

University of La Verne

External Review

Computer Science

And

Computer Engineering

December 15, 2013

David Falconer, Ph.D.

## ABSTRACT

This report documents the results of a program and department review of the Computer Science and Computer Engineering program at the University of La Verne on November 15, 2013. The reviewer commends the faculty on the notebook which they compiled in preparation for the review, which was very insightful. He also appreciates the supplemental tables subsequently supplied which updated offering and enrolment data. The visits with administrators, faculty, and students were very productive.

## SUMMARY

The program has clearly articulated its program goals and objectives for majors and minors. The learning outcomes for majors and minors are also clearly articulated.

The program is very innovative in that it combines significant elements of three of the traditional computer-related degree programs (Computer Science, Computer Engineering, and Information Systems) to give students a unique breadth of experience and perspective. Nonetheless, each course meets generally accepted standards of its parent discipline.

The quality of the program is enhanced and assessed by its combination of internships, seminars, projects, and the comprehensive exam.

The program seems to be pushing against capacity issues. The need for more faculty is illustrated in the subsequent discussion of accreditation and meetings with students brought out some space limitations in the laboratories (no open lab time.) The review notebook also noted the lack of laboratory space for laboratory sessions, particularly in the networks course.

The action recommendations in the notebook should be prioritized to help guide follow-through.

The greatest strength of the program is its three full-time faculty members who are knowledgeable, tireless, and caring. There is great appreciation within the student body for having them as their faculty.

Overall, the department seems to be at a crossroads. Should it expand? Or not? If so, in what direction(s)? Should there be an effort to become accredited?

## EXPANSION ISSUES

Probably the most pressing need in the workplace is expertise in cyber-security and related topics. If you will pardon me making reference to my home campus, the Mihaylo College of Business and Economics has a new hire in the security area and has introduced their first course in the current catalog; they are actively recruiting additional faculty with this expertise. In the College of Engineering and Computer Science, the Computer Science Department has recently hired two experts in cyber-security and is now offering two courses; three additional course proposals have started through the approval cycle and we project that at least four more course proposals will enter the approval cycle by Fall, 2014. The department is working hard to recruit one more full-time faculty member for this area; further, we have a retired trusted systems engineer from Raytheon helping us part time. The Computer Engineering faculty have two approved courses ready to offer and hiring a full-time specialist in cyber-security is their first priority. Finally, Cal State Fullerton has a very successful certificate program in computer forensics, which is managed by University Extended Education.

Specifically, there were questions about possible high demand concentrations and certificate programs. At the moment cyber-security and related topics should be investigated for expansion possibilities in both areas.

The existing certificates are appropriate and should help new graduates in the job market.

Computer Engineering tends to be a smallish program on many campuses and is very frequently combined with electrical engineering and/or computer science where there is a departmental structure. However, the department should consider adding an embedded systems course, which would involve purchase of hardware and certainly the use of laboratory space outside formal laboratory sessions.

The demand for master's degrees in computer science per se is pretty stable; however, the interest in master's degrees in software engineering is pretty robust, particularly for on-line programs. Cal State Fullerton started an on-line master's degree in software engineering several years ago, admitting two cohorts of 30 students each, every Fall. After a few years demand waned a bit and it required robust marketing to keep admissions up. Now, things have turned around and consideration is being given to admitting three cohorts this coming Fall. Fullerton has also started a "face-to-face" version of the program, admitting a cohort of 30 students for the Spring. This has been actively marketed to prospective students in Asia who will come to California for the duration of the program. Only a small handful of the students who have been admitted for this first cohort are local residents. Implementation of such a program requires the introduction of about eight (8) three-unit courses and the staffing to take on 30 three-unit projects concurrently at the end of the program. Copious information about the necessary courses is available from the Software Engineering Institute at Carnegie-Mellon University in Pittsburgh, PA.

## ACCREDITATION

There were a number of questions concerning accreditation. The program is titled “Computer Science and Computer Engineering”. Both computer science and computer engineering degree programs are accredited by ABET, formerly an acronym for Accreditation Board for Engineering and Technology but, since since 2005, now the formal name of the organization. One of the complicating factors in the accreditation process is that computing programs, including those called computer science, are accredited by the Computing Accreditation Commission (CAC), while engineering programs with a computer modifier in their titles are accredited by the Engineering Accreditation Commission (EAC), both commissions being part of ABET.

Departments with both computer engineering and computer science in their names frequently offer two different programs leading to two different degrees. California State University, Long Beach, which has a Department of Computer Engineering and Computer Science is the closest example. It is common in such cases for representatives from CAC and EAC to come at the same time to examine both programs concurrently. One can also point to analogous cases involving departments with electrical engineering and computer science in their names.

An ABET CAC document entitled “Criteria for Accrediting Computing Programs” and an abridgement of ABET EAC’s “Criteria for Accrediting Engineering Programs” are included as appendices.

Let’s examine one way to move forward on a path to accreditation. Since I am not well-versed in the engineering heritage at La Verne and the nuances inherent in the current name of the program, it is inappropriate for me to make a firm recommendation on the long-term use of the word “engineering”. However, for sake of discussion, let’s consider using the current curriculum as a basis for adding a BS in Computer Science, which could be a candidate for accreditation.

## BS IN COMPUTER SCIENCE

Fitting a high unit major with mandated supporting requirements and a healthy general education component is difficult to do within 128 units, particularly when the overwhelming majority of the courses are four (4) or five (5) units. One solution is to offer many of the advanced courses in the major as three (3) unit courses. A few units can also be gained by combining CMPN 280: Computer Organization and CMPS 371: Assembly Language into a single three (3) unit course. This has been done in many programs including the California statewide transfer curriculum in Computer Science developed as a result of SB 1440.

ABET requires one year of mathematics and science in support of the computer science major as part of a computer science degree. While many details would need to be worked out, the following course lists suggest an ABET-accredited curriculum.

Suggested mathematics and science:

MATH 201	Calculus I (4)
MATH 202	Calculus II (4)
MATH 327	Discrete Mathematics (4)
MATH ???	New Course – Probability/Statistics (4)
PHYS 203	Mechanics (5)
PHYS 204	Electricity and Magnetism (5)
CHEM 201	General Chemistry (5)
Or	
BIOL ???	

Note that PHYS 201/202 do not meet ABET norms.

Here is a sample set of required courses typical of majors in ABET-accredited programs. In general 4-unit versions of these courses already exist in the current curriculum:

CMPN/CMPS ???	New Course – Computer Organization and Assembly Language (3)
CMPS 301	Programming Concepts (4)
CMPS 367	Object Oriented Language C++ (4)
CMPS 368	Principles of Computer Networks (3)
CMPS 370	Seminar (1)
CMPS 385	Data Structures (4)
CMPS 399	Software Engineering (3)
CMPS 400	Analysis of Algorithms (3)
CMPS 451	Artificial Intelligence (3)
CMPS 455	Compiler Design (3)
CMPS 460	Operating Systems (3)
CMPN 480	Advanced Computer Architecture (3)
CMPS 490	Data Base Management Systems (3)
CMPS 499	Senior Project (1)
	Comprehensive Exam

In the near future, I expect that a course in security will become common-place. Curriculum recommendations from the Association for Computing Machinery, IEEE-Computer Society, and the Software Engineering Institute all recommend such a course be added.

## OTHER ACCREDITATION ISSUES

The faculty criterion for an ABET-accredited program states that “some full-time faculty members must have a Ph.D. in computer science”, which implies hiring at least one additional faculty member with a Ph.D. in computer science.

Based on experience with recent accreditations, the number of different class preparations for each full-time faculty member each semester would probably be a problem, particularly given the other elements of the faculty work load. Eliminating over-load teaching assignments would be a start in addressing such concerns. Also, expectations of research, given the overall workload, may well be a problem in the accreditation process.

## THE CURRENT PROGRAM

What changes might be made to the current program if a BS in Computer Science were implemented? There would need to be a reconciliation of course unit values, resulting in the possible opportunity to take more elective courses. I would highly recommend that if units are opened up in the Software Concentration by combining CMPN 280 and CMPS 371, that CMPS 399 be added to the Software Concentration. In fact, getting CMPS 399 into the Software Concentration by whatever means is very desirable.

## INTERACTION WITH OTHER PROGRAMS

I was asked to think about possible interactions with other programs. One possibility which comes to mind is to develop a course or some joint research with the Biology Department in the area of bioinformatics.

While it would probably serve only a few students, a concentration area in Scientific Computing in conjunction with the Mathematics Department is a possibility. The concentration could be based on an additional year of mathematics (calculus and/or linear algebra?), CMPS 362, and a mathematical modeling class. This concentration doesn't require any new courses.

I appreciate the opportunity to have worked with the La Verne community and will be glad to answer questions and/or elaborate on any of the issues raised.

Best wishes for the future,

David Falconer, Ph.D.