Program Improvement Plan

2015-2016

Bachelor of Science

in

Computer Science

Compiled by

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1 General Considerations of Assessment for the CSCI Department

To offer an effective Bachelor of Science (BS) programs in Computer Science (CSCI) and Computer Information Systems (CINS), the CSCI department must be sensitive to the needs of many constituencies, and must continually assess the needs of those constituencies and continuously evaluate and improve its programs to accommodate their changing needs. The constituencies involved in the process include the faculty, employers, alumni, and students. Each group provides detailed information at some point in the process. The department's mission has been designed to reflect the mission of the College of Engineering, Computer Science and Construction Management and of the University as well as the needs of the aforementioned constituencies.

The mission and objectives of the Computer Science department’s two undergraduate programs, the Bachelor of Science in Computer Science (CSCI) and the Bachelor of Science in Computer Information Systems (CINS), are reviewed at least once every other year by representatives of all constituencies. Annually, the department chair presents the programs’ objectives and outcomes to the Industrial Advisory Board for discussion and also presents the annual Program Assessment Reports. The faculty, as a whole, evaluates the inputs from all sources annually to determine whether changes in the objectives and/or outcomes are warranted. If changes are made, the assessment plans for either or both programs are revised to reflect the changes.

The CSCI department is responsible for verifying that its graduates satisfy the educational objectives of its programs. The CSCI department’s Program Educational Objectives (PEOs), Program Outcomes (POs), Assessment Plans, and Assessment Reports for both programs are posted on the department website at http://csci.ecst.csuchico.edu/assessment. The current assessment plan features an embedded assessment cycle that allows annual summaries of embedded assessments of all Program Outcomes,
2 General Mission, Vision, Goals & Objectives for the University, College & Department

The following sections describe the Mission Statements of:

- the California State University, Chico,
- the College of Engineering, Computer Science and Construction Management, and
- the Computer Science Department

2.1 CSU, Chico:

2.1.1 University Mission, Vision and Goals Statements:

**Mission:** California State University, Chico is a comprehensive university principally serving Northern California, our state and nation through excellence in instruction, research, creative activity, and public service. The University is committed to assist students in their search for knowledge and understanding and to prepare them with the attitudes, skills, and habits of lifelong learning in order to assume responsibility in a democratic community and to be useful members of a global society.

The division of Academic Affairs advances the mission of the University to serve Northern California, the state, the nation and the global community through excellence in learning, scholarship and creativity, and public engagement.

**Vision:** California State University, Chico sees its distinctive residential context as an opportunity to create an active, diverse, healthy, caring, innovative, and green learning and working environment. We aim to create a vital and collaborative living and learning experience for students, who will appreciate and embrace the local, regional, and global communities of which we are all a part. We have a well-respected and dedicated faculty, a superior staff, and committed leadership together with cutting-edge learning and information resources. All of these assets are placed within a beautiful and engaging physical environment. We are a place devoted to the academy's most fundamental, tenets: reason, respect, civility, and community.
The division of Academic Affairs is a vibrant learning community of engaged students and well respected, dedicated faculty, staff and administrators—that is purposeful, inclusive, collegial, respectful and celebrative. We are known for excellence in learning, especially for our role of facilitating student learning and student success. We acknowledge our public purpose by developing, applying and exchanging knowledge and expertise for the mutual benefit of our community and our region. We bring about personal, organizational, national and global sustainable development through efforts that are intellectually honest, environmentally friendly, economically sound, politically viable, and socially just. By compelling example and through effective dialogue, we improve the human condition in the twenty-first century.

2.1.2 University Strategic Goals (USGs):

The University will:

- Enhance student learning—both inside and outside the classroom.
  - Recruit, enroll, retain and graduate a diverse, high-quality student population.
  - Offer excellent and distinctive programs.
  - Deliver active, collaborative and transformative pedagogies.
  - Support student participation in regional, national and international learning opportunities.
  - Ensure access to the most effective information and learning resources.
  - Provide superior student support systems.
  - Demonstrate educational effectiveness.

- Nurture excellence in faculty and staff.
  - Recruit, develop, and retain a diverse, excellent faculty and staff.
  - Strengthen and integrate teaching, scholarship, student learning and public service.
  - Support professional growth and achievement.
  - Recognize value and celebrate outstanding performance.

- Educate for a sustainable global society.
o Deliver curricular and extra-curricular programs for sustainability.
o Promote scholarly and creative activities in sustainability.
o Provide regional leadership for sustainable development practices.
o Assist the University to serve as a model sustainable campus.

• Serve the North State and beyond.
o Address diverse educational needs.
o Stimulate sustainable economic development.
o Support a rich cultural and artistic environment.
o Collaborate through mutually beneficial public engagement initiatives.

• Strategically manage resources in support of mission, shared values and vision.
o Marshal resources to achieve mission, vision and goals.
o Align all resources to achieve mission, vision and goals.
o Foster a culture of evidence-based planning and decision making across all units.
o Demonstrate organizational effectiveness.

2.1.3 University Strategic Priorities (USP):

• Believing in the primacy of learning, we will continue to develop high-quality learning environments both inside and outside the classroom.
• Believing in the importance of faculty and staff, and their role in student success, we will continue to invest in faculty and staff development.
• Believing in the wise use of new technologies in learning and teaching, we will continue to provide the technology, the related training, and the support needed to create high quality learning environments both inside and outside of the classroom.
• Believing in the value of service to others, we will continue to serve the educational, cultural, and economic needs of Northern California.
• Believing that we are accountable to the people of the State of California, we will continue to diversify our sources of revenue and strategically manage the resources entrusted to us.
Believing that each generation owes something to those which follow, we will create environmentally literate citizens, who embrace sustainability as a way of living. We will be wise stewards of scarce resources and, in seeking to develop the whole person, be aware that our individual and collective actions have economic, social, and environmental consequences locally, regionally, and globally.

2.2 The College of Engineering, Computer Science, and Construction Management:

2.2.1 College Mission and Vision Statements:

Mission: We prepare students for successful professional careers in applied science, engineering, and technology. We educate them to be successful leaders and innovators capable of meeting complex challenges. We shape the college mission through our values:

- We teach, mentor, motivate, and challenge students
- We foster rich learning environments
- We advance scholarship and creativity
- We encourage industry engagement and collaboration
- We promote teamwork through projects and co-curricular activities
- We value graduate education and life-long learning
- We create a new generation of problem solvers for a sustainable future

Vision: We will:

- be known for providing supportive learning environments
- be known for our focus on student success
- be known for our commitment to community service
- be known for our commitment to high quality technical education throughout the North State and beyond
- be known for embracing the scholarship of applied sustainable practices
- be committed to continuous improvement
- be the programs of choice for our students and their employers
2.3 The Department of Computer Science:

2.3.1 Mission and Vision Statements:

Mission: The Department's Mission is to advance knowledge in the computing sciences by providing our students with the highest quality educational experience. The Department strives to:

- Provide excellence in teaching;
- Develop a community of scholars that includes faculty, staff, students and alumni;
- Provide service to others; and
- Respond to the changing demands for trained computing professionals.

Vision: The department prepares students for fulfilling careers in the computing sciences by providing an excellent educational experience within an engaging, friendly, learning community. Our efforts in teaching, research, and service make our department an important regional, national, and international resource center for the advancement of our discipline and for the development of computing and information technology systems and applications.

3 BS Program in Computer Science:

3.1 Computer Science Program Educational Objectives:

The program objectives of the B.S. in Computer Science program at California State University, Chico are to produce graduates who:

A. are able to apply the principles of computer science, mathematics, and scientific investigation to solve real world problems appropriate to the discipline;
B. are able to apply current industry accepted computing practices and new and emerging technologies to analyze, design, implement, and verify high quality computer-based solutions to real world problems;
C. exhibit teamwork and effective communication skills;
D. understand the ethical and technical context of their professional obligations and contributions;
E. are able to positively and appropriately apply knowledge of societal impacts of computing technologies in the course of career related activities; and
F. are successfully employed or accepted into a graduate program, and demonstrate a pursuit of lifelong learning.

The set of six Program Educational Objectives (PEOs) expresses the career and professional accomplishments that the program is preparing graduates to achieve, and is assessed from three to five years after graduation. Such objectives provide a meaningful expression of the department’s vision and mission. That mission and those accomplishments are consistent with the institutional mission as well as strategic objectives and priorities as described in Table 1, below.

The CSCI program objectives can be mapped directly to the University’s Mission Statement. Because the University’s Mission Statement is quite general, it is quite simple to map the department's Program Objectives to it.

The key difference between the University Mission and the Department’s CSCI PEOs is that the CSCI PEOs are stated in terms of the attainments of successful graduates, whereas the University’s mission is stated entirely in terms of how it will support learning among its students. CSCI PEOs A, B, D, E and F all relate directly to the University Mission of providing our students with “the knowledge, skills, and moral and intellectual virtues that form the basis for life-long learning and contribution.” Although the issue of teamwork, central to CSCI objective C, is not explicitly present anywhere within the stated University Mission, it is universally recognized as being required for effective performance in most application environments and has always been strongly recommended by the program’s Industrial Advisory Board (IAB).
<table>
<thead>
<tr>
<th>PEOs</th>
<th>Objectives</th>
<th>USGs*</th>
<th>USPs*</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>are able to apply the principles of computer science, mathematics, and scientific investigation to solve real world problems appropriate to the discipline;</td>
<td>3, 4</td>
<td>4, 5</td>
</tr>
<tr>
<td>B.</td>
<td>are able to apply current industry accepted computing practices and new and emerging technologies to analyze, design, implement, and verify high quality computer-based solutions to real world problems</td>
<td>3, 4</td>
<td>4, 5</td>
</tr>
<tr>
<td>C.</td>
<td>exhibit skills in effective oral and written communication, critical thinking, leadership, and teamwork;</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>D</td>
<td>understand the ethical and technical context of their professional obligations and contributions;</td>
<td>5</td>
<td>4, 5, 6</td>
</tr>
<tr>
<td>E.</td>
<td>are able to positively and appropriately apply knowledge of societal impacts of computing technologies in the course of career-related activities; and</td>
<td>5</td>
<td>5, 6</td>
</tr>
<tr>
<td>F.</td>
<td>are successfully employed or accepted into a graduate program, and demonstrate a pursuit of lifelong learning</td>
<td>4, 5</td>
<td>4, 6</td>
</tr>
</tbody>
</table>

*USG: University Strategic Goals (section 2.1.2).

*USP: University Strategic Priorities (section 2.1.3).
3.2 Process for Establishing PEOs:

The CSCI program has retained a number of the CSCI program PEOs for many years. However, the current set of PEOs is an amendment of the previous set, and dates from 2007, when the program was modified to collapse the existing four program options, Math-Science, Systems, Graphics and General, into a single, unified major. The decision to change the curriculum was motivated by the need to implement the most recent ACM recommendations, Industry Advisory Board recommendations, and was made in response to the fact that only a very small number of students was enrolling in options other than the General CSCI option. The Industrial Advisory Board and current students were closely involved in these changes. While both the IAB and students were directly involved in discussions regarding curricula, the current PEOs were adopted by the faculty and presented to the IAB for discussion at the time they were changed.

The interests of all constituencies were considered by the faculty in amending the Educational Objectives, although not all constituencies were directly involved in the process. The process produced a set of program objectives that addressed the needs of the Students, their Employers, the College, the University, and the State. The department made a concerted effort to communicate these objectives to all students who are planning to enter the program and to all students currently in the program at the time they were being considered.

Table 2, below, illustrates that the needs of each constituency are addressed at least once by the Program Educational Objectives.
### Table 2: CSCI PEOs and the Needs of Constituencies.

<table>
<thead>
<tr>
<th>Constituency</th>
<th>Needs</th>
<th>PEOs*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>Employment</td>
<td>A,B,C,D,E,F</td>
</tr>
<tr>
<td></td>
<td>Acquisition of Skills</td>
<td>A,B</td>
</tr>
<tr>
<td></td>
<td>Contribution to Society</td>
<td>C,D,E</td>
</tr>
<tr>
<td></td>
<td>Lifelong Learning</td>
<td>F</td>
</tr>
<tr>
<td>Employers</td>
<td>Technical Skills</td>
<td>A,B</td>
</tr>
<tr>
<td></td>
<td>Professional Responsibility</td>
<td>D,E</td>
</tr>
<tr>
<td></td>
<td>Professional Ethics</td>
<td>D,E</td>
</tr>
<tr>
<td></td>
<td>Working in Teams</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>Communication Skills</td>
<td>C</td>
</tr>
<tr>
<td>College</td>
<td>Student Success</td>
<td>A,B,C,D,E</td>
</tr>
<tr>
<td></td>
<td>Reputation of Graduates</td>
<td>A,B,C,D,E,F</td>
</tr>
<tr>
<td></td>
<td>Contribution to College Mission</td>
<td>A,B,C,D,E,F</td>
</tr>
<tr>
<td>University</td>
<td>Contributing Membership in Campus Community</td>
<td>C,D,E</td>
</tr>
<tr>
<td></td>
<td>Enhancement of University's Academic Status in System and State</td>
<td>A,B,C,D,E,F</td>
</tr>
<tr>
<td></td>
<td>Skilled Workforce for Grants &amp; Contracts</td>
<td>A,B,C</td>
</tr>
<tr>
<td>State</td>
<td>Highly Skilled Workforce for Economic Development</td>
<td>A,B,C</td>
</tr>
</tbody>
</table>

*Refer to section 3.1.

The needs for the University, and College were determined by studying their mission statements and mapping the CSCI program objectives to them. The needs of the employers...
have been based on years of interaction with the department’s IAB, the industrial experience and consulting that CSCI faculty members have been engaged in, the continuing contact between CSCI faculty members and the employers who have hired our students via meetings at Job Fairs, and periodic surveys of employers. The needs of the Students were based on CSCI faculty experience with current students and responses a questionnaire that is completed by all graduating seniors.

The educational objectives for the CSCI program have been amended over the many years the program has existed. As noted above, however, the most recent changes occurred in 2007, when the current CSCI curriculum was amended. The faculty arrived at a proposed set of objectives and requested feedback from the program’s IAB. The changes were enthusiastically supported by that group and by students representing the various student organizations in the department.

3.2.1 The Roles of Constituencies:

3.2.1.1 Role of the Industry Advisory Board:

The IAB consists of representatives from industry and government selected by the Department Chair in consultation with the faculty and the college dean. The members are all past, current, or prospective employers of CSCI graduates. Both the CINS and CSCI programs share a common IAB because many, if not all of the members hire the graduates of both programs. A list of the current IAB members is shown in Table 3, below. It is presumed that the membership of the IAB will be in constant flux, due to the relocation of various members of the board, and the CSCI Department Chair must work to ensure that the IAB membership always has an active membership that is representative of the companies and organizations that employ CSCI program graduates.
With new department chair leadership in 2012, the chair took on the task of building a high-profile Industry Advisory Board that would robustly represent the diverse range of employers of our students. This rebuilding of a strong advisory board has resulted in top executives (Presidents, CEOs, CIOs, Executive Vice Presidents, Software Development Managers, etc.) from over 30 distinguished companies who currently sit on the board. The six local Chico software companies (11 Main, Build, EXL Landa, Milestone Technologies, Sungard-BiTech and Wanderful Media) are all represented on the board as well.

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jeff Schlict, CEO</td>
<td>11 Main</td>
<td><a href="mailto:jeff.schlicht@11main.com">jeff.schlicht@11main.com</a></td>
</tr>
<tr>
<td>Ray Kaminski, Software Dev.</td>
<td>11 Main</td>
<td><a href="mailto:ray.kaminski@11main.com">ray.kaminski@11main.com</a></td>
</tr>
<tr>
<td>Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chris DiGiorgio, Principal</td>
<td>Accenture</td>
<td><a href="mailto:Chris@csdigio.com">Chris@csdigio.com</a></td>
</tr>
<tr>
<td>Leon Warman, Head AWS</td>
<td>Amazon</td>
<td><a href="mailto:lrwarman@gmail.com">lrwarman@gmail.com</a></td>
</tr>
<tr>
<td>Development</td>
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</tr>
<tr>
<td>Dan Davis, VP Software Dev.</td>
<td>Build.com</td>
<td><a href="mailto:dan@build.com">dan@build.com</a></td>
</tr>
<tr>
<td>Frank Zamani, Pres. and CEO</td>
<td>Caspio</td>
<td><a href="mailto:Frank.Zamani@caspio.com">Frank.Zamani@caspio.com</a></td>
</tr>
<tr>
<td>Travis Hayes, Software Dev.</td>
<td>Chevron</td>
<td><a href="mailto:THHV@chevron.com">THHV@chevron.com</a></td>
</tr>
<tr>
<td>Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kevin Kinnell, Indep. Conslt.</td>
<td>ChicoStart</td>
<td><a href="mailto:kevin@innovate-northstate.com">kevin@innovate-northstate.com</a></td>
</tr>
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<td>Ahmed Khattab, Software Dev.</td>
<td>CISCO</td>
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<td>Manager</td>
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<tr>
<td>Dan Kish, Software Dev.</td>
<td>EJ Gallo Winery</td>
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<tr>
<td>Manager</td>
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</tr>
<tr>
<td>Name</td>
<td>Title</td>
<td>Company</td>
</tr>
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<td>Ed Hohberg</td>
<td>Software Dev. Manager</td>
<td>EXL Landa</td>
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<td>Jay Dunlap</td>
<td>Snr. Vice President</td>
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<tr>
<td>Mark Fitzpatrick</td>
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<td>Aaron Gomez</td>
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<td>Adam Vasquez</td>
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<td>Catherine Rodgers</td>
<td>Exec. Vice President</td>
<td>IBM</td>
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<td>Robin Goldstone</td>
<td>Software Dev. Manager</td>
<td>Lawrence Livermore Lab</td>
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<td>Kim Cupps</td>
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<td>Lawrence Livermore Lab</td>
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<td>Manu Mehta</td>
<td>CEO and Pres.</td>
<td>Metabyte</td>
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<td>Dave Hodson</td>
<td>Software Dev. Manager</td>
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<td>Scott Shamblen</td>
<td>Software Dev. Manager</td>
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<td>Jeff Fisher</td>
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<td>NAVAIR</td>
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<td>Rob Salmon</td>
<td>Div. President</td>
<td>NetApp</td>
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<td>Tony Velcich</td>
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<td>Oracle</td>
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<td>Mike Burkert</td>
<td>Software Dev. Manager</td>
<td>Workday</td>
</tr>
</tbody>
</table>

**Table 3 Members of the Chico CSCI Industry Advisory Board June 2015**

Rebuilding the Advisory Board and starting a ‘Friends of Computer Science’ program has resulted directly in over $140,000 being donated to the department. These funds have partially been used for recruiting excellent faculty. Five new tenure-track faculty each received $10,000 additional in their hiring packages directly from the Department for their professional development. The funds have also been used to fund student activities, equipment and travel. The Department bought a new server to be used exclusively by our Security courses with some of the ‘Friends’ donations, also.
The Computer Science Industry Advisory Board meets twice yearly, once in the fall on-campus and once in the spring in the Silicon Valley. The results of two fall 2014 advisory board exercises are contained in this report. One exercise featured feedback on our program educational objectives and the other featured feedback on current skills and courses needed in the workplace. Those results are shared in the relevant sections of this report.

During the semi-annual meetings, the Board is presented the most recent annual Program Assessment Reports for each program, and asked to provide feedback about the programs’ objectives and outcomes. The discussion that ensues is very informative, and often results in specific changes to specific course curricula. The minutes of these meetings are summarized in the following year’s Program Assessment Reports and are presented to the faculty for discussion at the faculty meeting immediately following the IAB meeting. The topics presented by the IAB often continue to be discussed in multiple department meetings throughout the months following the IAB meeting.

At times, as when the department worked on the major curriculum revisions for CSCI, members of the IAB are asked to provide detailed feedback to issues via e-mails and telephone in addition to the annual formal meeting.

During the fall 2014 Industry Advisory Board Meeting the Board members, faculty and some student leaders all participated in an Interactive Workshop to identify crucial skills desired of the current graduates of the program. This workshop was received with great enthusiasm and the Department has decided to include such a workshop on the agenda for every fall meeting in the future. The questions posed and the extensive results of the workshop are attached in Appendix F.

3.2.1.2 Role of the Students in the Program:

The officers and members of several student organizations for CSCI and CINS students are frequently asked to provide feedback, particularly when curricular issues are involved. In addition, all graduating seniors take a questionnaire about their experiences in the program as undergraduates. The context for this questionnaire is the capstone project course: CSCI 490. The data from these Exit Surveys are summarized and related to Program Outcomes in
the annual Program Assessment Report and are also presented to the faculty at a regular faculty meeting as soon as these data become available, which is generally in the fall of the year following the collection of data. ..

3.2.1.3 Role of the Alumni in the Program:

The department communicates with this group primarily through meetings, campus visits, advancement visits to Sacramento and the Bay area, email, mail, and telephone conversations. The Departmental holds large ‘alumni reunions’ every two years. The last such event took place at the Tech Museum of Innovation in April of 2014, when the department celebrated its 45th anniversary. The IAB meeting was held at an adjacent time slot on the same date so that additional alumni could participate in the IAB meeting. New faculty were introduced and the state of the Department and its curriculum were discussed.

3.2.1.4 Role of the University Administration:

Most of our communications from the administration occur via the Dean and Associate Dean of the College. Additionally, the department chair invites various administrative officers to attend faculty meetings to provide input on important topics and answer questions from the faculty on a case-by-case basis. In a given year it is expected that various department meetings will include the Provost, at least one Dean from another College, and several other Department Chairs, from both inside and outside the College of Engineering, Computer Science and Construction Management.

4 Achieving PEOs:

The Computer Science Department's program assessment cycle/process for CSCI, shown in Figure 1, is based on Dr. Gloria Roger's Model for Quality Assurance of Student Learning Outcomes:
In particular, the Computer Science Department assesses the CSCI Program Educational Objectives (PEOs) and Program Outcomes (POs) regularly for the continuous improvement of the program.

4.1 The Industry Advisory Board (IAB) Meetings:

Members of the IAB are generally called upon to meet at least once per year. Although the meeting is generally held in the Bay Area so as to encourage better attendance by IAB members, it is sometimes scheduled in Chico. The decision as to when and where the meeting will occur is made by the Department Chair, in consultation with both IAB members and faculty.

The agenda, which generally includes the presentation of the past year’s Program Assessment results, is distributed in advance of the meeting, and detailed minutes are made of the proceedings. Relevant highlights of the meetings are generally included in the Program Assessment Report in the following year.
5 CSCI Program Outcomes:

Program outcomes are defined as “statements that describe what students are expected to know and be able to do by the time of graduation that enable them to meet the objectives.” The Program Outcomes for the Computer Science program are listed below:

Our CSCI graduates must demonstrate:

a. An ability to apply knowledge of computing and mathematics appropriate to the discipline.

b. An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.

c. An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.

d. An ability to function effectively on teams to accomplish a common goal.

e. An understanding of professional, ethical, legal, security and social issues and responsibilities.

f. An ability to communicate effectively with a range of audiences.

g. An ability to analyze the local and global impact of computing on individuals, organizations, and society.

h. Recognition of the need for and an ability to engage in continuing professional development.

i. An ability to use current techniques, skills, and tools necessary for computing practice.

j. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.

k. An ability to apply design and development principles in the construction of software systems of varying complexity.

These outcomes are posted on the department web site, at

http://csci.ecst.csuchico.edu/assessment/b.s.-in-computer-science/outcomes. They also
appear in a number of departmental documents, including the Program Assessment Plans, and the CSCI Program Assessment Reports found on the department web site.

5.1 Process for Establishing Outcomes

The Computer Science Department amended its list of outcomes to the current list at the time that it revised its program, folding four different options into a single option major in spring, 2007. At that time, the department decided to adopt the list of CSCI outcomes used by CAC if it could be validated by the IAB, alumni employers, alumni, and current students. From spring, 2007 to the present, the amended list of objectives and outcomes has been repeatedly presented and discussed with all of these groups via formal meetings, many e-mails and telephone conversations. In that time, no changes have been requested for any of the amended CSCI outcomes. In fact, the only major effort required for the change during that period of time was the mapping of the new outcomes to the objectives, and to the various measures used to assess those outcomes.

5.2 Relating Program Outcomes to Program Educational Objectives:

Our program outcomes identify what our graduates are expected to know or be able to do upon graduation. Table 4 below, lists the program objectives and the specific CSCI program outcomes that relate to each program objective.

<table>
<thead>
<tr>
<th>Program Objectives</th>
<th>Program Outcomes</th>
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<tbody>
<tr>
<td>A</td>
<td>a b c d e f g h i j k</td>
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<tr>
<td>A</td>
<td>X X X</td>
</tr>
<tr>
<td>B</td>
<td>X X X</td>
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</tbody>
</table>

Table 3: Program Objectives X Program Outcome Matrix
All CSCI Program Outcomes are closely associated with specific PEOs, and all of the PEOs can be assessed by examining the attainment of outcomes that are related to them. Many of the outcomes are measured by embedding them into courses, using direct tests for selected outcomes in the assessment of student performance and in the grading processes. These measures are augmented by indirect assessment of outcomes via (1) exit surveys of graduating seniors, (2) the Major Field Test (MFT) in Computer Science and (3) inputs from the Industrial Advisory Board. Performance on the various outcomes reflects upon their related objectives. Problems encountered in the assessment process may cause the objectives, and the outcomes associated with them, to be re-examined.

The direct assessment used in the outcomes is related to objectives A, B, C, D and E (i.e., the objectives related to all outcomes) and the measure is generally well integrated into the curriculum of the courses(s) chosen for the assessment of each Program Outcome. Consider, for example, CSCI 301, which is a core course in CSCI curriculum. This course is designed, in part, to address outcomes that relate specifically to PEOs C and D, which state that students will “exhibit skills in effective oral and written communication, critical thinking …,” and “understand the ethical and technical context of their professional obligations and contributions,” respectively. As shown in Table 4, these PEOs are related to Program Outcomes d (this portion of PEO C is not implemented in CSCI 301), e (“an understanding of professional, ethical, legal, security and social issues and responsibilities”), f (“an ability to communicate effectively [via speaking and writing] with a range of
audiences “) and g (“an ability to analyze the local and global impact of computing on individuals, organizations, and society”). These outcomes are reflected in specific questions included in quizzes and tests, and in other measures of classroom performance which are carefully chosen with this intent. Students who are successful in these measures are presumed to have achieved the outcomes targeted by the question sets. Similar rationales exist for every course in which embedded assessment of the outcomes that relate to these PEOs is done. Indirect assessments of these objectives are done via surveys of graduating students, and meetings with the IAB, which includes employers who have very specific outcomes they use as hiring criteria.

PEO C (“[alumni will] exhibit skills in effective oral and written communication, critical thinking, leadership, and teamwork”) is directly related to Program Outcomes d (“an ability to function effectively on teams to accomplish a common goal”), and f (“an ability to communicate effectively with a range of audiences”). These Program Outcomes are assessed in courses in which teamwork and/or communication is a major component. Assessment can take the form of determining each team-member’s effectiveness via anonymous reports, or by using a rubric to assess the student’s speaking and/or writing skills. Copies of some of these rubrics may be found in the portion of the department web site devoted to assessment.

Objective F is assessed by the simple expedient of querying graduating students about their employment prospects and by tracking the advancement of their careers. Surveying students’ employment prospects also occurs in the capstone course entitled “Directed Programming Experience,” which serves multiple purposes, including the determination of whether students recognize the necessity for a lifetime of learning to stay current in the discipline. The campus Placement Center maintains records of placements. Unfortunately, the accuracy of these records is impacted by the fact that they are based entirely on hiring that happens within the context of the Center’s interview and placement process, and many students either fail to provide follow-up information or obtain positions outside of the formal campus interview process and fail to update the Placement Center’s records. Additional input on this topic comes from the same surveys used to indirectly assess Outcomes associated with Objectives A, B, C, D and E. Finally, many of the individuals who hold
current positions on the Industrial Advisory Board are graduates of the program, and their observations reflect their own experience as well as those of a network of classmates.

5.3 Assessing CSCI Program Outcomes

5.3.1 Embedded Assessment:

Table 5, below, details the current alignment between the program core courses and the program student learning outcomes. The specific courses and the semesters they were used for the embedded assessment of specific outcomes are shown in Table 6.
<table>
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<tr>
<th>Core Courses</th>
<th>Student outcomes</th>
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<td></td>
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<tr>
<td>Area B3 (of General Education) Course</td>
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<tr>
<td>Science Course with a Lab (e.g., NSCI 102, CIVL 175, etc.)</td>
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<tr>
<td>CSCI 111 Programming and Algorithms I</td>
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<tr>
<td>MATH 120 Analytic Geometry and Calculus</td>
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<tr>
<td>MATH 121 Analytic Geometry and Calculus</td>
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<tr>
<td>CSCI 211 Programming and Algorithms II</td>
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<tr>
<td>PHYS 204A Mechanics</td>
<td>P</td>
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<td>PHYS 204B Electricity and Magnetism</td>
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<td>EECE 237 Embedded System Programming (with Assembly Language)</td>
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<td>CSCI 301 Computer's Impact on Society</td>
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<td>CSCI 311 Algorithms and Data Structures</td>
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<td>EECE 320 Computer Architecture</td>
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<td>CINS 370 Introduction to Databases</td>
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<td>CSCI 430 Software Engineering</td>
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<tr>
<td>CSCI 446 Intro to Comp Networks &amp; Network Management</td>
<td>A</td>
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<td>CINS 448 Survey of Computer Security</td>
<td>A</td>
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<td>CINS 465 Web Programming Fundamentals</td>
<td>P</td>
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<td>CSCI 490 Directed Programming Experience</td>
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<td>CSCI 515 Compiler Design</td>
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<td>CSCI 551 Numerical and Parallel Programming</td>
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<td>CSCI 580 Artificial Intelligence</td>
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A = assessed, P = practiced, I = introduced

Table 4: Core Course Program Outcome Matrix
## CSCI Program Outcomes

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<tr>
<th>Course</th>
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<td><strong>CSCI 301:</strong> Computers &amp; Soc-</td>
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<td><strong>CSCI 311:</strong> Algo, &amp; Data-</td>
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<td><strong>CSCI 340:</strong> Operating Syst.</td>
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<td><strong>CSCI 446:</strong> Computer Netw</td>
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<td><strong>CINS 370:</strong> Database Mgm</td>
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<td><strong>CSCI 430:</strong> Softw. Engin.</td>
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<td><strong>CINS 465:</strong> Web Programming</td>
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An ability to apply knowledge of computing and mathematics appropriate to the discipline.

An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.

An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet common goal.

An understanding of professional, ethical, legal, security and social issues and responsibilities.

An ability to function effectively on teams to accomplish a range of audiences.

An ability to communicate effectively with a range of audiences.

An ability to analyze the local and global impact of computing on individuals, organizations, and society.

Recognition of the need for and an ability to engage in continuing professional development.

An ability to use current techniques, skills, and tools necessary for computing practice.

An ability to apply mathematical foundations, algorithm design and development principles, and computer science theory in the modeling and construction of software systems of varying complexity.
The 2015-16 embedded assessment data for each outcome is to be based on data from an average of at least two courses, and at sometimes 3. An example of the Microsoft Excel form used for embedded assessment is shown in Appendix C. In years prior to 2009, the assessment cycle required measures for each outcome only once every three years. The annual cycle that has been in place since 2010 results in more frequent measures and should yield more stable information that enables meaningful comparisons to be made. Appendix F shows a ‘Combined Spreadsheet’ of all courses assessment over 2014-2015. This spreadsheet is used to collect all faculty embedded assessment measures and comments on the assessment metric effectiveness and any plans for improving results for the following semester.

### Analysis of Embedded Assessment Results:

A sample of the table summarizing the results, and the graph of those results is shown in Appendix D. The department has already found this format to be more useful than past methods of reporting, as the trends from yearly updates allow for more frequent and more
meaningful discussions with the faculty about changes to the curriculum to improve performance.

The Microsoft Excel “Workbooks” used to collect the embedded assessment data also allow ample space for faculty reflections on (1) the number of students passing their established criterion, (2) the effectiveness of the measure, and (3) suggested changes to the measure or to the curriculum. The 2014-15 report summarizing these comments in tabular form is shown in Appendix E, and this general format will be retained in future assessment reports.

5.4 Indirect Assessment of the Program Outcomes:

5.4.1 Senior Exit Survey:

The senior exit survey conducted by the college gives an indirect measure of how well graduating students feel they have met the program outcomes. The data from this survey are generally not available until the fall of the academic year following their collection.

The specific questions asked in the survey and the Program Objectives (POs), if any, that each relates to are listed below.

- “Did you take your introductory course to the major at CSUC?”
- “My introductory courses provided a good background/foundation for the major.”
- “My major prepared me to be able to design a system or component to meet specifications using modern tools.” (POs b, c, i)
- “My major prepared me to be able to document (internally in source code, and externally in user manuals and/or reports) a system or component to meet specifications using modern tools.” (POs f, b, c, i)
- “My major prepared me to be able to implement a system or component to meet specifications using modern tools.” (POs a, b, c, i)
- “My major prepared me to be able to test and verify a system or component to meet specifications using modern tools.” (PO c, i)
“My major prepared me to be capable of comparing and evaluating the performance, effectiveness, and suitability of alternate programming solutions to a problem.” (POs a, b, c, j, k)
“My major prepared me to have a solid understanding of basic (theoretical) principles in my major.” (POs i, j)
“My major prepared me to have a solid understanding of basic (applied) principles in my major.” (POs a, b, c, j)

The actual forms used for this survey are shown in Appendix D. The analysis of these data gives an indirect perspective of whether various outcomes are being attained. It has proved to be useful to separate the data summaries of students who are Community College transfers from “native” students who began college at CSUC.

5.4.2 Major Field Test (MFT):

The Computer Science Department uses Educational Testing Service’s (ETS) Major Field Test (MFT) in Computer Science for indirect assessment of the B.S. in Computer Science degree program. The MFT is administered to graduating seniors registered in the CSCI program’s capstone course, CSCI 490. CSCI 490 is offered every semester.

The MFT is a standardized, nationally normed test that provides assessment information in the form of cumulative score statistics. The questions on the MFT are known to cover program outcomes a, b, c, i, and j:

a. An ability to apply knowledge of computing and mathematics appropriate to the discipline;
b. An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution;
c. An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs);
i. An ability to use current techniques, skills, and tools necessary for computing practice); and
j. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices).

The results from this test are used for (1) an analysis of the general pattern of results for a given year’s graduates, and (2) the annual scores’ trend with regard to the percentile rank of CSUC CSCI majors in relation to national statistics.

The trend graph documenting CSUC students’ performance in the *MFT in Computer Science* for the past five years is shown in Appendix E.

6 **Continuous Assessment: Conclusions and Concerns:**

The primary purpose of the CSCI Program Assessment Report is to assess how well the program is preparing its graduates to meet Program Educational Objectives, and whether students are achieving the Program Outcomes by the time of graduation. The findings of the annual report are used by the department to amend the curriculum, course content, and other elements that impact student performance to better achieve the objectives of the program.

Because the primary purpose is the improvement of the program, the most critical feature of the report will be to identify those areas in which it is showing unacceptable, or trends toward unacceptable, performance with regard to outcomes and objectives.

Below is a summary of the embedded assessment outcomes from 2014-15 and the plans for improving these assessment measures during 2015-16:

**Summary of Outcome Assessment**

**Outcome a):** Neither direct nor indirect assessment data indicate that there is need to develop an improvement plan to increase attainment of this outcome.

**Outcome b):** Neither direct nor indirect assessment data indicate that there is need to develop an improvement plan to increase attainment of this outcome.
Outcome c): Neither direct nor indirect assessment data indicate that there is need to develop an improvement plan to increase attainment of this outcome.

Outcome d): Direct assessment data indicates that there is no need to develop an improvement plan to increase attainment of this outcome. Indirect assessment does shows mixed results with results varying from very high to marginal. There doesn't seem to be enough evidence to indicate an improvement plan is needed.

Outcome e): Both direct and indirect assessment data indicate that there is no need to develop an improvement plan to increase attainment of this outcome.

Outcome f): Both direct and indirect assessment data indicate that there is no need to develop an improvement plan to increase attainment of this outcome.

Outcome g): Neither direct nor indirect assessment data indicate that there is need to develop an improvement plan to increase attainment of this outcome.

Outcome h): Neither direct nor indirect assessment data indicate that there is need to develop an improvement plan to increase attainment of this outcome.

Outcome i): Direct assessment of this outcome occurred in multiple (three) courses: CINS 465, Web Programming, and CSCI 340, Operating Systems Concepts and CSCI 490, the Senior Project Capstone course. While Professor Henry in CINS 465 had a satisfactory result with 80.35% of his students achieving the designated metric and 88% of his students achieved the designated metric in CSCI 490, Professor Dixon saw only 68% of his OS students achieve the desired metric. A weighted average using the number of students in the three courses did bring the overall averaged metric up to 80%. Professor Dixon plans on using more in-class examples and exercises to assist students with the OS programming concepts covered and we will re-assess this outcome in fall 2015 to look for subsequent improvement. Indirect assessment using the Senior Survey shows a score of 4.31 out of 5 on a Likert scale and does not indicate cause for concern as an indirect measure.

Outcome j): Direct assessment of this outcome occurred in multiple (two) courses: CINS 465, Web Programming, and CSCI 340, Operating Systems Concepts. While Professor
Dixon saw 81% of his OS students achieve the desired metric, Professor Henry in CINS 465 had a concerning performance with only 61% of his students achieving the desired metric. A weighted average using the number of students in the two courses did bring the overall averaged metric up to 65%, but this is still less than the desired score of 70% that the department has set for attainment of this outcome. Professor Henry plans to update the course to include more discussion of design and good programming practices. Clearly students need more instruction in these areas. This will be part of our Program Improvement Plan for 2015-16 and the Department will reassess this outcome at the end of fall 2015. Another recent modification to the curriculum, to require a prerequisite web-programming course prior to taking CINS 465 should also assist in improving results for outcome J). The new prerequisite course, and Introduction to Web Programming, CINS 110 using JavaScript, will also give students more exposure to multiple languages and will help ensure that all students have a solid background in web programming before taking CINS 465. Indirect assessment using the Senior Survey shows a score of 3.64 out of 5 on a Likert scale. With the desired score of 3.5 or higher in this outcome, indirect assessment does not overtly indicate concern, yet seeing this this score of 3.64 dropped from 4.64 the previous year, the planned course improvements prompted by direct assessment are warranted.

**Outcome k):** Both direct and indirect assessment data indicate that there is no need to develop an improvement plan to increase attainment of this outcome.

### 6.1 Program Educational Objectives:

In addition to the assessment of how well current graduates are meeting CSCI Program Objectives, the utility of the objectives themselves must be re-examined on an annual basis. This determination is largely the purview of the IAB, in conjunction with the faculty. The data of the full assessment report provides a context for the discussion. In fact, the semi-annual IAB meeting traditionally begins with a presentation of the annual Program
Assessment Reports, and a discussion of the Program Objectives immediately follows this presentation.

6.2 Program Outcomes:

The program outcomes provide a more immediate and more detailed perspective of the efficacy of the program, and, because the outcomes are more closely tied to specific courses, the annual Program Assessment Report provides a detailed perspective of the contributions of the various courses included in the major, particularly of core courses.

Like the Program Objectives, the CSCI Program Outcomes must also be re-examined annually to determine whether they are appropriate to the goals of the program. This re-examination is done in the same manner as the re-examination of the Program Objectives.

As was noted above, the embedded assessment program allows annual summaries for all outcomes. The Department uses this thorough assessment schedule to assist in to recognizing important trends and the more quickly responding to them.
7 Appendix A: Embedded Assessment Excel Form
# Appendix A: Sample Excel Spreadsheet used for Embedded Data Collection

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<tr>
<th>A</th>
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<td>12</td>
<td>Description:</td>
<td>An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.</td>
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<td>20</td>
<td>Reflections on the number of students passing; i.e., do you feel the measure reflects what the students are learning?</td>
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<td>21</td>
<td>Perceived effectiveness of the measures used in this assessment; do you believe that the measure is the best one we can do for this outcome and this class?</td>
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<td>22</td>
<td>Do you think any changes to either the class or the assessment should be made?</td>
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**Notes:** You can right-click on the sheet tab to copy a sheet in case you need most of the contents duplicated for another program outcome for the same course and section(s).
### Appendix B: Summary Format for Embedded Data

#### Table 6: Trends in Embedded Assessment Data for CSCI Program.

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<td>3.47</td>
<td>4.63</td>
<td>4.23</td>
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<td>4.43</td>
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<tr>
<td>c</td>
<td>Design/eval system</td>
<td>4.20</td>
<td>4.29</td>
<td>3.93</td>
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<tr>
<td>d</td>
<td>Work on teams</td>
<td>4.58</td>
<td>5.00</td>
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<td>4.51</td>
<td>4.69</td>
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<tr>
<td>e</td>
<td>Prof./ethical responsib</td>
<td>4.74</td>
<td>4.00</td>
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<td>4.58</td>
<td>4.42</td>
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<td>f</td>
<td>Communicate</td>
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<td>g</td>
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<td>Prof. development</td>
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<td>i</td>
<td>Current tools</td>
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<td>Apply theory</td>
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<td>k</td>
<td>Construct systems</td>
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(Note: red text in a cell marks scores falling below department criterion of 3.5)

The data in the table above is shown graphically on the following Figure:
Effective Display of Trends in Embedded Assessment Results
9 Appendix C: Embedded Assessment - Faculty Reflections Form
<table>
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<th>Problem/Observation</th>
<th>Action Taken</th>
<th>Results</th>
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10 Appendix D: Senior Exit Survey Form
Graduating Senior Survey

College of Engineering, Computer Science, and Construction Management
CSU, Chico

Dear Graduating Senior,

The College of ECC has developed the enclosed survey to give you a forum for letting us know what you think of your experience at CSU, Chico, and to help us to continually improve the curriculum and services we offer. We care a great deal about the programs and your feedback is essential to helping us provide the highest quality education we can deliver. Thank you in advance for your time and attention to this survey.

We hope the years you have spent with us have enriched your life and provided you with the foundation for a successful career. Please stay in touch!

With best wishes, The College of ECC Faculty

---

1. Major
   - APCG
   - CMSC
   - ME
   - CM
   - CSCI
   - MECA
   - EE
   - MFGT

2. Graduation date
   - Semester
     - Spring
     - Summer
   - Year 2000

3. Did you come to Chico State as a...
   - First-time freshman
   - Transfer

4. How many semesters did you attend Chico State?
   - 1-3
   - 4-6
   - 7-9
   - 10-12
   - 13+

5. What is your overall GPA?
   - Below 2.25
   - 2.25 - 2.49
   - 2.50 - 2.74
   - 2.75 - 2.99
   - 3.00 - 3.24
   - 3.25 - 3.50
   - 3.51 - 3.74
   - 3.75 - 4.00

6. If you had an internship, co-op, or job related to your major while in school, how valuable was the experience?
   - Did not have internship, co-op, or job
   - Very valuable
   - Valuable
   - Somewhat valuable
   - Not valuable

7. If you were involved in any student/professional society, activities, or clubs, how valuable was the experience?
   - Was not involved in societies, activities, or clubs
   - Very valuable
   - Valuable
   - Somewhat valuable
   - Not valuable

8. Immediately after graduating are you planning to...
   - Attend graduate school
   - Yes
   - No
   - Begin working
   - Yes
   - No

If you are NOT planning to work full-time, or if you have not begun looking for a job, please skip to Question 13.

9. How many job offers have you received?
   - None
   - One
   - Two
   - Three
   - Four or more

10. Do you currently have a job offer that you are likely to accept?
    - Yes
    - No

    If ‘Yes,’ please provide:
    - Company name:
    - Your job title:
    - Starting annual salary:
      - Less than $30K
      - $30-40K
      - $41-50K
      - $51-60K
      - $61-70K
      - $71K or more

11. If you interviewed through the campus Career Planning & Placement Office, how helpful was it?
    - Did not interview through campus office
    - Very helpful
    - Helpful
    - Somewhat helpful
    - Not helpful

12. If you found a job that you are likely to accept, how did you find it?
    - Campus Career Planning & Placement Office
    - Faculty/department referral
    - Online posting
    - Mailed resume
    - Personal connections
    - Other:

13. Did you take a comprehensive exam (FE, CM, MFT or other) for your discipline?
    - No, did not take
    - Yes, and passed
    - Yes, and did not pass
    - Yes, and waiting for results

14. If you took a comprehensive exam, did you also attend a review course to prepare you for the exam?
    - Yes
    - No

    If ‘Yes,’ how valuable was the course?
    - Very valuable
    - Valuable
    - Somewhat valuable
    - Not valuable
### Educational Satisfaction Questions

At Chico State, how satisfied were you with the...

1. Quality of teaching by faculty in your department
2. Quality of teaching by other faculty
3. Access to faculty in your department
4. Availability of courses in your department
5. Quality of courses in your department
6. Access to laboratory facilities and equipment
7. Quality of laboratories and equipment
8. Access to computer facilities
9. Quality of computer facilities
10. Academic advising from your major advisor
11. Academic advising from the University Advising Office
12. Career information from your department
13. Availability of General Education courses
14. Quality of General Education courses
15. The overall quality of your education
16. Your overall experience at Chico State

### Program Outcomes Questions

Based on your educational experience here at Chico State, how well prepared are you to...

17. Apply knowledge of math, science, engineering, or technology to solve problems
18. Design and conduct experiments
19. Analyze and interpret experimental data
20. Design a component or system to meet desired needs
21. Function on a multidisciplinary team
22. Identify, formulate, and solve technical problems
23. Communicate technical matters in writing
24. Communicate technical matters orally
25. Understand and apply professional and ethical principles
26. Understand contemporary issues facing society
27. Use modern tools and technology
28. Enter the workplace
29. Continue learning
30. I would recommend my major program at CSU, Chico to others.

### Supplemental Questions

11 Appendix E: Sample MFT Results and Trend Data
Appendix E: Indirect Assessment using the Major Field Test (MFT) for Computer Science

The MFT for Computer Science measures knowledge and application of computing practices and principles and indirectly measures student learning outcomes a), b), i) and j). Every senior taking CSCI 490, the Senior Project Course, must take the MFT for Computer Science during the semester that they are in the class, whether they take it in fall or spring. The scores are averaged over the Academic year. Below is the graph of the low, median and high scores for the last 5 years with the data table below. Note: The top possible score is 200 on the exam.

![CSCI Seniors Scores on MFT for the Past 5 Years]

**Figure 4-1 CSCI majors Scores on the MFT**

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<td>173</td>
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<td>Low</td>
<td>138</td>
<td>131</td>
<td>142</td>
<td>136</td>
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<td>154.00</td>
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<td>Number of seniors tested</td>
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<td>24</td>
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</table>

**Table 7 Five Year Results Major Field Test (MFT) in Computer Science**

The Computer Science faculty have set the metric for successful performance on the MFT at having 50% of the students achieve the median score or higher on the MFT. The most recent (2014)
A comparative data guide for the MFT shows that the high score of 184 is in the 97th percentile, the median score of 157 is in the 66th percentile and the low score of 134 is in the 16th percentile. Thus, the high score was quite respectable and the median score is better than more than half of the students completing the exam. Of the 33 seniors who took the MFT in 2014-15, 22 or 67% earned scores above the national median of 149. The national median was calculated over the years 2011-2014, based on a total of 5528 students from 79 different US universities. The median score for Chico State Computer Science BS seniors in 2014-15 was better than that of 3503 of the total 5228 students who have taken the MFT between the years 2011 to 2014 inclusive. That is, 22 of 33 Chico State seniors did better than 3503 of the 5228 students that took the test in that 3 year span. While the Department has the goal of 70% or more of our seniors scoring above the national median, we still feel that this is a very respectable result for our seniors.
12 Appendix F: Industry Advisory Board Interactive Workshop
Questions and Sample Results from fall 2014
Appendix F: Continuous Improvement Method: Fall 2014 Interactive Workshop with Computer Science Industry Advisory Board – Results

Feedback from fall 2014 Industry Advisory Board workshop on needed skills of our Graduates:

Background: The Computer Science Department held its regular bi-semester meeting in the fall of 2014 on the Chico campus. This meeting was well-attended with over 20 members present. Computer Science tenure-track faculty member Todd Gibson conducted an interactive workshop in which groups 5 groups of 4 or 5 members walked around the room with their groups and gave their thoughts on the five key questions below. The workshop was quite dynamic, all members truly enjoyed it and many stated: “This is why we wanted to be on your board, to be able to give you this feedback.”

1) What skills have recent graduates acquired that are of little use? Or, what misconceptions do recent graduates have when they walk into their first job?

Misconceptions:
+ Expectation to make "big impact" day 1. (you need to be prepared to learn, and work your way up)
+ Some work will always be mundane -- deal with it!
+ You might have to work with someone else's code.
+ Process/paperwork exists and may slow you down.
+ Lack of understanding of the big picture and the life cycle (operations) of a system as application
+ Acquired & of little use: traditional Software Development Approaches
+ Misconception that their learning has just ended...it has just started -- they need to understand there is a lot to learn
+ Misconception that employers don't care how often grads change jobs.
+ The "halo effect" matters

2) What skills do you expect a Master's graduate to have that an undergraduate typically doesn't have?

+ Be able to work independently and start contributing without much new training
+ Have real world experience, e.g., summer internship
+ self-starter - Understand root cause (analysis) and carry projects through completion (end-to-end).
+ out-of-the-box creativity, i.e., transformation vs incremental
+ software development best practices and design patterns/architectural approaches.
+ Specialization in a certain field
+ collaboration skills
+ Advanced understanding in architecture
+ Algorithms/analysis
+ There is Science in C.S. - not just programming

3) **What skills (independent of tool/environment) do you want your recently graduated hires to have that they currently lack?**

+ Needs, Approach, Benefits, Competition (NABC) type skills
  - 1 minute elevator pitch
  - presentation of ideas to influence decision makers
  - Ability to "boil up" the details to a big picture view
+ Familiarity with popular toolsets/environments (git, AWS, Google analytics)
+ Ability to assess "build vs buy"
+ Flexibility/adaptability. This requires fundamental problem solving skills and solid CSCI fundamentals
+ SQA or more generally, Quality
+ Development life cycle: requirements, design, build, test, ...
+ team software development - source control
+ learn how to fail fast
+ SCRUM, Agile methodology
+ Crisp & clear communications
  - write a one-pager
  - deliver an elevator pitch
+ Think outside the box.
+ Hacker mentality
+ Change control, compliance
+ Project Management, interpersonal skills (esp. between [engineers?]), understanding business needs), project scoping
+ storyboarding - take ideas and build into (ideas?)

4) **Of the (tool/environment independent) skills that college graduates do have to varying degrees, which are most-important?**

+ technical competence
+ problem solving
+ work in a group - listen & communicate
+ Initiative
+ Must have base level of several important skills
  - Collaboration
  - Technical competence
  - Analytical thinking
  - Inquisitiveness
+ Problem solving
+ Debugging complex environments
+ versatility/adaptability
+ Willingness to understand big picture of company's objectives, not just write code
+ Technical depth
+ be good students, i.e., understand & execute on what senior staff are telling them
+ client-side development
+ Grow (reverse engineer) other people's code.
+ do not over-iterate on code - knowing the balance of when code is good enough.
+ JavaScript, SQL, HTML/CSS - If they know this we can use them day 1

5) If you could add any course(s) to the curriculum (may be tool/environment specific), what would you add?

+ UX - User Experience ("Don't make me think")
+ Mobile Development (Responsive design, iOS, Android, HTML 5)
+ Interpersonal skills - How to remain human and interact with your organization
+ Project Management
+ Java
+ Analytics
+ Testing - Development lifecycle
+ Agile Methodologies
+ Cyber security/CS
+ Systems at scale
+ Parallel programming/distributed computing
+ Cloud computing - How to build an app in the cloud, e.g., AWS, Open Stack
+ Client-side development, e.g., JavaScript, not just C or C++ Programming
13 Appendix G: Excel Spreadsheet of Combined Embedded Assessment 2014-15
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<th>Column 3</th>
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**Note:** The table continues with similar entries.
<table>
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<tr>
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</tr>
<tr>
<td>Spring</td>
<td>3</td>
<td>A</td>
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</tr>
</tbody>
</table>

CSU, Chico: B.S. in Computer Science
Program Improvement Plan

2015-2016