ABET, Inc.
111 Market Place, Suite 1050
Baltimore, MD 21202
Phone: 410-347-7700
Fax: 410-625-2238
www.abet.org
accreditation@abet.org

Applied Science Accreditation Commission
Computing Accreditation Commission
Engineering Accreditation Commission
Technology Accreditation Commission

August 13, 2007

Reza Abbaschian
Dean
Bourns College of Engineering
University of California, Riverside
A342 Bourns Hall
Riverside CA 92521

Dear Dr. Abbaschian:

The Computing Accreditation Commission (CAC) of ABET recently held its 2007 Summer Meeting to act on the program evaluations conducted during 2006-2007. Each evaluation was summarized in a report to the Commission and was considered by the full Commission before a vote was taken on the accreditation action. The results of the evaluation for University of California, Riverside are included in the enclosed Summary of Accreditation Actions. The Final Statement to your institution that discusses the findings on which each action was based is also enclosed.

The policy of ABET is to grant accreditation for a limited number of years, not to exceed six, in all cases. The period of accreditation is not an indication of program quality. Any restriction of the period of accreditation is based upon conditions indicating that compliance with the applicable accreditation criteria must be strengthened. Continuation of accreditation beyond the time specified requires a reevaluation of the program at the request of the institution as noted in the accreditation action. ABET policy prohibits public disclosure of the period for which a program is accredited. For further guidance concerning the public release of accreditation information, please refer to Section II.L. of the *2006-2007 Accreditation Policy and Procedure Manual* (available at www.abet.org).

A list of accredited programs is published annually by ABET. Information about ABET accredited programs at your institution will be listed in the forthcoming ABET Accreditation Yearbook and on the ABET web site (www.abet.org).

California, Riverside, University of

It is the obligation of the officer responsible for ABET accredited programs at your institution to notify ABET of any significant changes in program title, personnel, curriculum, or other factors which could affect the accreditation status of a program during the period of accreditation.

Please note that appeals are allowed only in the case of *Not to Accredit* actions. Also, such appeals may be based only on the conditions stated in Section II.G. of the *2006-2007 Accreditation Policy and Procedure Manual* (available at www.abet.org).

Sincerely,

Lawrence G. Jones

Lawrence Jones, Chair
Computing Accreditation Commission

Enclosures: Summary of Accreditation Actions
Final Statement

cc: France A. Cordova, Chancellor
Dennis K. Rice, Assistant Dean, Bourns College of Engineering
Lynn R. Carter, Visit Team Chair

ABET
Computing Accreditation Commission

Summary of Accreditation Actions
for the
2006-07 Accreditation Cycle

University of California, Riverside
Riverside, CA

Computer Science (BS)

Accredit to September 30, 2013. A request to ABET by January 31, 2012 will be required to initiate a reaccreditation evaluation visit. In preparation for the visit, a Self-Study Report must be submitted to ABET by July 1, 2012. The reaccreditation evaluation will be a comprehensive general review.

This is a newly accredited program. Please note that this accreditation action extends retroactively from October 1, 2005.

ABET
Computing Accreditation Commission

FINAL STATEMENT

to

UNIVERSITY OF CALIFORNIA
Riverside, CA

Dates of Visit:	8 – 10 October, 2006
Team Chair:	Lynn Robert Carter Carnegie Mellon University in Qatar Doha, Qatar
Program Evaluators:	Herbert L. Dershem Hope College Holland, MI

UNIVERSITY OF CALIFORNIA, RIVERSIDE

FINAL STATEMENT
2006-2007 EVALUATION

This is a confidential statement from the Computing Accreditation Commission to the University of California, Riverside. It is intended for internal use only and is not for release except as allowed by policies of ABET, Inc.

I. INTRODUCTION

The University of California, Riverside, is a major research university among the ten University of California campuses. A national center for the humanities, it offers its roughly 17,000 students a supportive, collegial learning environment with nationally and internationally recognized faculty dedicated to the highest standards in research, teaching, and public service.

Located on nearly 1,200 acres near the Box Spring Mountains in Southern California, the park-like campus provides convenient access to the vibrant and growing Inland region, the local mountains, and beautiful beaches creating an excellent environment while a wide array of industrial, commercial, and community provides opportunities for robust real-world scholarly engagement.

The Computer Science and Engineering Department, within The Marlan and Rosemary Bourns College of Engineering, has 26 faculty members dedicated to its the undergraduate computer science program serving 330 undergraduate students (fourteen of which are part time) and 139 graduate students (six of which are part time). The department also offers a Computer Engineering program, which has been accredited and is once again being evaluated by the Engineering Accreditation Commission of ABET, as well as an Information Systems program that has not been accredited and is not being evaluated at this time. These programs are clearly distinguished from one another in University publications.

The Computing Accreditation Commission (CAC) of ABET evaluated the BS Degree in Computer Science of the University of California, Riverside during the 2006-07 cycle for possible accreditation under the CAC/ABET "Criteria for Accrediting Computing Programs", dated October 29, 2005.

II. REPORT OF FINDINGS FROM THE CAC EVALUATION VISIT

The *Criteria* are divided into seven major *categories*, each containing a statement of *intent* and *standards*. The intents provide the underlying principles that each program must meet to be accredited. The standards provide a description detailing how a program can meet the intent. A

program can meet an intent either by satisfying all the associated standards or by demonstrating an alternate implementation.

This section contains the report of the findings at the time of the visit. CAC considers the following comments to relate directly to its accreditation actions. This section is structured as follows. For each category a statement summarizing whether the program meets its intent follows the statement of intent. All deficiencies, weaknesses, and concerns related to the category are then summarized, and detailed findings are presented. For better understanding, the reader may refer to a copy of the *Criteria*.

A. Objectives and Assessments

Intent: The program has documented, measurable objectives, including expected outcomes for graduates. The program regularly assesses its progress against its objectives and uses the results of the assessments to identify program improvements and to modify the program's objectives.

The program meets the intent of the Objectives and Assessments Category by satisfying all associated standards with no concerns.

The program shares assessment services with the other programs in the Bourns College of Engineering, which employs a number of assessment vehicles, both indirect and direct, to provide insight into its performance. A detailed data gathering plan employs direct assessment data from course examinations every term. In addition, data from end-of-term course evaluations and faculty assessments are gathered every term. There also are annual alumni surveys, annual employer surveys, and the program gathers data from its very active Board of Advisors annually. It has a documented set of four educational objectives and eleven related outcomes for graduating students that are measurable (Standards I-1 and I-2). Data relative to the objectives and outcomes are collected on a detailed schedule and the results are captured in a very powerful and easily accessible database (Standard I-3). The assessment process addresses each outcome and educational objective at least once a year and usually once a term (Standard I-4). On-line copies of minutes retained by the program show that the faculty members meet regularly to analyze and evaluate the data (Standard I-6). The Self-Study and provided documentation made available during the visit document a number of multi-cycle, data-driven, examples of curricular and program improvements (Standard I-5).

The visiting team notes that the self-study provided prior to the visit contained numerous inconsistencies and lacked some required material. In particular, requested assessment documentation and analysis results were not provided. While this material was provided during the visit, the team had to divert considerable effort to evaluating the objectives and assessment criteria, effort that should have been invested in other activities.

B. Student Support

Intent: Students can complete the program in a reasonable amount of time. Students have ample opportunity to interact with their instructors. Students are offered timely guidance and advice about the program's requirements and their career alternatives. Students who graduate the program meet all program requirements.

The program meets the intent of the Student Support Category by satisfying all associated standards with no concerns.

The combination of professional advisors and faculty mentors serve the students well. Required courses and elective courses are offered on a regular schedule, and the students verified they are able to complete the program in a timely manner (Standard II-1). Students commented that the faculty members are readily accessible because of reasonable sized class as well as their regular and extensive office hours. In addition, an innovative undergraduate research program augments and enhances faculty-student interactions (Standard II-2).

Regular and very active monitoring of progress by experienced Student Affairs advisors provides solid guidance on how to complete the program. Students agreed that the advisors were effective as well as knowledgeable and that the available on-line and paper documentation was also effective (Standard II-3). In addition to the Student Affairs advisors, the college has a career advisor to augment the mentoring and career advising the faculty performs. The students were united in their satisfaction with both categories of advising (Standard II-4).

Transcripts reviewed by the visiting team showed that the procedures employed by Student Affairs to review the students' completed courses and to document course substitutions for graduation are effective in ensuring students meet the requirements of the program (Standard II-5).

C. Faculty

Intent: Faculty members are current and active in the discipline and have the necessary technical breadth and depth to support a modern computer science program. There are enough faculty members to provide continuity and stability, to cover the curriculum reasonably, and to allow an appropriate mix of teaching and scholarly activity.

The program meets the intent of the Faculty Category by satisfying all associated standards with no concerns.

The department has twenty-six full-time faculty members, all of whom teach in the program and cover nearly all the courses. Twelve of these faculty members are full professors and each teaches at least one class in the undergraduate program each year, while some teach more. Well-qualified and very effective industrial adjuncts and graduate students cover four courses. The team was impressed by the engagement of the full-time faculty and the department chair to oversee all of the courses (Standards III-1, III-2, and III-3).

Thirteen faculty members have PhD's in computer science (Standard III-7), and the rest have appropriate graduate-level experience for the courses they teach. Those without graduate work in computer science have acquired the knowledge over the years by industrial work, self-study, and workshops (Standard III-6). All remain current in the discipline through research, consulting, and/or conference attendance (Standard III-5). The faculty's diverse areas of expertise, currency in the discipline, and dedication have established an excellent computer science curriculum (Standard III-4).

Faculty are all active in scholarly activities and the program supports this with teaching loads of only three term length courses per year for pre-tenure faculty, 3.5 term length courses for tenured faculty, and 9 term length courses per academic year for instructors. Departmental oversight keeps a focus on both quality of education and research (Standard III-8).

Faculty do not typically perform program advising, leaving that to the professional advisors from Student Affairs. The faculty members participate in a first year mentoring program. The goal of this program is to launch the students in a good direction and both the students and the faculty members seem to value this program. Since the professional advisors perform the bulk of the heavy program advising, the current load of mentoring spread over the faculty does not appear to be a burden (Standard III-9).

D. Curriculum

Intent: The curriculum is consistent with the program's documented objectives. It combines technical requirements with general education requirements and electives to prepare students for a professional career in the computer field, for further study in computer science, and for functioning in modern society. The technical requirements include up-to-date coverage of basic and advanced topics in computer science as well as an emphasis on science and mathematics.

The program meets the intent of the Curriculum Category by satisfying all associated standards. However, there is a concern with respect to Standard IV-17 that constitutes a weakness with respect to the Curriculum Category.

The computer science curriculum is cohesive and consistent with both the objectives and the learning outcomes of the program and with the ACM/IEEE Computing Curricula 2001 recommendations.

Particularly noteworthy is the ENG 180 course, Technical Communications, which focuses on oral and written technical communications. This course requires a great deal of oral and written work that deals nicely with the critical communications problems practicing professionals will likely face working with management, peers, and users in engineering domains, such as computer science. This course works particularly well with CS 179, the capstone project course, where the concepts and skills are applied to a real project.

General

The program requires 25 quarter hours of computer science core and 51 quarter hours of advanced materials for a total of 76 quarter hours, equivalent to just over 50 semester hours of coverage, exceeding the standard of 40 semester hours. The textbooks used are up-to-date and the displays provided detailed information that shows the courses are current as well (Standard IV-1). In addition, the program requires 28 quarter hours of mathematics and 18 quarter hours of science for a total of 46 quarter hours, equivalent to just over 30 semester hours, satisfying Standard IV-2.

The requirements for the major include 51 quarter hours (equivalent to 34 semester hours) from designated humanities, social sciences, arts, and other disciplines that serve to broaden the background of the student (Standard IV-3). Each of the expected outcomes for graduating students is mapped into the required courses. The depth of knowledge to be developed in the courses and the metrics for measuring the success of attainment are clearly defined. The provided course syllabi state the objectives of the courses and an explicit mapping to the program outcomes is provided (Standard IV-4).

Computer Science

Students take 25 quarter hours (equivalent to just over 16 semester hours) of a broad-based computer science core. This coverage of algorithms, data structures, software design, concepts of programming languages, and computer organization and architecture just exceeds the requirement for 16 semester hours (Standard IV-5 and IV-6). A careful review of the displays convinced the team that the theoretical foundations, problem analysis, and solution design are stressed within the core (Standard IV-7). All students work in both the Linux and Windows environments as well as learn and use C++, VHDL, and an assembly language. Review of the course displays indicated that these languages were indeed present to the extent required. In addition, several other courses exposed students to other higher-level languages (Standard IV-8). The program also requires 50 quarter hours (equivalent to 33 semester hours) of advanced work, which is more than double the work required by Standard IV-9.

Mathematics and Science

The program requires that students take 28 quarter hours (equivalent to just over 18 semester hours) of mathematics, exceeding the requirement of 15 semester hours (Standard IV-10). This coursework includes discrete mathematics, differential and integral calculus, and probability and statistics (Standard IV-11). In addition, there is a requirement for 18 quarter hours (12 semester hours) of science, which meets Standard IV-12. A three quarter (equivalent to two semester) laboratory physics sequence for engineering or science majors is required, which satisfies Standard IV-13. Finally, the program requires students to take a total of seven additional quarter hours from courses that enhance the student's abilities in the application of the scientific method (Standard IV-14).

Additional Areas of Study

The visiting team was particularly impressed with the approach the program employs to address oral and written communication skills development. An excellent course, Engineering 180, is used to develop these skills and it does it within the engineering and business domains. The application of these skills is accomplished in one of the versions of the capstone project course, CS 179. Other courses also develop and apply oral and written communication skills, but ENG 180 and CS 179 together are a very nicely linked pair in this regard (Standard IV-15 and IV-16).

There was very little evidence of student work demonstrating an understanding of social and ethical issues of computing in the displays for all but one of those classes that claimed coverage in the course syllabi. Discussion with the faculty led the team to conclude that there is confusion about how these topics should be covered. In particular, pointing to design documents and bi-weekly status reports as proof of coverage of these topics is not adequate, and the department chair agreed. It is clear that one required course does cover the topic, but given that so few faculty members understand what constitutes adequate coverage, there is considerable risk that a slight change in teaching assignments could allow students through the program without adequate coverage of this topic. There is a concern that the current lack of faculty consensus in addressing the social and ethical implications of computing in their classes may quickly result in an inadequate coverage of this topic (Standard IV-17). This concern leads to a weakness with respect to the Curriculum Category.

The visiting team notes that the course displays provided at the start of the visit did not provide adequate evidence of feedback to students on submitted work, and did not contain adequate documentation of oral and written communications being applied in the program. Additional course display material was provided during the visit addressing these issues.

E. Laboratories and Computing Facilities

Intent: Laboratories and computing facilities are available, accessible, and adequately supported to enable students to complete their course work and to support faculty teaching needs and scholarly activities.

The program meets the intent of the Laboratories and Computing Facilities Category by satisfying all associated standards with no concerns.

By means of numerous labs, servers, workstations, and networks, each student has more than adequate and reasonable access to the systems needed for each course (Standard V-1). From the team's discussion with students and faculty, there is general agreement that documentation for hardware and software is readily accessible (Standard V-2). Not one faculty member was unhappy with their access to computing facilities for class preparation and for scholarly activities and our direct observation supports the assertion that more than adequate access is provided (Standard V-3). There are adequate support personnel to install and maintain the laboratories and computing facilities. Excellent lab and computer support is provided by one full-time employee, who is highly praised by the faculty and students alike, and numerous part-time workers. In

addition there is currently an open line for another full-time support person (Standard V-4). Teaching assistants provide instructional assistance for the laboratories and computing facilities. Interviews with both faculty and students indicated that these assistants are not only competent, but also passionate, caring, and willing to go beyond the minimum requirements of their job. They were described by all as among the real heroes of the department (Standard V-5).

F. Institutional Support and Financial Resources

Intent: The institution's support for the program and the financial resources available to the program are sufficient to provide an environment in which the program can achieve its objectives. Support and resources are sufficient to provide assurance that the program will retain its strength throughout the period of accreditation.

The program meets the intent of the Institutional Support and Financial Resources Category by satisfying all associated standards with no concerns.

The department has developed a stable and very collegial group of faculty members. The team was struck by the degree that these people truly enjoy working with each other. While recent faculty searches to fill open lines have not been successful this last year, it was clear from everyone the team talked with that these search failures were not based on money or institutional support issues. Solid candidates that would enhance the existing faculty were found and competitive offers were made. The candidates elected to accept positions at more prestigious schools. In discussions with the Provost and the Chancellor, strategies and tactics are being developed to help the school to become more prestigious. The team was particularly impressed with the notion of "cluster hires", where the school would consider bringing whole groups of people into critical areas as a vehicle to attract one or two key people who would truly enhance the school's capability and reputation. Such creative thinking shows the commitment and support from the highest levels (Standard VI-1).

All of the faculty members have maintained competence as scholars and teachers by attending professional meetings or activities in the past two years. No request for professional travel has been denied (Standard VI-2). The department recognizes the importance of scholarly activities with rather light teaching loads at all levels, including instructors (Standard Vl-3). The program is supported by a department chair, an associate chair, three full time office/clerical staff, a number of part-time workers, and excellent support from people from the college. In the team's interaction with faculty, staff, and students, it was unanimous that the program enjoys more than just adequate office support (Standard VI-4). The department head and associate chair have released time for administrative duties and they expressed satisfaction with their work load (Standard VI-5).

Discussions with the faculty members, students, and with the senior administrators confirm support for the program from the upper levels of the administration. The program functions effectively within the university and the community (Standard VI-6). Careful expenditures and a modest lab fee arrangement have provided the program with more than adequate funding for laboratory equipment. Capital investments in buildings have been and continue to be made well

in advance of the need for this growing campus. As a result, the program has access to plenty of lab space to satisfy current as well as future needs (Standard VI-7).

Resources have been provided to support library and related information retrieval facilities to meet the needs of the program and there are numerous examples of continuity of institutional support and financial resources from both the college and the university (Standards VI-8 and VI-9).

G. Institutional Facilities

Intent: Institutional facilities including the library, other electronic information retrieval systems, computer networks, classrooms, and offices are adequate to support the objectives of the program.

The program meets the intent of the Institutional Facilities Category by satisfying all associated standards with no concerns.

The library that serves the computer science program is adequately staffed with professional librarians and support personnel. The librarian dedicated to the Bourns College of Engineering meets with every computer science student during their first quarter at the school to educate them about the library and its resources. All of the librarians and professional staff are available and qualified to support the students (Standard VIII-1).

The library provides the O'Reilly Safari service to all faculty and students. This gives them an access to an excellent collection of textbooks. This is by far the library resource that is used most by computer science students. All ACM and IEEE publications are provided in both print and electronic form (Standard VIII-2). Systems for locating and obtaining electronic information are available and support to help students learn to use them and assist them when problems occur is always available (Standard VIII-3). The classrooms are new, well equipped, and are in excellent condition. They more than meet the needs of the courses taught and our interactions with the faculty showed that they agreed with the team's assessment (Standard VIII-4). Every faculty member has a private office in a new facility. Faculty interviews indicated that faculty found their offices to be more than adequate to meet their responsibilities to students and for their professional needs (Standard VIII-5).

H. Observations

As noted previously, the self-study provided to the team prior to the visit contained numerous inconsistencies and lacked required material. In particular, requested assessment documentation and analysis results were not provided. In addition, the course displays initially provided to the team did not provide adequate evidence of feedback to students on submitted work and did not contain adequate documentation of oral and written communications being applied in the program. Inadequate course displays and self-study material can lead to adverse accreditation action recommendations if the visiting team cannot properly evaluate the program relative to the criteria.

III. ACTIONS SINCE THE VISIT

The UC Riverside's Department of Computer Science and Engineering expanded outcome J which previously read "*a knowledge of contemporary issues,*" to now read "*a knowledge of contemporary issues, including ethical and social issues.*" In addition, the department made outcome J an explicit objective of four upper-division (i.e. junior/senior-level) required courses: 1) CS 152 - Compiler Design, 2) CS 153 - Design of Operating Systems, 3) CS 161 - Design and Architecture of Computer Systems, and 4) CS 179 - Project in Computer Science. The syllabi for each of these four courses was modified to explicitly note the aspects of "ethical and social issues" to be covered, and an instructor's manual was prepared including a taxonomy of social and ethical topics to cover.

To document these changes, the program provided a detailed document including: a solid rationale for the changes, an updated list of the program outcomes, copies of each of the updated syllabi for the four courses mentioned above, and a current draft of the instructor's manual. Analysis of these syllabi shows that the following focus areas are spread over the four courses: integrity, computer crime, privacy and information use, property rights, responsibility, and social implications. The vehicle for assessing the coverage of these focus areas is the essay question in a class or final exam. The provided instructor's manual is a rather high level collection of topics with no indication for how they might be gracefully integrated into the courses' content, but the list has a great deal of useful detail and this is a good start for such a manual.

This removes the weakness with respect to the Curriculum Category; however, a concern remains with respect to Standard IV-17 until a future team observes the effectiveness of these changes.

IV. CONCLUSIONS

The University of California, Riverside, has an excellent computer science program within the Bourns College of Engineering. The quality of the faculty and the leadership of the chair is evident in the quality of program, and their dedication to an excellent direct measure assessment process. The speed with which a very detailed change was developed, implemented, and the quality of this change is a testament to the faculty and its leadership.
The program meets the intent for all categories in the *Criteria* by satisfying the associated standards. However, the following concern was identified:

1. (Standard IV-17) The coverage of social and ethical implications of computing needs to be consistently presented in the curriculum.

This concern may affect the stability, overall quality, or future accreditation of the program and will be of special interest to the next evaluation team.