email* morin@unm.edu

Branch Los Alamos Admin Phone* 505-662-5919 x331

Proposed effective term:

Semester Fall Year 2013

Course Information

Select Appropriate Program Undergraduate Degree Program

Name of New or Existing Program * NEW AS Computer Science (LA)

Select Category Major Degree Type AS

Select Action New

Exact Title and Requirements as they should appear in the catalog. If there is a change, upload current and proposed requirements.

See current catalog for format within the respective college (upload a doc/pdf file)

FormC_ASCS_10-30-12rev.pdf

☐ **Does this change affect other departmental program/branch campuses? If yes, indicate below.**

Reason(s) for Request * (enter text below or upload a doc/pdf file)

Attached document has degree requirements on pages 19 and 20. Attached document pages 1-9 has overview, justification, impact, etc. Page 23 has approval from UNM-LA Curriculum committee. Thank you.

FormC_ASCS_10-30-12rev.pdf

Upload a document that inlcudes justification for the program, impact on long-range planning, detailed budget analysis and faculty workload implications. *

FormC_ASCS_10-30-12rev.pdf

September 2012

UNM-Los Alamos
Computer Science and Information Technology
Degree Revitalization

Executive Summary

Recently, UNM-Los Alamos (UNM-LA), has re-affirmed its commitment to being a leading STEM (science, technology, engineering, and mathematics) branch campus of the University of New Mexico. In support of this effort, a grant to "Reinvigorate Information Technology Education with Cyber Security"[1] was written by Dr. Kate Massengale (UNM-LA's Dean of Instruction) and awarded by the National Science Foundation to UNM-LA. Simultaneously, efforts within UNM-LA's Computer Science/Network Administration department were underway to better meet the needs of its changing student population.

In order to streamline UNM-LA's offerings, optimize student opportunities, and leverage across Computer Science (CS), Network Administration, and Information Technology (IT) - related degree programs, we are proposing the following changes to our curriculum:

1) migrate existing Associate of Applied Science in Computer Science (both programming and gaming concentrations) to a single Associate of Science in Computer Science,

2) migrate existing Associate of Applied Science in Network Administration (both Windows and Linux/Unix concentrations) to an Associate of Applied Science in Information Technology with Cybersecurity,

3) and phase out the current Associate of Applied Science degrees of: Digital Media Arts, Office Communications and Technology, Technical Support, and Web Technologies.

Change #1 is driven by the fact that almost half of the CS-affiliated students for Spring 2012 were taking UNM-LA's CS courses for non-AAS purposes – preparing for CS graduate school, pursuing CS bachelor's degree, and/or professional development. Computer science positions targeted by the programming concentration (e.g. computer programmer and software developers) have a predicted "average" to "much faster than average" outlook and are typically held by those employees with a bachelor's degree.[2] Given the common need for a bachelor's degree in this field, we would like to offer a transfer-oriented Associate of Science degree thus leading to an almost seamless transition to UNM's Computer Science undergraduate department. (While video game designers also typically require a bachelor's degree, the projected growth is slower than average. Furthermore, in the last 2-3 years these very specialized courses have not had sufficient interest to run and have been subject to being "sunset" out of UNM-LA's current catalog.)

Change #2 is driven by the desire to give provide our students with a strong foundation in information technology to allow the pursuit of careers (or further education in) such areas as network administration, computer and information system managers, computer user support specialists, and information security analysts. As cited in the awarded grant proposal "According to Sandia fellow Jim

1 Attachment 1

2 Occupational Information Network (O*Net can be found at http://www.onetonline.org)

Gosler: ' There are about 1,000 security people in the US who have the specialized skills to operate effectively in cyberspace. We need 10,000 to 30,000.'" Given the need for a wide-range of extended technical coursework, we believe this is best met with an Associate of Applied Science degree in Information Technology with Cybersecurity.

Proposal #3 is driven by low enrollments for extended coursework. While we do expect to continue to offer some introductory courses in these areas, the extended curriculum and resources required to offer these AAS degrees are not economically beneficial at this time. We therefore will be able to focus existing affiliated resources on "service classes" (those used by degrees outside of the CS/IT department) and possibly specialized "employability" certificates which typically require 3-4 courses total.

The following sections of this document provide preliminary proposals for the two degree migrations as well as a projected combined course rotation for Computer Science and Information Technology departments at UNM-Los Alamos. Supporting documentation is provided as a separate attachment.

Preliminary Proposal
Associated of Science in Computer Science

1. Program Description

We propose to offer a transfer-oriented Associate of Science in Computer Science. Currently, UNM-Los Alamos is the only branch campus offering both 100 and 200 level CS courses for CS majors as part of an existing Associate of ***Applied*** Science in Computer Science. Essentially UNM core requirements would replace the majority of non-transferable technical classes such as CS170 Visual Basic and CS148 Introduction to Programming in C++. The target program for this transfer-oriented degree would be a Bachelor of Science in Computer Science at UNM, though the courses are applicable and potentially transferable to other 4 year institutions offering a similar degree.

Primary goals for the Associate of Science program would be quite similar to those of UNM's Computer Science department – namely:

> "The primary goal of the degree program in Computer Science is to provide students the foundations for future work and careers in computation-based problem solving. These foundations support both a successful career path in computing as well as provide appropriate qualifications for further degree work in computation related disciplines..."[3]

This migration fits well with the branch campus mission of offering transfer-oriented STEM degrees (also offered at UNM-LA are Associate of Science Degrees in Environmental Science, Pre-Professional Health Sciences, Pre-Engineering, and Science). It also fits with UNM's vision to "Educate and encourage students to develop the values, habits of mind, knowledge, and skills that they need to be enlightened citizens, contribute to the state and national economies, and lead satisfying lives."[4] None of the other branch campuses offer the full sequence of classes for CS majors at the freshman and sophomore level, as UNM-LA already does as part of the existing Associate of Applied Science in Computer Science.

The Associate of Science in Computer Science has a target start date of August 2013. There is minimal program development and it will be concluded this fall pending preliminary approval. (As UNM-LA already offers the CS majors sequence at the 100 and 200 levels, no new courses need to be developed. Existing courses required for the Associate of Applied Science currently – and not in demand as "service" classes – will be phased out in the coming years as students finish their current Associate of Applied Science program.)

2. Evidence of Need

As noted in the executive summary, a majority of our active CS student population (approximately 10 students last academic year) were not pursuing an AAS degree, but could be considered candidates for an AS degree if offered. Of the UNM branch campuses (Los Alamos, Taos, Valencia, and Gallup) UNM-LA is the only to offer a 2-year computer science degree at this time. Although Santa Fe Community College offers an Associate of Science in Computer Science, per their catalog description and UNM's listing of transfer equivalents, there are multiple first and second year courses missing (CS 293, CS 261, CS241, EECE 238). These courses are offered already on a regular rotation at UNM-LA.

3 http://www.cs.unm.edu/academics/degrees/bachelors_degrees/program-objectives/
4 UNM's Strategic Framework for 2008 and Beyond

Not taking these courses during the first two years of a degree program greatly hinders a student's ability to complete a bachelor's degree in four years. And although Northern New Mexico College offers some CS courses in support of their Engineering and other degrees, their current catalog does not show a CS degree program.

O*Net[5] summarizes the computer programmer career as "Create, modify, and test the code, forms and script that allow computer applications to run. Work from specifications drawn up by software developers or other individuals. May assist software developers by analyzing user needs and designing software solutions. May develop and write computer programs to store, locate, and retrieve specific documents, data and information." O*Net, the "nation's primary source of occupational information" being developed under sponsorship of the US Department of Labor/Employment and Training Administration, labels this and some other computer related careers such as Computer Systems Analysts and Computer and Information Systems Managers as "bright outlook."

Per the U.S. Department of Labor, "Software developers are the creative minds behind computer programs. Some develop the applications that allow people to do specific tasks on a computer or other device. Others develop the underlying systems that run the devices or control networks." The job outlook is listed as 30% for 2010-2020 and "much faster than average."[6]

3. Program Content and Quality

The following requirements are based on existing UNM requirements for a bachelor's in Computer Science, UNM-LA's existing Pre-Engineering degree (which also targets main campus as a degree program in the School of Engineering like CS), and a model proposed by the state-wide task force for CS articulation. Computer Science (CS) and Electrical Engineering and Computer Engineering (EECE) course numbers indicated by bold below are main campus courses currently offered at UNM-LA on a regular rotation. Note that although 67 total credits may be considered "high" by some for an associate's degree, this is the exact number of credits expected by UNM's School of Engineering during freshman and sophomore years when a student is majoring in Electrical Engineering or Computer Science at main campus.

Total Credits for Associate of Science in Computer Science: 67

General Education Component (43 credits):

Writing and Speaking 9 credits
ENGL 101
ENGL 102
ENGL 219

Lab Science 14 credits
PHYC 160 and 160L (4)
PHYC 161 and 161L (4)

5 Occupational Information Network (O*Net can be found at http://www.onetonline.org)

6 U.S. Department of Labor/U.S. Bureau of Labor Statistics Occupational Outlook Handbook Software Developer page (http://www.bls.gov/ooh/computer-and-information-technology/software-developers.htm)

2 additional science courses (of 3 or more credit hours each) chosen from:
BIOL 201, 202
CHEM 121, 123L, 122, 124L
EPS 101, 105L, 201L
ENVS 101, 102L

Mathematics 8 credits
MATH 162
MATH 163

UNM Core 12 credits
Divided as:

Fine Arts 3 credits
choose from:

Art History	101, 201, 202
Dance	105
Media Arts	210
Music	139, 140
Theater	122

Foreign Language 3 credits
choose any lower division non-English course in Linguistics, Spanish, Portuguese, or Foreign Languages & Literature

Humanities and Social and Behavioral Sciences 6 credits
choose any 2 from the following:

American Studies	182,185,186
Anthropology	101,130
Classics	107, 204, 205
Comparative Literature	223, 224
Economics	105, 106
Engineering	200
English	150, 292, 293
Geography	102
History	101, 102, 161, 162
Linguistics	101
Modern Languages	101
Philosophy	101, 201, 202
Political Science	110, 200
Psychology	105
Religious Studies	107
Sociology	101

Computer Science Component (24 credits):

CS101 Introduction to Computing	4
CS152 Introduction to Programming (Java – Majors)	3
CS220 Systems Analysis and Design	3
CS241 Data Organization	3
CS251 Intermediate Programming	3

CS261 Mathematical Foundations of Computer Science	3
CS293 Social and Ethical Issues in Computing	1
ECE238 Computer Logic Design	4

Sample Model/Sequence of Classes for Associate of Science in Computer Science degree:

ENGL 101	3	ENGL 102	3
MATH 162	4	MATH 163	4
CS 101	4	CS152	3
Lab Science #1	4	Lab Science #2	4
Core #1	3	Core #2	3
TOTAL	18	TOTAL	17

CS 251	3	CS 241	3
CS 261	3	CS 220	3
Lab Science #3	3	Lab Science #4	3
ENGL 219	3	ECE 238	4
Core #3	3	Core #4	3
		CS 293	1
TOTAL	15	TOTAL	17

As UNM-LA already offers the 100 and 200 level CS course sequence, no new computer science courses need to be added to the current rotation to meet these degree requirements. By shifting the focus from supplemental technical courses found in the current Associate of Applied Science program to more general education requirements, UNM-LA's offerings of the UNM-Core (Fine Arts, Foreign Languages, Humanities, Social and Behavioral Sciences) may see a slight boost in enrollment.

Our instructional model at UNM-LA includes, traditional face to face courses with integrated labs, hybrid courses (1 live + 1 online module per week), and fully online courses. While accreditation with ABET (the organization from which the UNM CS program has accreditation) might be desirable in the future, initial cost estimation is in the $5,000-$10,000 range for this process and not economically feasible at this time.

4. Evaluation and Assessment

Preliminary Broad Learning Goals for the Associate of Science in Computer Science include:

- Graduates will have a basic understanding of computer science principles and be able to apply problem solving skills.

- Graduates will have an introductory level of technical competence in the area of software development.

- Graduates will be prepared to pursue a bachelor's degree in Computer Science at a 4 year institution.

Preliminary Student Learning Outcomes for the Associate of Science in Computer Science include:

- Understand the Software Engineering Lifecycle (supports UNM goal of “applied skills”)
- Develop and analyze simple algorithms (supports UNM goal of “critical and creative thinking” and “problem solving” skills)
- Basic competence in at least one high-level programming language (supports UNM goal of “applied skills”)
- Experience with software testing and debugging techniques (supports UNM goal of “responsibility”)
- *An understanding of professiona*l and *social issues and responsibilities* (supports UNM goal of “responsibility”)
- Ability to communicate technical ideas both in written and oral forms as well as an ability to listen (supports UNM goal of “written and oral communication skills”)
- Academic training will demand sufficient standards for students to develop skills which will allow them to successfully complete a 4-year degree (supports UNM goal of “foundations and skills for lifelong learning”)

These learning goals and outcomes will be tracked by course assessments (conducted by faculty for designated courses) and reported to the department chair. The department chair will then utilize these results in conjunction with institutional/program-level data (e.g. retention and graduation rates) to provide the necessary reports to the Office of Instruction. Learning outcomes, measurement techniques, and assessment process will be evaluated on a regular cycle.

5. Required Resources

At this time, the UNM-LA's Computer Science department is staffed by one .5 FTE tenure-track Assistant Professor and multiple “regular” adjuncts, primarily from Los Alamos National Laboratory. This staffing level is not expected to change with this degree migration. There are no expected changes to existing course fees and costs as the courses are already established.

Given the general core academic requirements for the Associate of Science in Computer Science coincide with other associate degree programs at UNM-Los Alamos, these classes are already offered on a regular rotation. Initially we do not expect a significant enrollment increase; however, once the program has reliable enrollment, we will continually evaluate the need for hiring new faculty to teach additional sections of core classes.

CS courses are taught via live, hybrid (combination of live and online), and online formats. UNM-LA has existing computer labs including one furnished with new machines last academic year by the NSF

Grant “Reinvigorate IT with Cyber Security” which is available to be used by the CS Department and its students.

UNM-Los Alamos offers a variety of resources to students. From our Academic Support Center (tutoring for English, Math, and Science) to the library facility that offers a comfortable learning environment, which includes a variety of study spaces and ten public computer workstations, UNM-LA students have access to resources which support them in their academic pursuits. The NSF Grant “Reinvigorate IT with Cyber Security” is also providing funding to supplement tutor salaries at the Academic Support Center this semester (Fall 2012). Furthermore, our team of advisors can provide information on a variety of academic, administrative, and placement topics.

6. Projected Enrollments and Costs

The following table represents our projected enrollment figures for the program.

Year	**Projected Enrollment**
1	Minimum 6 students
2	Minimum 8 students
Following years	Minimum 12 students

As this is a degree migration with no expected increase in cost, existing institutional funds for the Computer Science department would be used to support the new degree and phase out the old degree.

The following table provides a high level, three-year projection of the program's estimated budget.

	Year 1	**Year 2**	**Year 3**
CS Assistant Professor .5 FTE (includes department chair duties) – existing institutional funds	$22,000	$22,000	$22,000
Adjunct Faculty for CS (majors) courses– existing institutional funds	$9,100	$9,100	$9,100
Total	$31,100.00	$31,100.00	$31,100.00

Preliminary Proposal
Associated of Applied Science in Information Technology with Cybersecurity

1. Program Description

We propose an Associate of Applied Science in Information Technology with an emphasis in Cybersecurity. The degree design utilizes some of the established courses from our existing Associate of Applied Science in Network Administration, which are then supplemented by recommendations from the Association of Computing Machinery's curriculum guidelines to provide a strong and broad IT foundation.[7] We then chose advanced security courses, again from the ACM guidelines, to comprise the cybersecurity component which is motivated by the existing NSF grant "Reinvigorate IT Education with Cybersecurity."

This program is specifically designed to prepare students as entry-level IT and/or Cybersecurity technicians to meet the needs of high-tech careers and businesses in New Mexico and throughout the United States. Students will learn critical security principles that will enable them to plan, develop, and perform security tasks. Curriculum will address hardware, software, processes, communications, applications, and policies and procedures with respect to organizational IT and Cybersecurity.

This migration from a narrowly focused Associate of Applied Science in Network Administration to an Associate of Applied Science in Information Technology with a Cybersecurity emphasis fits well with the branch campus mission of offering STEM degrees with the potential of immediately gaining employment in and serving the community. It also fits with UNM's vision to "Educate and encourage students to develop the values, habits of mind, knowledge, and skills that they need to be enlightened citizens, contribute to the state and national economies, and lead satisfying lives."[8] No other UNM branch campus offers a cyber-focused IT degree. Eastern New Mexico State – Ruidoso community college does offer a completely online Computer and Network Security 18 credit hour program and a self-paced professional Cybersecurity Certification non-credited program. As these offerings are based in their Information Systems department their focus is more applications based. We would expect there to be some overlap at the introductory level, though advanced coursework opportunities would differ. We believe a UNM-LA AAS in IT with Cybersecurity would be able to gain leverage from both the local CS offerings and future cross-school enrollment offerings (such as those with Ruidoso) through programs such as SUN-ONLINE.[9]

The Associate of Science in Information Technology with Cybersecurity emphasis has a target start date of August 2013. Program development is well underway with an expected completion date of Spring 2013 pending preliminary approval. As UNM-LA already offers the Network Administration related courses on a regular rotation, schedule modifications would be made for the handful of new and migrated courses (see Program Content Section for details on these courses) over the next three semesters (Spring 2013, Fall 2013, and Spring 2014). UNM-LA is in the unique position of having the NSF grant "Reinvigorate IT Education with Cyber Security" which will support such activities as faculty training, course development, outreach/recruitment, and evaluation activities over the next two years.

---

7 Information Technology 2008 Curriculum Guidelines for Undergraduate Degree Programs in Information Technology by Associate for Computing Machinery (ACM) and IEEE Computer Society (http://www.acm.org/education/curricula-recommendations)

8 UNM's Strategic Framework for 2008 and Beyond

9 Department of Labor TACT-grant (contact Kristen Krell, Manager, DOL – TACT Program, Santa Fe Community College, 6401 Richards Ave., Santa Fe, NM 87506.

2. Evidence of Need

From a quote in the recent Reuter's article titled "Experts warn of shortage of U.S. Cyber Pros"[10]:

> " 'None of the projections look positive,' said Moss, who serves as the chief security officer for ICANN, a group that helps run some of the Internet's infrastructure. 'The numbers I've seen look like shortages in the 20,000s to 40,000s for years to come.'"

The U.S. Department of Labor Occupational Outlook Handbook groups Information Security Analysts, Web Developers,and Computer Network Architects together. Their projected outlook over 2010-2020 is listed at 22% ("faster than average").[11]

O*Net[12] identifies the cybersecurity career as "Information Security Analysts" who "plan, implement, upgrade, or monitor security measures for the protection of computer networks and information. May ensure appropriate security controls are in place that will safeguard digital files and vital electronic infrastructure. May respond to computer security breaches and viruses." The O*Net prediction is "faster than average (20%-28%)" growth from 2010-2020. Although O*Net reports a majority of people in this field hold bachelor and advanced degrees, we strongly believe this expertise must start from the beginning of a student's education. Per the National Initiative for Cybersecurity Education Strategic Plan, a key objective is to "Increase the quantity and quality of undergraduate and graduate cybersecurity curricula for students in computer science and, more broadly, IT and cybersercurity-related degree programs."[13] It should also be noted that cybersecurity related positions differ from other IT opportunities in that U.S. Citizenship and security clearance are often required. UNM-LA is in a unique position with its proximity to Los Alamos National Laboratory where cybersecurity expertise can be found and is also required.

We have not found a comparable program (i.e. an Information Technology degree with Cybersecurity emphasis) at any of the nearby academic institutions for higher learning (Northern New Mexico College, UNM-Taos, and Santa Fe Community College). With the "Reinvigorate Information Technology Education with Cyber Security" grant there is approximately $4,500 for program promotion and student recruitment which will supplement typical campus recruitment efforts. The grant also has outreach and internship components, which we expect will highlight this unique opportunity at UNM-LA beyond the typical recruitment audience.

3. Program Content and Quality

A minimum of 63 credit hours must be earned to complete the Associate of Applied Science degree in Information Technology with Cybersecurity. The curriculum included in this degree program consists of several groups of courses designed to enhance each student's academic capabilities. The required courses encourage intellectual development in several areas of study to include writing and communication, mathematical reasoning, and scientific methods in the physical sciences.

---

10 Finkle and Randwich, June 12, 2012, Reuters, "Experts warn of shortage of U.S. Cyber Pros" (http://www.reuters.com/article/2012/06/12/us-media-tech-summit-symantec-idUSBRE85B1E220120612)

11 U.S. Department of Labor/U.S. Bureau of Labor Statistics Occupational Outlook Handbook (http://www.bls.gov/ooh/computer-and-information-technology/information-security-analysts-web-developers-and-computer-network-architects.htm)

12 Occupational Information Network (O*Net can be found at http://www.onetonline.org)

13 National Initiative for Cybersecurity Education Strategic Plan, Building a Digital Nation (August 11, 2011)

Total Credits for Associate of Applied Science in Information Technology with Cybersecurity Emphasis: 63

General Education Component (19 credits):

Writing and Speaking 9 credits
ENGL 101
ENGL 119 (ENGL 219 can substitute)
C&J 130

Lab Science 4 credits
PHYC 102 and 102L (PHYC 160 and 160L can substitute)

Mathematics 3 credits
MATH 150 (or higher)

Fine Arts, Foreign Language, Humanities, and Social Science 3 credits
Any of the following not applied elsewhere for degree:

Fine Arts

Art History	101, 201, 202
Dance	105
Media Arts	210
Music	139, 140
Theater	122

Foreign Language

choose any lower division non-English course in Linguistics, Spanish, Portuguese, or Foreign Languages & Literature

Humanities and Social and Behavioral Sciences

American Studies	182,185,186
Anthropology	101,130
Classics	107, 204, 205
Comparative Literature	223, 224
Economics	105, 106
Engineering	200
English	150, 292, 293
Geography	102
History	101, 102, 161, 162
Linguistics	101
Modern Languages	101
Philosophy	101, 201, 202
Political Science	110, 200
Psychology	105
Religious Studies	107
Sociology	101

Information Technology with Cybersecurity Component (44 credits):

CS 101 Introduction to Computing Science	4	(existing course)
CS 152 Introduction to Programming (Java-Majors)	3	(existing course)
CS 220 Systems Analysis and Design	3	(existing course)
CS 261 Mathematical Foundations of Computer Science	3	(existing course)
CS 293 Social and Ethical Issues in Computing	1	(existing course)

IT 119 Networking Core Concepts	3 (existing course)
IT 132 Microcomputer Operating Systems	3 (modified course)
IT 260 Information Assurance and Security	3 (course rename)
IT XXX Databases and Information Management	3 (modified course)
IT 235 Systems Administration	3 (combination of 2 existing courses)
IT 145 Web Fundamentals	3 (modified course)
IT 141 Technical Support	3 (course rename)
IT XXX Scripting for Network Defense	3 (new course)
IT XXX Forensics and Incident Response	3 (new course)
IT elective*	

** IT elective with approval: existing IT co-op, IT special topics course, advanced CS course*

Sample Model/Sequence of Classes for Associate of Applied Science in Information Technology with Cybersecurity:

ENGL 101	3	ENGL 119	3
MATH 150	3	PHYC 102 and 102L	4
CS 101	4	CS152	3
IT 119	3	IT 132	3
Breadth	3	IT 260	3
TOTAL	16	TOTAL	16

CJ 130	3	IT 141	3
CS 261	3	CS 220	3
IT 145	3	IT 235	3
IT Scripting	3	IT Forensics and IR	3
IT Databases/IM	3	IT elective	3
		CS 293	1
TOTAL	15	TOTAL	16

Our instructional model at UNM-LA includes, traditional face to face courses with integrated labs, hybrid courses (1 live + 1 online module per week), and fully online courses. The National Security Agency (NSA) does have a program for “Information Assurance Courseware Evaluation Program” which can lead to individual certifications and also the designation as a “National Center of Excellence in Information Assurance 2 year.” Certifications such as these may be pursued once the program is established. While there is no direct cost associated with this process, we have been told to expect 120-

160 hours of effort for mapping course content to INFOSEC certification criteria. (Note that to be a "Center of Excellence" two different certifications would be required, thus doubling the effort.)

Course Details (new, modified, and renamed courses)

IT 132 Microcomputer Operating Systems 3 credits (modified)

NOTE: modification of existing course IT 132 (Microcomputer Operating Systems)

"The role of the IT professional is to select, deploy, integrate and administer platforms or components to support an organization's IT infrastructure. This knowledge area includes the fundamentals of hardware and software along with how they integrate to form essential components of IT systems. Prerequisite: CS101"

IT 260 Information Assurance and Security 3 credits (rename)

NOTE: currently named IT 260 Network Security Practices, new name to conform with industry, though course description to remain the same

IT XXX Databases and Information Management 3 credits

NOTE: modification and renaming of existing CT 201 Applications of Relational Databases

"Information derived from data is important to the management, productivity and differentiation of an organization. Data must be efficiently collected, organized, retrieved and managed to make it meaningful to the organization. This course will cover development of relational databases as well as administration issues such as data quality and security. Prerequisite: CS101"

IT 235 Systems Administration 3 credits

NOTE: combination of 2 existing courses (IT 235 Systems administration and IT 237 Linux/System Administration I)

"Introduction to system administration. Topics include system configuration/organization, available tools, file system, and automations of tasks. Prerequisite: CS101"

IT 145 Web Fundamentals 3 credits

NOTE: modification of existing course IT 145 Web Design Fundamentals

"Introduction to development, creation, and management of websites. Topics to include HTML, JavaScript, and web server technology. Prerequisites: CS101 and CS 152"

IT 141 Technical Support 3 credits

NOTE: currently named IT 141 Help Desk I, new name to conform with industry, though course description to remain the same (prerequisites to change based on new course names and numbers)

IT XXX Scripting for Network Defense 3 creidts

"Scripting programming for security purposes. Students build on prior programming knowledge to develop, code, use, and debug new and existing scripts. Prerequisite: CS 101 and CS 152"

IT XXX Forensics and Incident Response 3 credits

"This course exposes the student to the topics of Computer Forensics and Incident Response. Topics include: fundamental concepts, history of computing forensics, data recovery techniques, and responses to security incidents. Prerequisite: IT 260 and IT XXX Scripting for Network Defense"

4. Evaluation and Assessment

Preliminary Broad Learning Goals for the Associate of Applied Science in Information Technology with Cybersecurity include:

- Graduates will have the ability to apply knowledge of computing and mathematics appropriate to the discipline
- Graduates will be able to analyze a problem, and identify and define the computing requirements appropriate to its solution

Preliminary Student Learning Outcomes for the Associate of Applied Science in Information Technology with Cybersecurity include:

- An ability to use current techniques, skills, and tools necessary for computing practice (supports UNM goal of "applied skills")
- An ability to use and apply current technical concepts and practices in the core information technologies (supports UNM goal of "applied skills")
- An ability to assess new security technologies and/or threats and recommend changes; review and evaluate security incident response policies; and assist in developing long-range plans for IT security systems (supports UNM goal of "critical and creative thinking" and "problem solving" skills)
- *An understanding of professiona*l and *social issues and responsibilities* (supports UNM goal of "responsibility")
- An ability to function effectively on teams to accomplish a common goal and to communicate effectively with a range of audiences (supports UNM goal of "written and oral communication skills")

These learning goals and outcomes will be tracked by course assessments (conducted by faculty for designated courses) and reported to the department chair. The department chair will then utilize these

results in conjunction with institutional/program-level data (e.g. retention and graduation rates) to provide the necessary reports to the Office of Instruction. Learning outcomes, measurement techniques, and assessment process will be evaluated on a regular cycle.

5. Required Resources

At this time, there is one .25 FTE Network Administration instructor, one .5 FTE Information Technology instructor (whose duties include serving as department chair) and multiple "regular" adjuncts. In the short-term it is expected there will be an increase of workload (estimated at .25 FTE) associated with the migration to the Associate of Applied Science in Information Technology with Cybersecurity (from the existing Network Administration program) and phasing out of the existing IT related programs. Long-range the workload is expected to be similar to the current level of effort.

UNM-LA is fortunate to have the "Reinvigorate IT Education with Cyber Security" grant and pending approval of this curriculum proposal will designate $5,500 for three semesters (Spring 2013, Fall 2013, and Spring 2014) for this associated, increased workload. Courses for the existing Network Administration degree are taught live, hybrid (combination of live and online), and online. UNM-LA has existing computer labs, including one furnished with new machines last academic year by the NSF Grant "Reinvigorate IT with Cyber Security." This same grant has additional funds to subsidize internships in conjunction with local employers, supplement existing outreach and recruiting efforts, and provide faculty training in the area of cybersecurity.

6. Projected Enrollments and Costs

The following table represents our projected enrollment figures for the program.

Year	Projected Enrollment
1	Minimum 8 students
2	Minimum 12 students
Following years	Minimum 16 students

In order to successfully implement this program, existing institutional funds and funds from the NSF grant "Reinvigorate IT Education with Cyber Security" will be used.

The following table provides a high level, three-year projection of the program's estimated budget.

	Year 1	Year 2	Year 3
IT instructor .5 FTE (includes department chair duties) – exiting institutional funds	$22,000	$22,000	$22,000
Grant related efforts (course creation/ migration) – NSF grant funds	$5,500.00	$11,000	$0.00
Network Administration instructor .25 FTE	$11,000.00	$11,000.00	$11,000.00

(migrated to IT) – existing institutional funds			
Adjunct Faculty for AAS in IT with Cyber courses– existing institutional funds	$10,500.00	$10,500.00	$10,500.00
Recruitment materials – NSF grant funds	$1,500.00	$1,500.00	$1,500.00
Internship Subsidies – NSF grant funds	$3,000.00	$3,000.00	$3,000.00
Total	$53,500.00	$59,000.00	$48,000.00

7. Additional Information (applicable for both CS and IT proposals)

These combined proposals would allow UNM-LA's CS and IT departments to streamline and leverage off each other's course offerings. The following rotation:

- is optimized for allowing 2 yr completion of either degree (assuming classes “run”)
- optimized attempted for “spreading” yet “maintaining” adjunct participation
- bold indicates main campus offering
- each semester is comprised of core/major offerings and “service” classes (those courses typically offered for the benefit/requirements of other academic departments and the community)
- does not include additional offerings (estimated at 2-3 courses per semester) over the next 2-3 years to allow current students in degree programs being phased out to meet graduation requirements for which reasonable substitutions cannot be found

MAJORS FALL	
CS 101	4
CS 251	3
CS 261	3
IT 119	3
IT Scripting	3
IT Databases/IM	3
IT 145	3

MAJORS SPRING	
CS 152	3
CS 220	3
CS 241	3
CS 293	1
IT 132	3
IT 141	3
IT 235	3
IT 260	3
IT Forensics and IR	3
IT Special Topics	3

Fall Service Classes	
CS 102	1
CS 103	1
CS 150/CT 102	3
CS 151	3
CT 125 Intro to Mac	1
DMA 165 Photoshop	3

Spring Service Classes	
CS 102	1
IT 165 Web Authoring	3
CS 150/CT102	3
CT 202 Spreadsheets	3
CT 111 Intro to CAD	3
DMA 203 Desktop Pub	3

Total Offered Fall
34 credits total

Total Offered Spring
44 credits total

8. Attachments (applicable for both CS and IT proposals)

NSF grant proposal “Reinvigorate information Technology Education with Cyber Security”

THE UNIVERSITY of
NEW MEXICO
Office of the Vice Provost for Academic Affairs
MSC05 3400
1 University of New Mexico
Albuquerque, NM 87131-0001
505.277.2611

To: Kate Massengale, Dean of Instruction, UNM-Los Alamos
Monique Morin, Assistant Prfoessor, CS, UNM-Los Alamos

From: Gregory L. Heileman, Associate Provost for Curriculum

Date: October 3, 2012

Re: Approval of Proposal for the CS and IT Degree Revitalization

Cc: Chaouki Abdallah, Provost and EVP for Academic Affairs
Elizabeth Barton, Associate Registrar
Kathleen Keating, Chair, Faculty Senate Curriculum Committee
Nancy Middlebrook, University Accreditation Director

Thank you for submitting the preliminary review outline for the Computer Science and Information Technology Degree Revitalization. In my judgment, the proposal has been sufficiently well developed to warrant submission to the Faculty Senate Curricula Committee, please feel free to proceed.

As you move forward, you may also want to consider coordinating with the undergraduate Computer Engineering program at UNM – Main Campus. The courses in the curriculum you are proposing appear to be directly appliable to that program as well.

Associate of Science in Computer Science
UNM-Los Alamos

About the Program

This is a transfer degree program designed for students interested in pursuing a baccalaureate degree in computer science. This program represents the first two years of course work in computer science. Program content is based upon the computer science baccalaureate degree offered at UNM Albuquerque campus.

Specific Requirements

1. **A minimum of 67 credit hours with a minimum cumulative grade point average of 2.0.** At least 15 of these 67 credit hours must be credit courses taken at a UNM campus.

2. **Computer science component courses must be completed with a minimum grade of C or better and of the courses, CS 151 or CS 152 must be completed with a B- or better.**

3. **All other courses below used for this degree must be completed with a grade of C- or better.**

4. **Writing and Speaking (9 credit hours)**
   ENGL 101: Composition I: Exposition (3)
   ENGL 102: Composition II: Analysis and Argument (3)
   ENGL 219: Technical and Professional Writing (3)

5. **Lab Science (14 credit hours)**
   Four science courses (of 3 or more credit hours) taken by science and engineering majors, two of which must come from one of the following sequences, including the laboratories. The remaining hours can be more advanced courses in the discipline chosen for the sequence or they can be additional introductory laboratory science hours.

   Physics is strongly recommended.

   Note: Students may not take both the sequence EPS 101, EPS 105L, EPS 201L AND the sequence ENVS 101, ENVS 102L, EPS 201L.)

   ASTR 270 and 270L: General Astronomy and General Astronomy Laboratory I (4)
   ASTR 271 and 271L: General Astronomy and General Astronomy Laboratory I (4)

   BIOL 201: Molecular and Cell Biology (4)
   BIOL 202: Genetics (4)

   CHEM 121 and CHEM 123L: General Chemistry I and General Chemistry Laboratory I (4)
   CHEM 122 and CHEM 124L: General Chemistry II and General Chemistry Laboratory II (4)

   EPS 101 and EPS 105L and EPS 201L: How the Earth Works – An Introduction to Geology and Physical Geology Laboratory (4) and Earth History (4)

ENVS 101 and ENVS 102L and EPS 201L : The Blue Planet and The Blue Planet Laboratory (4) and Earth History (4)

PHYC 160 and 160L : General Physics and General Physics Laboratory (4)
PHYC 161 and 161L: General Physics and General Physics Laboratory (4)

6. Mathematics (8 credit hours)

MATH 162: Calculus I (4) (with a grade of B- or better)
MATH 163: Calculus II (4)

7. UNM Core (12 credit hours)

Divided as:

Fine Arts (3 credit hours)

Foreign Language (3 credit hours)

Humanities and Social and Behavioral Sciences (6 credit hours)

8. Computer Science Component (24 credit hours)

CS 101: Introduction to Computing (4)

CS 151: Computer Programming Fundamentals for Non-Majors (3)
or
CS 152: Computer Programming Fundamentals for Computer Science Majors (3) *(recommended)*

CS 220: Systems Analysis and Design (3)
CS 241L: Data Organization (3)
CS 251L: Intermediate Programming (3)
CS 261: Mathematical Foundations of Computing Science (3)
CS 293: Social and Ethical Computing (1)
ECE 238: Computer Logic and Design (4)

Justification for
Associate of Science in Computer Science
UNM-Los Alamos

The proposed associate degree program, an Associate of Science in Computer Science, is a migration from the current Associate of Applied Science in Computer Science degree (proposed to be deleted *after* the 2013-2014 academic year). This migration is driven by the desire to provide our students with a transfer-oriented degree. Entry level positions in computer science typically require a baccalaureate degree, and we often have a significant portion of our CS-affiliated student body taking courses towards a 4 year degree, grad school preparation, and professional development.

The target program for this transfer-oriented degree would be a Bachelor of Science in Computer Science at UNM, though the courses are applicable and potentially transferable to other four year institutions offering a similar degree. Currently, UNM-Los Alamos is the only branch campus with a full offering of 100 and 200 level CS courses for CS majors as part of the existing Associate of *Applied* Science in Computer Science. Essentially this degree migration would result in UNM core requirements replacing the majority of non-transferable technical classes (e.g. CS170 Visual Basic and CS148 Introduction to Programming in C++). The non-transferable courses would be phased out and no new courses would need to be developed – thus allowing UNM-LA to streamline its CS offerings. Students in the current program would have the option of finishing their AAS degree with "legacy" course offerings (or course substitutions from the IT departments) OR switching to the new AS degree.

Budgetary and Faculty Load

This proposal has been coordinated in conjunction with UNM-LA's current CS and IT department chairs along with the dean of instruction. At this time, the UNM-LA's Computer Science department is staffed by one .5 FTE tenure-track Assistant Professor and multiple "regular" adjuncts, primarily from Los Alamos National Laboratory. This staffing level is not expected to change with this degree migration. There are no expected changes to existing course fees and costs as the courses are already established.

Given the general core academic requirements for the Associate of Science in Computer Science coincide with other associate degree programs at UNM-Los Alamos, these classes are already offered on a regular rotation. Initially we do not expect a significant enrollment increase; however, once the program has reliable enrollment, we will continually evaluate the need for hiring new faculty to teach additional sections of core classes.

The following table provides a high level, three-year projection of the program's estimated budget.

	Year 1	**Year 2**	**Year 3**
CS Assistant Professor .5 FTE (includes department chair duties) – existing institutional funds	$22,000	$22,000	$22,000
Adjunct Faculty for CS (majors) courses– existing institutional funds	$9,100	$9,100	$9,100
Total	$31,100.00	$31,100.00	$31,100.00

PLEASE NOTE: The full preliminary proposal for this degree program, which was approved by the Provost's Office, is attached.

Memorandum

To: Dr. Kate Massengale, Dean of Instruction

From: Dennis Davies-Wilson, Library Director

Date: October 25, 2012

Re: Library support for AS in Computer Science Form C

The UNM-Los Alamos Library currently collects up-to-date materials in support of Computer Science.

UNM-Los Alamos
New Degree Program Proposal

Associate of Science in Computer Science

The UNM-Los Alamos Curriculum Committee has approved the proposed new program above.

Dennis Davies-Wilson 10-25-12

Dennis Davies-Wilson, Chair Date

September 2012

UNM-Los Alamos
Computer Science and Information Technology
Degree Revitalization

Executive Summary

Recently, UNM-Los Alamos (UNM-LA), has re-affirmed its commitment to being a leading STEM (science, technology, engineering, and mathematics) branch campus of the University of New Mexico. In support of this effort, a grant to "Reinvigorate Information Technology Education with Cyber Security"[1] was written by Dr. Kate Massengale (UNM-LA's Dean of Instruction) and awarded by the National Science Foundation to UNM-LA. Simultaneously, efforts within UNM-LA's Computer Science/Network Administration department were underway to better meet the needs of its changing student population.

In order to streamline UNM-LA's offerings, optimize student opportunities, and leverage across Computer Science (CS), Network Administration, and Information Technology (IT) - related degree programs, we are proposing the following changes to our curriculum:

1) migrate existing Associate of Applied Science in Computer Science (both programming and gaming concentrations) to a single Associate of Science in Computer Science,

2) migrate existing Associate of Applied Science in Network Administration (both Windows and Linux/Unix concentrations) to an Associate of Applied Science in Information Technology with Cybersecurity,

3) and phase out the current Associate of Applied Science degrees of: Digital Media Arts, Office Communications and Technology, Technical Support, and Web Technologies.

Change #1 is driven by the fact that almost half of the CS-affiliated students for Spring 2012 were taking UNM-LA's CS courses for non-AAS purposes – preparing for CS graduate school, pursuing CS bachelor's degree, and/or professional development. Computer science positions targeted by the programming concentration (e.g. computer programmer and software developers) have a predicted "average" to "much faster than average" outlook and are typically held by those employees with a bachelor's degree.[2] Given the common need for a bachelor's degree in this field, we would like to offer a transfer-oriented Associate of Science degree thus leading to an almost seamless transition to UNM's Computer Science undergraduate department. (While video game designers also typically require a bachelor's degree, the projected growth is slower than average. Furthermore, in the last 2-3 years these very specialized courses have not had sufficient interest to run and have been subject to being "sunset" out of UNM-LA's current catalog.)

Change #2 is driven by the desire to give provide our students with a strong foundation in information technology to allow the pursuit of careers (or further education in) such areas as network administration, computer and information system managers, computer user support specialists, and information security analysts. As cited in the awarded grant proposal "According to Sandia fellow Jim

1 Attachment 1

2 Occupational Information Network (O*Net can be found at http://www.onetonline.org)

Gosler: ' There are about 1,000 security people in the US who have the specialized skills to operate effectively in cyberspace. We need 10,000 to 30,000.'" Given the need for a wide-range of extended technical coursework, we believe this is best met with an Associate of Applied Science degree in Information Technology with Cybersecurity.

Proposal #3 is driven by low enrollments for extended coursework. While we do expect to continue to offer some introductory courses in these areas, the extended curriculum and resources required to offer these AAS degrees are not economically beneficial at this time. We therefore will be able to focus existing affiliated resources on "service classes" (those used by degrees outside of the CS/IT department) and possibly specialized "employability" certificates which typically require 3-4 courses total.

The following sections of this document provide preliminary proposals for the two degree migrations as well as a projected combined course rotation for Computer Science and Information Technology departments at UNM-Los Alamos. Supporting documentation is provided as a separate attachment.

Preliminary Proposal
Associated of Science in Computer Science

1. Program Description

We propose to offer a transfer-oriented Associate of Science in Computer Science. Currently, UNM-Los Alamos is the only branch campus offering both 100 and 200 level CS courses for CS majors as part of an existing Associate of ***Applied*** Science in Computer Science. Essentially UNM core requirements would replace the majority of non-transferable technical classes such as CS170 Visual Basic and CS148 Introduction to Programming in C++. The target program for this transfer-oriented degree would be a Bachelor of Science in Computer Science at UNM, though the courses are applicable and potentially transferable to other 4 year institutions offering a similar degree.

Primary goals for the Associate of Science program would be quite similar to those of UNM's Computer Science department – namely:

> "The primary goal of the degree program in Computer Science is to provide students the foundations for future work and careers in computation-based problem solving. These foundations support both a successful career path in computing as well as provide appropriate qualifications for further degree work in computation related disciplines..."[3]

This migration fits well with the branch campus mission of offering transfer-oriented STEM degrees (also offered at UNM-LA are Associate of Science Degrees in Environmental Science, Pre-Professional Health Sciences, Pre-Engineering, and Science). It also fits with UNM's vision to "Educate and encourage students to develop the values, habits of mind, knowledge, and skills that they need to be enlightened citizens, contribute to the state and national economies, and lead satisfying lives."[4] None of the other branch campuses offer the full sequence of classes for CS majors at the freshman and sophomore level, as UNM-LA already does as part of the existing Associate of Applied Science in Computer Science.

The Associate of Science in Computer Science has a target start date of August 2013. There is minimal program development and it will be concluded this fall pending preliminary approval. (As UNM-LA already offers the CS majors sequence at the 100 and 200 levels, no new courses need to be developed. Existing courses required for the Associate of Applied Science currently – and not in demand as "service" classes – will be phased out in the coming years as students finish their current Associate of Applied Science program.)

2. Evidence of Need

As noted in the executive summary, a majority of our active CS student population (approximately 10 students last academic year) were not pursuing an AAS degree, but could be considered candidates for an AS degree if offered. Of the UNM branch campuses (Los Alamos, Taos, Valencia, and Gallup) UNM-LA is the only to offer a 2-year computer science degree at this time. Although Santa Fe Community College offers an Associate of Science in Computer Science, per their catalog description and UNM's listing of transfer equivalents, there are multiple first and second year courses missing (CS 293, CS 261, CS241, EECE 238). These courses are offered already on a regular rotation at UNM-LA.

3 http://www.cs.unm.edu/academics/degrees/bachelors_degrees/program-objectives/
4 UNM's Strategic Framework for 2008 and Beyond

Not taking these courses during the first two years of a degree program greatly hinders a student's ability to complete a bachelor's degree in four years. And although Northern New Mexico College offers some CS courses in support of their Engineering and other degrees, their current catalog does not show a CS degree program.

O*Net[5] summarizes the computer programmer career as "Create, modify, and test the code, forms and script that allow computer applications to run. Work from specifications drawn up by software developers or other individuals. May assist software developers by analyzing user needs and designing software solutions. May develop and write computer programs to store, locate, and retrieve specific documents, data and information." O*Net, the "nation's primary source of occupational information" being developed under sponsorship of the US Department of Labor/Employment and Training Administration, labels this and some other computer related careers such as Computer Systems Analysts and Computer and Information Systems Managers as "bright outlook."

Per the U.S. Department of Labor, "Software developers are the creative minds behind computer programs. Some develop the applications that allow people to do specific tasks on a computer or other device. Others develop the underlying systems that run the devices or control networks." The job outlook is listed as 30% for 2010-2020 and "much faster than average."[6]

3. Program Content and Quality

The following requirements are based on existing UNM requirements for a bachelor's in Computer Science, UNM-LA's existing Pre-Engineering degree (which also targets main campus as a degree program in the School of Engineering like CS), and a model proposed by the state-wide task force for CS articulation. Computer Science (CS) and Electrical Engineering and Computer Engineering (EECE) course numbers indicated by bold below are main campus courses currently offered at UNM-LA on a regular rotation. Note that although 67 total credits may be considered "high" by some for an associate's degree, this is the exact number of credits expected by UNM's School of Engineering during freshman and sophomore years when a student is majoring in Electrical Engineering or Computer Science at main campus.

Total Credits for Associate of Science in Computer Science: 67

General Education Component (43 credits):

Writing and Speaking 9 credits
ENGL 101
ENGL 102
ENGL 219

Lab Science 14 credits
PHYC 160 and 160L (4)
PHYC 161 and 161L (4)

5 Occupational Information Network (O*Net can be found at http://www.onetonline.org)

6 U.S. Department of Labor/U.S. Bureau of Labor Statistics Occupational Outlook Handbook Software Developer page (http://www.bls.gov/ooh/computer-and-information-technology/software-developers.htm)

2 additional science courses (of 3 or more credit hours each) chosen from:
BIOL 201, 202
CHEM 121, 123L, 122, 124L
EPS 101, 105L, 201L
ENVS 101, 102L

Mathematics 8 credits
MATH 162
MATH 163

UNM Core 12 credits
Divided as:

Fine Arts 3 credits
choose from:

Art History	101, 201, 202
Dance	105
Media Arts	210
Music	139, 140
Theater	122

Foreign Language 3 credits
choose any lower division non-English course in Linguistics, Spanish, Portuguese, or Foreign Languages & Literature

Humanities and Social and Behavioral Sciences 6 credits
choose any 2 from the following:

American Studies	182,185,186
Anthropology	101,130
Classics	107, 204, 205
Comparative Literature	223, 224
Economics	105, 106
Engineering	200
English	150, 292, 293
Geography	102
History	101, 102, 161, 162
Linguistics	101
Modern Languages	101
Philosophy	101, 201, 202
Political Science	110, 200
Psychology	105
Religious Studies	107
Sociology	101

Computer Science Component (24 credits):

CS101 Introduction to Computing	4
CS152 Introduction to Programming (Java – Majors)	3
CS220 Systems Analysis and Design	3
CS241 Data Organization	3
CS251 Intermediate Programming	3

CS261 Mathematical Foundations of Computer Science	3
CS293 Social and Ethical Issues in Computing	1
ECE238 Computer Logic Design	4

Sample Model/Sequence of Classes for Associate of Science in Computer Science degree:

ENGL 101	3	ENGL 102	3
MATH 162	4	MATH 163	4
CS 101	4	CS152	3
Lab Science #1	4	Lab Science #2	4
Core #1	3	Core #2	3
TOTAL	18	TOTAL	17

CS 251	3	CS 241	3
CS 261	3	CS 220	3
Lab Science #3	3	Lab Science #4	3
ENGL 219	3	ECE 238	4
Core #3	3	Core #4	3
		CS 293	1
TOTAL	15	TOTAL	17

As UNM-LA already offers the 100 and 200 level CS course sequence, no new computer science courses need to be added to the current rotation to meet these degree requirements. By shifting the focus from supplemental technical courses found in the current Associate of Applied Science program to more general education requirements, UNM-LA's offerings of the UNM-Core (Fine Arts, Foreign Languages, Humanities, Social and Behavioral Sciences) may see a slight boost in enrollment.

Our instructional model at UNM-LA includes, traditional face to face courses with integrated labs, hybrid courses (1 live + 1 online module per week), and fully online courses. While accreditation with ABET (the organization from which the UNM CS program has accreditation) might be desirable in the future, initial cost estimation is in the $5,000-$10,000 range for this process and not economically feasible at this time.

4. Evaluation and Assessment

Preliminary Broad Learning Goals for the Associate of Science in Computer Science include:

- Graduates will have a basic understanding of computer science principles and be able to apply problem solving skills.

- Graduates will have an introductory level of technical competence in the area of software development.

- Graduates will be prepared to pursue a bachelor's degree in Computer Science at a 4 year institution.

Preliminary Student Learning Outcomes for the Associate of Science in Computer Science include:

- Understand the Software Engineering Lifecycle (supports UNM goal of “applied skills”)
- Develop and analyze simple algorithms (supports UNM goal of “critical and creative thinking” and “problem solving” skills)
- Basic competence in at least one high-level programming language (supports UNM goal of “applied skills”)
- Experience with software testing and debugging techniques (supports UNM goal of “responsibility”)
- *An understanding of professiona*l and *social issues and responsibilities* (supports UNM goal of “responsibility”)
- Ability to communicate technical ideas both in written and oral forms as well as an ability to listen (supports UNM goal of “written and oral communication skills”)
- Academic training will demand sufficient standards for students to develop skills which will allow them to successfully complete a 4-year degree (supports UNM goal of “foundations and skills for lifelong learning”)

These learning goals and outcomes will be tracked by course assessments (conducted by faculty for designated courses) and reported to the department chair. The department chair will then utilize these results in conjunction with institutional/program-level data (e.g. retention and graduation rates) to provide the necessary reports to the Office of Instruction. Learning outcomes, measurement techniques, and assessment process will be evaluated on a regular cycle.

5. Required Resources

At this time, the UNM-LA's Computer Science department is staffed by one .5 FTE tenure-track Assistant Professor and multiple “regular” adjuncts, primarily from Los Alamos National Laboratory. This staffing level is not expected to change with this degree migration. There are no expected changes to existing course fees and costs as the courses are already established.

Given the general core academic requirements for the Associate of Science in Computer Science coincide with other associate degree programs at UNM-Los Alamos, these classes are already offered on a regular rotation. Initially we do not expect a significant enrollment increase; however, once the program has reliable enrollment, we will continually evaluate the need for hiring new faculty to teach additional sections of core classes.

CS courses are taught via live, hybrid (combination of live and online), and online formats. UNM-LA has existing computer labs including one furnished with new machines last academic year by the NSF

Grant “Reinvigorate IT with Cyber Security” which is available to be used by the CS Department and its students.

UNM-Los Alamos offers a variety of resources to students. From our Academic Support Center (tutoring for English, Math, and Science) to the library facility that offers a comfortable learning environment, which includes a variety of study spaces and ten public computer workstations, UNM-LA students have access to resources which support them in their academic pursuits. The NSF Grant “Reinvigorate IT with Cyber Security” is also providing funding to supplement tutor salaries at the Academic Support Center this semester (Fall 2012). Furthermore, our team of advisors can provide information on a variety of academic, administrative, and placement topics.

6. Projected Enrollments and Costs

The following table represents our projected enrollment figures for the program.

Year	**Projected Enrollment**
1	Minimum 6 students
2	Minimum 8 students
Following years	Minimum 12 students

As this is a degree migration with no expected increase in cost, existing institutional funds for the Computer Science department would be used to support the new degree and phase out the old degree.

The following table provides a high level, three-year projection of the program's estimated budget.

	Year 1	**Year 2**	**Year 3**
CS Assistant Professor .5 FTE (includes department chair duties) – existing institutional funds	$22,000	$22,000	$22,000
Adjunct Faculty for CS (majors) courses– existing institutional funds	$9,100	$9,100	$9,100
Total	$31,100.00	$31,100.00	$31,100.00

Preliminary Proposal
Associated of Applied Science in Information Technology with Cybersecurity

1. Program Description

We propose an Associate of Applied Science in Information Technology with an emphasis in Cybersecurity. The degree design utilizes some of the established courses from our existing Associate of Applied Science in Network Administration, which are then supplemented by recommendations from the Association of Computing Machinery's curriculum guidelines to provide a strong and broad IT foundation.[7] We then chose advanced security courses, again from the ACM guidelines, to comprise the cybersecurity component which is motivated by the existing NSF grant "Reinvigorate IT Education with Cybersecurity."

This program is specifically designed to prepare students as entry-level IT and/or Cybersecurity technicians to meet the needs of high-tech careers and businesses in New Mexico and throughout the United States. Students will learn critical security principles that will enable them to plan, develop, and perform security tasks. Curriculum will address hardware, software, processes, communications, applications, and policies and procedures with respect to organizational IT and Cybersecurity.

This migration from a narrowly focused Associate of Applied Science in Network Administration to an Associate of Applied Science in Information Technology with a Cybersecurity emphasis fits well with the branch campus mission of offering STEM degrees with the potential of immediately gaining employment in and serving the community. It also fits with UNM's vision to "Educate and encourage students to develop the values, habits of mind, knowledge, and skills that they need to be enlightened citizens, contribute to the state and national economies, and lead satisfying lives."[8] No other UNM branch campus offers a cyber-focused IT degree. Eastern New Mexico State – Ruidoso community college does offer a completely online Computer and Network Security 18 credit hour program and a self-paced professional Cybersecurity Certification non-credited program. As these offerings are based in their Information Systems department their focus is more applications based. We would expect there to be some overlap at the introductory level, though advanced coursework opportunities would differ. We believe a UNM-LA AAS in IT with Cybersecurity would be able to gain leverage from both the local CS offerings and future cross-school enrollment offerings (such as those with Ruidoso) through programs such as SUN-ONLINE.[9]

The Associate of Science in Information Technology with Cybersecurity emphasis has a target start date of August 2013. Program development is well underway with an expected completion date of Spring 2013 pending preliminary approval. As UNM-LA already offers the Network Administration related courses on a regular rotation, schedule modifications would be made for the handful of new and migrated courses (see Program Content Section for details on these courses) over the next three semesters (Spring 2013, Fall 2013, and Spring 2014). UNM-LA is in the unique position of having the NSF grant "Reinvigorate IT Education with Cyber Security" which will support such activities as faculty training, course development, outreach/recruitment, and evaluation activities over the next two years.

---

7 Information Technology 2008 Curriculum Guidelines for Undergraduate Degree Programs in Information Technology by Associate for Computing Machinery (ACM) and IEEE Computer Society (http://www.acm.org/education/curricula-recommendations)

8 UNM's Strategic Framework for 2008 and Beyond

9 Department of Labor TACT-grant (contact Kristen Krell, Manager, DOL – TACT Program, Santa Fe Community College, 6401 Richards Ave., Santa Fe, NM 87506.

2. Evidence of Need

From a quote in the recent Reuter's article titled "Experts warn of shortage of U.S. Cyber Pros"[10]:

> " 'None of the projections look positive,' said Moss, who serves as the chief security officer for ICANN, a group that helps run some of the Internet's infrastructure. 'The numbers I've seen look like shortages in the 20,000s to 40,000s for years to come.'"

The U.S. Department of Labor Occupational Outlook Handbook groups Information Security Analysts, Web Developers,and Computer Network Architects together. Their projected outlook over 2010-2020 is listed at 22% ("faster than average").[11]

O*Net[12] identifies the cybersecurity career as "Information Security Analysts" who "plan, implement, upgrade, or monitor security measures for the protection of computer networks and information. May ensure appropriate security controls are in place that will safeguard digital files and vital electronic infrastructure. May respond to computer security breaches and viruses." The O*Net prediction is "faster than average (20%-28%)" growth from 2010-2020. Although O*Net reports a majority of people in this field hold bachelor and advanced degrees, we strongly believe this expertise must start from the beginning of a student's education. Per the National Initiative for Cybersecurity Education Strategic Plan, a key objective is to "Increase the quantity and quality of undergraduate and graduate cybersecurity curricula for students in computer science and, more broadly, IT and cybersercurity-related degree programs."[13] It should also be noted that cybersecurity related positions differ from other IT opportunities in that U.S. Citizenship and security clearance are often required. UNM-LA is in a unique position with its proximity to Los Alamos National Laboratory where cybersecurity expertise can be found and is also required.

We have not found a comparable program (i.e. an Information Technology degree with Cybersecurity emphasis) at any of the nearby academic institutions for higher learning (Northern New Mexico College, UNM-Taos, and Santa Fe Community College). With the "Reinvigorate Information Technology Education with Cyber Security" grant there is approximately $4,500 for program promotion and student recruitment which will supplement typical campus recruitment efforts. The grant also has outreach and internship components, which we expect will highlight this unique opportunity at UNM-LA beyond the typical recruitment audience.

3. Program Content and Quality

A minimum of 63 credit hours must be earned to complete the Associate of Applied Science degree in Information Technology with Cybersecurity. The curriculum included in this degree program consists of several groups of courses designed to enhance each student's academic capabilities. The required courses encourage intellectual development in several areas of study to include writing and communication, mathematical reasoning, and scientific methods in the physical sciences.

---

10 Finkle and Randwich, June 12, 2012, Reuters, "Experts warn of shortage of U.S. Cyber Pros" (http://www.reuters.com/article/2012/06/12/us-media-tech-summit-symantec-idUSBRE85B1E220120612)

11 U.S. Department of Labor/U.S. Bureau of Labor Statistics Occupational Outlook Handbook (http://www.bls.gov/ooh/computer-and-information-technology/information-security-analysts-web-developers-and-computer-network-architects.htm)

12 Occupational Information Network (O*Net can be found at http://www.onetonline.org)

13 National Initiative for Cybersecurity Education Strategic Plan, Building a Digital Nation (August 11, 2011)

Total Credits for Associate of Applied Science in Information Technology with Cybersecurity Emphasis: 63

General Education Component (19 credits):

Writing and Speaking 9 credits
ENGL 101
ENGL 119 (ENGL 219 can substitute)
C&J 130

Lab Science 4 credits
PHYC 102 and 102L (PHYC 160 and 160L can substitute)

Mathematics 3 credits
MATH 150 (or higher)

Fine Arts, Foreign Language, Humanities, and Social Science 3 credits
Any of the following not applied elsewhere for degree:

Fine Arts

Art History	101, 201, 202
Dance	105
Media Arts	210
Music	139, 140
Theater	122

Foreign Language

choose any lower division non-English course in Linguistics, Spanish, Portuguese, or Foreign Languages & Literature

Humanities and Social and Behavioral Sciences

American Studies	182,185,186
Anthropology	101,130
Classics	107, 204, 205
Comparative Literature	223, 224
Economics	105, 106
Engineering	200
English	150, 292, 293
Geography	102
History	101, 102, 161, 162
Linguistics	101
Modern Languages	101
Philosophy	101, 201, 202
Political Science	110, 200
Psychology	105
Religious Studies	107
Sociology	101

Information Technology with Cybersecurity Component (44 credits):

CS 101 Introduction to Computing Science	4	(existing course)
CS 152 Introduction to Programming (Java-Majors)	3	(existing course)
CS 220 Systems Analysis and Design	3	(existing course)
CS 261 Mathematical Foundations of Computer Science	3	(existing course)
CS 293 Social and Ethical Issues in Computing	1	(existing course)

IT 119 Networking Core Concepts	3 (existing course)
IT 132 Microcomputer Operating Systems	3 (modified course)
IT 260 Information Assurance and Security	3 (course rename)
IT XXX Databases and Information Management	3 (modified course)
IT 235 Systems Administration	3 (combination of 2 existing courses)
IT 145 Web Fundamentals	3 (modified course)
IT 141 Technical Support	3 (course rename)
IT XXX Scripting for Network Defense	3 (new course)
IT XXX Forensics and Incident Response	3 (new course)
IT elective*	

** IT elective with approval: existing IT co-op, IT special topics course, advanced CS course*

Sample Model/Sequence of Classes for Associate of Applied Science in Information Technology with Cybersecurity:

ENGL 101	3	ENGL 119	3
MATH 150	3	PHYC 102 and 102L	4
CS 101	4	CS152	3
IT 119	3	IT 132	3
Breadth	3	IT 260	3
TOTAL	16	TOTAL	16

CJ 130	3	IT 141	3
CS 261	3	CS 220	3
IT 145	3	IT 235	3
IT Scripting	3	IT Forensics and IR	3
IT Databases/IM	3	IT elective	3
		CS 293	1
TOTAL	15	TOTAL	16

Our instructional model at UNM-LA includes, traditional face to face courses with integrated labs, hybrid courses (1 live + 1 online module per week), and fully online courses. The National Security Agency (NSA) does have a program for “Information Assurance Courseware Evaluation Program” which can lead to individual certifications and also the designation as a “National Center of Excellence in Information Assurance 2 year.” Certifications such as these may be pursued once the program is established. While there is no direct cost associated with this process, we have been told to expect 120-

160 hours of effort for mapping course content to INFOSEC certification criteria. (Note that to be a "Center of Excellence" two different certifications would be required, thus doubling the effort.)

Course Details (new, modified, and renamed courses)

IT 132 Microcomputer Operating Systems 3 credits (modified)

NOTE: modification of existing course IT 132 (Microcomputer Operating Systems)

"The role of the IT professional is to select, deploy, integrate and administer platforms or components to support an organization's IT infrastructure. This knowledge area includes the fundamentals of hardware and software along with how they integrate to form essential components of IT systems. Prerequisite: CS101"

IT 260 Information Assurance and Security 3 credits (rename)

NOTE: currently named IT 260 Network Security Practices, new name to conform with industry, though course description to remain the same

IT XXX Databases and Information Management 3 credits

NOTE: modification and renaming of existing CT 201 Applications of Relational Databases

"Information derived from data is important to the management, productivity and differentiation of an organization. Data must be efficiently collected, organized, retrieved and managed to make it meaningful to the organization. This course will cover development of relational databases as well as administration issues such as data quality and security. Prerequisite: CS101"

IT 235 Systems Administration 3 credits

NOTE: combination of 2 existing courses (IT 235 Systems administration and IT 237 Linux/System Administration I)

"Introduction to system administration. Topics include system configuration/organization, available tools, file system, and automations of tasks. Prerequisite: CS101"

IT 145 Web Fundamentals 3 credits

NOTE: modification of existing course IT 145 Web Design Fundamentals

"Introduction to development, creation, and management of websites. Topics to include HTML, JavaScript, and web server technology. Prerequisites: CS101 and CS 152"

IT 141 Technical Support 3 credits

NOTE: currently named IT 141 Help Desk I, new name to conform with industry, though course description to remain the same (prerequisites to change based on new course names and numbers)

IT XXX Scripting for Network Defense 3 creidts

"Scripting programming for security purposes. Students build on prior programming knowledge to develop, code, use, and debug new and existing scripts. Prerequisite: CS 101 and CS 152"

IT XXX Forensics and Incident Response 3 credits

"This course exposes the student to the topics of Computer Forensics and Incident Response. Topics include: fundamental concepts, history of computing forensics, data recovery techniques, and responses to security incidents. Prerequisite: IT 260 and IT XXX Scripting for Network Defense"

4. Evaluation and Assessment

Preliminary Broad Learning Goals for the Associate of Applied Science in Information Technology with Cybersecurity include:

- Graduates will have the ability to apply knowledge of computing and mathematics appropriate to the discipline
- Graduates will be able to analyze a problem, and identify and define the computing requirements appropriate to its solution

Preliminary Student Learning Outcomes for the Associate of Applied Science in Information Technology with Cybersecurity include:

- An ability to use current techniques, skills, and tools necessary for computing practice (supports UNM goal of "applied skills")
- An ability to use and apply current technical concepts and practices in the core information technologies (supports UNM goal of "applied skills")
- An ability to assess new security technologies and/or threats and recommend changes; review and evaluate security incident response policies; and assist in developing long-range plans for IT security systems (supports UNM goal of "critical and creative thinking" and "problem solving" skills)
- *An understanding of professiona*l and *social issues and responsibilities* (supports UNM goal of "responsibility")
- An ability to function effectively on teams to accomplish a common goal and to communicate effectively with a range of audiences (supports UNM goal of "written and oral communication skills")

These learning goals and outcomes will be tracked by course assessments (conducted by faculty for designated courses) and reported to the department chair. The department chair will then utilize these

results in conjunction with institutional/program-level data (e.g. retention and graduation rates) to provide the necessary reports to the Office of Instruction. Learning outcomes, measurement techniques, and assessment process will be evaluated on a regular cycle.

5. Required Resources

At this time, there is one .25 FTE Network Administration instructor, one .5 FTE Information Technology instructor (whose duties include serving as department chair) and multiple "regular" adjuncts. In the short-term it is expected there will be an increase of workload (estimated at .25 FTE) associated with the migration to the Associate of Applied Science in Information Technology with Cybersecurity (from the existing Network Administration program) and phasing out of the existing IT related programs. Long-range the workload is expected to be similar to the current level of effort.

UNM-LA is fortunate to have the "Reinvigorate IT Education with Cyber Security" grant and pending approval of this curriculum proposal will designate $5,500 for three semesters (Spring 2013, Fall 2013, and Spring 2014) for this associated, increased workload. Courses for the existing Network Administration degree are taught live, hybrid (combination of live and online), and online. UNM-LA has existing computer labs, including one furnished with new machines last academic year by the NSF Grant "Reinvigorate IT with Cyber Security." This same grant has additional funds to subsidize internships in conjunction with local employers, supplement existing outreach and recruiting efforts, and provide faculty training in the area of cybersecurity.

6. Projected Enrollments and Costs

The following table represents our projected enrollment figures for the program.

Year	Projected Enrollment
1	Minimum 8 students
2	Minimum 12 students
Following years	Minimum 16 students

In order to successfully implement this program, existing institutional funds and funds from the NSF grant "Reinvigorate IT Education with Cyber Security" will be used.

The following table provides a high level, three-year projection of the program's estimated budget.

	Year 1	Year 2	Year 3
IT instructor .5 FTE (includes department chair duties) – exiting institutional funds	$22,000	$22,000	$22,000
Grant related efforts (course creation/ migration) – NSF grant funds	$5,500.00	$11,000	$0.00
Network Administration instructor .25 FTE	$11,000.00	$11,000.00	$11,000.00

(migrated to IT) – existing institutional funds			
Adjunct Faculty for AAS in IT with Cyber courses– existing institutional funds	$10,500.00	$10,500.00	$10,500.00
Recruitment materials – NSF grant funds	$1,500.00	$1,500.00	$1,500.00
Internship Subsidies – NSF grant funds	$3,000.00	$3,000.00	$3,000.00
Total	$53,500.00	$59,000.00	$48,000.00

7. Additional Information (applicable for both CS and IT proposals)

These combined proposals would allow UNM-LA's CS and IT departments to streamline and leverage off each other's course offerings. The following rotation:

- is optimized for allowing 2 yr completion of either degree (assuming classes “run”)
- optimized attempted for “spreading” yet “maintaining” adjunct participation
- bold indicates main campus offering
- each semester is comprised of core/major offerings and “service” classes (those courses typically offered for the benefit/requirements of other academic departments and the community)
- does not include additional offerings (estimated at 2-3 courses per semester) over the next 2-3 years to allow current students in degree programs being phased out to meet graduation requirements for which reasonable substitutions cannot be found

MAJORS FALL	
CS 101	4
CS 251	3
CS 261	3
IT 119	3
IT Scripting	3
IT Databases/IM	3
IT 145	3

MAJORS SPRING	
CS 152	3
CS 220	3
CS 241	3
CS 293	1
IT 132	3
IT 141	3
IT 235	3
IT 260	3
IT Forensics and IR	3
IT Special Topics	3

Fall Service Classes	
CS 102	1
CS 103	1
CS 150/CT 102	3
CS 151	3
CT 125 Intro to Mac	1
DMA 165 Photoshop	3

Spring Service Classes	
CS 102	1
IT 165 Web Authoring	3
CS 150/CT102	3
CT 202 Spreadsheets	3
CT 111 Intro to CAD	3
DMA 203 Desktop Pub	3

Total Offered Fall
34 credits total

Total Offered Spring
44 credits total

8. Attachments (applicable for both CS and IT proposals)

NSF grant proposal “Reinvigorate information Technology Education with Cyber Security”

THE UNIVERSITY of
NEW MEXICO
Office of the Vice Provost for Academic Affairs
MSC05 3400
1 University of New Mexico
Albuquerque, NM 87131-0001
505.277.2611

To: Kate Massengale, Dean of Instruction, UNM-Los Alamos
Monique Morin, Assistant Prfoessor, CS, UNM-Los Alamos

From: Gregory L. Heileman, Associate Provost for Curriculum

Date: October 3, 2012

Re: Approval of Proposal for the CS and IT Degree Revitalization

Cc: Chaouki Abdallah, Provost and EVP for Academic Affairs
Elizabeth Barton, Associate Registrar
Kathleen Keating, Chair, Faculty Senate Curriculum Committee
Nancy Middlebrook, University Accreditation Director

Thank you for submitting the preliminary review outline for the Computer Science and Information Technology Degree Revitalization. In my judgment, the proposal has been sufficiently well developed to warrant submission to the Faculty Senate Curricula Committee, please feel free to proceed.

As you move forward, you may also want to consider coordinating with the undergraduate Computer Engineering program at UNM – Main Campus. The courses in the curriculum you are proposing appear to be directly appliable to that program as well.

Associate of Science in Computer Science
UNM-Los Alamos

About the Program

This is a transfer degree program designed for students interested in pursuing a baccalaureate degree in computer science. This program represents the first two years of course work in computer science. Program content is based upon the computer science baccalaureate degree offered at UNM Albuquerque campus.

Specific Requirements

1. **A minimum of 67 credit hours with a minimum cumulative grade point average of 2.0.** At least 15 of these 67 credit hours must be credit courses taken at a UNM campus.

2. **Computer science component courses must be completed with a minimum grade of C or better and of the courses, CS 151 or CS 152 must be completed with a B- or better.**

3. **All other courses below used for this degree must be completed with a grade of C- or better.**

4. **Writing and Speaking (9 credit hours)**
   ENGL 101: Composition I: Exposition (3)
   ENGL 102: Composition II: Analysis and Argument (3)
   ENGL 219: Technical and Professional Writing (3)

5. **Lab Science (14 credit hours)**
   Four science courses (of 3 or more credit hours) taken by science and engineering majors, two of which must come from one of the following sequences, including the laboratories. The remaining hours can be more advanced courses in the discipline chosen for the sequence or they can be additional introductory laboratory science hours.

   Physics is strongly recommended.

   Note: Students may not take both the sequence EPS 101, EPS 105L, EPS 201L AND the sequence ENVS 101, ENVS 102L, EPS 201L.)

   ASTR 270 and 270L: General Astronomy and General Astronomy Laboratory I (4)
   ASTR 271 and 271L: General Astronomy and General Astronomy Laboratory I (4)

   BIOL 201: Molecular and Cell Biology (4)
   BIOL 202: Genetics (4)

   CHEM 121 and CHEM 123L: General Chemistry I and General Chemistry Laboratory I (4)
   CHEM 122 and CHEM 124L: General Chemistry II and General Chemistry Laboratory II (4)

   EPS 101 and EPS 105L and EPS 201L: How the Earth Works – An Introduction to Geology and Physical Geology Laboratory (4) and Earth History (4)

ENVS 101 and ENVS 102L and EPS 201L : The Blue Planet and The Blue Planet Laboratory (4) and Earth History (4)

PHYC 160 and 160L : General Physics and General Physics Laboratory (4)
PHYC 161 and 161L: General Physics and General Physics Laboratory (4)

6. Mathematics (8 credit hours)

MATH 162: Calculus I (4) (with a grade of B- or better)
MATH 163: Calculus II (4)

7. UNM Core (12 credit hours)

Divided as:

Fine Arts (3 credit hours)

Foreign Language (3 credit hours)

Humanities and Social and Behavioral Sciences (6 credit hours)

8. Computer Science Component (24 credit hours)

CS 101: Introduction to Computing (4)

CS 151: Computer Programming Fundamentals for Non-Majors (3)
or
CS 152: Computer Programming Fundamentals for Computer Science Majors (3) *(recommended)*

CS 220: Systems Analysis and Design (3)
CS 241L: Data Organization (3)
CS 251L: Intermediate Programming (3)
CS 261: Mathematical Foundations of Computing Science (3)
CS 293: Social and Ethical Computing (1)
ECE 238: Computer Logic and Design (4)

Justification for
Associate of Science in Computer Science
UNM-Los Alamos

The proposed associate degree program, an Associate of Science in Computer Science, is a migration from the current Associate of Applied Science in Computer Science degree (proposed to be deleted *after* the 2013-2014 academic year). This migration is driven by the desire to provide our students with a transfer-oriented degree. Entry level positions in computer science typically require a baccalaureate degree, and we often have a significant portion of our CS-affiliated student body taking courses towards a 4 year degree, grad school preparation, and professional development.

The target program for this transfer-oriented degree would be a Bachelor of Science in Computer Science at UNM, though the courses are applicable and potentially transferable to other four year institutions offering a similar degree. Currently, UNM-Los Alamos is the only branch campus with a full offering of 100 and 200 level CS courses for CS majors as part of the existing Associate of *Applied* Science in Computer Science. Essentially this degree migration would result in UNM core requirements replacing the majority of non-transferable technical classes (e.g. CS170 Visual Basic and CS148 Introduction to Programming in C++). The non-transferable courses would be phased out and no new courses would need to be developed – thus allowing UNM-LA to streamline its CS offerings. Students in the current program would have the option of finishing their AAS degree with "legacy" course offerings (or course substitutions from the IT departments) OR switching to the new AS degree.

Budgetary and Faculty Load

This proposal has been coordinated in conjunction with UNM-LA's current CS and IT department chairs along with the dean of instruction. At this time, the UNM-LA's Computer Science department is staffed by one .5 FTE tenure-track Assistant Professor and multiple "regular" adjuncts, primarily from Los Alamos National Laboratory. This staffing level is not expected to change with this degree migration. There are no expected changes to existing course fees and costs as the courses are already established.

Given the general core academic requirements for the Associate of Science in Computer Science coincide with other associate degree programs at UNM-Los Alamos, these classes are already offered on a regular rotation. Initially we do not expect a significant enrollment increase; however, once the program has reliable enrollment, we will continually evaluate the need for hiring new faculty to teach additional sections of core classes.

The following table provides a high level, three-year projection of the program's estimated budget.

	Year 1	**Year 2**	**Year 3**
CS Assistant Professor .5 FTE (includes department chair duties) – existing institutional funds	$22,000	$22,000	$22,000
Adjunct Faculty for CS (majors) courses– existing institutional funds	$9,100	$9,100	$9,100
Total	$31,100.00	$31,100.00	$31,100.00

PLEASE NOTE: The full preliminary proposal for this degree program, which was approved by the Provost's Office, is attached.

Memorandum

To: Dr. Kate Massengale, Dean of Instruction

From: Dennis Davies-Wilson, Library Director

Date: October 25, 2012

Re: Library support for AS in Computer Science Form C

The UNM-Los Alamos Library currently collects up-to-date materials in support of Computer Science.

UNM-Los Alamos
New Degree Program Proposal

Associate of Science in Computer Science

The UNM-Los Alamos Curriculum Committee has approved the proposed new program above.

Dennis Davies-Wilson 10-25-12

Dennis Davies-Wilson, Chair Date

September 2012

UNM-Los Alamos
Computer Science and Information Technology
Degree Revitalization

Executive Summary

Recently, UNM-Los Alamos (UNM-LA), has re-affirmed its commitment to being a leading STEM (science, technology, engineering, and mathematics) branch campus of the University of New Mexico. In support of this effort, a grant to "Reinvigorate Information Technology Education with Cyber Security"[1] was written by Dr. Kate Massengale (UNM-LA's Dean of Instruction) and awarded by the National Science Foundation to UNM-LA. Simultaneously, efforts within UNM-LA's Computer Science/Network Administration department were underway to better meet the needs of its changing student population.

In order to streamline UNM-LA's offerings, optimize student opportunities, and leverage across Computer Science (CS), Network Administration, and Information Technology (IT) - related degree programs, we are proposing the following changes to our curriculum:

1) migrate existing Associate of Applied Science in Computer Science (both programming and gaming concentrations) to a single Associate of Science in Computer Science,

2) migrate existing Associate of Applied Science in Network Administration (both Windows and Linux/Unix concentrations) to an Associate of Applied Science in Information Technology with Cybersecurity,

3) and phase out the current Associate of Applied Science degrees of: Digital Media Arts, Office Communications and Technology, Technical Support, and Web Technologies.

Change #1 is driven by the fact that almost half of the CS-affiliated students for Spring 2012 were taking UNM-LA's CS courses for non-AAS purposes – preparing for CS graduate school, pursuing CS bachelor's degree, and/or professional development. Computer science positions targeted by the programming concentration (e.g. computer programmer and software developers) have a predicted "average" to "much faster than average" outlook and are typically held by those employees with a bachelor's degree.[2] Given the common need for a bachelor's degree in this field, we would like to offer a transfer-oriented Associate of Science degree thus leading to an almost seamless transition to UNM's Computer Science undergraduate department. (While video game designers also typically require a bachelor's degree, the projected growth is slower than average. Furthermore, in the last 2-3 years these very specialized courses have not had sufficient interest to run and have been subject to being "sunset" out of UNM-LA's current catalog.)

Change #2 is driven by the desire to give provide our students with a strong foundation in information technology to allow the pursuit of careers (or further education in) such areas as network administration, computer and information system managers, computer user support specialists, and information security analysts. As cited in the awarded grant proposal "According to Sandia fellow Jim

1 Attachment 1

2 Occupational Information Network (O*Net can be found at http://www.onetonline.org)

Gosler: ' There are about 1,000 security people in the US who have the specialized skills to operate effectively in cyberspace. We need 10,000 to 30,000.'" Given the need for a wide-range of extended technical coursework, we believe this is best met with an Associate of Applied Science degree in Information Technology with Cybersecurity.

Proposal #3 is driven by low enrollments for extended coursework. While we do expect to continue to offer some introductory courses in these areas, the extended curriculum and resources required to offer these AAS degrees are not economically beneficial at this time. We therefore will be able to focus existing affiliated resources on "service classes" (those used by degrees outside of the CS/IT department) and possibly specialized "employability" certificates which typically require 3-4 courses total.

The following sections of this document provide preliminary proposals for the two degree migrations as well as a projected combined course rotation for Computer Science and Information Technology departments at UNM-Los Alamos. Supporting documentation is provided as a separate attachment.

Preliminary Proposal
Associated of Science in Computer Science

1. Program Description

We propose to offer a transfer-oriented Associate of Science in Computer Science. Currently, UNM-Los Alamos is the only branch campus offering both 100 and 200 level CS courses for CS majors as part of an existing Associate of ***Applied*** Science in Computer Science. Essentially UNM core requirements would replace the majority of non-transferable technical classes such as CS170 Visual Basic and CS148 Introduction to Programming in C++. The target program for this transfer-oriented degree would be a Bachelor of Science in Computer Science at UNM, though the courses are applicable and potentially transferable to other 4 year institutions offering a similar degree.

Primary goals for the Associate of Science program would be quite similar to those of UNM's Computer Science department – namely:

> "The primary goal of the degree program in Computer Science is to provide students the foundations for future work and careers in computation-based problem solving. These foundations support both a successful career path in computing as well as provide appropriate qualifications for further degree work in computation related disciplines..."[3]

This migration fits well with the branch campus mission of offering transfer-oriented STEM degrees (also offered at UNM-LA are Associate of Science Degrees in Environmental Science, Pre-Professional Health Sciences, Pre-Engineering, and Science). It also fits with UNM's vision to "Educate and encourage students to develop the values, habits of mind, knowledge, and skills that they need to be enlightened citizens, contribute to the state and national economies, and lead satisfying lives."[4] None of the other branch campuses offer the full sequence of classes for CS majors at the freshman and sophomore level, as UNM-LA already does as part of the existing Associate of Applied Science in Computer Science.

The Associate of Science in Computer Science has a target start date of August 2013. There is minimal program development and it will be concluded this fall pending preliminary approval. (As UNM-LA already offers the CS majors sequence at the 100 and 200 levels, no new courses need to be developed. Existing courses required for the Associate of Applied Science currently – and not in demand as "service" classes – will be phased out in the coming years as students finish their current Associate of Applied Science program.)

2. Evidence of Need

As noted in the executive summary, a majority of our active CS student population (approximately 10 students last academic year) were not pursuing an AAS degree, but could be considered candidates for an AS degree if offered. Of the UNM branch campuses (Los Alamos, Taos, Valencia, and Gallup) UNM-LA is the only to offer a 2-year computer science degree at this time. Although Santa Fe Community College offers an Associate of Science in Computer Science, per their catalog description and UNM's listing of transfer equivalents, there are multiple first and second year courses missing (CS 293, CS 261, CS241, EECE 238). These courses are offered already on a regular rotation at UNM-LA.

3 http://www.cs.unm.edu/academics/degrees/bachelors_degrees/program-objectives/
4 UNM's Strategic Framework for 2008 and Beyond

Not taking these courses during the first two years of a degree program greatly hinders a student's ability to complete a bachelor's degree in four years. And although Northern New Mexico College offers some CS courses in support of their Engineering and other degrees, their current catalog does not show a CS degree program.

O*Net[5] summarizes the computer programmer career as "Create, modify, and test the code, forms and script that allow computer applications to run. Work from specifications drawn up by software developers or other individuals. May assist software developers by analyzing user needs and designing software solutions. May develop and write computer programs to store, locate, and retrieve specific documents, data and information." O*Net, the "nation's primary source of occupational information" being developed under sponsorship of the US Department of Labor/Employment and Training Administration, labels this and some other computer related careers such as Computer Systems Analysts and Computer and Information Systems Managers as "bright outlook."

Per the U.S. Department of Labor, "Software developers are the creative minds behind computer programs. Some develop the applications that allow people to do specific tasks on a computer or other device. Others develop the underlying systems that run the devices or control networks." The job outlook is listed as 30% for 2010-2020 and "much faster than average."[6]

3. Program Content and Quality

The following requirements are based on existing UNM requirements for a bachelor's in Computer Science, UNM-LA's existing Pre-Engineering degree (which also targets main campus as a degree program in the School of Engineering like CS), and a model proposed by the state-wide task force for CS articulation. Computer Science (CS) and Electrical Engineering and Computer Engineering (EECE) course numbers indicated by bold below are main campus courses currently offered at UNM-LA on a regular rotation. Note that although 67 total credits may be considered "high" by some for an associate's degree, this is the exact number of credits expected by UNM's School of Engineering during freshman and sophomore years when a student is majoring in Electrical Engineering or Computer Science at main campus.

Total Credits for Associate of Science in Computer Science: 67

General Education Component (43 credits):

Writing and Speaking 9 credits
ENGL 101
ENGL 102
ENGL 219

Lab Science 14 credits
PHYC 160 and 160L (4)
PHYC 161 and 161L (4)

5 Occupational Information Network (O*Net can be found at http://www.onetonline.org)

6 U.S. Department of Labor/U.S. Bureau of Labor Statistics Occupational Outlook Handbook Software Developer page (http://www.bls.gov/ooh/computer-and-information-technology/software-developers.htm)

2 additional science courses (of 3 or more credit hours each) chosen from:
BIOL 201, 202
CHEM 121, 123L, 122, 124L
EPS 101, 105L, 201L
ENVS 101, 102L

Mathematics 8 credits
MATH 162
MATH 163

UNM Core 12 credits
Divided as:

Fine Arts 3 credits
choose from:

Art History	101, 201, 202
Dance	105
Media Arts	210
Music	139, 140
Theater	122

Foreign Language 3 credits
choose any lower division non-English course in Linguistics, Spanish, Portuguese, or Foreign Languages & Literature

Humanities and Social and Behavioral Sciences 6 credits
choose any 2 from the following:

American Studies	182,185,186
Anthropology	101,130
Classics	107, 204, 205
Comparative Literature	223, 224
Economics	105, 106
Engineering	200
English	150, 292, 293
Geography	102
History	101, 102, 161, 162
Linguistics	101
Modern Languages	101
Philosophy	101, 201, 202
Political Science	110, 200
Psychology	105
Religious Studies	107
Sociology	101

Computer Science Component (24 credits):

CS101 Introduction to Computing	4
CS152 Introduction to Programming (Java – Majors)	3
CS220 Systems Analysis and Design	3
CS241 Data Organization	3
CS251 Intermediate Programming	3

CS261 Mathematical Foundations of Computer Science	3
CS293 Social and Ethical Issues in Computing	1
ECE238 Computer Logic Design	4

Sample Model/Sequence of Classes for Associate of Science in Computer Science degree:

ENGL 101	3	ENGL 102	3
MATH 162	4	MATH 163	4
CS 101	4	CS152	3
Lab Science #1	4	Lab Science #2	4
Core #1	3	Core #2	3
TOTAL	18	TOTAL	17

CS 251	3	CS 241	3
CS 261	3	CS 220	3
Lab Science #3	3	Lab Science #4	3
ENGL 219	3	ECE 238	4
Core #3	3	Core #4	3
		CS 293	1
TOTAL	15	TOTAL	17

As UNM-LA already offers the 100 and 200 level CS course sequence, no new computer science courses need to be added to the current rotation to meet these degree requirements. By shifting the focus from supplemental technical courses found in the current Associate of Applied Science program to more general education requirements, UNM-LA's offerings of the UNM-Core (Fine Arts, Foreign Languages, Humanities, Social and Behavioral Sciences) may see a slight boost in enrollment.

Our instructional model at UNM-LA includes, traditional face to face courses with integrated labs, hybrid courses (1 live + 1 online module per week), and fully online courses. While accreditation with ABET (the organization from which the UNM CS program has accreditation) might be desirable in the future, initial cost estimation is in the $5,000-$10,000 range for this process and not economically feasible at this time.

4. Evaluation and Assessment

Preliminary Broad Learning Goals for the Associate of Science in Computer Science include:

- Graduates will have a basic understanding of computer science principles and be able to apply problem solving skills.

- Graduates will have an introductory level of technical competence in the area of software development.

- Graduates will be prepared to pursue a bachelor's degree in Computer Science at a 4 year institution.

Preliminary Student Learning Outcomes for the Associate of Science in Computer Science include:

- Understand the Software Engineering Lifecycle (supports UNM goal of “applied skills”)
- Develop and analyze simple algorithms (supports UNM goal of “critical and creative thinking” and “problem solving” skills)
- Basic competence in at least one high-level programming language (supports UNM goal of “applied skills”)
- Experience with software testing and debugging techniques (supports UNM goal of “responsibility”)
- *An understanding of professiona*l and *social issues and responsibilities* (supports UNM goal of “responsibility”)
- Ability to communicate technical ideas both in written and oral forms as well as an ability to listen (supports UNM goal of “written and oral communication skills”)
- Academic training will demand sufficient standards for students to develop skills which will allow them to successfully complete a 4-year degree (supports UNM goal of “foundations and skills for lifelong learning”)

These learning goals and outcomes will be tracked by course assessments (conducted by faculty for designated courses) and reported to the department chair. The department chair will then utilize these results in conjunction with institutional/program-level data (e.g. retention and graduation rates) to provide the necessary reports to the Office of Instruction. Learning outcomes, measurement techniques, and assessment process will be evaluated on a regular cycle.

5. Required Resources

At this time, the UNM-LA's Computer Science department is staffed by one .5 FTE tenure-track Assistant Professor and multiple “regular” adjuncts, primarily from Los Alamos National Laboratory. This staffing level is not expected to change with this degree migration. There are no expected changes to existing course fees and costs as the courses are already established.

Given the general core academic requirements for the Associate of Science in Computer Science coincide with other associate degree programs at UNM-Los Alamos, these classes are already offered on a regular rotation. Initially we do not expect a significant enrollment increase; however, once the program has reliable enrollment, we will continually evaluate the need for hiring new faculty to teach additional sections of core classes.

CS courses are taught via live, hybrid (combination of live and online), and online formats. UNM-LA has existing computer labs including one furnished with new machines last academic year by the NSF

Grant “Reinvigorate IT with Cyber Security” which is available to be used by the CS Department and its students.

UNM-Los Alamos offers a variety of resources to students. From our Academic Support Center (tutoring for English, Math, and Science) to the library facility that offers a comfortable learning environment, which includes a variety of study spaces and ten public computer workstations, UNM-LA students have access to resources which support them in their academic pursuits. The NSF Grant “Reinvigorate IT with Cyber Security” is also providing funding to supplement tutor salaries at the Academic Support Center this semester (Fall 2012). Furthermore, our team of advisors can provide information on a variety of academic, administrative, and placement topics.

6. Projected Enrollments and Costs

The following table represents our projected enrollment figures for the program.

Year	**Projected Enrollment**
1	Minimum 6 students
2	Minimum 8 students
Following years	Minimum 12 students

As this is a degree migration with no expected increase in cost, existing institutional funds for the Computer Science department would be used to support the new degree and phase out the old degree.

The following table provides a high level, three-year projection of the program's estimated budget.

	Year 1	**Year 2**	**Year 3**
CS Assistant Professor .5 FTE (includes department chair duties) – existing institutional funds	$22,000	$22,000	$22,000
Adjunct Faculty for CS (majors) courses– existing institutional funds	$9,100	$9,100	$9,100
Total	$31,100.00	$31,100.00	$31,100.00

Preliminary Proposal
Associated of Applied Science in Information Technology with Cybersecurity

1. Program Description

We propose an Associate of Applied Science in Information Technology with an emphasis in Cybersecurity. The degree design utilizes some of the established courses from our existing Associate of Applied Science in Network Administration, which are then supplemented by recommendations from the Association of Computing Machinery's curriculum guidelines to provide a strong and broad IT foundation.[7] We then chose advanced security courses, again from the ACM guidelines, to comprise the cybersecurity component which is motivated by the existing NSF grant "Reinvigorate IT Education with Cybersecurity."

This program is specifically designed to prepare students as entry-level IT and/or Cybersecurity technicians to meet the needs of high-tech careers and businesses in New Mexico and throughout the United States. Students will learn critical security principles that will enable them to plan, develop, and perform security tasks. Curriculum will address hardware, software, processes, communications, applications, and policies and procedures with respect to organizational IT and Cybersecurity.

This migration from a narrowly focused Associate of Applied Science in Network Administration to an Associate of Applied Science in Information Technology with a Cybersecurity emphasis fits well with the branch campus mission of offering STEM degrees with the potential of immediately gaining employment in and serving the community. It also fits with UNM's vision to "Educate and encourage students to develop the values, habits of mind, knowledge, and skills that they need to be enlightened citizens, contribute to the state and national economies, and lead satisfying lives."[8] No other UNM branch campus offers a cyber-focused IT degree. Eastern New Mexico State – Ruidoso community college does offer a completely online Computer and Network Security 18 credit hour program and a self-paced professional Cybersecurity Certification non-credited program. As these offerings are based in their Information Systems department their focus is more applications based. We would expect there to be some overlap at the introductory level, though advanced coursework opportunities would differ. We believe a UNM-LA AAS in IT with Cybersecurity would be able to gain leverage from both the local CS offerings and future cross-school enrollment offerings (such as those with Ruidoso) through programs such as SUN-ONLINE.[9]

The Associate of Science in Information Technology with Cybersecurity emphasis has a target start date of August 2013. Program development is well underway with an expected completion date of Spring 2013 pending preliminary approval. As UNM-LA already offers the Network Administration related courses on a regular rotation, schedule modifications would be made for the handful of new and migrated courses (see Program Content Section for details on these courses) over the next three semesters (Spring 2013, Fall 2013, and Spring 2014). UNM-LA is in the unique position of having the NSF grant "Reinvigorate IT Education with Cyber Security" which will support such activities as faculty training, course development, outreach/recruitment, and evaluation activities over the next two years.

---

7 Information Technology 2008 Curriculum Guidelines for Undergraduate Degree Programs in Information Technology by Associate for Computing Machinery (ACM) and IEEE Computer Society (http://www.acm.org/education/curricula-recommendations)

8 UNM's Strategic Framework for 2008 and Beyond

9 Department of Labor TACT-grant (contact Kristen Krell, Manager, DOL – TACT Program, Santa Fe Community College, 6401 Richards Ave., Santa Fe, NM 87506.

2. Evidence of Need

From a quote in the recent Reuter's article titled "Experts warn of shortage of U.S. Cyber Pros"[10]:

> " 'None of the projections look positive,' said Moss, who serves as the chief security officer for ICANN, a group that helps run some of the Internet's infrastructure. 'The numbers I've seen look like shortages in the 20,000s to 40,000s for years to come.'"

The U.S. Department of Labor Occupational Outlook Handbook groups Information Security Analysts, Web Developers,and Computer Network Architects together. Their projected outlook over 2010-2020 is listed at 22% ("faster than average").[11]

O*Net[12] identifies the cybersecurity career as "Information Security Analysts" who "plan, implement, upgrade, or monitor security measures for the protection of computer networks and information. May ensure appropriate security controls are in place that will safeguard digital files and vital electronic infrastructure. May respond to computer security breaches and viruses." The O*Net prediction is "faster than average (20%-28%)" growth from 2010-2020. Although O*Net reports a majority of people in this field hold bachelor and advanced degrees, we strongly believe this expertise must start from the beginning of a student's education. Per the National Initiative for Cybersecurity Education Strategic Plan, a key objective is to "Increase the quantity and quality of undergraduate and graduate cybersecurity curricula for students in computer science and, more broadly, IT and cybersercurity-related degree programs."[13] It should also be noted that cybersecurity related positions differ from other IT opportunities in that U.S. Citizenship and security clearance are often required. UNM-LA is in a unique position with its proximity to Los Alamos National Laboratory where cybersecurity expertise can be found and is also required.

We have not found a comparable program (i.e. an Information Technology degree with Cybersecurity emphasis) at any of the nearby academic institutions for higher learning (Northern New Mexico College, UNM-Taos, and Santa Fe Community College). With the "Reinvigorate Information Technology Education with Cyber Security" grant there is approximately $4,500 for program promotion and student recruitment which will supplement typical campus recruitment efforts. The grant also has outreach and internship components, which we expect will highlight this unique opportunity at UNM-LA beyond the typical recruitment audience.

3. Program Content and Quality

A minimum of 63 credit hours must be earned to complete the Associate of Applied Science degree in Information Technology with Cybersecurity. The curriculum included in this degree program consists of several groups of courses designed to enhance each student's academic capabilities. The required courses encourage intellectual development in several areas of study to include writing and communication, mathematical reasoning, and scientific methods in the physical sciences.

---

10 Finkle and Randwich, June 12, 2012, Reuters, "Experts warn of shortage of U.S. Cyber Pros" (http://www.reuters.com/article/2012/06/12/us-media-tech-summit-symantec-idUSBRE85B1E220120612)

11 U.S. Department of Labor/U.S. Bureau of Labor Statistics Occupational Outlook Handbook (http://www.bls.gov/ooh/computer-and-information-technology/information-security-analysts-web-developers-and-computer-network-architects.htm)

12 Occupational Information Network (O*Net can be found at http://www.onetonline.org)

13 National Initiative for Cybersecurity Education Strategic Plan, Building a Digital Nation (August 11, 2011)

Total Credits for Associate of Applied Science in Information Technology with Cybersecurity Emphasis: 63

General Education Component (19 credits):

Writing and Speaking 9 credits
ENGL 101
ENGL 119 (ENGL 219 can substitute)
C&J 130

Lab Science 4 credits
PHYC 102 and 102L (PHYC 160 and 160L can substitute)

Mathematics 3 credits
MATH 150 (or higher)

Fine Arts, Foreign Language, Humanities, and Social Science 3 credits
Any of the following not applied elsewhere for degree:

Fine Arts

Art History	101, 201, 202
Dance	105
Media Arts	210
Music	139, 140
Theater	122

Foreign Language

choose any lower division non-English course in Linguistics, Spanish, Portuguese, or Foreign Languages & Literature

Humanities and Social and Behavioral Sciences

American Studies	182,185,186
Anthropology	101,130
Classics	107, 204, 205
Comparative Literature	223, 224
Economics	105, 106
Engineering	200
English	150, 292, 293
Geography	102
History	101, 102, 161, 162
Linguistics	101
Modern Languages	101
Philosophy	101, 201, 202
Political Science	110, 200
Psychology	105
Religious Studies	107
Sociology	101

Information Technology with Cybersecurity Component (44 credits):

CS 101 Introduction to Computing Science	4	(existing course)
CS 152 Introduction to Programming (Java-Majors)	3	(existing course)
CS 220 Systems Analysis and Design	3	(existing course)
CS 261 Mathematical Foundations of Computer Science	3	(existing course)
CS 293 Social and Ethical Issues in Computing	1	(existing course)

IT 119 Networking Core Concepts	3 (existing course)
IT 132 Microcomputer Operating Systems	3 (modified course)
IT 260 Information Assurance and Security	3 (course rename)
IT XXX Databases and Information Management	3 (modified course)
IT 235 Systems Administration	3 (combination of 2 existing courses)
IT 145 Web Fundamentals	3 (modified course)
IT 141 Technical Support	3 (course rename)
IT XXX Scripting for Network Defense	3 (new course)
IT XXX Forensics and Incident Response	3 (new course)
IT elective*	

** IT elective with approval: existing IT co-op, IT special topics course, advanced CS course*

Sample Model/Sequence of Classes for Associate of Applied Science in Information Technology with Cybersecurity:

ENGL 101	3	ENGL 119	3
MATH 150	3	PHYC 102 and 102L	4
CS 101	4	CS152	3
IT 119	3	IT 132	3
Breadth	3	IT 260	3
TOTAL	16	TOTAL	16

CJ 130	3	IT 141	3
CS 261	3	CS 220	3
IT 145	3	IT 235	3
IT Scripting	3	IT Forensics and IR	3
IT Databases/IM	3	IT elective	3
		CS 293	1
TOTAL	15	TOTAL	16

Our instructional model at UNM-LA includes, traditional face to face courses with integrated labs, hybrid courses (1 live + 1 online module per week), and fully online courses. The National Security Agency (NSA) does have a program for “Information Assurance Courseware Evaluation Program” which can lead to individual certifications and also the designation as a “National Center of Excellence in Information Assurance 2 year.” Certifications such as these may be pursued once the program is established. While there is no direct cost associated with this process, we have been told to expect 120-

160 hours of effort for mapping course content to INFOSEC certification criteria. (Note that to be a "Center of Excellence" two different certifications would be required, thus doubling the effort.)

Course Details (new, modified, and renamed courses)

IT 132 Microcomputer Operating Systems 3 credits (modified)

NOTE: modification of existing course IT 132 (Microcomputer Operating Systems)

"The role of the IT professional is to select, deploy, integrate and administer platforms or components to support an organization's IT infrastructure. This knowledge area includes the fundamentals of hardware and software along with how they integrate to form essential components of IT systems. Prerequisite: CS101"

IT 260 Information Assurance and Security 3 credits (rename)

NOTE: currently named IT 260 Network Security Practices, new name to conform with industry, though course description to remain the same

IT XXX Databases and Information Management 3 credits

NOTE: modification and renaming of existing CT 201 Applications of Relational Databases

"Information derived from data is important to the management, productivity and differentiation of an organization. Data must be efficiently collected, organized, retrieved and managed to make it meaningful to the organization. This course will cover development of relational databases as well as administration issues such as data quality and security. Prerequisite: CS101"

IT 235 Systems Administration 3 credits

NOTE: combination of 2 existing courses (IT 235 Systems administration and IT 237 Linux/System Administration I)

"Introduction to system administration. Topics include system configuration/organization, available tools, file system, and automations of tasks. Prerequisite: CS101"

IT 145 Web Fundamentals 3 credits

NOTE: modification of existing course IT 145 Web Design Fundamentals

"Introduction to development, creation, and management of websites. Topics to include HTML, JavaScript, and web server technology. Prerequisites: CS101 and CS 152"

IT 141 Technical Support 3 credits

NOTE: currently named IT 141 Help Desk I, new name to conform with industry, though course description to remain the same (prerequisites to change based on new course names and numbers)

IT XXX Scripting for Network Defense 3 creidts

"Scripting programming for security purposes. Students build on prior programming knowledge to develop, code, use, and debug new and existing scripts. Prerequisite: CS 101 and CS 152"

IT XXX Forensics and Incident Response 3 credits

"This course exposes the student to the topics of Computer Forensics and Incident Response. Topics include: fundamental concepts, history of computing forensics, data recovery techniques, and responses to security incidents. Prerequisite: IT 260 and IT XXX Scripting for Network Defense"

4. Evaluation and Assessment

Preliminary Broad Learning Goals for the Associate of Applied Science in Information Technology with Cybersecurity include:

- Graduates will have the ability to apply knowledge of computing and mathematics appropriate to the discipline
- Graduates will be able to analyze a problem, and identify and define the computing requirements appropriate to its solution

Preliminary Student Learning Outcomes for the Associate of Applied Science in Information Technology with Cybersecurity include:

- An ability to use current techniques, skills, and tools necessary for computing practice (supports UNM goal of "applied skills")
- An ability to use and apply current technical concepts and practices in the core information technologies (supports UNM goal of "applied skills")
- An ability to assess new security technologies and/or threats and recommend changes; review and evaluate security incident response policies; and assist in developing long-range plans for IT security systems (supports UNM goal of "critical and creative thinking" and "problem solving" skills)
- *An understanding of professiona*l and *social issues and responsibilities* (supports UNM goal of "responsibility")
- An ability to function effectively on teams to accomplish a common goal and to communicate effectively with a range of audiences (supports UNM goal of "written and oral communication skills")

These learning goals and outcomes will be tracked by course assessments (conducted by faculty for designated courses) and reported to the department chair. The department chair will then utilize these

results in conjunction with institutional/program-level data (e.g. retention and graduation rates) to provide the necessary reports to the Office of Instruction. Learning outcomes, measurement techniques, and assessment process will be evaluated on a regular cycle.

5. Required Resources

At this time, there is one .25 FTE Network Administration instructor, one .5 FTE Information Technology instructor (whose duties include serving as department chair) and multiple "regular" adjuncts. In the short-term it is expected there will be an increase of workload (estimated at .25 FTE) associated with the migration to the Associate of Applied Science in Information Technology with Cybersecurity (from the existing Network Administration program) and phasing out of the existing IT related programs. Long-range the workload is expected to be similar to the current level of effort.

UNM-LA is fortunate to have the "Reinvigorate IT Education with Cyber Security" grant and pending approval of this curriculum proposal will designate $5,500 for three semesters (Spring 2013, Fall 2013, and Spring 2014) for this associated, increased workload. Courses for the existing Network Administration degree are taught live, hybrid (combination of live and online), and online. UNM-LA has existing computer labs, including one furnished with new machines last academic year by the NSF Grant "Reinvigorate IT with Cyber Security." This same grant has additional funds to subsidize internships in conjunction with local employers, supplement existing outreach and recruiting efforts, and provide faculty training in the area of cybersecurity.

6. Projected Enrollments and Costs

The following table represents our projected enrollment figures for the program.

Year	Projected Enrollment
1	Minimum 8 students
2	Minimum 12 students
Following years	Minimum 16 students

In order to successfully implement this program, existing institutional funds and funds from the NSF grant "Reinvigorate IT Education with Cyber Security" will be used.

The following table provides a high level, three-year projection of the program's estimated budget.

	Year 1	Year 2	Year 3
IT instructor .5 FTE (includes department chair duties) – exiting institutional funds	$22,000	$22,000	$22,000
Grant related efforts (course creation/ migration) – NSF grant funds	$5,500.00	$11,000	$0.00
Network Administration instructor .25 FTE	$11,000.00	$11,000.00	$11,000.00

(migrated to IT) – existing institutional funds			
Adjunct Faculty for AAS in IT with Cyber courses– existing institutional funds	$10,500.00	$10,500.00	$10,500.00
Recruitment materials – NSF grant funds	$1,500.00	$1,500.00	$1,500.00
Internship Subsidies – NSF grant funds	$3,000.00	$3,000.00	$3,000.00
Total	$53,500.00	$59,000.00	$48,000.00

7. Additional Information (applicable for both CS and IT proposals)

These combined proposals would allow UNM-LA's CS and IT departments to streamline and leverage off each other's course offerings. The following rotation:

- is optimized for allowing 2 yr completion of either degree (assuming classes “run”)
- optimized attempted for “spreading” yet “maintaining” adjunct participation
- bold indicates main campus offering
- each semester is comprised of core/major offerings and “service” classes (those courses typically offered for the benefit/requirements of other academic departments and the community)
- does not include additional offerings (estimated at 2-3 courses per semester) over the next 2-3 years to allow current students in degree programs being phased out to meet graduation requirements for which reasonable substitutions cannot be found

MAJORS FALL	
CS 101	4
CS 251	3
CS 261	3
IT 119	3
IT Scripting	3
IT Databases/IM	3
IT 145	3

MAJORS SPRING	
CS 152	3
CS 220	3
CS 241	3
CS 293	1
IT 132	3
IT 141	3
IT 235	3
IT 260	3
IT Forensics and IR	3
IT Special Topics	3

Fall Service Classes	
CS 102	1
CS 103	1
CS 150/CT 102	3
CS 151	3
CT 125 Intro to Mac	1
DMA 165 Photoshop	3

Spring Service Classes	
CS 102	1
IT 165 Web Authoring	3
CS 150/CT102	3
CT 202 Spreadsheets	3
CT 111 Intro to CAD	3
DMA 203 Desktop Pub	3

Total Offered Fall
34 credits total

Total Offered Spring
44 credits total

8. Attachments (applicable for both CS and IT proposals)

NSF grant proposal “Reinvigorate information Technology Education with Cyber Security”

THE UNIVERSITY of
NEW MEXICO
Office of the Vice Provost for Academic Affairs
MSC05 3400
1 University of New Mexico
Albuquerque, NM 87131-0001
505.277.2611

To: Kate Massengale, Dean of Instruction, UNM-Los Alamos
Monique Morin, Assistant Prfoessor, CS, UNM-Los Alamos

From: Gregory L. Heileman, Associate Provost for Curriculum

Date: October 3, 2012

Re: Approval of Proposal for the CS and IT Degree Revitalization

Cc: Chaouki Abdallah, Provost and EVP for Academic Affairs
Elizabeth Barton, Associate Registrar
Kathleen Keating, Chair, Faculty Senate Curriculum Committee
Nancy Middlebrook, University Accreditation Director

Thank you for submitting the preliminary review outline for the Computer Science and Information Technology Degree Revitalization. In my judgment, the proposal has been sufficiently well developed to warrant submission to the Faculty Senate Curricula Committee, please feel free to proceed.

As you move forward, you may also want to consider coordinating with the undergraduate Computer Engineering program at UNM – Main Campus. The courses in the curriculum you are proposing appear to be directly appliable to that program as well.

Associate of Science in Computer Science
UNM-Los Alamos

About the Program

This is a transfer degree program designed for students interested in pursuing a baccalaureate degree in computer science. This program represents the first two years of course work in computer science. Program content is based upon the computer science baccalaureate degree offered at UNM Albuquerque campus.

Specific Requirements

1. **A minimum of 67 credit hours with a minimum cumulative grade point average of 2.0.** At least 15 of these 67 credit hours must be credit courses taken at a UNM campus.

2. **Computer science component courses must be completed with a minimum grade of C or better and of the courses, CS 151 or CS 152 must be completed with a B- or better.**

3. **All other courses below used for this degree must be completed with a grade of C- or better.**

4. **Writing and Speaking (9 credit hours)**
   ENGL 101: Composition I: Exposition (3)
   ENGL 102: Composition II: Analysis and Argument (3)
   ENGL 219: Technical and Professional Writing (3)

5. **Lab Science (14 credit hours)**
   Four science courses (of 3 or more credit hours) taken by science and engineering majors, two of which must come from one of the following sequences, including the laboratories. The remaining hours can be more advanced courses in the discipline chosen for the sequence or they can be additional introductory laboratory science hours.

   Physics is strongly recommended.

   Note: Students may not take both the sequence EPS 101, EPS 105L, EPS 201L AND the sequence ENVS 101, ENVS 102L, EPS 201L.)

   ASTR 270 and 270L: General Astronomy and General Astronomy Laboratory I (4)
   ASTR 271 and 271L: General Astronomy and General Astronomy Laboratory I (4)

   BIOL 201: Molecular and Cell Biology (4)
   BIOL 202: Genetics (4)

   CHEM 121 and CHEM 123L: General Chemistry I and General Chemistry Laboratory I (4)
   CHEM 122 and CHEM 124L: General Chemistry II and General Chemistry Laboratory II (4)

   EPS 101 and EPS 105L and EPS 201L: How the Earth Works – An Introduction to Geology and Physical Geology Laboratory (4) and Earth History (4)

ENVS 101 and ENVS 102L and EPS 201L : The Blue Planet and The Blue Planet Laboratory (4) and Earth History (4)

PHYC 160 and 160L : General Physics and General Physics Laboratory (4)
PHYC 161 and 161L: General Physics and General Physics Laboratory (4)

6. Mathematics (8 credit hours)

MATH 162: Calculus I (4) (with a grade of B- or better)
MATH 163: Calculus II (4)

7. UNM Core (12 credit hours)

Divided as:

Fine Arts (3 credit hours)

Foreign Language (3 credit hours)

Humanities and Social and Behavioral Sciences (6 credit hours)

8. Computer Science Component (24 credit hours)

CS 101: Introduction to Computing (4)

CS 151: Computer Programming Fundamentals for Non-Majors (3)
or
CS 152: Computer Programming Fundamentals for Computer Science Majors (3) *(recommended)*

CS 220: Systems Analysis and Design (3)
CS 241L: Data Organization (3)
CS 251L: Intermediate Programming (3)
CS 261: Mathematical Foundations of Computing Science (3)
CS 293: Social and Ethical Computing (1)
ECE 238: Computer Logic and Design (4)

Justification for
Associate of Science in Computer Science
UNM-Los Alamos

The proposed associate degree program, an Associate of Science in Computer Science, is a migration from the current Associate of Applied Science in Computer Science degree (proposed to be deleted *after* the 2013-2014 academic year). This migration is driven by the desire to provide our students with a transfer-oriented degree. Entry level positions in computer science typically require a baccalaureate degree, and we often have a significant portion of our CS-affiliated student body taking courses towards a 4 year degree, grad school preparation, and professional development.

The target program for this transfer-oriented degree would be a Bachelor of Science in Computer Science at UNM, though the courses are applicable and potentially transferable to other four year institutions offering a similar degree. Currently, UNM-Los Alamos is the only branch campus with a full offering of 100 and 200 level CS courses for CS majors as part of the existing Associate of *Applied* Science in Computer Science. Essentially this degree migration would result in UNM core requirements replacing the majority of non-transferable technical classes (e.g. CS170 Visual Basic and CS148 Introduction to Programming in C++). The non-transferable courses would be phased out and no new courses would need to be developed – thus allowing UNM-LA to streamline its CS offerings. Students in the current program would have the option of finishing their AAS degree with "legacy" course offerings (or course substitutions from the IT departments) OR switching to the new AS degree.

Budgetary and Faculty Load

This proposal has been coordinated in conjunction with UNM-LA's current CS and IT department chairs along with the dean of instruction. At this time, the UNM-LA's Computer Science department is staffed by one .5 FTE tenure-track Assistant Professor and multiple "regular" adjuncts, primarily from Los Alamos National Laboratory. This staffing level is not expected to change with this degree migration. There are no expected changes to existing course fees and costs as the courses are already established.

Given the general core academic requirements for the Associate of Science in Computer Science coincide with other associate degree programs at UNM-Los Alamos, these classes are already offered on a regular rotation. Initially we do not expect a significant enrollment increase; however, once the program has reliable enrollment, we will continually evaluate the need for hiring new faculty to teach additional sections of core classes.

The following table provides a high level, three-year projection of the program's estimated budget.

	Year 1	**Year 2**	**Year 3**
CS Assistant Professor .5 FTE (includes department chair duties) – existing institutional funds	$22,000	$22,000	$22,000
Adjunct Faculty for CS (majors) courses– existing institutional funds	$9,100	$9,100	$9,100
Total	$31,100.00	$31,100.00	$31,100.00

PLEASE NOTE: The full preliminary proposal for this degree program, which was approved by the Provost's Office, is attached.

Memorandum

To: Dr. Kate Massengale, Dean of Instruction

From: Dennis Davies-Wilson, Library Director

Date: October 25, 2012

Re: Library support for AS in Computer Science Form C

The UNM-Los Alamos Library currently collects up-to-date materials in support of Computer Science.

UNM-Los Alamos
New Degree Program Proposal

Associate of Science in Computer Science

The UNM-Los Alamos Curriculum Committee has approved the proposed new program above.

Dennis Davies-Wilson 10-25-12

Dennis Davies-Wilson, Chair Date