Computer Science Program Review

El Camino College – Fall 2017

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I. Overview of the Program

Mission Statement: The Computer Science Department offers quality, comprehensive educational programs and services to ensure the educational success of students from our diverse community.

The Computer Science Department at El Camino College provides an outstanding learning environment in which students can develop the skills and knowledge needed for today's technology-oriented jobs. We offer quality, comprehensive computer science courses to ensure the educational success of students from our diverse community, with an emphasis on preparing students to transfer to STEM-related majors at four year colleges and universities.

We have provided instruction for approximately 450 to 1050 students each year since spring 2014. The core course of the CS Department is CSCI 1 (Problem Solving and Program Design in C++), our introductory programming course. This has accounted for 50-60% of our students each semester.

Our next tier of courses includes CSCI 2 (Intro to Data Structures), CSCI 3 (Java Programming), CSCI 30 (Advanced C++ Programming), and CSCI 40 (Intro to UNIX Operating Systems). Our first hybrid course, CSCI 12 (Programming Using PHP, JavaScript and XHTML), was introduced successfully in Spring 2013 and we plan to offer it 100% online in the Spring 2018. We also introduced CSCI 14 (Computer Programming in Python) in Spring 2016.

Our overall departmental success rate has been from a low of 59% in Fall 2016 to a high of 79% in Summer 2016, and has consistently exceeded the 60% level over the past three years. We are pleased that our retention rates have risen from a low of 71% to a high of 89%, and has surpassed 70% over the past three years.

b) Describe the degrees and/or certificates offered by the program.

The department offers an A.S. Degree in Computer Science. By introducing new courses, we have improved the variety of elective course to increase the interest in our A.S. degree.

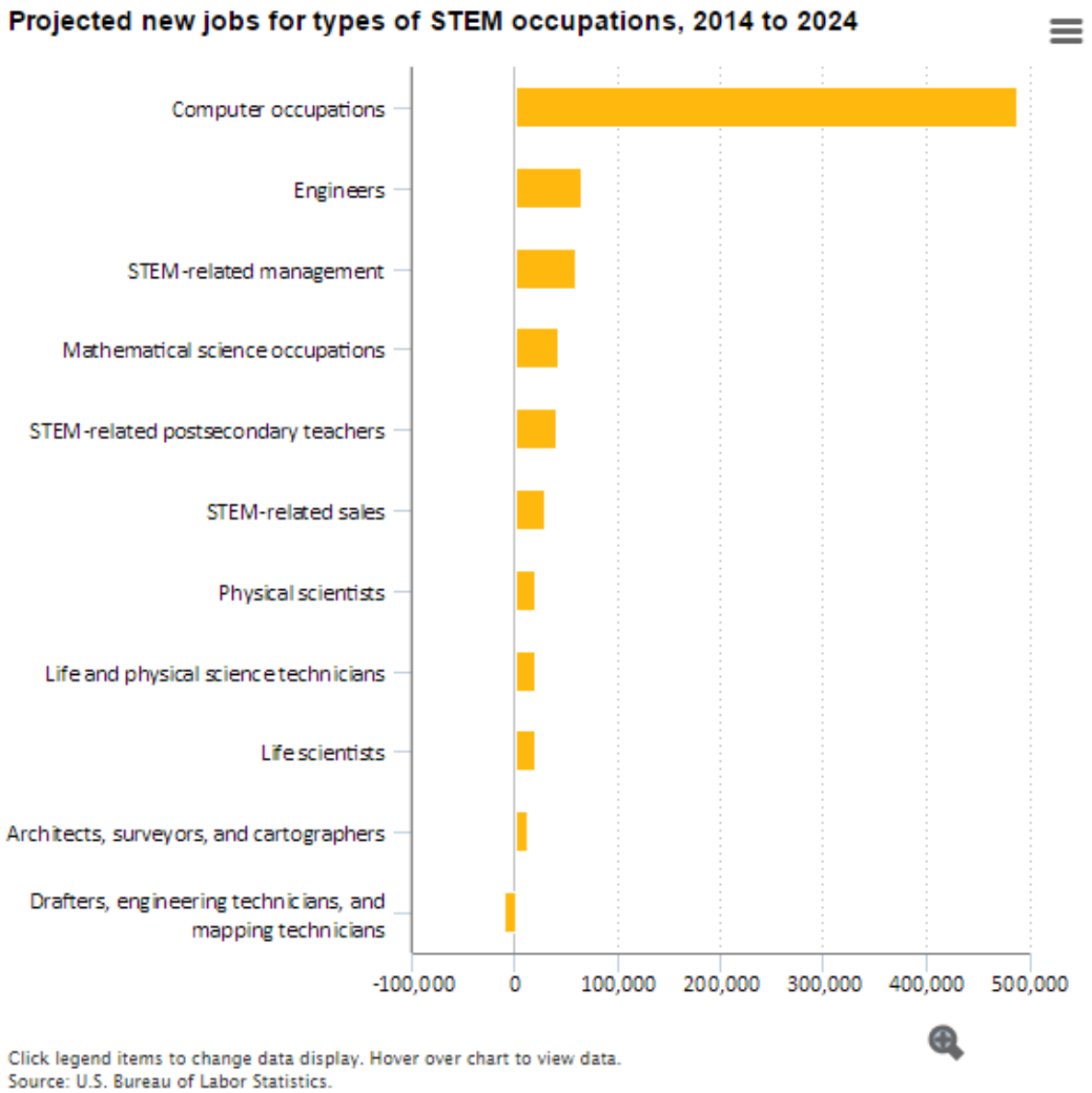
c) Explain how the program fulfills the college's mission and aligns with the strategic initiatives.

In the U.S. News and World Report list of the top 100 jobs in the next decade, no less than 5 of the top 40 fields are CS related, with Computer Systems Analyst, Database Administrator, Software Developer, Cyber Security, and Computer Programmer in the top 40. Students who take courses in the Computer Science Department are forming the core of the skills they will need to be successful in these fields. This is aligned with college mission of transforming lives by inspiring individuals to excel.

The Bureau of Labor Statistics projects that employment of software developers is projected to grow 17% from 2014 to 2024, much faster than the average for all occupations. The main reason for the rapid growth is a large increase in the demand for computer software. The BLS website states:

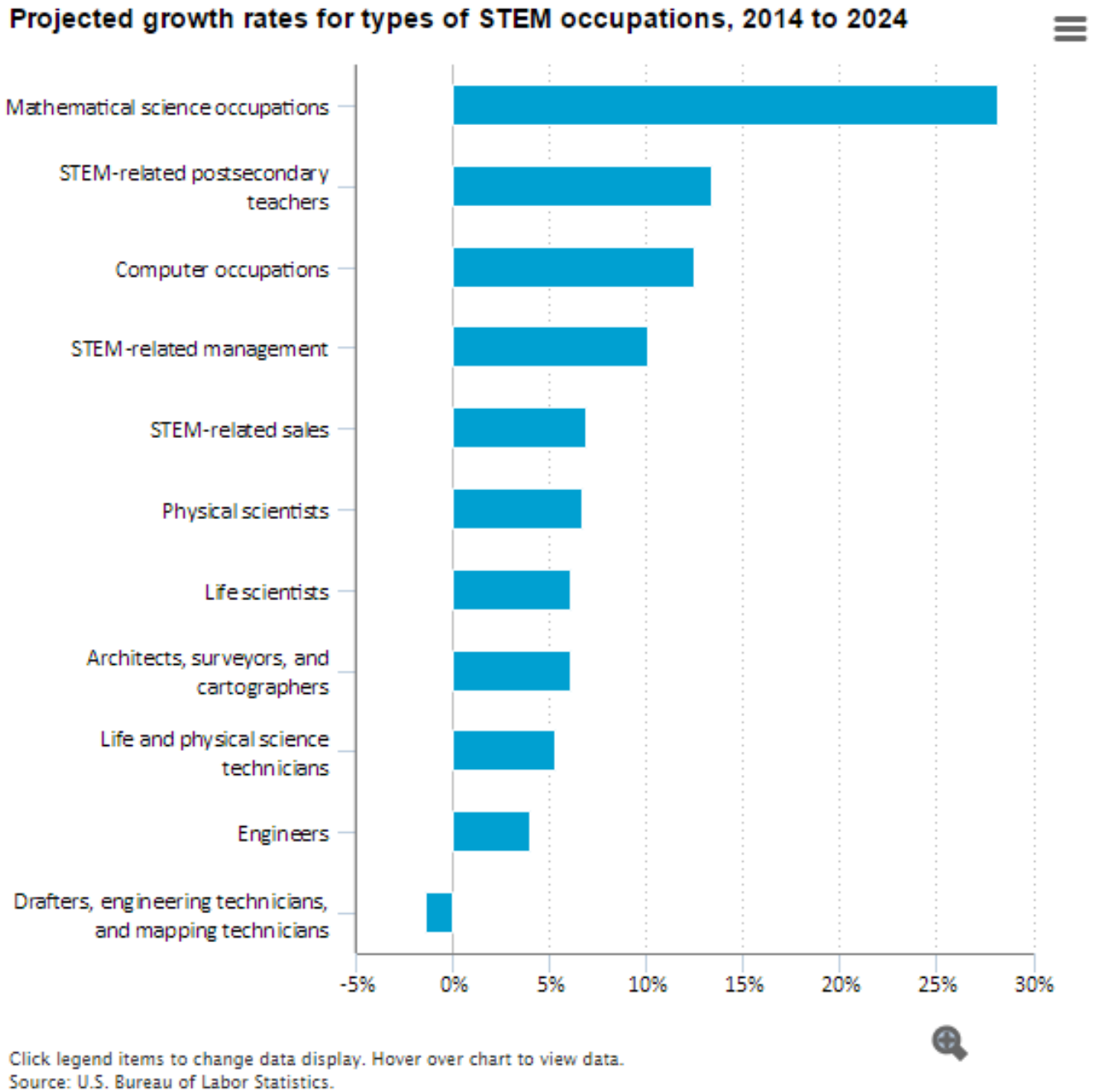
"Software developers usually have a bachelor's degree, typically in computer science, software engineering, or a related field. A degree in mathematics is also acceptable. Computer science degree programs are the most common, because they tend to cover a broad range of topics. Students should focus on classes related to building software to better prepare themselves for work in the occupation." They further state that "Although writing code is not their priority, developers must have a strong background in computer programming. They usually gain this experience in school." Computer Science faculty is providing high level instructions to improve student learning and by providing help sessions, tutoring, and programming contest preparations to support student success which are part of college strategic initiatives.

The graphic below demonstrates how much Computer Science dominates the STEM disciplines.



According to the Bureau of Labor Statistics the STEM group that is projected to grow fastest from

2014 to 2024 is the mathematical science occupations group at 28.2 percent, compared with the average projected growth for all occupations of 6.5 percent. This group includes occupations such as statisticians and mathematicians. Since this group had the lowest employment among the STEM groups in 2014, this growth will result in only about 42,900 new jobs over the period. The only STEM group that is projected to show little or no change is drafters, engineering technicians, and mapping technicians, with a slight projected decline of 1.4 percent, a decline of about 9,600 jobs.



There was a huge downturn in the Tech industry in the middle of the last decade, caused in large part by the bursting of the DotCom bubble, but the computer industry has recovered, prospered and grown.

The ECC Computer Science Department had not been allowed to keep up. However, in the past 3 years we have hired 3 new full-time faculty and have increased our sections from low of 7 sections to 22 sections since then, as demand has returned. This is barely enough to sustain a thriving environment for student learning. With the changes in the department we have been able to accommodate students' ability to transfer and provide them with the opportunity to get a more well-rounded Computer Science background, but the demand surpasses out ability to meet the needs of all the students in the CS department and we have had to turn away many students.

Our goal in this program review is to make a case that the Computer Science Department at El Camino College to grow by increasing our lab space, hiring new faculty to reduce reliance on adjunct faculty, support such as MESA workshops be offered, and technology be routinely updated.

Programming Contest Success

Since fall 2013 a group of El Camino Students have entered the Southern California Regional trials for the ACM International Collegiate Programming Contest, held at Riverside College. This contest is primarily for University level students, but junior college contestants are encouraged to participate for the experience. El Camino's team has placed well, finishing ahead of teams from local Cal State schools such as CSULB, CSULA, and CSUF.

Members of the CS faculty get involved with the students in these extracurricular activities by

1) Recruiting students via announcements in class,
2) Organizing meetings of interested students to disseminate information,
3) Organizing practice sessions to prepare students for the contests, and
4) Raising funds to defer costs for students to participate.

d) Discuss the status of recommendations from your previous program review.

Status of Previous Recommendations from 2013

Recommendation 1: Develop new courses, or revitalize existing curriculum to cover newer technologies that are of interest to employers and our students**. Status:** CSCI 14 (Computer Programming in Python) was introduced, and hybrid class CSCI 12 was converted to 100% online to accommodate more students. We are in the process of introducing two new CS courses.

Recommendation 2: Obtain training for existing staff on newer hardware and software platforms that will form the basis of our newer courses.

Status: In 2012 and 2013 with no funding and no inspiration due to course offerings being scaled back to being barely on life-support. **Status:** In 2015 using CTEA grant money we could update faculty laptops and faculty are using them to better prepare for the lectures and experiments with new software to help our students better prepare for their future.

Recommendation 3: Continue to adhere to the three-year cycle of upgrading the resources within

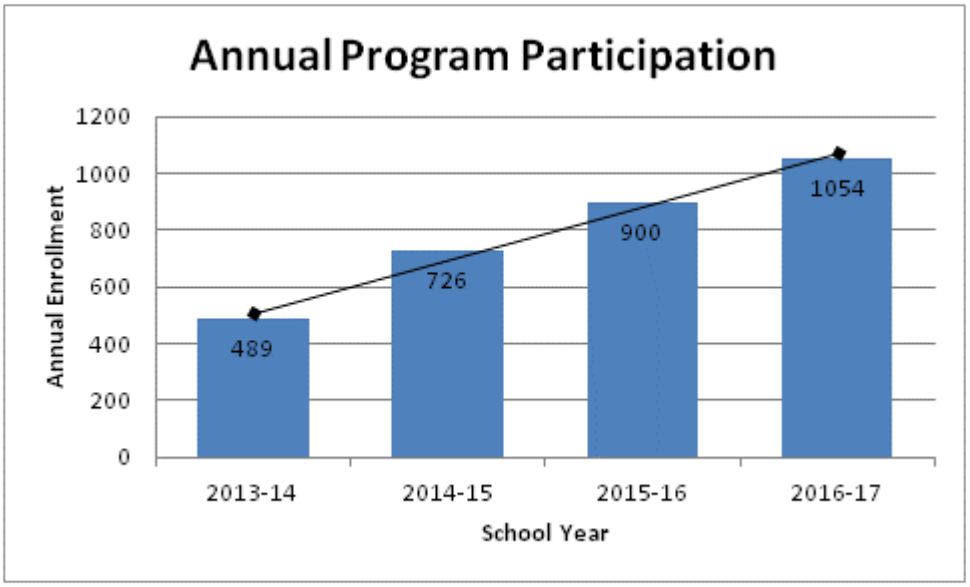
our computer labs. **Status:** We successfully applied for a CTEA grant to buy a cart with 24 laptops so it can be used as a mobile lab. We are in the process of purchasing the cart and laptops.

Recommendation 4: Work to articulate El Camino Colleges Computer Science classes with the CSU, UC and other private universities. **Status:** All active CS courses are transferable and articulate. We also started working with CSUDH to create a seamless transfer program into their Computer Science program, where students can complete all of their first 2 years Computer Science requirements at ECC.

II. Analysis of Institutional Research and Planning Data

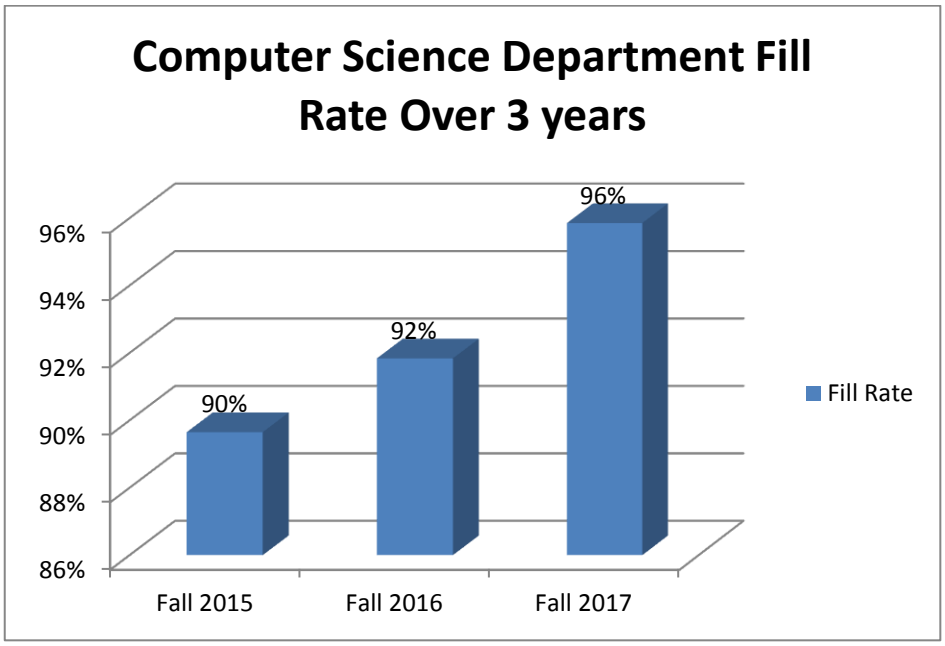
Enrollment Rates

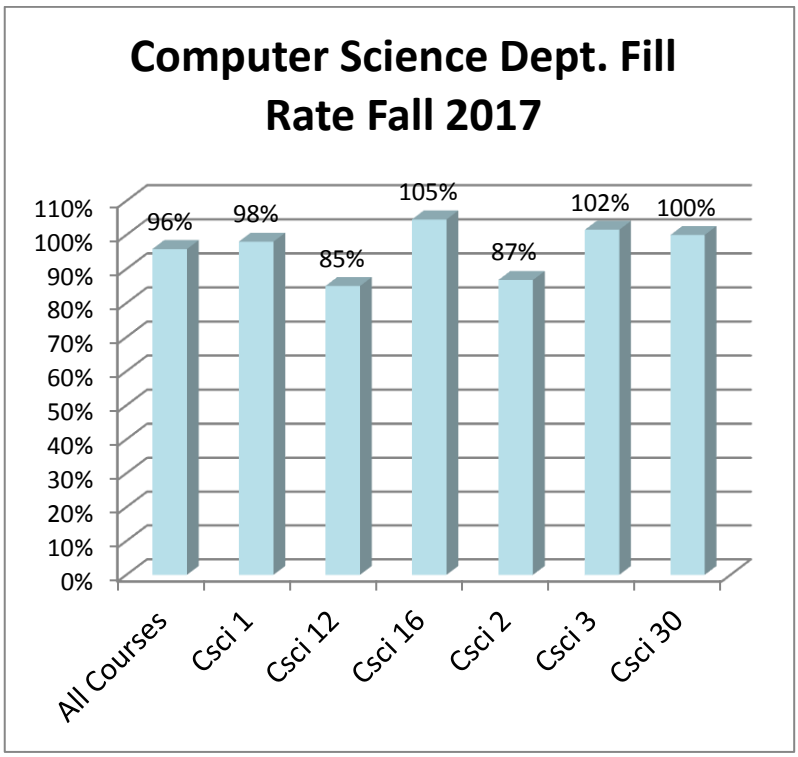
The enrollment in Computer Science has increased steadily in the past 4 years from 489 in 2013-14 to 1054 in 2016-17. Despite the Computer Science department growth we look to expand enrollment with new courses.



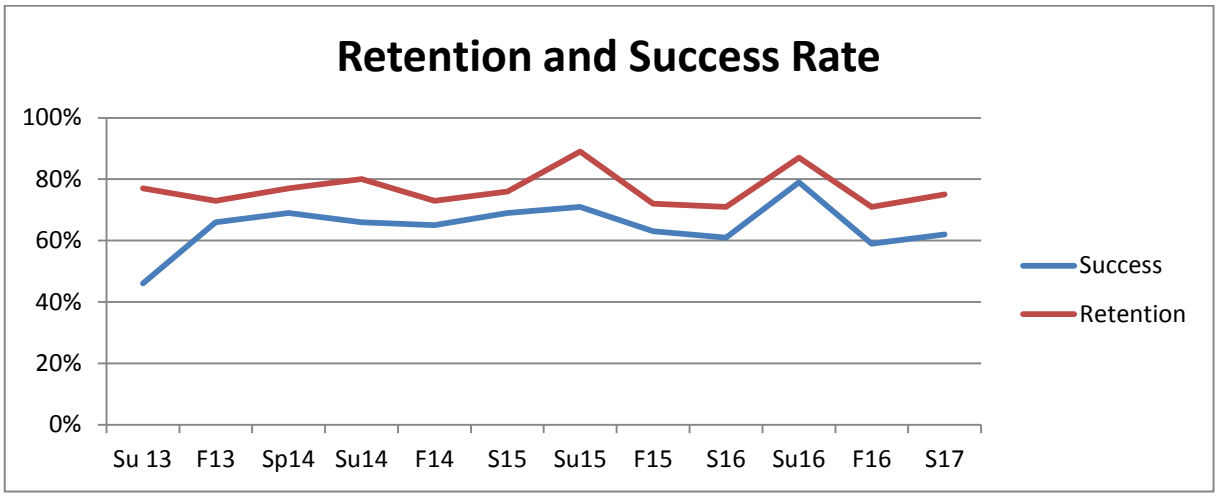
Computer Science Fill Rate

The increase in the number of sections offered by Computer Science department is catching up with the demand for our courses as illustrated by the near 100% fill rate each semester. Additionally, the classes and their wait lists fill up faster than most other courses indicating a very high demand for these core STEM courses.





We are pleased that our overall success and retention rates have risen from where they were in Summer 2013. Since the low success rate of 46% in Summer 2013 the rate has never been below 59% and has been over 60% in most semesters with an average of 65% for the 4-year period. A similar situation holds for the retention rates. From a low of 71% in Fall and Spring 2016, with the highest rate of 89% in Summer2015, and an average of 77% over the 4 year period.



Gender and Ethnicity of the Student Population

The data indicate that males outnumber females in the CSCI program by 7 to 1. This is similar to the situation with many STEM fields.

The percentage of Latinos in the program has ranged from 24.8% to 33.1% from 2014 to 2017, which is short of the 44.7% Latino population in the overall ECC student population. The percentage of African-Americans has ranged from 3.8% to 7.1% from 2014 to 2017, which isn't close to the overall student population proportion of 17.0%.

We believe that MESA could do a great job of improving these numbers. The MESA Director, Arturo Hernandez, agrees that we should try to get a MESA workshop for our introductory course, CSCI 1. Later we could attach workshops to key courses like CSCI 2 and CSCI 3.

		Fall Term Computer Science				ECC Student Population	District Boundary Population
		2012	2013	2014	2015	Fall 2015	2010 Census
Term Headcount		160	189	332	407	*24,000*	*556,400*
Gender	F	17.5%	11.1%	14.5%	16.5%	*51.6%*	*51.0%*
	M	81.3%	83.6%	76.5%	76.2%	*48.4%*	*49.0%*
Ethnicity	African-American	5.6%	7.4%	6.3%	6.1%	*14.6%*	*15.1%*
	Amer. Ind. or Alask. Native	0.0%	0.0%	0.0%	0.0%	*0.2%*	*0.2%*
	Asian	43.1%	28.6%	29.2%	32.7%	*14.8%*	*13.6%*
	Latino	26.3%	29.6%	32.2%	33.9%	*51.5%*	*34.5%*
	Pacific Islander	0.6%	0.0%	0.6%	0.0%	*0.6%*	*0.5%*
	White	16.3%	22.8%	17.5%	15.7%	*13.3%*	*32.8%*
	Two or More	3.8%	5.3%	4.5%	3.9%	*4.6%*	*2.9%*
	Unknown or Decline	3.8%	1.1%	0.6%	0.2%	*0.5%*	*0.4%*
Age/ Age Group	<17	0.0%	0.5%	0.0%	0.2%	*1.7%*	*24.2%*

	17	0.0%	0.5%	2.1%	2.2%	*2.2%*	
	18	6.3%	4.8%	6.6%	7.9%	*12.5%*	*2.5%*
	19	19.4%	12.7%	12.0%	12.5%	*14.8%*	
	20	25.6%	18.0%	15.4%	16.2%	*12.4%*	*1.2%*
	21	12.5%	16.9%	12.0%	10.6%	*9.8%*	*1.2%*
	22	7.5%	6.3%	10.8%	9.3%	*7.5%*	
	23	10.0%	4.8%	6.3%	7.4%	*5.9%*	*3.9%*
	24	3.1%	10.1%	7.8%	4.4%	*4.4%*	
	25-29	10.6%	14.8%	9.3%	13.0%	*13.2%*	*7.4%*
	30-39	2.5%	3.2%	6.3%	6.4%	*8.7%*	*14.9%*
	40-49	1.3%	1.6%	0.9%	1.0%	*3.5%*	*15.9%*
	50-64	0.6%	0.5%	0.6%	1.2%	*2.8%*	*18.1%*
	65+	0.0%	0.0%	0.6%	0.2%	*0.6%*	*10.6%*
Class Load	Full-time	71.9%	63.5%	61.7%	56.0%	*32.8%*	
	Part-time	27.5%	31.2%	29.2%	36.6%	*66.3%*	
Academic Level	College degree	5.6%	7.9%	9.9%	10.8%	*11.8%*	
	HS Grad	90.6%	84.1%	78.0%	77.9%	*82.8%*	
	Not a HS Grad	1.9%	0.5%	0.0%	0.2%	*0.5%*	
	K-12 Special Admit	0.0%	0.5%	0.3%	0.5%	*2.4%*	
	Unknown	1.3%	1.6%	2.7%	3.2%	*4.1%*	

Survey Analysis

We administered a survey to 244 of our students in the week before final exams in Spring 2017**.** Detailed results can be found in Appendix B.

The four questions related to instructors indicate that instructors positively impacted student success. A majority of respondents either agreed or strongly agreed that instructors helped them achieve their academic goals (93.03%), stay on track (89.76%), provide opportunities to actively participate in class (90.58%) or feel valued in the program (86.07%). The majority of respondents (72.95%) indicated that they want to pursue a major in computer science.

The out of classroom support services of tutoring and extracurricular activities showed similar results approximately 50% responded positively (agreeing or strongly agreeing) about the strength of those services. Even though last year was the ACM (Association of Computing Machinery) chapter's first full year being active 35.66% of respondents agreed or strongly agreed that it increased their interest in the CS program.

The survey indicates that there is great demand for areas in computer science that we currently don't offer classes in. Students respondent that they were either interested on very interested in App Development (81.15%), Cyber Security (75.41%) and Cloud Computing (72.96%). A majority of respondents, 56.97%, work either full (9.43%) or part time (47.54%).

III. Curriculum

The Computer Science department a CTE discipline considers following main stakeholders in developing, maintaining, and advancing curriculum. The main stakeholders are students, faculty, local software/hardware industries, and universities to which our students transfer for four-year degree. In developing and upgrading any courses, input is taken from all four stakeholders. The Computer Science department has also established an Association of Computing Machinery (ACM) chapter that is run by student officer and advised by computer science faculty. Industry and university stakeholders are asked to deliver seminars in ACM general meetings on topics, in which they would like students to develop skills. Based on student response to these lectures, faculty and other resources available, attempts would be made in the future to add curricular components in the skill areas of high demand.

Since our last program review, one such highly popular area has been the Python programming language. Our curriculum committee approved the new course CS 14 (Python Programming) in 2016, and the first offering was made in Spring 2017. Student response to this course has been phenomenal. All CSCI courses are transferable and all CSCI students take many other STEM courses in other departments. Recently we have seen two other new major groups of students that have shown highly elevated interest in computer science courses. One group is "other STEM majors" that have realized that an excellent knowledge of coding, computer science in general, and algorithms would give them "double deep skills" that would make them very attractive to employers. Thus, this group has been taking our CS2, CS14 (Python), and CS30 (Advanced C++), and CS3 (Java) courses with higher frequency.

The other major groups that have shown highly advanced interest in CS courses are local high schools. We are already offering CS1 and CS2 courses at Redondo Union High School (in fall and spring respectively). We have received requests from at least four other local high schools to start offering CS1 on their campus as a dual enrollment class. Our CS14 (Python) is also expected to become very popular as a dual enrollment course. The heightened interest in a computer science degree in general, interest from "other STEM" majors, and demand from local high schools, require us to offer more sections of entry level and advanced CS courses at El Camino. This calls for adding a new full-time faculty position as well as continued recruitment of more adjunct faculty. Once again, due to the explosive growth of computer science, the adjunct faculty pool has some retention problems, because many of our past adjunct professors have been hired as full time (in other institutions), and new ones must replace them.

The table below shows all our courses that, except CS14 Python (a new course) have been reviewed in last six years.

Course Number	Course Title	Course Review Dates	Transferability
CSCI1	Problem Solving & Program Design Using C++	03/31/2014	Yes
CSCI2	Introduction to Data Structure	11/02/2010	Yes

CSCI3	Computer Programming in Java	11/02/2015	Yes
CSCI12	Programming for Internet Applications using PHP, JavaScript, & XHTML	11/02/2010	Yes
CSCI14	Computer Programming in Python	09/18/2015	Yes
CSCI16	Assembly Language for the IBM PC & Compatibles	03/28/2016	Yes
CSCI30	Advanced Programming in C++	03/28/2016	Yes
CSCI40	Introduction to UNIX & LINUX Operating Systems	04/28/2016	Yes

IV. Assessments and Student Learning Outcomes (SLOs)

The computer science has assessed SLO's in all courses.

Program Level SLOs

Upon completion of their course of study in the computer science department:

PLO# 1 Students, when given a specification for a program or program segment, will be able to design, code, compile, test and document a solution;

PLO# 2 Students, when given a code segment, will be able to trace the execution and give the output;

PLO#3 Students, when given a code segment with errors, will be able to identify and correct the problems;

PLO#4 Students will be able to explain concepts specific to a particular language.

Course Level SLOs

Each SLO matches up with the corresponding PLO with the same number.

CSCI 1 Problem Solving and Program Design Using C++:

SLO #1 Students will write correct and detailed algorithms. (Properly analyze a problem using top down design, and write an algorithm that can be translated into computer code).

SLO #2 Students will write C++ code that uses correct syntax. (When declaring data types, writing algebraic and logical expressions, naming variables, etc.)

SLO #3. Students will write C++ code that correctly uses control structures (and nested control structures) [Including conditionals (like "if"), loops (like "while" and "for") and user defined functions (both void and value returning)]

SLO #4. Students will write C++ code that correctly uses basic data structures (Including strings, arrays, and structs)

CSCI 2 Introduction to Data Structures:

SLO #1 Students will design, code, compile, test and document a programming solution to a problem involving the basic data structures: lists, stacks, queues, trees, and related abstract data types.

SLO #2 Students, when given a C++ code segment, will be able to trace the execution, give the output, and analyze the efficiency of the basic data structures and techniques involved.

SLO #3. Students, when given a C++ code segment with errors, will be able to identify and correct the problems.

SLO #4. Students will be able to explain the C++ concepts related to pointers, classes, recursion, searching, sorting, templates and dynamic memory allocation.

CSCI 3 Computer Programming with Java:

SLO #1 Students, when given a specification for a program or program segment, will be able to design, code, compile, test and document a solution.

SLO #2 When given a code segment involving control structures, iteration structures and method calls, students will be able to trace the execution and give the output.

SLO #3 When given a code segment involving data objects, graphical interface objects, and processing objects, students will be able to describe what the users sees and the events that take place as the user interacts with the interface.

SLO #4 Students understand and be able to develop both desktop and web applications involving graphical user interfaces, animations, sound manipulations, File I/O, database, applets, and threads.

CSCI 12 Internet Applications using PHP, JavaScript, and XHTML:

SLO #1 Interactive Web Pages Design and implement an interactive web page.

SLO #2 Side-Scripts Develop a client-side script to create a drop down menu for a web page.

SLO #3 Web Pages Date and Time Design and implement a program or function to process data collected from a web form.

SLO #4 Processing Web Data Design and implement a server-side program or function to a database and interact (insert, delete, update records) with it.

CSCI 14 Computer Programming in Python for Computer Science

SLO# 1 Writing algorithms: Student write and correct detailed algorithms, some of them would include text processing. (Properly analyze a software problem using top down design, and write related algorithm that can be translated into computer program in Python).

SLO# 2 Students will write Python code that uses correct syntax (when declaring data types, writing algebraic and logical expressions, naming variables, etc.)

PLO# 3 Control Structures: Students will write Python code that correctly uses control structures (and nested control structures) including conditionals (like "if"), loops (like "while" and "for") and user defined functions (both void and value returning)

SLO# 4 Basic Data Structures: Students will write Python code that correctly uses basic data structures (including strings, arrays, and classes).

CSCI 16 Assembly Language Programming for the IBM PC and Compatibles

SLO #1 Students will design, code, compile, test and document programming solutions to problems by developing PC assembly language code that makes direct use of processor instructions, interrupts, registers, the stack, as well as existing macro and procedure libraries.

SLO #2 Students, when given a code segment will be able to trace the execution, providing the real-time content of registers during operations, the dynamic content of the stack during procedure calls and returns, and tracing the conditional execution of code generally, and within looping structures specifically.

SLO #3 Students, when given PC assembly language code with errors, will be able to identify what those errors are and will be able to modify the PC assembly language code to eliminate those errors.

SLO #4 Students will be able to explain the concepts of PC assembly language registers, interrupts, data segment organization, addressing modes, internal data representation, decision structures, macros and procedures.

CSCI 30 Advanced Programming in C++:

SLO #1 Students will design, code, compile, test and document programming solutions to problems requiring the development of C++ classes (by inheritance, by composition; templates), requiring C++ operator overloading, requiring effective use of the Standard Template Library, requiring effective use of pointers and dynamic memory allocation.

SLO #2 Students, when given a code segment involving use of a class, will be able to trace the construction of class objects, trace the destruction of class objects, verify whether memory leaks have occurred, trace object assignment operations, verify when copy constructors are invoked and when overloading of copy constructors is required

SLO #3 Students, when given C++ code with errors, will be able to identify what those errors are and will be able to modify the C++ code to eliminate those errors.

SLO #4 Students will be able to explain the concept of C++ class templates and how they relate to the concept of generics, the concept of virtual functions and polymorphism, the concept of multiple inheritance and virtual base classes, the concept of container types and the circumstances where

specific containers should or should not be used.

CSCI 40 Introduction to UNIX and LINUX Operating Systems:

SLO #1. Given a specification for a set of operating system tasks, students will create, edit, move, display, copy and delete files and subdirectories.

SLO #2. *Students* use shell programming to create file processing applications and control user interaction.

SLO #3 Students create, schedule, filter, monitor, format, sort and redirect and delete input / output of programs and processes.

SLO #4 Students perform basic administration functions in system installation and maintenance, network services, user

COURSES IN PROGRAM:

CSci 1	Problem Solving and Program Design using C++
CSci 2	Introduction to Data Structures
CSci 3	Computer Programming in Java
CSci 12	Internet Applications using PHP, JavaScript, and XHTML
CSci 14	Computer Programming in Python for Computer Science
CSci 16	Assembly Language Programming for the IBM PC and Compatibles
CSci 30	Advanced Programming in C++
CSci 40	Introduction to UNIX Operating Systems

SLO Timeline:

During the past 4 years all Computer Science department SLO courses have been assessed for all offered sections. Computer Science department has completed 100% of assessments. Based on the assessments and student survey results CS department started a tutoring program. Based on the SLO assessments and their alignments with PLO are also assessed indirectly.

Next 4 years timeline:

Academic Year 2014		Academic Year 2015		Academic Year 2016		Academic Year 2017	
SLO/PLO #1		SLO/PLO #2		SLO/PLO #3		SLO/PLO #4	
S2014	F2014	S2015	F2015	S2016	F2016	S2017	F2017
						Year of Program Review	
CSCI 12 CSCI 30 CSCI 40	CSCI 1 CSCI 2 CSCI 3 CSCI 16	CSCI 12 CSCI 30 CSCI 40	CSCI 1 CSCI 2 CSCI 3 CSCI 16	CSCI 12 CSCI 30 CSCI 40	CSCI 1 CSCI 2 CSCI 3 CSCI 16	CSCI 12 CSCI 30 CSCI 40	CSCI 1 CSCI 2 CSCI 3 CSCI 16

Assessment results and recommended/implemented changes resulting from course and program level SLO assessment

During this program review cycle, all offered courses were assessed, and the assessments were conducted in spring 2014, fall 2014, spring 2015, Fall 2015, Spring 2016, Fall 2016, and Spring 2017. Overall, the results met expectations.

Program SLOs and manner of assessment

Program's level of SLO/assessment implementation: Awareness; Development; Proficiency; or Sustainable Continuous Quality Improvement

The CS programs are at the proficiency level defined in its SLO implementation:

SLOs and assessments are in place for its courses, as well as at the program level.
Results of assessments have been used to guide the department in improving its courses and program.
There is department-wide dialogue about the results of assessment.
Decision-making is purposefully directed towards improving student learning based on the results of assessment. Students are aware of these student learning outcomes because they are on course syllabi.

Alignment grid for courses, program and institution.

Mathematical Sciences **Institutional (ILO), Program (PLO), and Course (SLO)**											
Program: Computer Science			**Number of Courses: 6**		**Date Updated 1.2 6.1**	**Submitted by** Junko Forbes Ext. 7217					
Institutional SLOs	I. Content Knowledge	II. Critical, Creative, and Analytical Thinking	III. Communication and Comprehension	IV. Professional and Personal Growth	V. Community and Collaboration	VI. Information and Technology Literacy					
Program Rating	4	4	3	2	2	3					
Program Level SLOS						**ILOs to PLOs Alignment** (Rate 1-4)					
						I	II	III	IV	V	VI
PLO #1 Using Specifications: Upon completion of their course of study in the Computer Science Department, students, when given a specification for a program or program segment, will be able to design, code, compile, test and document a solution.						4	4	3	2	2	3
PLO #2 Tracing Execution Upon completion of their course of study in the Computer Science Department, students, when given a code segment, will be able to trace the execution and give the output.						4	4	2	2	2	3
PLO #3 Identifying and Correcting Problems Upon completion of their course of study in the Computer Science Department, students, when given a code segment with errors, will be able to identify and correct the problems.						4	4	2	2	2	3
PLO #4 Concepts of Computer Language Upon completion of their course of study in the Computer Science Department, students will be able to explain concepts specific to a particular language.						2	2	4	2	2	3

Course Level SLOs	Course to Program SLO Alignment Mark with an X				ILOs to Course SLOs Alignment (Rate 1-4)					
	P1	**P2**	**P3**	**P4**	**I**	**II**	**III**	**IV**	**V**	**VI**
CSCI 1 Problem Solving and Program Design Using C++:SLO #1 Writing Algorithms Student will write correct and detailed algorithms. (Properly analyze a problem using top down design, and write an algorithm that can be translated into computer code)	X			X	4	4	3	2	2	3
CSCI 1 Problem Solving and Program Design Using C++:SLO #2 Using Correct Syntax Student will write C++ code that uses correct syntax. (When declaring data types, writing algebraic and logical expressions, naming variables, etc.)	X		X	X	4	4	3	2	2	3
CSCI 1 Problem Solving and Program Design Using C++:SLO #3. Input and Output Information Student will write C++ code that correctly input and output information. (Moving data to and from the screen and to and from text files. Also inputting predefined functions, etc, from included libraries.)	X	X		X	4	4	3	2	2	3
CSCI 1 Problem Solving and Program Design Using C++:SLO #4. Nested Control Structures Student will writeC++ code that correctly uses control structures (and nested control structures) [Including conditionals (like"if"), loops (like "while" and "for") and user defined functions (both void and value returning)]	X	X		X	4	4	3	2	2	3
CSCI 1 Problem Solving and Program Design Using C++:SLO #5. Basic Data Structures Student will write C++ code that correctly uses basic data structures (Including strings, arrays, and structs)	X	X			4	4	3	2	2	3
CSCI 1 Problem Solving and Program Design Using C++:SLO #6. Debugging and Running Programs Student will use software environment to debug and run C++ programs and to test them using various inputs.		X			4	4	3	2	2	3

CSCI 2 Introduction to Data Structures: SLO #1 Programming Solutions Students will design, code, compile, test and document a programming solution to a specified problem requiring basic data structures	X	X			4	4	3	2	2	3
CSCI 2 Introduction to Data Structures: SLO #2 Output of Program Segments Students will trace the execution and give the output of a given program or program segment pertaining to data structures		X			4	4	3	2	2	3
CSCI 2 Introduction to Data Structures: SLO #3. Correcting Errors Students will identify and correct the errors in a given program or program segment pertaining to data structures.		X		4	4	3	2	2	3	
CSCI 2 Introduction to Data Structures: SLO #4.Basic Data Structures Students will implement and explain the concepts underlying the basic data structures: lists, stacks, queues, trees, and related abstract data types.				X	4	4	3	2	2	3
CSCI 2 Introduction to Data Structures: SLO #5. Data Structure Techniques Students will explain and implement basic data structure techniques: pointers, classes, recursion, searching, sorting, templates and dynamic memory allocation.	X			X	4	4	3	2	2	3
CSCI 2 Introduction to Data Structures: SLO #6. Efficiency of Basic Data Students will analyze the efficiency of the basic data structures and techniques.	X	X			4	4	3	2	2	3
CSCI 3 Computer Programming with Java: SLO #1 Designing, Coding, Compiling and Testing Students, when given a specification for a program or program segment, will be able to design, code, compile, test and document a solution.	X				4	4	3	2	2	3
CSCI 3 Computer Programming with Java: SLO #2 Tracing Execution When given a code segment involving control structures, iteration structures and method calls, will be able to trace the execution and give the output.		X			4	4	3	2	2	3
CSCI 3 Computer Programming with Java: SLO #3 Describing What Users See When given a code segment involving data objects, graphical interface objects, and processing objects, will be able to describe what the users sees and the events that take place as the user interacts with the interface.		X			4	4	3	2	2	3

CSCI 3 Computer Programming with Java: SLO #4 Using File Objects and Interfaces Understand and be able to correctly use the File input/output objects and interfaces.			X	X	4	4	3	2	2	3
CSCI 3 Computer Programming with Java: SLO #5 Java Applications Understand and be able to develop Java applications involving graphical animations and sound manipulations.			X	X	4	4	3	2	2	3
CSCI 3 Computer Programming with Java: SLO #6 Web Applications Understand and be able to develop web applications involving applets with threads.			X	X	4	4	3	2	2	3
CSCI 12 Internet Applications using PHP, JavaScript, and XHTML: SLO #1 Interactive Web Pages Design and implement an interactive web page.	X			X	4	4	3	2	2	3
CSCI 12 Internet Applications using PHP, JavaScript, and XHTML: SLO #2 Side-Scripts Develop a client-side script to create a drop down menu for a web page.	X				4	4	3	2	2	3
CSCI 12 Internet Applications using PHP, JavaScript, and XHTML: SLO #3 Web Pages Date and Time Write a PHP program segment to display the current date and time on a web page.	X			X	4	4	3	2	2	3
CSCI 12 Internet Applications using PHP, JavaScript, and XHTML: SLO #4 Processing Web Data Design andimplement a program to process data gathered from a web form.	X				4	4	3	2	2	3
CSCI 12 Internet Applications using PHP, JavaScript, and XHTML: SLO #5 Cookies Design and implement aprogram to define and manage cookies.	X				4	4	3	2	2	3
CSCI 12 Internet Applications using PHP, JavaScript, and XHTML: SLO #6 Server Side Program Design and implement a server side program to connect to a database and interact with it.	X			X	4	4	3	2	2	3
CSCI 30 Advanced Programming in C++: SLO #1 Not User Member Initialization Students should be able to follow the consequences of not using the member initialization list in class constructors.		X	X		4	4	3	2	2	3

CSCI 30 Advanced Programming in C++: SLO #2 Data Abstraction Develop C++ classes that show an understanding of data abstraction.	X		X		4	4	3	2	2	3
CSCI 30 Advanced Programming in C++: SLO #3 Virtual Functions Develop C++ classes that use friend functions, and that contain virtual functions.	X		X	X	4	4	3	2	2	3
CSCI 30 Advanced Programming in C++: SLO #4 Inheritance and/or Compositions Develop new C++ classes based on existing classes by inheritance, by composition, or by a combination of both inheritance and composition.	X		X		4	4	3	2	2	3
CSCI 30 Advanced Programming in C++: SLO #5 Virtual Base Classes Develop C++ classes derived from multiple existing classes, and where applicable/necessary implement virtual base classes.	X		X	X	4	4	3	2	2	3
CSCI 30 Advanced Programming in C++: SLO #6 Standard Template Library Understand and effectively use the Standard Template Library.	X			X	4	4	3	2	2	3
CSCI 30 Advanced Programming in C++: SLO #7 Functions and Classes Develop C++ template functions and template classes.	X			X	4	4	3	2	2	3
CSCI 40 Introduction to UNIX and LINUX Operating Systems: SLO #1. Shell Script Solutions Given a specification for a set of operating system tasks, the student will design, code, test and document a shell script solution.	X				4	4	3	2	2	3
CSCI 40 Introduction to UNIX and LINUX Operating Systems: SLO #2. Creating Networks Understand and beable to create TCP/IP network addressing schemes for subnets, gateways, DHCP and DNS servers.				X	4	4	3	2	2	3
CSCI 40 Introduction to UNIX and LINUX Operating Systems SLO #3 Shell Program Segment When given a shell program segment, will be able to trace the execution and give the output.	X				4	4	3	2	1	3
CSCI 40 Introduction to UNIX and LINUX Operating Systems SLO #4 Identify and Correct Problems Given a shell program with errors, will be able to identify and correct the problems.		X			4	4	3	2	1	3
CSCI 40 Introduction to UNIX and LINUX Operating Systems: SLO #5. Process Monitoring and Scheduling Understand and be able to use process monitoring and scheduling			X		4	4	3	2	1	3

CSCI 40 Introduction to UNIX and LINUX Operating Systems: SLO #6. Installation Understand and can administer operating system installation, user installation, hardware and software installation, system maintenance and services.			X		4	4	3	2	1	3

V. Facilities, Equipment and Technology

A. Facilities and Equipment

Computer Lab

In our current building, we now have only one computer lab dedicated to computer science courses. This is causing scheduling problems, which will only get worse as we continue to grow. In order to cope with this problem, it is recommended that we purchase a sufficient number of laptops to effectively add two labs, without any construction costs. The laptops could be signed out to students at the beginning of a lab session, and returned at the end. Given this, any classroom could effectively be "converted" to a computer lab. Since the number of students in any given lab session has been capped at 22, we would need to purchase at least 44 laptops, and make sure that any relevant software site licenses would apply to them. We were approved for a CTEA grant in Fall 2017 to purchase one cart with laptops and we are in the process of purchasing the cart and computers. More details on these items follow.

B. Technology

Computers

Student Computers

Dedicated Lab: Our dedicated lab (MBA 113) will need upgrading to current technology levels periodically in order provide the platform to train our students using the industry standard tools. Since Visual Studio has updated to major revisions every two years (2013, 2015, 2017), it is recommended to upgrade to the 2017 version, we need to have 24 desktops (22 in service + 2 spares) equipped to the handle the latest technology requirements for development using Visual Studio. The computers in our current lab should be upgraded to handle the update to the 2017 version, but only have 2013 installed. Cost: approx. $3,000 ea. x 24 =$72,000

Mobile Labs: We need to have one additional "mobile" computer lab that moves in and out of general classrooms, requiring 25 laptops (22 in service + 3 spares) equipped to the handle the latest technology requirements for development using Visual Studio.
Cost: approx. $90,000

Instructor Computers

It is recommended that instructor computers be replaced at least every three years (and possibly earlier) to keep up with the technology changes related to the courses we teach. It is also recommended that faculty be given an additional monitor for

their office so that the problem of small laptop screens with the associated eye strain would be alleviated. We currently have 6 instructor positions (4 current + 2 opening to be filled soon) needing this support. Cost: approx. $2,000 ea x 6 = $12,000

Final Analysis:

After interviewing IT decision makers at this school (Paul Yoder) and other schools, we feel that a 3-4 year plan is all that is feasible right now. The industry trend is to move computer software and computing power to the Cloud computing model. So the items outlined above are expected to last for up to 4 years. After 4 years, we would need to re-evaluate our position relative to the industry trends.

So, our bottom line will be approximately $174,000 ($72,000 + $90,000 + $12,000 = $174,000).

VI. Technology and Software

Software

Programming:

Specifically related to CSCI 1, CSCI 2, and CSCI 30, Visual Studio allows software development in the C++ programming language.

Specifically related to CSCI 16, Visual Studio allows software development in assembly language.

Related to courses we have offered in the past, and potentially may offer again in the future, Visual Studio allows software development in the C# programming language, software development implementing graphical user interfaces generally, and graphical user interfaces that specifically may be implemented and accessed through the internet.

It should be noted that for the spring 2017 term, there are features of the most recent version of C++ (C++ 17) that we are unable to investigate for our students (specifically anyone teaching CSCI 30, which is our advanced C++ course) because Visual Studio 2013, the current version in the computer lab, and also in the classrooms, does not support those features.

Software Training for Course Development

It is recommended that budgeting be made available to allow faculty to explore newer technologies to meet student demand for courses that allow software development for those newer technologies. An example would be the purchase of iPads, at a cost of $600 to $800 each (total $3,600 to $4,800), for faculty with the

intent of being able to fully explore the development of apps for such technology, and finally the ability to offer a course in that software development to our students. It should be noted that it is one thing to have a concept of an application, to have mapped out the development of software related to that concept, and it is another thing entirely to provide a real-world implementation of that concept. Without the hardware to be able to test the software, no one can test the validity or real usefulness of the software.

In summary, the total here will be approximately $19,440 ($4,700 * 3 + $180 * 3 + $4,800 = $19,440), assuming a three-year period.

VII. Staffing

a) Describe the program's current staffing, including faculty, administration, and classified staff.

Currently we have four full-time Computer Science faculty, and four Math/CS hybrid faculty members, considered part-time. There have been several retirements since then, and demand for courses and the improving economy necessitate the hiring of more faculty members capable of teaching a wide spectrum of the current CS curriculum. Also, new faculty could help develop new courses to help us meet the demands of the next generation of computer science students, who need to be exposed to a wide variety of programming languages and ideas, both old and new.

Faculty	CS Load
Edwin Ambrosio	**100%**
Massoud Ghyam	**100%**
Solomon Russell	**100%**
Satish Singhal	**100%**

Spring 2017 -

Full-Time Faculty FTEF: 4.0	Percentage of Program: 67%
Part-Time FTEF: 2.0	Percentage of Program: 33%

b) Explain and justify the program's staffing needs in the immediate (1-2 years) and long-term (2-4+ years). Provide cost estimates and explain how the position/s will help the program better meet its goals.

The Computer Science Department is poised to grow if given the proper tools, one of the most important of which is a group of full-time faculty dedicated to the success of the department.

An increase of full-time faculty in the department will provide the impetus needed to modernize the curriculum at El Camino College, to make it a place where students will come from far away to

prepare for transfer and career. The infusion of new blood will help to build courses built on new languages and new technology, such as a games programming curriculum.

Staffing Recommendation #1: The College should hire two new full-time computer science faculty in 2018.

Staffing Recommendation #2: The college should hire three new part-time computer science faculty in 2018, to build a pool of qualified instructors and allow the course and section offerings to grow without uncertainty about staffing (it is better for students to see who is teaching a CS class, rather than to see STAFF, so that they can make an informed decision about which classes to take).

VIII. Direction and Vision

Computer Science department has come a long way from the last program review, but growth of all types is still needed. We have hired 3 new full-time faculty members and increased our offering both in variety of courses and the increasing sections of popular courses. We have very active and knowledgeable new faculty who are actively researching and proposing new courses to improve the depth of offerings in our department. We are in the last steps of the process of articulation with CSUDH to create a seamless transfer program to their program so the students can finish their bachelor degree in 4 years. Once we have completed the process we must reach out to other CSU campuses and use the agreement as a template to create such agreements. We also should consider offering more courses to train people with degrees who are planning to change jobs. We are consulting with our industrial advisory board to plan for such courses and programs.

In the past 3 years as our program has revived, our reputation is improving so that students can count on the availability of the courses they need to transfer. More students are returning to take classes in Computer Science Department, but we still have the room to grow if funding is provided to increase the number of faculty and labs to offer more classes.

A primary goal at ECC is to get students to transfer to 4-year colleges. There likely is no group anywhere on campus that has a greater potential of doing this than students enrolling in our computer science courses. From our recent survey 98% of them plan to transfer to a 4-year college. They have had trigonometry (the prerequisite for CS1) so they have already made huge progress toward transferring before they enroll in a CS class. Seventy-five percent of them are majoring in computer science or computer engineering or gaming. We will slow them down due to the inability to fund and offer the courses they need and slow the growth of the department if appropriate funding and support for growth is not provided.

Why shouldn't El Camino be a leader in community college computer science education?

Changes in the Field

1. Jobs are increasing faster in Computer Sciences. This makes a need for the program to grow.

2. The AS-T degree is a change
    a. Due to major changes required to our course the department faculty have decided not to participate in AS-T degree and we need to develop an alternative to work around it to help our students.

3. The smart phone is a change. It is a computer in disguise. Our computer program department in the future must address apps for cell phones.

4. The commonness of Laptops is a change: We are very close to the point where every student will soon own their own lap-top or iPad-type device that they can bring with them to school.

Vision and Plan

1. Prepare students better for transferring. **The plan**: Offer students the Computer Science courses they need by offering more sections and introducing new courses.
2. Introduce and offer course to prepare students are able to write Apps for the cell phone. We have already begun working on this, and plan to offer courses to accomplish this.
3. Offer sufficient sections and course so students can be assured they will be able to complete their requirements and transfer on time. Gradually increase the number of sections, and faculty as funds allow, until we are meeting the needs of our students.
4. Open another computer lab, allowing the program to strengthen and expand (and to make up for losing a lab when we moved to the new building).
5. Work with local high schools to fulfill their needs for computer science courses.
6. Provide professional development for industry professionals, and high school teachers.

IX. Prioritized Recommendations

Status of Previous Recommendations from 2013

Recommendation 2013-A: (Increase Course Offerings) It is recommended that we increase our course offerings to keep up with demand. We should increase our offerings of CSCI-1 to 6 sections each semester. We should have 2 sections of CSCI-2 and CSCI-3 each semester. Sections of later courses should be offered more often, some courses should be reactivated, and the development of new courses focusing on new trends in programming be supported.
Status: We have accomplished this goal and beyond.

Recommendation 2013-B: (Faculty Hiring) It is recommended that a full-time Computer Science faculty and/or a hybrid Math/CS faculty be hired. Also, a search for part-time faculty capable of teaching the CS curriculum is desirable.
Status: Done

Recommendation 2013-C: (MESA Workshops and Tutoring) It is recommended that a MESA

workshop and facilitator be created for CSCI-1 for the Spring 2014 semester. MESA workshops for CSCI-2 and CSCI-3 would also be desirable by Fall 2014. Fund more hours for the Computer Science tutor.

Status : Done

Prioritized Recommendations for 2017 and Beyond

Recommendation 2017-A: (Technology)

1) To upgrade the resources in the labs in a 3 year cycle plan.
    - Cost approximately $350,000

2) To provide a productive Unix/Linux environment (alternative operating systems) we would need a webhosting site to allow students to have both on and off campus access to their accounts. Our IT department has vetoed allowing students to login to accounts running on campus hosts for security reasons. The cost for such a site would be $10-$15 per month. ($180 per year). For on campus access, replacing equipment costs $2740.
    - Cost approximately $5,000

3) To provide budgeting to allow faculty to explore newer technologies (Software and Hardware) in order to catch up with current technology and meet student demand. For courses that allow software development for those newer technologies. An example would be the purchase of iPads, at a cost of $600 to $800 each (total $3,600 to $4,800), for faculty with the intent of being able to fully explore the development of apps for such technology, and finally the ability to offer a course in that software development to our students.
    - Cost approximately $5,000

4) To provide budgeting for a Macintosh Lab with 25 computers.
    - Cost approximately $400,000

5) To provide budgeting for faculty training and travel to sites for training on new technologies.
    - Cost approximately $10,000

Recommendation 2017-B: (Curriculum)

1) Hiring new full time faculty to meet our need and potential growth based on section 3 data.

2) Creating new courses to accommodate re-training of displaced workers with required technology to compete in today's job market.

3) Budget for Lab aides in lab classes

a. Cost implications: $20,000 per year

4) Based on survey results in section 2 there is strong interest in computer science courses in mobile computing, cyber security and cloud computing.

5) Establishing relationships with local CSUs for a seamless transfer program and articulate as many of our courses as possible.

a. Cost implications: $0 per year

Appendix A – Survey Results – Administered May 2017

244 students surveyed

Computer Science Student Survey

N=244 **Spring 2017**

Instructors in this program have helped me achieve my academic goals.

Response	Frequency	Percent
Strongly Agree	159	65.16
Agree	68	27.87
Neither Agree nor Disagree	14	5.74
Disagree	2	0.82
Strongly Disagree	1	0.41

Instructors in this program have helped me stay on track.

Response	Frequency	Percent
Strongly Agree	146	59.84
Agree	73	29.92
Neither Agree nor Disagree	19	7.79
Disagree	5	2.05
Strongly Disagree	0	0.00
Invalid	1	0.41

Instructors in this program provide opportunities to actively participate in my classes.

Response	Frequency	Percent
Strongly Agree	148	60.66
Agree	73	29.92
Neither Agree nor Disagree	18	7.38
Disagree	3	1.23
Strongly Disagree	1	0.41
Invalid	1	0.41

I have felt a sense of community within this program.

Response	Frequency	Percent
Strongly Agree	121	49.59
Agree	62	25.41
Neither Agree nor Disagree	47	19.26
Disagree	10	4.10
Strongly Disagree	1	0.41
Invalid	3	1.23

Student contributions have been valued by instructors in this program.

Response	Frequency	Percent
Strongly Agree	139	56.97
Agree	71	29.10
Neither Agree nor Disagree	28	11.48
Disagree	4	1.64
Strongly Disagree	1	0.41
Invalid	1	0.41

There is an appropriate range of courses offered in this program

Response	Frequency	Percent
Strongly Agree	116	47.54
Agree	74	30.33
Neither Agree nor Disagree	35	14.34
Disagree	15	6.15
Strongly Disagree	1	0.41
Invalid	3	1.23

Courses were scheduled on days and times that were convenient to me

Response	Frequency	Percent
Strongly Agree	121	49.59
Agree	81	33.20
Neither Agree nor Disagree	18	7.38
Disagree	18	7.38
Strongly Disagree	6	2.46

I've been able to register for the classes I need within this program

Response	Frequency	Percent
Strongly Agree	141	57.79
Agree	75	30.74
Neither Agree nor Disagree	12	4.92
Disagree	10	4.10
Strongly Disagree	4	1.64
Invalid	2	0.82

The courses in this program have helped me meet my academic goals

Response	Frequency	Percent
Strongly Agree	139	56.97
Agree	79	32.38
Neither Agree nor Disagree	18	7.38
Disagree	1	0.41
Strongly Disagree	4	1.64
Invalid	3	1.23

There is a variety of extracurricular activities related to this program on campus

Response	Frequency	Percent
Strongly Agree	75	30.74
Agree	51	20.90
Neither Agree nor Disagree	89	36.48
Disagree	22	9.02
Strongly Disagree	5	2.05
Invalid	2	0.82

The library has the resources to help me succeed in this program

Response	Frequency	Percent
Strongly Agree	65	26.64
Agree	31	12.70
Neither Agree nor Disagree	98	40.16
Disagree	31	12.70
Strongly Disagree	16	6.56
Invalid	3	1.23

The tutoring sessions help me succeed in this program

Response	Frequency	Percent
Strongly Agree	83	34.02
Agree	39	15.98
Neither Agree nor Disagree	106	43.44
Disagree	9	3.69
Strongly Disagree	6	2.46
Invalid	1	0.41

The buildings and classrooms used in this program are satisfactory

Response	Frequency	Percent
Strongly Agree	139	56.97
Agree	75	30.74
Neither Agree nor Disagree	10	4.10
Disagree	14	5.74
Strongly Disagree	5	2.05
Invalid	1	0.41

I am satisfied with the computers and software used in this program

Response	Frequency	Percent
Strongly Agree	98	40.16
Agree	71	29.10
Neither Agree nor Disagree	26	10.66
Disagree	27	11.07
Strongly Disagree	18	7.38
Invalid	4	1.64

I am aware of the course outcomes-what I should be able to learn and what skills I should possess after completing courses n the program

Response	Frequency	Percent
Strongly Agree	146	59.84
Agree	79	32.38
Neither Agree nor Disagree	14	5.74
Disagree	0	0.00
Strongly Disagree	0	0.00
Invalid	5	2.05

The ACM (Association for Computing Machinery) chapter has increased my interest in the CS program

Response	Frequency	Percent
Strongly Agree	59	24.18
Agree	28	11.48
Neither Agree nor Disagree	140	57.38
Disagree	11	4.51
Strongly Disagree	3	1.23
Invalid	3	1.23

The programming contest has increased my interest in the Computer Science program

Response	Frequency	Percent
Strongly Agree	55	22.54
Agree	30	12.30
Neither Agree nor Disagree	143	58.61
Disagree	11	4.51
Strongly Disagree	1	0.41
Invalid	4	1.64

Other CS clubs and activities have increased my interest in the Computer Science program

Response	Frequency	Percent
Strongly Agree	55	22.54
Agree	36	14.75
Neither Agree nor Disagree	129	52.87
Disagree	14	5.74
Strongly Disagree	6	2.46
Invalid	4	1.64

The number of units that I am taking this semester:

Response	Frequency	Percent
15 or more units	54	22.13
12-14 units	99	40.57
9-11 units	38	15.57
6-8 units	27	11.07
5 or less units	23	9.43
Invalid	3	1.23

If you have taken classes at other colleges, what were the reasons you chose those colleges over El Camino College? (Mark all that apply)

Response	Frequency	Percent
There were schedule conflicts with classes that I needed	24	9.84
I was advised to take the class elsewhere	8	3.28
Travel/commute times were shorter	30	12.30
Parking is not as much of a problem	6	2.46
Classes that I needed were not being offered	21	8.61
The classes are less demanding.	4	1.64
More support services are available	12	4.92
Invalid	157	64.34

Are you currently employed?

Response	Frequency	Percent
Yes- Full time	23	9.43
Yes- Part time	116	47.54
Not employed	102	41.80
Invalid	3	1.23

If employed, how many hours per week are you working?

Response	Frequency	Percent
More than 35 hours	16	6.56
25-34 hours	23	9.43
15-24 hours	49	20.08
5-14 hours	44	18.03
Less than 5 hours	22	9.02
Invalid	90	36.89

Satisfaction with being able to enroll in classes:

Indicate the area of your major at El Camino College::

Response	Frequency	Percent
Behavioral/Social Sciences	2	0.82
Business/Computer Informaton Systems	5	2.05
Computer Science	178	72.95
Fine Arts	0	0.00
Health Sciences and Athletics	0	0.00
Humanities	0	0.00
Industry and Technology	8	3.28
Mathematical Sciences	30	12.30
Natural Sciences	15	6.15
Invalid	6	2.46

The early morning before 10:00am

Response	Frequency	Percent
Very Satisfied	73	29.92
Satisfied	59	24.18
Neither Satisfied nor Dissatisfied	68	27.87
Dissatisfied	14	5.74
Very Dissatisfied	15	6.15
Invalid	15	6.15

The late morning/early afternoon from 10:00am to 2:00pm

Response	Frequency	Percent
Very Satisfied	88	36.07
Satisfied	67	27.46
Neither Satisfied nor Dissatisfied	45	18.44
Dissatisfied	21	8.61
Very Dissatisfied	7	2.87
Invalid	16	6.56

The late afternoon from 2:00pm to 5:00pm

Response	Frequency	Percent
Very Satisfied	89	36.48
Satisfied	86	35.25
Neither Satisfied nor Dissatisfied	39	15.98
Dissatisfied	15	6.15
Very Dissatisfied	2	0.82
Invalid	13	5.33

The evening from 5:00pm and later

Response	Frequency	Percent
Very Satisfied	80	32.79
Satisfied	61	25.00
Neither Satisfied nor Dissatisfied	62	25.41
Dissatisfied	15	6.15
Very Dissatisfied	7	2.87
Invalid	19	7.79

The summer session

Response	Frequency	Percent
Very Satisfied	71	29.10
Satisfied	51	20.90
Neither Satisfied nor Dissatisfied	78	31.97
Dissatisfied	19	7.79
Very Dissatisfied	5	2.05
Invalid	20	8.20

Interest in the following area of computer science:

Through distance education [online]

Response	Frequency	Percent
Very Satisfied	46	18.85
Satisfied	37	15.16
Neither Satisfied nor Dissatisfied	117	47.95
Dissatisfied	15	6.15
Very Dissatisfied	7	2.87
Invalid	22	9.02

Cloud Computing

Response	Frequency	Percent
Very Interested	91	37.30
Interested	87	35.66
Neutral	53	21.72
Not Interested	9	3.69
Invalid	4	1.64

App Development

Response	Frequency	Percent
Very Interested	133	54.51
Interested	65	26.64
Neutral	30	12.30
Not Interested	11	4.51
Invalid	5	2.05

Cyber Security

Response	Frequency	Percent
Very Interested	123	50.41
Interested	61	25.00
Neutral	40	16.39
Not Interested	15	6.15
Invalid	5	2.05

Embedded System

Response	Frequency	Percent
Very Interested	85	34.84
Interested	63	25.82
Neutral	69	28.28
Not Interested	21	8.61
Invalid	6	2.46

Appendix B

U.S. News and World Report – Top 100 Jobs of 2017 (the top 13)

1) Dentist
2) Nurse Practitioner
3) Physician Assistant
4) Statistician
5) Orthodontist
6) Nurse Anesthetist
7) Pediatrician
8) Computer Systems Analyst
9) Oral and Maxillofacial Surgeon
10) Obstetrician and Gynecologist
11) Optometrist
12) Occupational Therapy Assistant
13) Software Developer

Career and Technical Education- Supplemental Questions

The Computer Science Program at El Camino College.

1. **How strong is the occupational demand for this program?**
   According to the ECC Computer Science Analyst Report, there are over 102,000 computer jobs in California. There are predicted to be about 1,600 new jobs this year which is a large part of all STEM-related new jobs.

2. **How has the demand changed in the last 5 years and what is the outlook for the next 5 years?** The growth in computer jobs in California has averaged about 1.6% per year for the last 5 years… but the job growth from year to year has been volatile. For instance, in 2011 the growth was a mere 1%, but in 2012 (the last year we have data for) it was 3%. The estimated job growth over the next 5 years is estimated at about 8%, which far exceeds the population growth. According to US-BLS employment projections, in the next 5 years (thru 2018) 71% of all new STEM jobs will be in computing.

3. **What is the El Camino College District's need for the program?**
   Jobs in Computer science are the fastest growing of any STEM field. We need to be a part of this. It is our mission to serve the community and to offer affordable education … education that leads to jobs. Our school has produced excellent students, winning 1^{st} or 2^{nd} place in the Progfest programming contest the last 5 years in a row, which builds school spirit and gives evidence for the excellence of our school.

4. **What is the state's need for the program?**
   Computer programming is everywhere…in our cell phones and computers, our cell phones, our automobiles. Computer programming has changed the face of what technology is and what it can do, it has changed the way we live our lives here in California and everywhere. It creates jobs, creating income for individuals and for the state. California has always been a leader in Technology. Much of that technology is computer-based.

5. **How does the program address needs that are not met by similar programs in the region?**
   We are doing a good job of meeting those needs that are met by other community colleges in the region (after all, we are winning contests). We are meeting needs that are not addressed at all by the four year colleges… we have people still in work who just need a course or two to improve their work skills, we educate people who do not yet qualify to enter a 4 year college. We educate students at reduced prices that the 4 year colleges cannot compete with.

6. **Are the students satisfied with their preparation for employment?**
   As instructors it is our experience our students, including those students who are currently

employed and seek to prepare themselves to be better employed enjoy the courses we offer and are positive about the usefulness of what they learn. If, due to the huge cuts in our offerings they are not able to get into a course and complete their preparation then they, of course, are frustrated.

7. **Are the employers in the field satisfied with the level of preparation of our graduates?**
   El Camino College does not keep or collect this data. Only those students already in a job and seeking to better their knowledge go directly into a job after their education at El Camino College. 98% of our students intend to go on to earn a BA and put off getting a computer job until they have graduated from a 4-year college. We are not informed of their eventual employers.

8. **What are the completion, success, and employment rates of the students?**
   - Our completion rate has been over 70% every semester since the fall of 2008. Our latest data (Fall of 2012) shows a 76%retention rate.
   - Our success rate has been over 60% every semester since 2010, and for the latest semester we have data on (Fall 2012) it was just over 60%.
   - We do not have access to data on computer-science related employment, which generally occurs 4 to 8 years after leaving El Camino, after graduating from at a 4 year college or university with a BA, MA, or PhD.

9. **What is the role of the advisory committee?**
   The computer science committee acts as the advisory committee and makes the decisions that affect every course and the way they are run. We are expanding our advisory committee to include outside persons.

10. **There is no licensure exam for computer science students.**