UTAH SYSTEM OF
HIGHER EDUCATION
Building a Stronger State of Minds

November 9, 2016

MEMORANDUM

TO: State Board of Regents

FROM: David L. Buhler

SUBJECT: <u>Snow College – Bachelor of Science in Software Engineering with Emphases in Entrepreneurship, Digital Media Design, and Web Development</u>

Issue

Snow College requests approval to offer a Bachelor of Science (BS) in Software Engineering effective Fall Semester, 2017. Three areas of emphasis from among which students may choose are part of the proposal. These include: 1) Entrepreneurship, 2) Digital Media Design, and 3) Web Development. The proposed program and the three areas of emphasis were approved by the institutional Board of Trustees April 29, 2016.

Background

Central Utah faces economic challenges. Rural communities within the central region have endured the most severe and longest economic contraction since the Great Depression. There are several long-term structural challenges to rural prosperity that can create more challenges to recover from an economic downturn than what is often realized in higher populated areas. These include out-migration, consolidation, and access to financial capital. Economic developers within Snow College's service region have noted there is a significant income gap between the Sanpete, Sevier, Juab, Millard, Piute, and Wayne Counties and other more populated areas such as Salt Lake County.

This income gap is impacted by another factor that results in Central Utah being referred as the "donut hole." This label describes both its central location in the state along with a void of technology learning opportunities for students. This void is believed to fuel out-migration, resulting in a widened income gap.

Snow College officials and economic development personnel within the College's service region proposed that the BS in Software Engineering be offered as a way to reduce out-migration and grow the economic base for central Utah. Several potential employers have expressed interest in locating in less populated, Tier-3 locations (a Tier-3 location has 20,000 to 49,999 residents). Sanpete County has 28,778 residents (as per the United States Census Bureau's July 1, 2015 estimates). Key decision drivers for technology companies considering relocation include: 1) access to a talented workforce, 2) IT professionals with experience, and 3) access to a partnership with a higher-education institution to foster relationships that lead students to full-time employment.

The proposed program is designed to address out-migration and serve as a catalyst to incent computer technology companies to invest in Central Utah as a place to locate operations and as a source of talent for

software engineering and related positions where employee proximity to a specific physical location is often of lesser importance to fulfillment of job duties as compared to other occupations where physical proximity is required.

The proposed program will prepare individuals to be collaborative professionals working on a team to develop software products that meet customer requirements. Graduates of the program will possess the practical knowledge and skill of a defined engineering approach for complex systems analysis, planning, design and construction. The coursework builds upon computer science fundamentals and mathematical principles to cover the design, analysis, verification, validation, implementation, deployment, and maintenance of software systems.

The software engineering curriculum culminates in a year-long capstone sequence where students will work in teams to build software systems reflective of current industry practices. Additionally, students will be encouraged to participate in internships. Snow College plans to partner with businesses to develop these work-based learning opportunities.

Snow College has hired a terminally qualified faculty member in computer science and has plans to hire two additional appropriately credentialed faculty members to support the program. Additionally, two new labs that will support the program have been planned for inclusion within the institution's new science building. In developing program courses, Snow College personnel have followed ABET accreditation criteria and have consulted with technology companies who would be likely candidates to hire program graduates. They have also worked with local economic development leaders to ensure the program fits within the region's strategic economic plans.

The Utah Department of Workforce Services Occupational Explorer shows the Software Developers occupational group as having strong labor market need as per the following statewide projection for 2014 – 2024:

SOC Code	Occupation	Annual Percent Change in Job Openings	Total Annual Openings	Hourly Median Wage
15-1132	Software Developers, Applications	5.9	640	$43.96
15-1133	Software Developers, Systems Software	4.3	170	$44.63

Similar degrees offered within the Utah System of Higher Education include a bachelor's degree in Software Engineering at Utah Valley University, a bachelor's' degree in Computer Science with emphasis in Software Development at Utah State University, and a bachelor's degree in Computer and Information Technology with Emphasis in Software Development at Dixie State University. From labor market projections it is believed that statewide demand is strong and will continue to be sufficiently strong into the foreseeable future to justify offering all of these related programs, including the addition of this proposed program from Snow College.

<u>Policy Issues</u>

Regent Policy R312 classifies Snow College as a Comprehensive Community or Associate's College. This classification provides that an institution may award up to ten percent of its degrees at the baccalaureate level. The Bachelor of Music, currently offered at Snow College, accounts for approximately three percent of the College's degrees awarded in 2016. It is not anticipated that the proposed program would cause Snow College to exceed the ten percent threshold.

The proposed program has been developed through established institutional procedures and Board of Regents policy. Chief academic officers as well as faculty in related departments from the Utah System of Higher Education institutions have reviewed the proposal and have provided input.

<u>Commissioner's Recommendation</u>

<u>The Commissioner recommends the Board of Regents approve the Bachelor of Science in Software Engineering with Emphases in Entrepreneurship, Digital Media Design, and Web Development.</u>

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David L. Buhler
Commissioner of Higher Education

DLB/BKC
Attachment

Utah System of Higher Education

Section I: The Request

Snow College requests approval to offer a Bachelor of Science Degree in Software Engineering with Emphases in: 1) Entrepreneurship, 2) Digital Media Design, and 3) Web Development effective Fall Semester, 2017. Approval was granted by the Snow College institutional Board of Trustees on April 29, 2016.

Section II: Program Proposal

Program Description

The goal of the Snow College Bachelor of Science Degree in Software Engineering is the preparation of software engineers: collaborative professionals working on a team to develop software products on time, within budget, and that meet customer requirements. Graduates of this program will possess the practical knowledge and skill of a defined engineering approach for complex systems analysis, planning, design and construction. The coursework builds upon computer science fundamentals and mathematical principles to cover the design, analysis, verification, validation, implementation, deployment, and maintenance of software systems.

There is often confusion regarding the differences between computer science, software engineering and information technology/information services. The following diagram from the Association for Computing Machinery (ACM) provides insight into the relationship between each of the areas.
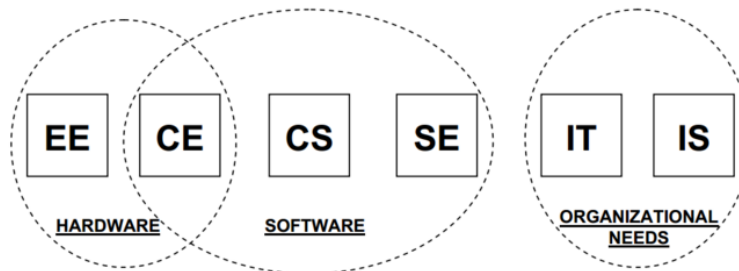

Figure 1: ACM Computing Curricula 2005 Overview Report[1]

Electrical Engineers (EE) are primarily involved with hardware design, while Computer Engineers (CE) design systems that include both hardware and software. Computer Science (CS) covers the concepts and technology involved with how to make a computer do something (graphics, robotics, etc.), and software engineering (SE) focuses on how to design and build software. There is significant overlap between computer science and software engineering and the intersection between the two is often programming; however, there is a key difference. Computer scientists test theories and work at the edge of the unknown. Software engineering is an engineering discipline. Engineering starts with knowledge that has already been proven reliable and develops solutions for technical, societal and commercial problems. Information Technology (IT) and Information Services (IS) are focused on delivering technology solutions to an organization.

The Snow College Software Engineering program will provide students with an educational experience that builds upon traditional computer science and engineering and produces software engineers that create high-quality software in a systematic, controlled, and efficient manner. This will be accomplished in the following ways:

- Emphasis on mathematics and use of engineering methods in software design.
- Emphasis on software processes and lifecycles utilizing a team approach to building software with active learning (learning by doing).

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[1] http://www.acm.org/education/education/curric_vols/CC2005-March06Final.pdf

- Course content in project planning, resource allocation, quality assurance, testing, metrics, maintenance and troubleshooting, configuration management and personnel management.
- Use of student teams to work on activities specifically designed to guide students to collaboratively construct their own understanding of key concepts, and at the same time develop key process skills like communication, teamwork, critical thinking and problem solving.
- Inclusion of three areas of emphasis from which students may choose:
  - Entrepreneurship: The combination of computational and entrepreneurial thinking to identify, assess and implement ideas that will create new markets and technologies.
  - Digital Media Design: The use of integrated media to communicate messages through electronic mediums such as the Internet, film, television and mobile technologies.
  - Web Development: The use of tools including HTML, CSS, and JavaScript to create and maintain high quality, interactive websites.

The software engineering curriculum culminates in a year-long capstone sequence where the students work in teams to build a software system reflective of current practices in the industry. Additionally, students are encouraged to participate in internships prior to and during enrollment in these capstone courses in order to gain direct industry experience and insight before embarking upon their own projects. Snow College will be partnering with businesses to develop these learning opportunities that will provide students with industry relevant experience.

The Snow College Software Engineering program prepares students to enter the software engineering profession immediately or to go on to pursue advanced educational opportunities. The first two years of the program are also compatible with transfer to an institution offering a degree in computer science.

Consistency with Institutional Mission

Snow College is designated as a Comprehensive Community or Associate's College by Regent Policy R312. This policy provides that up to ten percent of undergraduate degrees may be at the baccalaureate level. It is anticipated that the Bachelor of Music currently offered at Snow College will account for approximately three percent of degrees awarded. It is not anticipated that the proposed Bachelor of Science in Software Engineering Degree will cause the institution to exceed the ten percent limit.

The mission statement of Snow College includes:
- Continue a tradition of excellence;
- Encourage a culture of innovation;
- Cultivate an atmosphere of engagement to advance students in the achievement of their educational goals.

The proposed program will continue a tradition of excellence by providing a venue for active learning which is the standard model for many Snow College programs. It extends a well-established two-year computer science program to give students an option to complete a baccalaureate degree in a high demand area. Snow College has a successful history of transferring students from its computer science program to four-year programs at four year institutions. This will remain an option for students.

This program will encourage a culture of innovation by continually introducing students to new ideas and ways of thinking. Instructors will guide students by integrating theoretical knowledge with current industry practices. Students will be encouraged to experiment and develop creative new solutions to contemporary applied challenges.

Snow College personnel will use the program to cultivate an atmosphere of engagement both within the college and in the community. Within the college, the benefits of this program have the potential to reach beyond the engineering students. Computing is becoming one of the core disciplines of a 21st century education -- all educated individuals must possess some level of proficiency and understanding of computing technology. In recognition of computational thinking as being one of the fundamental skills desired of all graduates, it is likely that in the future almost every undergraduate student will take some instruction in computing. It will be important to provide introductory level

instruction across a broad range of subject areas that are accessible and attractive to students from many disciplines. This also serves the dual purpose of attracting more students to the computing field who may not have had an initial inclination otherwise.

In conjunction with industry and government partners, Snow College has included economic development as one its five main goal areas in its strategic plan. As part of this, four key action items were identified to meet the economic development goals including:
- Enriching the curriculum with courses that emphasize entrepreneurial skills
- Creating more logical pathways for students to enter industry prepared to be economic contributors
- Developing programs that will lift the standard of living in the six-county service region
- Strengthening relationships with industry in the six-county region by developing programs that meet their needs.

One of Snow College's objectives is to serve as a regional steward by encouraging innovative economies. Currently, rural central Utah is largely dependent upon agriculture and natural resource industries. A desired outcome of this bachelor degree program is to reduce this dependency and provide new economic development opportunities for central Utah. This Software Engineering program will produce immediately employable graduates having skills and experience that are currently in high demand but short supply. This will create a pool of trained professionals who have the potential to attract high-tech businesses and inspire new venture opportunities in the six-county region.

Section III: Needs Assessment

Program Rationale
Central Utah faces economic challenges. Since 2007, rural communities have endured the steepest and longest economic contraction since the Great Depression. There are several long-term structural challenges to rural prosperity including out-migration, consolidation, and access to financial capital that threaten rural prosperity. This is evidenced by a significant gap in per capita income that exists between the College's six county service region and Salt Lake County. Snow College officials indicate that this gap is widening and exceeds $17,000 per year.

This income gap will be impacted by another factor which results in Central Utah being referred as the "donut hole." This label describes both its central location in the state along with the void of technology learning opportunities for students. This void of technology learning opportunities fuels the out-migration which will widen the income gap.

This new program will be part of a larger economic strategy to reduce out-migration and grow the economic base for central Utah. The institution has reported that several potential employers have expressed interest in locating in less populated, Tier-3 locations (a Tier-3 location has 20,000 to 49,999 residents). Sanpete County has 28,778 residents. The key decision drivers for a technology company considering relocation are access to a talented workforce.

In Utah's Economic Development Plan (http://business.utah.gov/wp-content/uploads/GovPlanLR.pdf), Governor Gary R. Herbert cited four key objectives: 1) Strengthen and grow existing Utah businesses, both urban and rural; 2) Increase innovation, entrepreneurship, and investment; 3) Increase national and international business; and 4) Prioritize education to develop the workforce of the future. Education is essential to achieving the first objective because, as stated earlier, the availability of skilled labor is the number one site selection factor for relocating companies. Education is also essential to achieving the fourth objective, especially with regard to technology because the current demand for skilled resources far exceeds the available supply.

This software engineering program is designed to address these workforce issues. It will also prepare students to continue to more advanced educational opportunities. This program will be accessible to students of all backgrounds, particularly young women and students from underserved communities.

Through classes and technical events (coding clubs, challenges, and camps), local K-12 students, that currently do not have access to technology education, will be connected to these events. To ensure this, Snow College is working with school districts to create a well-defined, connected technical education pathway. Other partnerships with industry groups and industry partners will connect women to the high-tech industry. Finally, a key cornerstone of the proposed program will be internships. These internships will provide mentoring, targeted master courses and on-the-job support that not only help students build industry relevant technology skills but facilitate the creation of a student portfolio that highlights student accomplishments.

Through outreach and engagement with local school districts, the proposed program will help reduce the technology donut-hole effect in central Utah. Pathways are currently being established in the Sanpete and Sevier School Districts to support the State of Utah's Public Education plan to integrate Computer Science into K-12 by making classes available to high school students and providing a clear path to a degree. Snow College is assisting with delivery of these educational offerings. This will be extended to the other counties' districts as possible.

Labor Market Demand

Nationally, according to the Occupational Outlook Handbook published by the Bureau of Labor Statistics, employment of software developers is projected to grow 17 percent from 2014 to 2024[2]. This occupation is expected to experience much faster than average employment growth with a high volume of annual job openings. This growth is driven by a large increase in the demand for computer software. Business expansion, as opposed to the need for replacements, will provide the majority of job openings in the coming decade. Job prospects will be best for applicants with knowledge of the most up-to-date programming tools and languages. Compared to all occupations, wages for this occupation are very high, growing much faster than the average for all occupations.

The Utah Department of Workforce Services Occupational Explorer shows the Software Developers occupational group as having strong labor market need. Statewide projections for software development show the following 2014 - 2024 labor market trends:

SOC Code	Occupation	Annual Percent Change in Job Openings	Total Annual Openings	Hourly Median Wage
15-1132	Software Developers, Applications	5.9	640	$43.96
15-1133	Software Developers, Systems Software	4.3	170	$44.63

Student Demand

Student interest in computing programs is continuing to rise nationally and within Utah. The institution reported that the number of students declaring computer science or a closely related program as their major has risen steadily over the past few years. The number of students enrolling in the introductory computer science course at Snow College has almost doubled from 55 in FY2013 to 97 in FY/2016.

Similar Programs

Similar programs to the proposed program are outlined in Tables 1 and 2. Table 1 lists similar programs at institutions within the Utah System of Higher Education. Table 2 lists computer science/software engineering programs provided by other institutions in Utah.

Table 1: State of Utah Higher Education Programs offering Computer Science / Software Engineering Degrees

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[2] http://www.bls.gov/ooh/computer-and-information-technology/software-developers.htm

USHE School Name	School Type & Setting	Computer Science Programs Offered	Software Engineering Program Offered
University of Utah (Accreditation: ABET, Computer Engineering)	Four year, public; midsize city	• BS in Computer Science, • BS in Computer Engineering • MS in Computer Science, • PhD in Computer Science	
Utah State University (Accreditation: ABET),	Four year, public; small city	• BS in Computer Science • BS in Computer Engineering • MS in Computer Science • MCS in Computer Science • PhD in Computer Science	• BS in Computer Science with Emphasis in Software Development
Southern Utah University (Accreditation: ABET)	Four-year, public; small city	• AS in Computer and Information Systems - Security Emphasis • BS in Computer Science Composite, • BS in Computer Science Composite - Forensic Science Emphasis, • MFS in Computing	
Utah Valley University (Accreditation: ABET in Computer Science and Engineering)	Four year, public; midsize city	• AS Pre-Major in Computer Science, • AAS in Computer Science, • AAS in Computer Science - Computer Engineering or Computing and Networking Sciences, • BAS in Computer Science - Computer Engineering, Computer Networking, Computer Science or Database Engineering	• BS in Software Engineering
Dixie State University (Accreditation: Northwest Commission on Colleges and Universities)		• BS in Computer Science, • BS in Computer and Information Technology • BS in Computer and Information Technology (Digital design emphasis) • BS in Computer and Information Technology (IT emphasis) • BS in Computer and Information Technology (IT emphasis)	• BS in Computer and Information Technology with Emphasis in Software Development
USHE School Name	School Type & Setting	Computer Science Programs Offered	Software Engineering Program Offered
Weber State	Four-year, public;	• AAS in Computer Science,	

University (Accreditation: ABET)	small city	• BS in Computer Science, • BIS in Computer Science	
Salt Lake Community College	Two-year, public; large suburb	• AS in Computer Sciences and Information Systems • COC in Business & Personal Computing	• AAS in Computer Sciences and Information Systems - Computer Programming and Design, Database Design, Management and Administration or Web Programming and Development • Software Engineering (CP) • Software Development (CP)

Table 2: Other Utah Higher Education Programs offering Computer Science / Software Engineering Degrees

Other Utah Schools	School Type & Setting	Computer Science Programs Offered	Software Engineering Program Offered
Brigham Young University (Accreditation: ABET)	Four year, private not-for-profit; midsize city	• BS in Computer Science, • BS in Computer Science - Animation Emphasis or Bioinformatics Emphasis • MS in Computer Science, • PhD in Computer Science	
Westminster College	Four year, private not-for-profit; midsize city	• BS in Computer Science	
Neumont University (Accreditation: ACICS)	Four year private; midsize city	• BS in Computer Science	

Labor market demand and student demand appear to be more than sufficient to justify the addition of the proposed program. A unique aspect of the Snow College software engineering degree program is the software entrepreneurship emphasis that provides collaboration between fields such as accounting, marketing, business management, and software engineering to teach students how to monetize software products and services.

Collaboration with and Impact on Other USHE Institutions
This program will not be delivered outside of Snow College's service area. A major intent is to provide a steady stream of software engineering professionals as an attraction for industry to locate in central Utah.

Student demand for computing degrees is rising significantly in the State of Utah. It is anticipated that this proposed program will help alleviate rising student and market demand pressure while having minimal impact on similar programs within the state.

This software engineering program utilizes the traditional first two years of a computer science curriculum. Students desiring to major in computer science can continue to attend Snow College for the first two years. They would then transfer to another institution to finish a bachelor of science degree.

External Review and Accreditation
Snow College will seek accreditation from ABET as soon as the eligibility requirements for accreditation have been satisfied. Those requirements include having at least one graduate and undergoing a readiness review. This readiness review requires a preliminary self-study report and the submission of one graduate's official transcript. The first graduate should complete by the end of the program's second year. The self-study report will be completed during those first two years so that it can be submitted at the time students begin to complete the program.

Although ABET accreditation of this program is essential, the participation of local industry partners is equally as important. This program will operate with direction of an advisory board comprised of individuals from both high-tech companies and non-tech companies seeking to employ qualified technical candidates. The board will provide guidance on the content of program, the tools being utilized by the program, and opportunities such as internships for program participants.

Section IV: Program Details

Graduation Standards and Number of Credits
Graduation requirements include 126 total credits including seven credits specific to an area of emphasis. This is the maximum number of credits required for a baccalaureate degree as specified by Regent policy.

A minimum grade of C- is required for all Mathematics, Science, and Software Engineering Courses.

Admission Requirements
Any matriculated Snow College student is eligible to apply to and begin work in this software engineering program. Admission requirements for this degree program are ready to enroll in CS 1410 and MATH 1210.

Continuation in the upper-division courses of this program requires maintaining a C- or higher grade in all required courses.

Curriculum and Degree Map
The tables in Appendix A provide a list of courses and Appendix B provides a program Degree Map for each emphasis, also referred to as a graduation plan.

Institutional Readiness

The study of engineering was formalized at Snow College in the early 1970s. The Engineering Department was created in the late 1980s. Computer Science was added to the Engineering Department in the 1990s. Engineering and computer science education at Snow College has been and continues to be robust. The number of students studying engineering and computer science at Snow College has trended upward throughout these past decades.

A new science building is currently being constructed that will provide space and facilities for the program. This state-of-the-art facility will be the home for the proposed program. Two engineering computer labs are planned into the design and will be significant in delivering the program to students.

Faculty

The existing department faculty members are all currently teaching full loads in lower-division engineering and computer science coursework. To support the program and to continue to support the department's existing student demand, a new faculty member has been hired and two additional faculty hires are planned. The program will also require the use of adjunct instructors with expertise in specific areas. Plans are in place to provide the necessary resources to support these new hires.

Staff

The Information Technology staff at Snow College is capable and supportive of all computer and technology equipment across the college. These employees will provide support to set-up and maintain the computer labs used in the program.

Student Advisement

Department faculty will be responsible for program advisement as well as for assisting students with career planning. Students will be assigned a faculty advisor. Students will meet with their advisor each semester to ensure they are making appropriate progress toward completion.

Library and Information Resources

The library currently solicits input for resources and materials. Engineering Initiative monies and Snow College's match will be used to support this need.

Section VI: Program Evaluation

Program Assessment

The main goals of this program are 1) to produce graduates who are ready to be productive software engineers requiring little or no in-house training after graduation, and 2) to produce graduates who qualify for immediate admission into a graduate computer science or software engineering program of study.

The goal of graduates being ready to be productive will be assessed by tracking placement of graduates entering the software engineering industry. Initial assessment by employers will be sought as well as assessment a year later to determine what additional training was needed.

The goal of producing graduates who qualify for graduate school will be assessed by tracking acceptance rates of graduates who pursue graduate studies.

This program will also be assessed to fulfill Northwest and ABET accreditation requirements.

Student Standards of Performance

Students will:

1. Demonstrate the ability to apply knowledge of mathematics, science, and software engineering.
2. Demonstrate effective oral and written communications with supervisors, team members, and clients. Specifically, they should exhibit lucid, clear and concise technical and professional communication as well as be able to convey complex technical ideas to non-technical individuals.
3. Design and implement software solutions based on sound software engineering principles utilizing state-of-the-practice tools and techniques.
4. Solve a software engineering problem demonstrating ability to manage, design, and implement.
5. Follow and meet objectives of a project plan and recognize the need for adaptation, adjustments and restructuring of the plan, both as an individual software developer and as a team member.
6. Demonstrate an understanding of professional and ethical responsibility. They will respect their professors, other students, different cultures, customs, and professional technical methods and procedures inherent in an industry with many differences locally and regionally.
7. Demonstrate leadership through positive, realistic interactions that earn team member respect and facilitate project success.
8. Effectively apply software engineering skills to an emphasis such as entrepreneurship, digital media design, or information systems.

Formative and summative assessment will be conducted. Examples of formative assessments will include asking students to:
- Create design documents that illustrate their understanding and design thinking for a solution
- Submit assignments that exhibit an understanding of lecture topics
- Design and develop software solutions that exhibit understanding and practice of sound software engineering practices

Examples of summative assessments that will be utilized include:
- Quizzes and Exams
- Final projects
- Papers

A key outcome of this program is the development of software engineers who are ready for industry. The assessments outlined above will resemble the assessment procedures used in industry. This will familiarize students with assessment techniques suitable for a software development environment aimed at solving problems based on groups of people collaborating and cooperating with clear goals for serving and meeting the demands of real clients.

Appendix A: Program Curriculum

Course Prefix	Course Number	NEW Course: Mark with X	Course Title	Credit Hours
General Education Courses (list specific courses if recommended for this program on Degree Map)				
			General Education Credit Hour Sub-Total	24[3]
Required Courses				
CS	1410		Object-oriented Programming	3
CS	1415		Object-oriented Programming Lab	1

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[3] The remaining GE credits are satisfied in the Required Courses

Prefix	Number	New	Course Title	Credits
CS	2420		Data Structures and Algorithms	3
CS	2450		Intro. to Software Engineering	3
CS	2700		Digital Circuits	3
CS	2810		Computer Organization and Architecture	3
CS	2860	X	Operating Systems Theory	3
MATH	1210		Calculus I	5
MATH	1220		Calculus II	4
MATH	2270		Linear Algebra	3
MATH	3000	X	Statistics for Scientists and Engineers	3
MATH	3310	X	Discrete Math	3
PHYS	2210		Physics for Scientists and Engineers I	4
PHYS	2215		Physics for Scientists and Engineers I Laboratory	1
PHYS	2220		Physics for Scientists and Engineers II	4
PHYS	2225		Physics for Scientists and Engineers II Laboratory	1
ENGL	3260	X	Technical Writing	3
SE	3250	X	Survey of Languages	3
SE	3410	X	Human Factors in Software Design	3
SE	3450	X	Principles and Patterns of Software Design	3
SE	3520	X	Database Theory	3
SE	3620	X	Distributed Internet Application Development	3
SE	3630[4]		Mobile Application Development	3
SE	4120	X	Management of Software Projects	2
SE	4140	X	Social & Ethical Issues in Computing	2
SE	4220	X	Requirements Engineering	3
SE	4230	X	Software Testing and Quality Engineering	3
SE	4320	X	Personal Software Process	3
SE	4340	X	Secure Coding Practices	3
SE	4400	X	Software Engineering Practicum I	4
SE	4450	X	Software Engineering Practicum II	4
			Required Course Credit Hour Sub-Total	**92**

Course Prefix	Course Number	NEW Course: Mark with X	Course Title	Credit Hours
Elective Courses				
CHEM	1210/1215		Principles of Chemistry I/Lab	4/1
BIOL	2060/2065		Microbiology/Lab	3/1
BIOL	2030/2035		Introductory Genetics/Lab	3/1
MATH	2210		Calculus III	3
			Elective Credit Hour Sub-Total	**3**
Emphasis Option #1				
Are students required to choose an emphasis? ☒ *Yes or* ☐ *No*				
Name of Emphasis: Entrepreneurship				

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[4] This course is currently being offered as CS 2630

BUS	1600		Entrepreneurship Seminars	1
BUS	2222		Entrepreneurship	3
BUS	2650		Management Principles for Entrepreneurs	3
			Emphasis #1 Credit Hour Sub-Total	**7**
			Total Number of Credits to Complete Program	**126**
Emphasis Option #2				
Name of Emphasis: Digital Media Design				
ART	1120		2D Surface	3
ART	1140		4D Time	3
ART	1300		Digital Media Fundamentals	3
			Emphasis #2 Credit Hour Sub-Total	**9**
			Total Number of Credits to Complete Program	**125[5]**
Emphasis Option #3				
Name of Emphasis: Web Development				
CIS	1640		Database Design - PHP	3
CIS	1811		Web Site Development	3
CIS	1820		Web Site Application Development	3
			Emphasis #3 Credit Hour Sub-Total	**9**
			Total Number of Credits to Complete Program	**125[6]**

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[5] This combination of Art classes satisfies the GE Fine Arts requirement.

[6] SE 3620: Distributed Internet Application Development will be satisfied by this combination of CIS courses

Appendix B: Degree Map

Entrepreneurship Emphasis Suggested Schedule

First Year				
Fall Semester	Credits		Spring Semester	Credits
CS 1410: Object-oriented Programming	3		CS 2420: Data Structures & Algorithms	3
CS 1415: Object-oriented Programming Lab	1		CS 2700: Digital Circuits	3
MATH 1210: Calculus I	5		MATH 1220: Calculus II	4
ENGL 1010: Expository Composition	3		ENGL 2010: Intermediate Research Writing	3
GE Life Science	3		GE American Institutions	3
Semester Total	15		Semester Total	16

Second Year				
Fall Semester	Credits		Spring Semester	Credits
CS 2810: Computer Organization & Architecture	3		CS 2450: Intro to Software Engineering	3
MATH 2270: Linear Algebra	3		CS 2860: Operating Systems Theory	3
MATH 3310: Discrete Math	3		MATH/SCI Elective	3
PHYS 2210: Physics for Scientists & Engineers I	4		PHYS 2220: Physics for Scientists & Engineers II	4
PHYS 2215: Physics for Scientists & Engineers I Lab	1		PHYS 2225: Physics for Scientists & Engineers II Lab	1
GE FA/HU/SS	3		GE FA/HU/SS	3
Semester Total	17		Semester Total	17

Third Year				
Fall Semester	**Credits**		**Spring Semester**	**Credits**
SE 3250: Survey of Languages	3		SE 3410: Human Factors in Software Design	3
SE 3520: Database Theory	3		SE 3450: Principles and Patterns of Software Design	3
SE 3620: Distributed Internet Application Development	3		SE 3630: Mobile Application Development	3
MATH 3000: Statistics for Scientists and Engineers	3		ENGL 3260: Technical Writing	3
BUS 1600: Entrepreneurship Seminars	1		BUS 2222: Entrepreneurship	3
GE FA/HU/SS	3			
Semester Total	**16**		**Semester Total**	**15**

Fourth Year				
Fall Semester	**Credits**		**Spring Semester**	**Credits**
SE 4120: Management of Software Projects	2		SE 4140: Social & Ethical Issues in Computing	2
SE 4220: Requirements Engineering	3		SE 4230: Software Testing and Quality Engineering	3
SE 4320: Personal Software Process	3		SE 4340: Secure Coding Practices	3
SE 4400: Software Engineering Practicum I	4		SE 4450: Software Engineering Practicum II	4
BUS 2650: Management Principles for Entrepreneurs	3		COMM 1020: Public Speaking	3
Semester Total	**15**		**Semester Total**	**15**

Digital Media Design Emphasis Suggested Schedule

First Year				
Fall Semester	Credits		Spring Semester	Credits
CS 1410: Object-oriented Programming	3		CS 2420: Data Structures & Algorithms	3
CS 1415: Object-oriented Programming Lab	1		CS 2700: Digital Circuits	3
MATH 1210: Calculus I	5		MATH 1220: Calculus II	4
ENGL 1010: Expository Composition	3		ENGL 2010: Intermediate Research Writing	3
GE Life Science	3		GE American Institutions	3
Semester Total	15		Semester Total	16

Second Year				
Fall Semester	Credits		Spring Semester	Credits
CS 2810: Computer Organization & Architecture	3		CS 2450: Intro to Software Engineering	3
MATH 2270: Linear Algebra	3		CS 2860: Operating Systems Theory	3
MATH 3310: Discrete Math	3		MATH/SCI Elective	3
PHYS 2210: Physics for Scientists & Engineers I	4		PHYS 2220: Physics for Scientists & Engineers II	4
PHYS 2215: Physics for Scientists & Engineers I Lab	1		PHYS 2225: Physics for Scientists & Engineers II Lab	1
GE HU/SS	3		GE /HU/SS	3
Semester Total	17		Semester Total	17

Third Year				
Fall Semester	Credits		Spring Semester	Credits
SE 3250: Survey of Languages	3		SE 3410: Human Factors in Software Design	3
SE 3520: Database Theory	3		SE 3450: Principles and Patterns of Software Design	3
SE 3620: Distributed Internet Application Development	3		SE 3630: Mobile Application Development	3
MATH 3000: Statistics for Scientists and Engineers	3		ENGL 3260: Technical Writing	3
ART 1120: 2D Surface	3		ART 1140: 4D Time	3
Semester Total	15		Semester Total	15

Fourth Year				
Fall Semester	Credits		Spring Semester	Credits
SE 4120: Management of Software Projects	2		SE 4140: Social & Ethical Issues in Computing	2
SE 4220: Requirements Engineering	3		SE 4230: Software Testing and Quality Engineering	3
SE 4320: Personal Software Process	3		SE 4340: Secure Coding Practices	3
SE 4400: Software Engineering Practicum I	4		SE 4450: Software Engineering Practicum II	4
ART 1300: Digital Media Fundamentals	3		COMM 1020: Public Speaking	3
Semester Total	15		Semester Total	15

Web Development Emphasis Suggested Schedule

First Year				
Fall Semester	Credits		Spring Semester	Credits
CS 1410: Object-oriented Programming	3		CS 2420: Data Structures & Algorithms	3
CS 1415: Object-oriented Programming Lab	1		CS 2700: Digital Circuits	3
MATH 1210: Calculus I	5		MATH 1220: Calculus II	4
ENGL 1010: Expository Composition	3		ENGL 2010: Intermediate Research Writing	3
GE Life Science	3		GE American Institutions	3
Semester Total	15		Semester Total	16

Second Year				
Fall Semester	Credits		Spring Semester	Credits
CS 2810: Computer Organization & Architecture	3		CS 2450: Intro to Software Engineering	3
MATH 2270: Linear Algebra	3		CS 2860: Operating Systems Theory	3
MATH 3310: Discrete Math	3		MATH/SCI Elective	3
PHYS 2210: Physics for Scientists & Engineers I	4		PHYS 2220: Physics for Scientists & Engineers II	4
PHYS 2215: Physics for Scientists & Engineers I Lab	1		PHYS 2225: Physics for Scientists & Engineers II Lab	1
GE FA/HU/SS	3		GE FA/HU/SS	3
Semester Total	17		Semester Total	17

Third Year				
Fall Semester	Credits		Spring Semester	Credits
SE 3250: Survey of Languages	3		SE 3410: Human Factors in Software Design	3
SE 3520: Database Theory	3		SE 3450: Principles and Patterns of Software Design	3
MATH 3000: Statistics for Scientists and Engineers	3		SE 3630: Mobile Application Development	3
CIS 1640: Database Design - PHP	3		CIS 1811: Web Site Development	3
GE FA/HU/SS	3		ENGL 3260: Technical Writing	3
Semester Total	15		Semester Total	15

Fourth Year				
Fall Semester	Credits		Spring Semester	Credits
SE 4120: Management of Software Projects	2		SE 4140: Social & Ethical Issues in Computing	2
SE 4220: Requirements Engineering	3		SE 4230: Software Testing and Quality Engineering	3
SE 4320: Personal Software Process	3		SE 4340: Secure Coding Practices	3
SE 4400: Software Engineering Practicum I	4		SE 4450: Software Engineering Practicum II	4
CIS 1820: Web Site Application Development	3		COMM 1020: Public Speaking	3
Semester Total	15		Semester Total	15

Appendix C: Current and New Faculty / Staff Information

Part I. Department Faculty / Staff

Identify # of department faculty / staff (headcount) for the year preceding implementation of proposed program.

	# Tenured	# Tenure -Track	# Non -Tenure Track	
Faculty: Full Time with Doctorate	1	1	0	
Faculty: Part Time with Doctorate	0	0	0	
Faculty: Full Time with Masters	1	1	0	
Faculty: Part Time with Masters	0	0	0	
Faculty: Full Time with Baccalaureate	0	0	0	
Faculty: Part Time with Baccalaureate	0	0	0	
Teaching / Graduate Assistants	///////	///////	0	
Staff: Full Time	0	0	1	
Staff: Part Time	0	0	0	

Part II. Proposed Program Faculty Profiles

List current faculty within the institution -- with academic qualifications -- to be used in support of the proposed program(s).

	First Name	Last Name	Tenure (T) / Tenure Track (TT) / Other	Degree	Institution where Credential was Earned	Est. % of time faculty member will dedicate to proposed program.	If "Other," describe
Full Time Faculty							
	Kristal	Ray	TT	Ph.D.	Colorado Technical University	100%	
	Garth	Sorenson	T	M.S.	Utah State University	100%	
	Brian	Newbold	T	Ph.D.	Brigham Young University	10%	
	Kyle	Rowley	TT	M.S.	Brigham Young University	10%	
Part Time Faculty							

Part III: New Faculty / Staff Projections for Proposed Program

Indicate the number of faculty / staff to be hired in the first three years of the program, if applicable. Include additional cost for these faculty / staff members in Appendix D.

	# Tenured	# Tenure -Track	# Non -Tenure Track	Academic or Industry Credentials Needed	Est. % of time to be dedicated to proposed program.
Faculty: Full Time with Doctorate	0	2	0	Ph.D. in Software Engineering or Computer Science	100%
Faculty: Part Time with Doctorate	0	0	0		
Faculty: Full Time with Masters	0	0	0		
Faculty: Part Time with Masters	0	0	0		
Faculty: Full Time with Baccalaureate	0	0	0		
Faculty: Part Time with Baccalaureate	0	0	0		
Teaching / Graduate Assistants	///////	///////			
Staff: Full Time	0	0	0		
Staff: Part Time	0	0	0		

Appendix D: Projected Program Participation and Finance

Part I.
Project the number of students who will be attracted to the proposed program as well as increased expenses, if any. Include new faculty & staff as described in Appendix C.

Three Year Projection: Program Participation and Department Budget						
	Year Preceding Implementation	New Program				
		Year 1	Year 2	Year 3	Year 4	Year 5
Student Data						
# of Majors in Department	150	160	190	215	260	280
# of Majors in Proposed Program(s)	///////	50	75	100	140	192
# of Graduates from Department	30	30	50	60	65	70
# Graduates in New Program(s)	///////	0	15	20	24	30
Department Financial Data						
		Department Budget				
		Year 1	Year 2	Year 3		
Project additional expenses associated with offering new program(s). Account for New Faculty as stated in Appendix C, "Faculty Projections."	Year Preceding Implementation (Base Budget)	Addition to Base Budget for New Program(s)	Addition to Base Budget for New Program(s)	Addition to Base Budget for New Program(s)		
EXPENSES – nature of additional costs required for proposed program(s)						
List salary benefits for additional faculty/staff each year the positions will be filled. For example, if hiring faculty in year 2, include expense in years 2 and 3. List one-time operating expenses only in the year expended.						
Personnel (Faculty & Staff Salary & Benefits)		$195,000	$205,000	$215,000		
Operating Expenses (equipment, travel, resources)		$73,000	$24,000	$34,000		
Other: Student equipment/supplies		$2,500	$3,750	$5,000		
TOTAL PROGRAM EXPENSES	///////	$270,500	$232,750	$254,000		
TOTAL EXPENSES	$0	$270,500	$232,750	$254,000		
FUNDING – source of funding to cover additional costs generated by proposed program(s)						
Describe internal reallocation using Narrative 1 on the following page. Describe new sources of funding using Narrative 2.						
Internal Reallocation		$95,000	$100,000	$105,000		
Appropriation		$49,000	$0	$0		
Special Legislative Appropriation		$95,000	$100,000	$105,000		
Grants and Contracts		$5,000	$5,000	$5,000		
Special Fees		$2,500	$3,750	$5,000		
Tuition		$14,200	$21,300	$28,400		
Differential Tuition (requires Regents approval)		$2,400	$5,600	$6,400		
PROPOSED PROGRAM FUNDING	///////	$263,100	$235,650	$254,800		
TOTAL DEPARTMENT FUNDING	$0	$263,100	$235,650	$254,800		
Difference						
Funding - Expense	$0	($7,400)	$2,900	$800		

Part II: Expense explanation

Expense Narrative

Describe expenses associated with the proposed program.

Salary and benefits of two new tenure-track faculty with Ph.D. is $190,000. Adjunct faculty compensation is $5,000.
The first-year startup costs for laboratory computers, mobile devices for instruction, printers, and other equipments is $49,000.
On-going costs of computer replacement, faculty development, supplies and equipment, and other department expenses are $24,000.

Part III: Describe funding sources

Revenue Narrative 1

Describe what internal reallocations, if applicable, are available and any impact to existing programs or services.

The Legislated Engineering Initiative Funds allocated to Snow College require reallocation of college funds as match. These matching funds will be used to cover half of the new faculty expenses.

Revenue Narrative 2

Describe new funding sources and plans to acquire the funds.

The on-going Engineering Initiative Funds allocated to Snow College in FY 2016 will be used to cover half of the new faculty expenses.
The new Science Building equipment appropriation will fund the first-year startup cost for equipment.
There will be special fees associated with Software Engineering courses.
A differential-tuition will be assessed to students enrolled in the upper-division courses of this Software Engineering program.