I. SELF-STUDY (suggested length of 1-3 pages)

A. Five-Year Review Planning Goals

   Present your planning goals from your last 5-year plan.

The Department of Computer Science has a proven track record of success. Our graduated students are quite successful in Silicon Valley and in the national and international IT sector. In November 2014, The Washington Post reported that CSUEB Computer Science graduates were ranked #9 nationally in terms of career earnings, and ranked #7 nationally for the best rate of return for both in-state and out-of-state tuition. According to exit surveys done by AACE, Computer Science majors are the most successful of CSUEB graduates at finding degree-related employment within one year of graduation.

The local technology industry recovered relatively quickly from the recent economic downturn, and IT jobs in the Bay Area are abundant. Overall enrollment in our B.S. Computer Science program has increased roughly 40% since the date of our last 5-year review.

The Bachelor’s degree in Computer Science goals from the last 5 year review included the following:

1) Increase enrollment
2) Replace retiring faculty
3) Curriculum - ABET
4) Implement an assessment plan
5) Resources – technical laboratories. IT support

B. Progress Toward Five-Year Review Planning Goals

Report on your progress toward achievement of the 5-Year Plan. Include discussion of problems reaching each goal, revised goals, and any new initiatives taken with respect to each goal.

1) Overall enrollment in our B.S. Computer Science program has increased roughly 40% since the date of our last 5-year review. To better serve our undergraduate students, we have created and undergraduate
adviser position. The undergraduate adviser is a first contact for students who want to plan their computer science schedules, receive transfer credit evaluation, request job/internship/graduate school recommendations, and review graduation requirements. The undergraduate advisor contacts and counsels students who have low GPA’s in their Computer Science courses and meets with students who have been cited for academic dishonesty. The advisor also meets with perspective students and parents. The Computer Science Club and new ACM-W club have become active on campus. The groups participated in a Google Spark outreach project teaching children from the Hayward Boys and Girls Club Python programming, competed in several programming competitions (placing third out of eleven at Google), and have hosted numerous speakers. Dr. Ertaul continues to lead his Hackathon each year.

2) Dr. Reiter, Dr. Jurca, Dr. Yu, and Dr. Simon have all completed their FERP and are now retired. We continue to have difficulty hiring both tenure track faculty and lecturers. The following shows our hiring history for tenure track faculty since 2015:

<table>
<thead>
<tr>
<th>Year</th>
<th>Open Positions</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-16</td>
<td>two</td>
<td>one filled</td>
</tr>
<tr>
<td>2016-17</td>
<td>two</td>
<td>one filled</td>
</tr>
<tr>
<td>2018-19</td>
<td>one</td>
<td>not filled</td>
</tr>
<tr>
<td>2019-20</td>
<td>two</td>
<td>search in progress</td>
</tr>
</tbody>
</table>

The department currently functions with eleven tenure track faculty and twelve lecturers. The department’s search for two new faculty members in 2016-17 resulted in the hire of one professor, Dr. Zahra Derakhshandeh. Her expertise is in Distributed Computing, Algorithm Design and Optimization, Bio-inspired Algorithms, and Programmable Matter will be an asset to the department. Our search in 2018-2019 was unsuccessful. As in the past, potential candidates consistently report that they were deterred from accepting our position due to the cost of living in the Bay area and CSUEB’s compensation. We will again search for two new faculty members next year as the department is understaffed and relies on lecturers for many course sections.

3) The Computer Science department continues to face the challenges of managing an appropriate curriculum that adapts to our dynamically evolving discipline, while at the same time maintaining a solid core of fundamentals.

4) At the time of our last five year review, we were beginning to identify program learning outcomes and student learning outcomes. We currently have these in place and conduct assessment via post-assessment examinations for required courses. The exams are deployed through Blackboard and automatically scored. We had some difficulty with these quizzes as some courses addressed multiple PLOs. With semester conversion, we have created new Program Learning Outcomes for all our degrees and will assess one PLO per course through Blackboard which will allow for easier evaluation of results. For 2018-2019, we evaluated PLO4 and PLO5.

5) The Computer Science program is in need of resources such as technical laboratories and office space. Moving to the SF building was a positive experience, however, we there will not be enough room for our new hires. Through the generosity of the College of Science, the department was able to create an open Computer Science Lab for students in N Sci 337. This lab is staffed with student TAs and is heavily utilized by students. We have fewer classroom labs, however, which are needed for many of our courses. Currently our classroom labs are VBT 218, N Sci 336, and a small room N Sci 104. We have added lab
components to five of our courses for semesters and fear that this shortage will be a dire problem in the future. We were lucky enough to hire Brian Campbell as our technician who currently splits his time between the computer science department and IT. Moving forward, we would eventually like to have this position transition to support computer science department full time.

C. Program Changes and Needs

Report on changes and emerging needs not already discussed above. Include any changes related to SB1440, significant events which have occurred or are imminent, program demand projections, notable changes in resources, retirements/new hires, curricular changes, honors received, etc., and their implications for attaining program goals. Organize your discussion using the following subheadings.

Overview:

Undergraduate computer science student enrollment has increased by 40%. The department is currently serving 900 undergraduate students and 300 graduate students. With only eleven tenure track faculty and one FERPer, the department has become increasingly dependent on lecturers. We are facing space issues in regards to computer labs, teaching labs, and office space. In addition, we lack a dedicated information technology technician to maintain the labs and faculty software needs.

Curriculum:

Since our last five year review, three new hybrid courses have been added to the curriculum: Security in Mobile, Wireless, Grid and Pervasive Computing, Security Management and Cloud Computing. These courses are currently tiered with graduate sections.

Students:

Undergraduate computer science student enrollment has increased by 40%. The department is currently serving 900 undergraduate students and 300 graduate students. We saw a 14% growth in class enrolments from last year. In previous reports, we mentioned a problem with oversubscribed courses. Graduate students with early registration appointment times would sign up for the maximum allowed by the system (4 enrollments and 4 waiting lists). They would then drop the courses they did not want on the last day of the Add/Drop period. This meant that students with later registration appointments, including all incoming students and BS students, would be on waiting lists. This continues to be an issue; however, the department policy allows graduate students to enroll in only two CS prefix courses prior to the start of the quarter. This is helping the situation though our administrative assistant is forced to drop graduate students manually when they break our policy. Students are allowed to add more courses after the first day of the quarter.

Academic dishonesty continues to be an issue. The current departmental policy states that students with an academic dishonesty report may not be graders and cannot take the CS498 internship course. We plan to amend our catalog to remove students who have more than two academic dishonesty reports from the program. The undergraduate and graduate advisors meet with all students cited for academic dishonesty.
Faculty:

Retiring faculty continues to be an issue. Dr. Reiter and Dr. Jurca completed their FERP this year. Dr Yu is in his last year of FERP. The department currently functions with eleven tenure track faculty. Our SFR is currently 32 with a target of 30. The department’s search for two new faculty members in 2016-17 resulted in the hire of one professor, Dr. Zahra Derakhshandeh. Her expertise is in Distributed Computing, Algorithm Design and Optimization, Bio-inspired Algorithms, and Programmable Matter will be an asset to the department. Our search in 2018-2019 was unsuccessful. Potential candidates reported that they were deterred from accepting our position due to the cost of living in the Bay area and CSUEB’s compensation. We will again search for two new faculty members next year as the department is understaffed and relies on lecturers for many course sections.

Staff:

We are currently functioning with department administrative assistant, Stephanie Wiley, Student Services Coordinator, Janet Synder, and student workers who all help to serve the 1200 undergraduate and graduate computer science students.

The computer science has long functioned with a dedicated lab technician to support our classroom labs and faculty software needs. Our technician issues student accounts, manages dedicated servers that support web, security, and database courses, and manages virtual operating system environments. We were lucky enough to hire Brian Campbell as our technician who currently splits his time between the computer science department and IT. Moving forward, we would like to have this position transition to support computer science department full time.

Resources: (facilities, space, equipment, etc.)

The Department was pleased that space was made available in the new Student and Faculty Support (SF) building for the department office and faculty offices. Faculty had been spread over all four floors of both Science buildings previously. Proximity to colleagues and the department office has already led to increased communication between department faculty, more frequent department committee meetings, and increased productivity. Unfortunately, space was not made available for all department faculty. In particular, faculty participating in the FERP program, and all lecturers are still housed in the Science buildings. In addition, there is not enough space in the new building to house the faculty that would result from successful searches that have been approved for next year. Ideally, it would be beneficial to house the entire department in one place with enough space available for desired growth. Some shared experimental lab space has also been made available in SE S125. However, some adjustments need to be made in order for all faculty to be able to utilize the space.

The College of Science has provided some limited additional teaching lab space, but this is still a significant concern as current space is insufficient to meet department needs. As our outside reviewer mentioned, if we choose to seek accreditation, our relative lack of teaching would be a major concern to the accrediting board. The Department is in discussions with the Dean of the College of Science to address these issues.
The centralization of Information Technology Services (ITS) on campus left the Department of Computer Science with no dedicated support for its teaching and research support needs. The centralized model is unwieldy, slow, and has not served the Department well. It has impacted the students as software and hardware testbeds and learning environments have become outdated or unusable. We have been more dependent on the virtual environment of BayCloud, however, BayCloud has not proven to be consistently stable. The Department is in discussions with the College of Science to increase dedicated lab course support as is the norm for other lab-based disciplines, however, we find our department classroom teaching labs being reduced rather than increased.

Please fill in - Any equipment needs? 7 lecturers

The need for additional resources to fund readers, Teaching Assistants, and travel to academic conferences is little changed. Our outside reviewer specified lack of funding for continuing development and other department needs was a significant issue. The lack of funding is especially an important factor as we attempt to hire new faculty who are especially in need of grading support, and are expected to publish and present at conferences.

Library offerings have been uneven, with important database subscriptions cancelled and re-established. Access to a wide range of journals and conference proceedings is especially important as we plan to increase the rigor of our graduate courses under the semester system.

Assessment:

We created SLOs and PLOs for the Computer Science program in the academic year 2012-2013. The decision was made to use Blackboard as a means to provide students with an assessment exam that addresses the SLOs of each course which are aligned to the PLOs for each program and the ILOs of the university. We have these in place for approximately eight courses in the B.S. Computer Science program at this time. The results of these exams are being stored in a separate Blackboard shell repository for the department. Evaluating the results of these exams is challenging, as each assessment contains questions for multiple PLOs. Additionally, each instructor creates the assessments in different ways – some combining PLOs in one question and some keeping them separate. We are currently looking at averages over the entire exam. As we move to semesters, our undergraduate committee will create assessments which address only one PLO for each class thus simplifying the evaluation of data. Currently another challenge is addressing PLOs for courses that serve both the graduate and undergraduate degree programs. Under semesters this will not be an issue as graduate students will not be able to take undergraduate courses.

For changes made to close the loop for PLOs, adjustments are in an ad hoc manner. Instructors rotate for each class and may not be aware of the previous instructor’s assessment results. We have evaluated PLO’s 1, 2, 3, and 4. This year we evaluated PLO 1 and PLO 6.

Other: (e.g., major program modifications)

The B.S. Computer Science degree has been transformed with the goal of aligning the program with the ABET/CSAB accreditation standards. Changes include requiring a year of a lab science, increasing the
number of courses required by all majors, and increasing the number of programming languages to which students are exposed. Required courses now include: CS 401 Software Engineering, CS 311 Programming Languages, CS 211 Computer Organization and Assembly Language, CS 321 Architecture, CS 441 Computer Networks, and CS 231 Computers and Social Responsibility. Courses are grouped in the following categories: required math and science, required lower division, required upper division, and breadth and depth electives. At a minimum, students will gain experience programming in Assembly, Python, C++, and Java programming languages. The Software Engineering and Computer Network options were folded into the major requirements in order for all students to benefit from the course content.

Most courses in the new curriculum are 3 units. However, to allow students more time and practice developing their programming skills, we previously added a lab component to four of our programming intensive courses. In 2018-2019 we ran labs for CS 101 Computer Science I, CS 201 Computer Science II, CS 301 Data Structures, and CS 401 Software Engineering. However, due to funding and staffing constraints we now only offer lab components for CS 101 and CS201 starting Fall 2019. Courses that were previously cross-listed with engineering, Assembly language, Computer Architecture, now have a CS prefix while Digital Signal Processing and Architecture II will have the prefix ENG. We have eliminated tiered dual listed, undergraduate/graduate courses.

Previously, the Computer Science Department did not offer General Education (GE) courses. We submitted several courses for GE consideration. These include: CS 100 Programming for Everyone, CS 180 Computer Literacy, CS 300 Data Structures for Everyone, CS 350 Web Development for Everyone. CS 300 and CS 350 were accepted as B6 GE courses for 2019. We will also be submitting CS 470 Cyber Security Awareness for Everyone for area E.

In addition, we have introduced several new service courses to support a certificate program with Health Sciences. These include CS 100 Programming for Everyone, CS 200 Advanced Programming for Everyone, CS 350 Web development for Everyone, and CS 370 Databases for Social and Health Sciences. We also plan to extend this beyond a certificate and offer a minor titled Data Technology. The minor combines theories with emerging technologies, and uses evidence-based educational practices as well as contextualized problem-based pedagogy in which students acquire key technical knowledge and skills by solving real-world problems. The proposed required courses are CS100, CS200, CS300, CS350, and CS370.

Program Learning Outcomes (PLO’s) were modified and new curriculum maps and assessment plans were completed for the degree program.

II. SUMMARY OF ASSESSMENT (suggested length of 1-2 pages)

A. Program Learning Outcomes (PLO)
List all your PLO in this box. Indicate for each PLO its alignment with one or more institutional learning outcomes (ILO). For example: “PLO 1. Apply advanced computer science theory to computation problems (ILO 2 & 6).”

Students graduating with a Bachelor of Science in Computer Science will be able to:

1. apply knowledge of mathematics and computational theory to appropriate problems in computer science (ILO 2 & 6)
2. analyze a problem, and identify and define the resources and requirements needed for its solution (ILO 1)
3. design and implement a program to meet stated needs (ILO 6)
4. develop and maintain computer-based systems, processes, and platforms (ILO 1 & 6)
5. recognize and distinguish the mechanisms, components and architecture of computing systems (ILO 1 & 6)
6. employ current techniques, skills, and tools necessary for computing practice (ILO 1 & 2)
7. identify professional, ethical, legal, and security issues and responsibilities and the impact of computing on individuals, organizations, and society (ILO 5)
8. perform successfully on teams to accomplish a common goal, and communicate effectively in written and oral form (ILO 4)

B. Program Learning Outcome(S) Assessed
   List the PLO(s) assessed. Provide a brief background on your program’s history of assessing the PLO(s) (e.g., annually, first time, part of other assessments, etc.)
   
   We have evaluated PLO’s 1, 2, 3, and 4 in the past three years. This year we evaluate PLO 1 and PLO 6.

C. Summary of Assessment Process
   Summarize your assessment process briefly using the following sub-headings.
   Instrument(s): (include if new or old instrument, how developed, description of content)

   Blackboard Assessment Quizzes – questions with multiple choice answers

   Sampling Procedure:

   All students in the assessed course complete an assessment quiz at the end of the quarter

   Sample Characteristics:

   Percentage of correct/incorrect answers for each assessment question.

   Data Collection: (include when, who, and how collected)

   Instructor gathers results from their Blackboard course shell and sends them to the undergraduate assessment coordinator, Leann Christianson

   Data Analysis:

   Assessment coordinator compiles the results in tabular form.
D. Summary of Assessment Results

Summarize your assessment results briefly using the following sub-headings.

This year we are assessing

**PLO 1:** Apply knowledge of mathematics and computational theory to analyze problems in computer science, and identify and define the resources and requirements needed for their solution.

**PLO 6:** Perform successfully on teams to accomplish a common goal, and communicate effectively in written and oral form.

This PLO was assessed in CS 411 Automata and Computation (PLO 1 - Convert a problem to an equivalent formal representation), CS 401 Software Engineering (PLO 6 - Develop teamwork skills using current SW Management and Production tools)

**Main Findings:**

- **PLO 6:** CS 401 - Software Engineering - 1 section
  Questions 6-10, 60%

- **PLO 1:** CS 411 - Automata and Computation - 1 section
  All questions, 47%

**Recommendations for Program Improvement:** (changes in course content, course sequence, student advising)

Course content will be somewhat adjusted under semester conversion, however, we are not seeing content as an issue in these courses. In general, we are happy with the results, but realize there is a need for more courses to be assessed.

We have noticed that many students take courses out of sequence which hinders their success in moving forwards through their degree work. With the previous appointment of Dr. Christianson and now newly appointment of Dr. Erickson as undergraduate advisors, we have been reaching out to students for major advising with positive responses from students. In particular, we are targeting students with lower GPA’s.

**Next Step(s) for Closing the Loop:** (recommendations to address findings, how & when)

For changes made to close the loop, new PLO’s have been created for semester conversion. We have created standardized assessment quizzes for all required courses. Each quiz addresses a single PLO. With the assessments established, we plan to start looking for trends as data is collected and develop actionable strategies to address issues we find.
Other Reflections:

Currently, we do not have standardized assessments so consistency and validation is an issue. In addition, new lecturers are not always aware of the assessments and do not give them. We have created a standard repository for the assessment quizzes for easier deployment in the future. We also plan to add this procedure to a lecturer handbook that is currently under development.

E. Assessment Plans for Next Year
Summarize your assessment plans for the next year, including the PLO(s) you plan to assess, any revisions to the program assessment plan presented in your last five-year plan self-study, and any other relevant information.

Next year we will assess PLO 5.

III. DISCUSSION OF PROGRAM DATA & RESOURCE REQUESTS
Each program should provide a one-page discussion of the program data available through CAPR. This discussion should include an analysis of trends and areas of concern. Programs should also include in this discussion requests for additional resources including space and tenure-track hires. Resource requests must be supported by reference to CAPR data only. Requests for tenure-track hires should indicate the area and rank that the program is requesting to hire. If a program is not requesting resources in that year, indicate that no resources are requested.

A. Discussion of Trends & Reflections
Notable Trends:
Summarize and discuss any notable trends occurring in your program over the past 3-5 years based on program statistics (1-2 paragraphs). You may include 1-2 pages of supplemental information as appendices to this report (e.g., graphs and tables).

We have had 14% growth in class enrollments in MS and BS together with our fill rate reaching 93%. Currently our SFR is 32 with a Target or 30. We have a total of 27 faculty+lectures (11 CS regular faculty, 12 lecturers, 2 Eng Faculty, 2 Math faculty) teaching CS courses. For the past several years, we have had to rely more on heavily on lecturers. The majority of classes are now taught by lecturers.
Reflections on Trends and Program Statistics:

Provide your reflections on the trends discussed above and statistics and supplemental information presented in this report.

We will continue to have problems in the future to find lecturers and/or tenure track faculty with PhDs and teaching experience if we are not able to offer suitable compensation to match market demand for computer science and the high cost of living in the bay area. We run the largest MS program in COS with 270 international students, which brings ~3 million dollars to the university annually. For ABET and for our department, the majority of undergrad CS courses should be taught by regular faculty with PhD degrees. All the MS CS courses must be taught by PhD holders. To sustain this standards we need to hire more faculty. If we are unable to fill our tenure track positions this year, we will have to consider cutting our MS program.

B. Request for Resources  (suggested length of 1 page)

1. Request for Tenure-Track Hires

We have requested and been granted permission to hire two new faculty for the Fall 2019-20 year.

2. Request for Other Resources

We are in dire need of more computer lab classrooms as we compete with the rest of the University for scheduling these rooms. We are also in need of a dedicated information technology assistant.