

Program Proposal

Bachelor of Applied Science in Information Technology: Software Development

Green River Community College

April 2014



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Cover Sheet (Form C)

Form C

COVER SHEET NEW DEGREE PROGRAM PROPOSAL

Program Information

Program Name: Bachelor of Applied Science in Information Technology: Software Development

Institution Name: Green River Community College

Degree: BAS IT: Software Development Level: Bachelor Type: Applied Science CIP Code: 11.0201
(e.g. B.S. Chemistry) (e.g. Bachelor) (e.g. Science)

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Chief Academic Officer

4/23/2014

Date

Introduction

Green River Community College is excited about the prospect of offering a Bachelor of Applied Science (BAS) in Information Technology: Software Development, beginning in Fall 2014. The BAS in IT: Software Development is designed to prepare students for employment in a variety of software development, such as software developer, software tester, systems analyst, quality assurance analyst, mobile application developer, and web developer.

The BAS in IT: Software Development will help meet the demand for skilled IT workers in our region with bachelor's degrees. The current demand greatly exceeds the supply of qualified workers. The Workforce Development Council of Seattle-King County estimates that there will be an annual shortage of 3,631 qualified information technology job candidates in King County during 2014–2019.¹ Demand for this degree was fully demonstrated and explained in Green River Community College's statement of need.

The development of this applied baccalaureate program was funded in part by an \$80,000 grant from the State Board of Community and Technical Colleges (SBCTC) to increase capacity and successful graduation of highly skilled workers in science, technology, engineering, and mathematics (STEM). In developing the BAS program in IT: Software Development, Green River Community College worked with administrators and faculty in the Puget Sound Skills Center, Kent School District, and Auburn School District to align existing and develop new pathways for secondary school students to continue on into a technical associate degree and then into this applied baccalaureate degree program in software development, a high demand profession. Work on developing these pathways is continuing with Green River and our K-12 school district partners meeting to design high quality dual credit/concurrent enrollment courses that provide students with an early college experience at the secondary school level.

In this new degree program proposal, Green River Community College will describe and explain:

- The curriculum for the BAS in IT: Software Development, including program learning outcomes, program evaluation criteria and process, course preparation needed by students transferring in, general education components, and course work needed at junior and senior levels in the bachelor's degree program.
- Green River's plan to provide highly credentialed full-time and adjunct faculty for the IT: Software Development program.
- The admission process for the program, which is consistent with an open-door institution. Entry requirements for the BAS in IT: Software Development program have been designed to provide access to many and to ensure that prospective applicants are prepared for success once they enter the program.
- The myriad of Green River's student-focused support services that will help students in the BAS in IT: Software Development program achieve success.
- A comprehensive, realistic financial plan for the first five years of the BAS in IT: Software Development program. Green River Community College is committed to providing funding for this new program until it becomes fully self-supporting, which is anticipated by the fifth year (factoring in repayment of the first year's deficit, as shown in Table 10).
- Rationale for not seeking specialized program accreditation for the BAS in IT: Software Development program.

¹ Workforce Development Council of Seattle-King County, Talent Pipeline Study for Information Technology, Business Services, Finance and Insurance, Mar 2012, p. ii.

- Extensive, ongoing collaboration with institutions in the area that confer graduate degrees to articulate clear and efficient pathways for BAS graduates who wish to continue their education onto a master's degree program.
- A summary of the two external expert evaluations of the program. Both experts were favorably impressed with the BAS in IT: Software Development program and expressed their support of the program's curricula.

Criterion 1: Curriculum Demonstrates Baccalaureate Level Rigor

Green River Community College has carefully designed the Bachelor of Applied Science (BAS) degree in IT: Software Development curriculum to include baccalaureate-level academic rigor as well as the high-level technical knowledge and skills demanded by employers.

Program Learning Outcomes

The Bachelor of Applied Science in IT: Software Development is designed to prepare students for employment in a variety of software development positions, such as software developer, software test developer, systems analyst, quality assurance analyst, mobile application developer, and web developer. After conducting an occupational analysis (DACUM: Develop a Curriculum) with professional software developers and software development managers, our industry panel agreed that successful graduates of the BAS in IT: Software Development should be able to:

- Develop stable, robust, secure, and efficient code following best practices in data design and software construction.
- Communicate with project stakeholders, both with technical and non-technical backgrounds.
- Troubleshoot technical defects from identification through resolution.
- Perform software quality assurance activities throughout the entire software lifecycle.
- Engage in professional development activities as assigned in various core courses to develop networks and industry contacts and stay updated with technical trends.
- Engage in relevant courses and class projects that will support and promote understanding, acceptance and proactive partnership with diverse populations in both the program and in the workplace.
- Write technical documentation to support software lifecycle activities.
- Perform related technical duties such analyzing data, estimating work effort, and assessing technical risk.

Program Evaluation Criteria and Process

Program evaluation is a continuous process at Green River Community College, beginning during the initial exploration and development of a degree. Numerous resources have been used to evaluate both the need for the BAS in IT: Software Development and appropriate program curriculum, including IT Advisory Committee input, an employer survey, discussions between IT faculty and IT managers in local-area industry, and meetings of IT faculty with area IT educators at post-secondary institutions. External experts with experience in IT and higher education have also assessed the BAS in IT: Software Development program curriculum to ensure rigor, consistency, and quality. Green River Community

College will continue to gather input from IT experts in industry and higher education throughout the curriculum development and implementation phases to ensure rigor of the content, appropriate learning methodologies, and technical currency.

Industry will continually participate in recommendation and review of the BAS in IT: Software Development program curriculum and program elements through the IT Advisory Committee. This advisory committee, which has been instrumental in the success of Green River Community College's Information Technology AAS-T degrees, has expanded its scope to include the BAS in IT: Software Development degree program. Committee members include IT industry managers and workers in large and small companies and a local government agency.

At Green River Community College, a formal Program Assessment and Improvement review is conducted every five years. This review process entails a thorough assessment of every part of the program including:

- Description of the program
 - Student demographics
 - Enrollment trends
 - Annual course offerings/cancellations
 - Quarterly enrollment
 - Quarterly course completion
 - Employment and wage status
- Personnel summary: courses taught by full-time versus adjunct faculty by quarter
- Program curriculum
 - Course Adoption Revision (CAR) status
 - Program Adoption Revision (PAR) status
- Course prerequisites
- Program support: instructional resources; facilities, equipment, and budget; and miscellaneous support services
- Learning outcomes
 - Campus-wide learning outcomes
 - Program-level learning outcomes
 - Course-level learning outcomes
- Advisory committee/industry relations
- Overall assessment of the program

In addition to the recommendations of the IT Advisory Committee and the Program Assessment and Improvement process, Green River Community College will routinely collect and analyze data and feedback from students, program faculty, and the institution to evaluate the BAS in IT: Software Development program's effectiveness. Table 1 outlines various assessment tools that will be used for program assessment. The BAS program manager and IT faculty members will review these assessments every year at the end of the spring quarter, so that any changes, if needed, can be implemented by the next fall quarter.

Table 1: Program Assessment Tools

Assessment Tool	Used to Assess	Assessor / Assessed	Implementation
Student course evaluations	<ul style="list-style-type: none"> Satisfaction with balance of knowledge, skills, theory, and practice in the course Student preparedness upon entering individual courses 	Instructor / students	Quarterly
Student survey	<ul style="list-style-type: none"> Effectiveness of the program in meeting students' expectations 	Instructor / students	Fall and spring quarters
BAS in IT degree program faculty survey	<ul style="list-style-type: none"> Preparedness of students upon entering the program Preparedness of students upon entering individual courses Effectiveness of institutional and program resources and support Preparedness to teach the curriculum 	Department chair / faculty	Fall and spring quarters
Institution program statistics	<ul style="list-style-type: none"> Student demographics Student enrollment trends Student retention Student success/completion by course Student progression through the program 	Office of Institutional Effectiveness and assigned faculty	Fall and spring quarters
Post-graduation student survey	<ul style="list-style-type: none"> Effect of program completion on career Effectiveness of the program in meeting job expectations Effect of the program on wage and career progression 	Office of Institutional Effectiveness and assigned faculty	Winter quarter per Office of Institutional Effectiveness schedule
Post-graduation employer survey	<ul style="list-style-type: none"> Effectiveness of the program in meeting employers' expectations Observed increased skills and performance Perceived strengths and weaknesses of the program 	Office of Institutional Effectiveness and assigned faculty	Winter quarter per Office of Institutional Effectiveness schedule
Diversity survey	<ul style="list-style-type: none"> Effectiveness of methodology, inclusivity, marketing to and retention of underserved/ minority students in program 	Office of Institutional Effectiveness and assigned faculty	Fall and spring quarters

Course Preparation Needed by Students Transferring With a Technical Associates Degree

The Bachelor of Applied Science in IT: Software Development is designed to provide a pathway for students who have earned a CS- or IT-related technical associates degree. Students with such a degree will typically be able to complete the BAS in IT: Software Development in two years of full-time study.

The entry requirements for the BAS in IT: Software Development program are designed to accommodate as many qualified students as possible, while ensuring that students are prepared for success at the baccalaureate level. Students may enter the program if they have earned a:

- CS- or IT-related technical associates degree (90 quarter credits from a regionally accredited institution),
- Cumulative grade point average of 2.5 or higher from all college courses, and
- Minimum grade of 2.5 in all CS- and IT-related courses

Students may request provisional acceptance into the program if they will complete the entrance requirements within one quarter.

The following courses, or their equivalents, are strongly recommended before entering the applied baccalaureate program because they contain foundational knowledge upon which the upper-division courses build:

- CS& 131 Computer Science I C++ or CS& 141 Computer Science I Java
- CS 132 C++ Data Structures or CS 145 Java 2
- IT 131 Networking Infrastructure Fundamentals
- IT 160 Windows Server Administration
- IT 190 Linux Administration
- IT 201 Relational Database Design
- IT 282 Android Application Development

Students completing the Associate of Applied Science-Transfer degree in Information Technology: Systems (Summer 2014 update) and/or students in concurrent enrollment programs at our partner secondary schools (starting Fall 2014) typically take the courses listed above in their program of study.

General Education Components

General education is an important component of all applied baccalaureate degrees, providing students with a baseline of knowledge and understanding in communication skills, quantitative and symbolic reasoning skills, humanities, social sciences, and natural sciences. These general education requirements are detailed in Table 2.

Table 2: General Education Requirements

Area of Study	Course	Credits	Typical Completion
Communication Skills	ENGL& 101 English Composition I	5	Associate

(15 credits)	CMST& 210 Interpersonal Communication or CMST& 230 Small Group Communication or ENGL 128 Research Writing: Science/Engineering/Business	5	Associate
	ENGL 335 Advanced Technical Writing	5	BAS
Quantitative/Symbolic Reasoning Skills (15 credits)	CS& 131 Computer Science I C++ or CS& 141 Computer Science I Java	5	Associate
	CS 132 C++ Data Structures or CS 145 Java 2	5	Associate
	MATH& 141 Precalculus I or MATH& 142 Precalculus II or MATH 147 Finite Mathematics or MATH& 148 Business Calculus or MATH& 151 Calculus I or MATH& 152 Calculus II or MATH 210 Discrete Mathematics or MATH 240 Topics in Linear Algebra or MATH 256 Statistics for Business and Social Science	5	Associate
Humanities (10 credits)	ART 109 Beginning Design or CMST& 220 Public Speaking	5	BAS
	CMST 338 Diversity in the Workplace	5	BAS
Social Sciences (10 credits)	Social Science elective: 5 credit course from the list of Social Science courses approved for the AA-DTA degree ²	5	BAS
	Social Science elective: 5 credit course from the list of Social Science courses approved for the AA-DTA degree	5	BAS
Natural Sciences (10 credits)	PHYS& 110 Concepts of the Physical World (recommended) or 5 credit course from List A of the Natural Science courses approved for the AA-DTA degree	5	BAS
	Natural Science elective: 5 credit course from List A of the Natural Science courses approved for the AA-DTA degree or MATH& 148 Business Calculus or MATH& 151 Calculus I or MATH& 152 Calculus II or MATH 210 Discrete Mathematics or MATH 240 Topics in Linear Algebra or MATH 256 Statistics for Business and Social Science	5	BAS
	Total Credits of General Education	60	25 Associate 35 BAS

² Green River Community College, 2013-2015 Catalog, <http://www.greenriver.edu/academics/catalog.htm>, p. 38.

Coursework Needed at Junior and Senior Levels in the BAS

Ninety credits of coursework are required at the junior and senior levels in the Bachelor of Applied Science in IT: Software Development. This includes 35 general education credits (detailed in Table 2) and 55 credits in core software development classes.

Table 3: Coursework Needed at Junior and Senior Levels

Area of Study	Course	Credits
General Education Requirements (35 credits)	ART 109 Beginning Design or CMST& 220 Public Speaking	5
	CMST 338 Diversity in the Workplace	5
	ENGL 335 Advanced Technical Writing	5
	Social Science elective: 5 credit course from the list of Social Science courses approved for the AA-DTA degree	5
	Social Science elective: 5 credit course from the list of Social Science courses approved for the AA-DTA degree	5
	PHYS& 110 Concepts of the Physical World (recommended) or 5 credit course from List A of the Natural Science courses approved for the AA-DTA degree	5
	Natural Science elective: 5 credit course from List A of the Natural Science courses approved for the AA-DTA degree	5
Core Requirements (55 credits)	CS 301 Systems Programming and Computer Architecture	5
	CS 333 Data Structures and Algorithms	5
	IT 305 Web Development Frameworks	5
	IT 328 Full Stack Web Development	5
	IT 355 Agile Development Methodologies	5
	IT 372 Debugging, Maintenance, and Evolution	5
	IT 405 Mobile Development Frameworks	5
	IT 426 Collaborative Design	5
	IT 434 Secure Development Practices	5
	IT 485 Product/Service Initiation and Design	5
	IT 486 Product/Service Construction and Deployment	5
Total Credits at Junior and Senior Level		90

These core courses will provide BAS program students with advanced software development knowledge and skills that build on the knowledge and skills they acquired from associates level CS and IT courses. Please see Appendix A: Course Descriptions for detailed course descriptions listed in Table 3.

Note that 180 total credits are required for graduation with the BAS in IT: Software Development. The BAS includes 90 credits transferred from the technical associate's degree and 90 credits of coursework taken at the junior and senior level (listed in Table 3).

A student attending full-time, 15 credits per quarter, will be able to complete the BAS in IT: Software Development in six to eight quarters (two years). A sample full-time student schedule is shown in Table 4.

Table 4: Sample Student Schedule

Year	Fall Quarter	Winter Quarter	Spring Quarter	Summer Quarter
Junior	CS 301 Systems Programming and Computer Architecture	CS 333 Data Structures and Algorithms	IT 355 Agile Development Methodologies	Internship (recommended) or General Education courses (if needed)
	IT 305 Web Development Frameworks	IT 328 Full Stack Web Development	IT 372 Debugging, Maintenance, and Evolution	
	CMST& 220 Public Speaking	PHYS& 110 Concepts of the Physical World	ENGL 335 Advanced Technical Writing	
Senior	IT 426 Collaborative Design	IT 485 Product/Service Initiation and Design	IT 486 Product/Service Construction and Deployment	
	IT 405 Mobile Development Frameworks	IT 434 Secure Development Practices	Natural Science elective	
	Social Science elective	Social Science elective	CMST 338 Diversity in the Workplace	

The program director and/or program manager will work with each student in the BAS in IT: Software Development program to develop an academic plan, ensuring that students are able to efficiently meet their degree goals.

Criterion 2: Qualified Faculty

Green River Community College projects 35 FTE enrollment the first year the Bachelor of Applied Science (BAS) in IT: Software Development program is offered. It projects full enrollment of 96 FTEs by the fifth year. To support this degree program, one full-time equivalent faculty will be dedicated to the program during the initial fall quarter (single cohort start), and a second full-time equivalent faculty will be added to the program in winter quarter (when the second cohort is added).

The IT faculty member assigned to the program during year one will be the program director, and will be assigned one-third to instruction and two-thirds to program administration duties. The second faculty member, added in winter quarter, will be assigned 100 percent to instruction.

Green River Community College faculty teaching junior- and senior-level general education courses in the BAS in IT: Software Development program will teach these courses as part of their normal load, so no additional faculty will be required in departments outside of Information Technology.

Faculty Credentials

IT faculty teaching in the BAS in IT: Software Development program will typically be required to hold a minimum of a master’s degree. Exceptions may be made for highly technical IT courses. In these instances, a combination of baccalaureate degree, industry experience, and industry certifications may be considered adequate, because a master’s degree is not typically attained by software developers.

Table 5 shows the faculty profiles of Green River Community full-time and adjunct faculty who will teach in the BAS program.

Table 5: Faculty Member Profiles

Name	Education Credentials	Full-time or Adjunct	Upper-Division Course(s)
Alan Carter	MS in Information Technology: Network Architecture and Design	Full-time IT Faculty	BAS in IT core courses
New Faculty Member	Master’s in Computer Science or related area	Full-time IT Faculty	BAS in IT core courses
Jackson Muhirwe	PhD in Computer Science	Full-time IT Faculty	BAS in IT core courses
Ken Hang	Master of Software Engineering	Full-time IT/Computer Science Faculty, BAS Program Director	BAS in IT core courses
New Faculty Member	Master’s in Computer Science or related area	Full-time IT Faculty	BAS in IT core courses
Krish Mahadevan	MS in Electrical Engineering	Full-time IT Faculty	BAS in IT core courses
Tim Mason	DBA in Management of Information Systems	Adjunct IT Faculty	BAS in IT core courses
William Scott	MA in Cultural Studies/Rhetoric	Full-time Communication Studies Faculty, Humanities Division Chair	General education: Diversity in the Workplace
Amanda Schaefer	MA in English	Full-time English Faculty	General education: Technical Writing

Professional/Technical Certification

All faculty and administrators who are responsible for the core requirements technical courses in the BAS in IT: Software Development degree program meet the certification requirements for professional

and technical instructors and administrators as stated in the Washington Administrative Code, WAC 131-16-091.

Criterion 3: Admissions Process Consistent With an Open-Door Institution

Admission to Green River Community College’s Bachelor of Applied Science (BAS) degree in IT: Software Development program will be consistent with an open door institution.

Selection and Admission Process

All persons who meet the entry requirements for the BAS in IT: Software Development program will be admitted into the program. The admissions process will be non-selective and non-competitive. The entry requirements for the BAS in IT: Software Development program are detailed in Table 6.

Table 6: Entry Requirements

Entry Requirements	Notes
Technical associate’s degree in IT- or CS- related field that includes at least 20 credits of general education courses, which must include ENGL& 101 or higher and a five-credit math class numbered 141 or higher.	90 credits from a regionally accredited institution
Cumulative GPA of 2.5 in all college courses	
Minimum grade of 2.5 in all CS and IT courses	

Entry requirements for the BAS in IT: Software Development program have been designed to provide access to many and to ensure that prospective applicants are prepared for success once they enter the program.

To ensure that graduates from nearby community colleges are given an opportunity to complete the proposed BAS degree, Green River Community College plans a two-part approach. First, we will work with each of the surrounding schools to articulate their IT associate’s degrees to the proposed BAS degree. Second, we will perform outreach to their students by visiting other campuses to talk to students who are nearing graduation, and by holding an open house about the BAS degree during Spring Quarter 2014 at Green River Community College.

Efforts to Assure Marketing to and Recruitment of a Diverse Population

One of Green River Community College’s institutional goals is: “Members of our diverse communities will have reasonable access to affordable educational programs and services that meet their needs”³ Equity is a core value that is integral to every program offered at Green River Community College,

³ Green River Community College, About GRCC, <http://www.greenriver.edu/about-grcc/welcome-from-president.htm> Oct, 2012.

including its existing associate’s-level IT programs and its future BAS in IT: Software Development program. We encourage, foster respect for and respond equitably to diverse perspectives and needs.

The BAS in IT: Software Development fits within the Career and Technical Education core theme at Green River. Within this core theme, equity is a core objective. The BAS in IT: Software Development program will partner with the Green River Diversity and Equity Council, the Office of Recruitment and Outreach, and the Marketing and Communications office to develop an early outreach plan and marketing plan to diverse populations at local high schools. We currently offer a youth reengagement program with the Kent School District called iGrad and we plan to market this program to the diverse populations we serve through iGrad. Through the SBCTC grant for STEM majors, we are currently building relationships with the Kent School District, Auburn School District, Tahoma School District, and the Puget Sound Skills Center to provide students access to early college experiences and dual credit/concurrent enrollment programs (CEPs). Our first CEP, “College IT in the High School” has a planned Fall 2014 launch at the Puget Sound Skills Center. Students enrolling in the elective College IT in the High School program at the Puget Sound Skills Center will have the opportunity to complete an AAS-T in IT: Systems at the secondary level and continue on the BAS in IT: Software Development upon graduating from high school. The Green River Community College IT faculty members and Program Manager have been and will continue to be the main representatives who visit the high schools and build the CEPs.

While it is anticipated that several students in Green River Community College’s BAS in IT: Software Development program will have earned their AAS-T in IT at Green River Community College, Green River Community College IT faculty and administrators have been meeting with—and will continue to reach out to diverse populations—within IT programs at other technical and community colleges in the area, including Bates Technical College, Highline Community College, Clover Park Technical College, and Tacoma Community College, to ensure a path for their graduates toward an applied baccalaureate degree. The demographics of these colleges are different from Green River and hopefully will enhance overall diversity within the BAS in IT: Software Development.

Green River Community College IT faculty, working with the Information Technology Advisory Committee and the BAS program manager, will also promote the BAS in IT: Software Development to local businesses to reach currently employed IT workers who need to upgrade their education and skills. Delivery modes and course schedules will take into account the needs of employed students. Delivery modes will center on face-to-face classroom time to focus on teamwork and communication skills that employers seek from potential employees, but will also include online and hybrid classes, when the content of the class will allow for such modes. Course schedules will allow for full-time students’ needs, but will also have evening and alternate classes to accommodate those who work during the weekdays.

Criterion 4: Appropriate Student Services Plan

Green River Community College is committed to providing a variety of student-focused support services that will help students in the Bachelor of Applied Science (BAS) degree in IT: Software Development program achieve success.

The success of the BAS in IT: Software Development will be measured by indicators of proportional representation of diverse students' success in the program, following up on the recruitment of this diverse student population. We will perform student and faculty surveys to measure the program's climate and attitude toward diverse students and responsiveness to diverse communities, as shown in table 1. We will ensure that we utilize the surveys, industry research and training events to better help our diverse student population with appropriate, timely and relevant services.

Academic Advising Services

New and continuing BAS program students will receive one-on-one comprehensive academic advising services from the BAS faculty program director and, as appropriate, from the BAS program manager. Students entering the program will work with the program director and/or program manager to build a degree plan for their junior and senior year and ensure that they have all of the resources they need to successfully begin their studies as a junior level student. The program director and program manager also serve as a "one stop shop" to help BAS students navigate and access student services that are available on campus. Helping to support BAS student success, especially those students who are new to Green River, is an essential role of both the program director and program manager.

Another aspect of academic advising and support involves monitoring student progress and helping students who may be struggling with a particular topic or course. An early warning system called PASS: Progress and Alerts for Student Success is available to all faculty members at Green River. Instructors can log into PASS and alert the student's advisor if the student is struggling in a course. Upon receiving the alert, the student's advisor (either the program director or program manager) can work with both the student and the instructor to identify the issue and develop a plan to help the student get back on track and succeed. The plan may include:

- Providing tutoring resources to the student (included in Table 9: Projected Program Expenses),
- Facilitating a peer learning group between the student and other students in the program,
- Negotiating a performance improvement plan between the student and the instructor, and/or
- Introducing the student to support services on campus (see Student Services Plan)

The program director and program manager will continuously work to help students bridge academic instruction and student services to ensure a positive, safe, and supportive learning environment for the students in the BAS program.

Student Services Plan

Green River Community College places the highest priority on the needs and success of all of its students. The college is committed to providing students with open access to comprehensive programs and services in a nurturing environment, empowering students to take initiative and responsibility for their educational and professional development.

Students in the BAS in IT: Software Development program will be supported by the same high-quality student services that all Green River Community College students receive. Most student services will be provided by the BAS program manager; he or she will partner and work with all student services offices

on campus to create and maintain a central hub of services specifically for the Bachelor of Applied Science (BAS) degree in IT: Software Development program. These services include but are not limited to: admissions and enrollment, degree advising and planning, financial aid, veteran's and disability services, and career advising and placement.

Since the Program Manager is dedicated to the Bachelor of Applied Science (BAS) degree in IT: Software Development program, this person will be able to manage the projected enrollment in year 5 of 96 students (see Table 7). The Program Manager will have spent the preceding years creating and building the partnerships needed for this number, and will also have the knowledge and experience to utilize proper resources and services for each student. The BAS program manager's hours of service will adjust both to when classes are offered and other offices/services across the campus are open, and will be no less than 40 hours per week, on average.

In addition, it is anticipated that the following services will be those most frequently used by students in the BAS degree program:

Bookstore: The Paper Tree bookstore offers students one-stop convenience for textbook and general school supplies needs. Students may purchase textbooks online as well as on campus.

Career and Advising Center: The Career and Advising Center offers comprehensive career and education planning resources for current and prospective students, alumni, and community members. The BAS Program Manager and the BAS Program Director will provide most of the advising and educational planning services for IT BAS students. The BAS Program staff will work collaboratively with the Career and Advising Center in order to promote student success and completion.

Child Care Center: The center enables parents to pursue their educations and careers by providing a safe, nurturing environment for their children. Fees are based on a sliding scale depending on the age of the child, gross monthly or annual income, and family size. JOBS, Employment Child Care, and Transitional Child Care funding sources are welcome.

Counseling and Health Services (CHS): CHS seeks to promote physical and psychological health of Green River Community College students and the campus community to support student success. CHS provides short-term mental health counseling and self-care/wellness education to Green River Community College students. Workshops and consultation services are offered for staff, faculty, and student organizations. Services are free and confidential.

Disability Support Services (DSS): DSS assists students with **physical, learning, sensory, cognitive** and/or **psychological** disabilities by identifying and coordinating reasonable accommodations for equal access to academic programs and activities.

Diversity, Equity & Inclusion: The Office of Diversity, Equity and Inclusion ensures respect for all civil and human rights, works diligently to promote intellectual discourse across the disciplines, minority leadership skills and social justice among students, staff, faculty and our surrounding communities. In order to ensure equity ODEDI provides bi-lingual and multicultural services in diverse languages and

religious faiths to support students, staff, faculty and members of the community including translation, peer mentoring, financial literacy training, academic and personal advising, and quarterly support workshops. ODEI provides the service area with the most innovative, engaging and intellectual diversity conferences in the Pacific Northwest.

Enrollment Services: Enrollment Services provides a variety of support to prospective students, current students, and the campus. It interprets and applies Green River Community College's policy and procedures for admissions, registration, records and graduation. The BAS program manager will work in partnership with this office to ensure policies and procedures are adhered to as student's progress through their program.

Financial Aid: Please see the *Financial Aid Services* section on the next page.

Starting in the second year of the program, the BAS program manager will be a full-time position. It is anticipated that the BAS program manager will work extensively with students to help them find and secure work in their chosen field. The BAS program manager will sponsor career forums and job fairs specifically for the IT BAS students who are nearing graduation.

Library and Open Computer Labs: The Holman Library serves the students, faculty, and staff of Green River Community College by providing the resources and services necessary to ensure access to information and development of information literacy skills. The library houses approximately 59,000 items. It has a collection of more than 25,000 eBooks. The library provides online access to approximately 15,000 periodicals through subscription databases. The library also subscribes to 200 periodicals in print format. Students have access to more than 150 networked computers in the Information Commons open computer lab of the Holman Library. Students also have access to more than 100 networked computer workstations in an open computer lab in the college's Technology Center.

Online Services: Online services enable students to apply for admissions, plan their schedules, register and pay for classes, run a Degree Audit to view graduation requirements for their program and courses needed to complete the program, and view their unofficial transcript. Students can also access their student e-mail account, eLearning content and resources, and library services.

Student Life: Student Life recognizes that lifelong connections are formed both inside and outside the classroom. They coordinate activities and events that will provide opportunities to connect to students' community at Green River, as well as the greater King County area.

Student Life host events on and off campus in environments that foster personal and professional relationship building, provide occasion to enrich students' cultural experience, cultivate community connections, and support a healthy school-life balance. They encourage involvement by offering a wide variety of experiences. Events include: volunteering, lectures that will challenge students' current perspectives and ideas in a safe and educational setting, leadership opportunities, and students' favorite- FUN!

Student Life is here to be students' resource for involvement as they grow into a well-educated and active global citizen.

Tutoring and Academic Resources: Students have access to free tutoring services and academic resources. Four primary tutoring centers are available on campus, including the Tutoring and Resource Center, the Writing Center, the Public Speaking Center, and the Math Learning Center.

Veterans Services: The Veterans Service office assists veterans in activating and maintaining their educational benefits. Green River Community College actively reaches out to veterans through its Veterans Coordinating Council, which engages in marketing and outreach to veterans about resources available on campus, honors veterans with symbolic events, and seeks to help veterans with the transition from college to career or workforce.

Financial Aid Services

The Financial Aid office prepares and disburses federal, state, and institutional aid for all Green River Community College students. To streamline the disbursement process, Green River Community College, working with HigherOne, provides students with Gator Choice Cards. These cards allow students to choose how to receive their financial aid disbursement.

Green River Community College recognizes that paying for college is a challenge for most students. Financial aid is available in three forms: gift aid—grants and scholarships; employment—jobs on or off campus; and loans—low interest with deferred repayment. In 2013-2014, the Green River Community College Foundation offered more than 213 scholarships to students at Green River Community College. Once the proposed BAS degree is approved, the Green River Community College Foundation will reach out to local companies to create BAS program-specific scholarships.

The G.I. Bill, veteran's assistance and other military education benefits can all be applied to the cost of attending Green River Community College.

Green River Community College offers students a tuition payment plan, called STEP, which enables students to pay their tuition and fees in three manageable payments. STEP is also an option for students who are waiting for their Financial Aid file to be reviewed.

Criterion 5: Commitment to Build and Sustain a High-Quality Program

Green River Community College is committed to developing and sustaining the Bachelor of Applied Science (BAS) degree in IT: Software Development program.

Financial Plan

Green River Community College proposes the following comprehensive financial plan for its Bachelor of Applied Science (BAS) degree in IT: Software Development program.

Funds Used to Support the Program

The BAS in IT: Software Development program will be funded as a State FTE program in an excess enrollment mode.

Projected enrollments in the BAS in IT: Software Development program for the first five years are shown in Table 7. The first year’s enrollments will consist primarily of students who are currently completing their technical associate’s degree at Green River and neighboring community and technical colleges. Going forward into year 2 and beyond, it is projected that students in our partner high schools (Puget Sound Skills Center, Kent School District, Auburn School District) will enroll in the BAS in IT: Software Development as they will have completed some (or many, by year 3) of the technical associate’s classes at the secondary level through concurrent enrollment partnerships. There will also be an ongoing effort to recruit students who have an associate’s degree and work experience but may be looking to enhance their career options or make a career change.

Table 7: Projected Enrollments

	Year 1 2014-15	Year 2 2015-16	Year 3 2016-17	Year 4 2017-18	Year 5 2018-19
FTEs	35	76	84	92	96

The projected enrollment has been used to compute the projected program revenue as shown in Table 8. The tuition to be charged to students is set forth in the Washington State Community College FY2013-14 Tuition Schedule for Upper Division Courses in Applied Baccalaureate Degree Programs.⁴ It is assumed that students will attend three quarters per year.

Table 8: Projected Program Revenue

	Year 1 2014-15	Year 2 2015-16	Year 3 2016-17	Year 4 2017-18	Year 5 2018-19
Applied Baccalaureate Operating Budget	\$220,197	\$492,485	\$560,655	\$632,471	\$679,769

Note: Revenue projection assumes a 3% average tuition increase per year in years 2-5.

Projected Program Expenses

Green River Community College is committed to making this program succeed. Green River Community College anticipates program expenses for the first five years of the BAS in IT: Software Development program as detailed in Table 9.

Table 9: Projected Program Expenses

⁴ Washington State Board for Community and Technical Colleges, Washington State Community Colleges FY2013-14 Tuition Schedule for Upper Division Courses in Applied Baccalaureate Degree Programs, <http://www.sbctc.edu/college/finance/FY2013-14UpperDivisionTuition.pdf> April, 2014.

	Year 1 2014-15	Year 2 2015-16	Year 3 2016-17	Year 4 2017-18	Year 5 2018-19
Full-time Faculty Salaries (Includes Faculty Program Director)	\$ 98,428	\$ 182,437	\$ 187,910	\$ 193,547	\$ 199,353
Related Instruction Division: Convert 1 adjunct teaching 9 classes per year to full-time faculty (Add 1 after year 3)	-	-	-	\$ 61,014	\$ 62,845
Part-time Faculty Salaries	\$ 11,530	\$ 27,711	\$ 36,697	\$ 36,697	\$ 37,798
BAS Program Manager Salary	\$ 70,000	\$ 72,100	\$ 74,263	\$ 76,491	\$ 78,786
Instructional Lab Tech Salary	\$ 16,065	\$ 16,547	\$ 17,043	\$ 17,555	\$ 18,081
Benefits	\$ 66,204	\$ 106,722	\$ 125,718	\$ 129,489	\$ 133,374
Stipends and Travel for Green River Accelerated College Experience	-	-	-	\$ 12,000	\$ 14,500
Curriculum Development Stipends	\$ 8,000	\$ 8,000	\$ 8,000	\$ 3,000	\$ 3,000
Equipment	\$ 20,000	\$ 20,000	\$ 20,000	\$ 25,000	\$ 30,000
Goods and Services	\$ 5,000	\$ 5,000	\$ 5,000	\$ 5,000	\$ 5,000
Library	\$ 5,000	\$ 5,000	\$ 5,000	\$ 5,000	\$ 5,000
Prof. Development/Conferences/Travel	\$ 5,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000
Prof Development for New Faculty Seattle University	\$ 3,600	\$ 1,800	\$ 1,800	\$ 1,800	-
Measure-Up Practice Exams	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000
Program Promotion	\$ 10,000	\$ 10,000	\$ 10,000	\$ 8,000	\$ 8,000
Tutoring	\$ 4,900	\$ 10,640	\$ 11,760	\$ 12,880	\$ 13,440
Total Estimated Program Expenses	\$ 333,727	\$ 485,957	\$ 523,191	\$ 607,473	\$ 629,177

Note: The projected expenditures assume a 3% average salary increase per year in years 2-5.

For fall quarter of year one (program start), one full-time faculty member will be the IT BAS Program Director, and will be assigned 1/3 to instruction and 2/3 to program administration duties. A second full time faculty member will be added winter quarter of year one, and one additional faculty member will be added year two, with each being assigned 100 percent to instruction.

Green River plans to spend approximately \$10,000 each year for an online IT research database in the library, located in the "Library" line of Table 9. This cost will be split between the Bachelor of Applied Science (BAS) degree in IT: Software Development program and Green River Community College's other BAS in IT: Network Administration and Security, for the line item of \$5,000.

The Equipment line factors in the additional budget for equipment being purchased through Green River's other BAS in IT: Network Administration and Security, and by our campus's technology fee and technology replacement schedule. Additional equipment purchases for the first three years will be

funded through a National Science Foundation grant for Advanced Technological Education (pending award) and through grants from our industry partners.

Professional development for our new faculty will be instrumental to the program’s success. The professional development line will send our new faculty to Seattle University’s “Supporting New Faculty Success”, a yearlong program designed to enhance teaching skills, especially for diverse student populations.

Program promotion will be key for the BAS in IT: Software Development program. At the forefront of this type of IT degree, we will be creating an Software Developer that will have the concrete job skills and knowledge base to immediately begin working in the field. In addition, we are aware that both students and businesses may not understand what a bachelor’s of applied science is, or that a community college can offer this type of degree. We will want to explain and promote all of the above information, and this will require a budget that supports a variety of promotional avenues and materials.

Tutoring support for students will be a combination of in-person tutoring and online tutoring support. Green River is currently investigating subscription-based online tutoring services that have staff that can help students with programming questions. In addition, senior level students who perform well in a class will be offered stipends to maintain regular tutoring hours, either in-person or online, to help junior level students in their classes.

Sustaining the BAS Over Time

Green River Community College is committed to providing funding for the new BAS in IT: Software Development program until it becomes fully self-supporting, which is anticipated to occur after the first year, as shown in Table 10.

Table 10: Estimated Net Program Excess (Deficiency)

	Year 1 2014-15	Year 2 2015-16	Year 3 2016-17	Year 4 2017-18	Year 5 2018-19
Total Program Income	\$ 220,197	\$ 492,485	\$ 560,655	\$ 632,471	\$ 679,769
Estimated total program expenses (from Table 9)	\$ 333,727	\$ 485,957	\$ 523,191	\$ 607,473	\$ 629,117
Bridge -- Repay first year’s deficit		\$ 6,500	\$ 37,400	\$ 24,630	\$ 45,000
Estimated net program excess (deficiency)	\$ (113,530)	\$ 28	\$ 64	\$ 368	\$ 5,592

Facilities, Equipment, and Technology

Green River Community College has developed a Facilities Master Plan to improve its facilities and services to students and the surrounding communities. Over the past 10 years, Green River Community

College has constructed three new buildings on its main Auburn campus: the Technology Center, the Marv Nelson Science Learning Center, and most recently, Salish Hall. In the state-of-the-art Technology Center, there are classrooms devoted to IT classes and an additional dedicated server room to support the IT program.

Green River Community College maintains a high level of modern equipment and technology to deliver its existing associate's-level IT programs, in addition to the new bachelor's programs. For example, the college recently purchased a state-of-the-art server computer with enormous capacity that supports virtualization and storage area networking. This server computer is being used to support a variety of IT classes and is able to simultaneously serve many students from multiple classes.

Green River Community College has an Instructional Technology committee that works with our Information Technology department to plan and implement regular equipment replacements. Most classroom computers are scheduled for replacement every three to four years. Some classrooms are replaced more often than that to keep hardware and software up-to-date to meet industry demands.

Green River Community College plans to use its existing facilities, equipment, and technology for the BAS in IT: Software Development program. The college will also purchase new equipment, such as Cisco firewalls, to support the program's upper-division programming and security classes. It will also purchase mobile devices such as Android, Apple, and Windows-based tablet computers for the Mobile Application Development courses. Costs for these equipment purchases have been included in the projected program expenses in the "Equipment" line of Table 9.

Other anticipated technology resources that have also been included in the projected program expenses include library subscriptions to periodicals and software licenses.

Criterion 6: Program Specific Accreditation

Green River Community College does not plan to seek specialized program accreditation for the Bachelor of Applied Science (BAS) degree in IT: Software Development program at this time.

Green River Community College is regionally accredited through the Northwest Commission on Colleges and Universities. The BAS in IT: Software Development should be a minor change, requiring a minor change notification.

Baccalaureate programs in information technology may be accredited by ABET, a nonprofit, non-governmental organization, through its Computing Accreditation Commission (CAC).⁵ However, currently only 22 bachelor's level information technology programs in the United States are accredited by ABET's CAC.⁶ All of these programs are traditional Bachelor of Science degree programs—none are Bachelor of Applied Science degree programs. In addition, all 22 programs are housed at large universities, none of which are located in Washington State.

⁵ ABET, Accreditation Commissions, <http://www.abet.org/accreditation-commissions/>, Oct 10, 2012.

⁶ ABET, Find Accredited Programs, <http://main.abet.org/aps/Accreditedprogramsearch.aspx>, Oct 10, 2012.

Criterion 7: Pathway Options Beyond Baccalaureate Degree

Green River Community College is committed to identifying and developing pathway options for students that extend beyond earning their Bachelor of Applied Science degree in IT: Software Development.

The Bachelor of Applied Science in IT: Software Development is designed to give students options beyond a bachelor's degree, but it is not our intention to market it to students as a pathway to a Master's degree. The program will be marketed as an applied science degree which prepares students for a variety of jobs in the software development field.

Articulation to Graduate Degree Programs

Green River Community College IT faculty members are working with institutions that confer graduate degrees to articulate clear and efficient pathways for BAS graduates who wish to continue their education onto a master's degree program.

In October 2012, Green River Community College IT faculty conferred with Dr. Robert Friedman, Associate Professor and Director of the University of Washington Tacoma's Institute of Technology, to discuss the possibility of Green River Community College BAS graduates entering University of Washington Tacoma's Master in Cybersecurity and Leadership degree program. Dr. Friedman stated that the requirements for admission to this master's degree program are successful completion of a baccalaureate degree from an accredited institution, with at least a 3.0 cumulative GPA.⁷ Dr. Friedman stated that he believed Green River's BAS in Information Technology would meet those admission requirements, and that he would welcome applications from Green River Community College BAS program graduates.

In November 2012, Green River Community College IT faculty spoke with Dr. Erik Fretheim, Program Director at the City University of Seattle School of Management, to discuss articulation of the BAS in Information Technology to master's programs at City University of Seattle. City University of Seattle offers a Master of Science in Computer Systems and a Master of Science in Information Security. To gain admission to either of these master's degree programs requires a four-year or approved three-year bachelor's degree or equivalent from an accredited or otherwise recognized institution.⁸ In addition, the Master of Science in Computer Systems and the Malware Reverse Engineering track within the Master of Science degree in Information Security requires students to have taken two programming classes.⁹ Students pursuing the BAS in Information Technology at Green River will have completed this two course requirement prior to entering the BAS program at the junior level. In January, 2014, the Green River IT faculty asked Dr. Fretheim to review the BAS in IT: Software Development content and his feedback has been incorporated into our curriculum design. Once the BAS in IT: Software Development is approved, Green River IT faculty plan to pursue a full articulation agreement with City University of Seattle.

⁷ University of Washington Tacoma. *Master in Cybersecurity and Leadership*, p. 5.

⁸ City University of Seattle, 2011-2012 Catalog, http://www.cityu.edu/pdf/CityU_CourseCatalog.pdf, Oct, 2012.

⁹ Fretheim, Erik, telephone conversation, Nov 5, 2012.

The Green River Community College IT faculty plan to discuss articulation pathways for graduates of the BAS in Information Technology degree program into the numerous online Master of Science degrees in Information Technology at Western Governors University. The Green River Community College IT faculty plans to confer with Dr. Leo Irakliotis, the Dean of the College of Information Technology at Western Governors University. Because the primary admission requirement for the Western Governors University online master's degrees in IT is a bachelor's degree from a regionally or Distance Education and Training Council (DETC)-accredited institution, Green River Community College is confident that it will be able to successfully articulate a pathway for students from the BAS in Information Technology degree program to enter one or more of the master's degree programs in IT offered by Western Governors University.¹⁰

Criterion 8: External Expert Evaluation of Program

Green River Community College selected two external experts to review the Bachelor of Applied Science in IT: Software Development program. Philip Greenspun, Ph.D., developed and taught the Software Engineering for Internet Application course at the Massachusetts Institute of Technology (MIT) and was the founder and CEO of ArsDigita Corporation, an open-source enterprise software company with \$20 million in annual revenue. Philo Juang, Ph.D., developed and taught a course at Princeton University and is currently a software engineer on the YouTube team at Google. Both experts are technically current in the software development field and both have worked in higher education. This combination of attributes enabled these reviewers to provide high-quality evaluations of the BAS program. Summaries of the external reviewer's comments and subsequent modifications to the proposal based on their comments follow.

Philip Greenspun commented that the degree program "looks great overall." With respect to any critical content missing from the Core Requirements, Dr. Greenspun suggested bringing real clients into the Collaborative Design course and possibly offering another course on Algorithms. He also mentioned that "it is great that the database is taught so early." Dr. Greenspun also suggested that students should be encouraged to pursue a Cisco certification. Dr. Greenspun did suggest removing the general education requirement for Diversity in the Workplace and replace it with another course as students will receive training on workplace diversity from their employer. As a result, of Dr. Greenspun's comments, we are allowing students the flexibility to take any humanities course to fulfill their general education requirement.

Philo Juang mentioned that "this is a fairly comprehensive set of courses!" Dr. Juang also commented that the general education courses were a good fit for our degree program as "a shockingly large part of [a software developer's] job is to convince other people -- fellow engineers or management -- why we should be doing certain things." Dr. Juang stressed the importance of writing design documents and creating effective presentations.

¹⁰ Western Governors University, MS in IT Network Management Degree Details, http://www.wgu.edu/online_it_degrees/network_management_master_degree_details#admission Oct, 2012.

In terms of core requirements, Dr. Juang mentioned that Extreme Programming might not be a standalone course, but the concepts covered in the course are important. The Green River IT faculty also heard this comment from an industry reviewer of our program: that the Extreme Programming course should be a little more general. As a result, we have changed the course to be Agile Development Methodologies to cover all the existing content in the Extreme Programming course and additional topics relating to technical project management.

In another comment about the core courses, Dr. Juang also mentioned that the Web Development Methodologies course could possibly be combined with the Cloud Computing Services course since they are so closely related and they could be taught at the same time. The Green River IT faculty also received a similar comment from an industry reviewer. We have combined the two courses: Web and Cloud into one and that gave us an extra course to allow for a more detailed examination of software design and integration issues.

Appendix A: Course Descriptions

ART 109 Beginning Design

Introduces the visual elements of design and the fundamental principles of visual organization. Uses computers and traditional materials. Through visual problem solving, students strengthen their compositional skills while obtaining a better understanding of the visual world and the vocabulary with which to discuss it.

CMST& 210 Interpersonal Communication

For students who wish to gain greater insight into communication that occurs in more personal relationships in order to better understand and control their own communication behavior, and thus more effectively manage their interpersonal relationships. Prerequisite: Eligible for ENGL 100 or instructor's permission.

CMST& 220 Public Speaking

A course in public speaking that helps students develop confidence and competence in addressing diverse audiences in community and professional settings. Students compose and deliver speeches, as well as evaluate others' presentations. Emphasizes choice and organization of material, sound reasoning, audience analysis, and delivery. Prerequisite: Eligible for ENGL 100 or instructor's permission.

CMST& 230 Small Group Communication

Includes analysis of leadership and discussion in small group contexts with a goal of developing communication behaviors that promote a more effective, efficient, and satisfying interaction in groups and leadership contexts. Addresses the functional problems of leadership, organization in groups, developing involvement strategies within groups, problem solving, consensus building, and conflict management. Prerequisite: Eligible for ENGL 100 or instructor's permission.

CMST 338 Diversity in the Workplace

Explores and analyzes the issues, challenges and opportunities related to changing demographics and increasing diversity in the workplace. Through intercultural communication theories, concepts, and principles, the course examines ways in which challenges of effective communication in a diverse workplace can be identified and work to develop tools and skills to improve communication competency in these situations. Prerequisite: Admission to a bachelor's degree program; ENGL& 101; and instructor's permission.

ENGL 128 Research Writing: Science/Engineering/Business

A composition course with readings designed to teach research-based writing in the sciences, engineering and business. Continues to develop the basic reading and writing skills taught in ENGL& 101, but emphasizes the

development of academic research and writing skills. Students engage in critical thinking which includes the analysis, interpretation, evaluation, documentation, and synthesis of multiple sources and evidence. Prerequisite: A grade of 2.0 or higher in ENGL& 101.

ENGL 335 Advanced Technical Writing

Prepare students to communicate effectively in a professional environment. Students become familiar with the processes, forms, and styles of technical writing as they create various documents, including instructions, proposals, and discipline-specific and/or client-based research projects. Emphasizes the purpose and audience, as well as clarity, concision, and document design. Prerequisite: Admission into a bachelor's degree program, ENGL& 101 and instructor's permission.

CS& 131 Computer Science I C++

C++ programming language is used to illustrate concepts in engineering and computer science. Introduces students to problem solving methods, algorithm development and object-oriented design. Students design, implement, document, and debug C++ computer programs. Prerequisite: MATH& 142 and CS/ENGR 120; or instructor's permission.

CS 132 C++ Data Structures

A continuation of CS& 131. Uses C++ data structure to illustrate concepts in computer science. Students organize and write C++ language computer programs to obtain the solutions to assigned problems. Emphasizes use of common data structures, abstract data types, inheritance, modularity, encapsulation, and recursion. Students learn to understand, design and implement medium-sized programs. Prerequisite: CS& 131 with a grade of 2.0 or higher.

CS& 141 Computer Science I Java

Course uses programming language Java to illustrate concepts in engineering and computer science. Introduces students to problem solving methods, algorithm development, and object-oriented design. Students design, implement, document and debug Java computer programs. Prerequisites: CS/ENGR 120, IT 102, or CS& 131; and MATH& 142; or instructor's permission.

CS 145 Java 2

A continuation of CS& 141. Uses Java language to cover topics such as classes and interfaces, inheritance, basic design principles, exceptions, stream I/O, user interfaces, recursion, elementary data structures and associated algorithms (lists, queues, stacks, trees); and introduces performance analysis and implementation trade-offs. Successful completion of the course gives students the tools they need to construct substantial computer programs and understand computers and software. Course also provides a good foundation for further study in computer science and engineering. PREREQUISITE: CS& 141 with a grade of 2.0 or higher.

CS 301 Systems Programming and Computer Architecture

Introduces students to computer systems from the perspective of a programmer. Topics covered include data representation, assembly and machine-level representation of high-level language programs, the memory hierarchy, linking, exceptions, interrupts, processes and signals, virtual memory, and system-level I/O. Learn about the hierarchy of abstractions and implementations that comprise a modern computer system. Practical issues that affect performance, portability, robustness, and extensibility. Prerequisites: CS& 131 or CS& 141; and admission into a bachelor's degree program.

CS 333 Data Structures and Algorithms

Store and organize data in data structures such as lists, stacks, queues, trees, hash tables, heaps, and graphs. Compare algorithm design techniques such as the greedy method, divide and conquer, dynamic programming, and backtracking. Analyze runtime performance using asymptotic (big O) notation and worst-case analysis. Prerequisites: CS 132 or CS 145; and admission into a bachelor's degree program.

IT 131 Networking Infrastructure Fundamentals

Introduces networking to students who are interested in a career managing routers and switches. Topics include TCP/IP and OSI modules, subnetting, protocols, network applications, switching and routing fundamentals, and an introduction to configuring Cisco routers and switches. Prerequisite: IT 114 or instructor's permission.

IT 160 Microsoft Windows Server Implementation

Provides students with the knowledge and skills necessary to install and configure Microsoft Windows Server to create file, print, web, and Terminal servers. Prerequisite: IT 114 or instructor's permission.

IT 190 Linux Administration

Provides hands-on experience in installing and configuring a Linux operating system. Presents principal Linux concepts including essential commands and the command line, file systems, kernel compilation, basic user security, and an introduction to Internet-related services. Prerequisite: IT 101 or IT 114; or instructor's permission.

IT 201 Relational Database Design

Students analyze real world scenarios, organize data into relational tables for storage, and query information for reporting through the use of a database management system (DBMS). Focuses on the industry standard Structured Query Language (SQL) as the means to create, modify, and maintain database tables, queries, views, and constraints. Students practice their database design skills through hands-on exercises and labs.

IT 282 Android Application Development

Introduces the tools and application programming interfaces (APIs) used to build applications for the Android platform. Students bring their skills and knowledge from prior coursework in visual design and computer programming to build Android applications that support touch interface technology and object-oriented design using an event-driven software architecture. Prerequisite: CS& 131 or CS& 141; or instructor's permission.

IT 305 Web Development Frameworks

Modern web application frameworks have three-tier architectures: a presentation tier (user interface), logic tier (business rules), and a data tier (database). Build web sites using one or more of the major web development frameworks (e.g. Node.js, ASP.NET, Rails) and evaluate strengths and limitations. Security is examined in each tier. Focus on technology integration, testing, and maintaining a separation of concerns between tiers. Survey of major cloud computing providers, their services, and their application programming interfaces. Prerequisites: CS 132 or CS 145; and admission into a bachelor's degree program.

IT 328 Full Stack Web Development

Continuation of IT 305. Examines design, integration, and testing issues in each layer and interface of the web development stack, including leaky abstractions. Topics include multithreading, parallel processing, and resource management in the server environment, modeling of application and domain logic using object-oriented design patterns, integration with databases using object-relational mapping, use of NoSQL data stores, application of the Model-View-Controller software pattern, and integration with third-party software. Prerequisite: IT 305.

IT 355 Agile Programming Methodologies

Technical practices include test driven development (unit testing), continuous integration, refactoring, pair programming, kanban boards, and simple design. Focus on unit testing, functional testing, and acceptance testing and understanding the relationship between requirements, verification, and validation. Exposure to refactoring techniques. Prerequisite: IT 328.

IT 370 Debugging, Maintenance, and Evolution

Defect analysis and resolution is a process where software defects are identified, replicated, evaluated, and classified before repair, testing, and release. Tools used include: bug/defect tracking software, source code control systems, and regression testing suites. Exposure to defect management practices such as triage and risk assessment. Brownfield development project where students upgrade an existing system without changing existing functionality. Prerequisite: IT 328.

IT 405 Mobile Development Frameworks

Mobile applications are typically developed for use on multiple mobile platforms (e.g. iOS and Android). Develop apps using both native and cross platform frameworks. Compare the strengths and limitations of each platform and of each development framework. Examine issues such as submission to the app store/marketplace, licensing, pricing models, updates, scalability, and security and privacy issues. Prerequisite: IT 328.

IT 426 Collaborative Design

Software developers collaborate with clients, interaction designers, and end-users to design user interfaces, while working with technical team members to design the internal architecture and components of the software. Topics include prototyping, usability, design notations, design patterns, reuse, and design for change. Emphasis on design communication, design integrity, design tradeoffs, and negotiation. Prerequisite: IT 328.

IT 434 Secure Development Practices

Information security is the practice of defending information from unauthorized access, use, disclosure, or destruction. Presents a holistic approach to addressing security in the entire software development lifecycle, not just as an afterthought. Topics include security as a non-functional requirement, security in multi-tier software architectures, secure coding practices, and testing techniques. Prerequisite: IT 328.

IT 485 Product/Service Initiation and Design

First of two capstone project courses. Technical team members partner with business team members and end users/customers to develop a product or service concept. Technical team uses Scrum for project management while reconciling it with the business team's use of traditional project management techniques. Prerequisites: IT 355, IT 370, IT 405, IT 426, and IT 434.

IT 486 Product/Service Construction and Deployment

Second of two capstone project courses. Technical teams use an Application Lifecycle Management tool, with bug tracking. Maintain source code control. Produce production-quality code. Deliver or deploy the product or service in regularly scheduled release cycles. Prerequisite: IT 485.

PHYS& 110 Concepts of the Physical World

For the student with no previous experience in physics or other physical science courses and even an apprehension toward science and math. Topics such as light, sound, electricity, and motion, are used to develop underlying principles which describe some of our physical universe. Stresses conceptual reasoning while mathematics is limited to arithmetic reasoning. Uses a hands-on approach to more easily gain insight to the concepts being studied. Prerequisite: Eligible for ENGL& 101.

Appendix B: Reviewer Feedback

Philip Greenspun, PhD, Lecturer at MIT***Comments on General Education Requirements***

Diversity in the Workplace seems like a real waste of students' time. A university can't teach this better than an employer or an employer's contractor. Algorithms is something that they will remember and use for rest of their lives.

I would replace the Intro to Business course with a full-fledged accounting course. It is a real skill to know how to do accounting. It can be measured. It is useful when setting up a startup company.

Comments on Core Requirements

I would not teach C++. It is very confusing and it is unclear what the academic value might be. The same concepts can all be taught in Java. You give them C in CS 301. That's enough.

I think it is great that the database is taught so early.

For IT 131 I think it should lead to a Cisco certification. Maybe the students need to spend an extra intensive two weeks after the semester ends to prepare and earn their Cisco certification, but that's a real achievement.

I'm worry about your Collaborative Design course unless you can round up some real clients (which is what I do at MIT when teaching a software engineering lab).

Comments on Missing Content

Algorithms. It is an easy course to teach. There are a lot of great textbooks. Students should know why it matters that something is $O(n^2)$ instead of $O(n \log n)$.

Philo Juang, PhD, Software Engineer at YouTube (Google)

Comments on General Education Requirements

ENGL 335 is surprisingly important. That and CMST 220, in any software development program I'd stress that a shockingly large part of your job is to convince other people – fellow engineers or management – why we should be doing certain things.

Though I think ENGL 335 should have a particular emphasis on writing design documents and creating effective presentations.

Comments on Core Requirements

I think this is a fairly comprehensive set of courses! If I were to write down nitpicky quibbles, I might say:

- Not sure about XP as a standalone course, though concepts like continuous unit testing, integration, regression testing, pair programming, these all are definitely important topics.
- I think IT 305 and IT 328 might be somewhat closely related. Many startups begin using a LAMP stack on Amazon (or Ruby-on-Rails, ASP, PHP, AppEngine, what have you) and you could imagine a single course that evaluates both.
- One thing that I didn't notice was exposure to XSRF attacks – security in Web Development Frameworks I read as SQL-injection, for example. I can see this being part of the capstone projects, though.
- Given the spate of news about it recently, it might be worth having some exposure to privacy, privacy policies (like ACLs), and encryption. E.g. how to avoid having rogue foreign governments come in and extract your data, beyond just operational security in and out of your system.
- Big data? Tools like Hadoop and Lucene, for example.

Comments on Missing Content

I don't know if databases is an important course -- I certainly didn't take it, and caught up on it later, but with the different database and database-like software packages out there it might come in handy. (I admit I wish I did have some exposure to it as an undergrad though.)