Response to Program Review Standards

Computer Science Program
Department of Mathematics and Computer Science
College of Arts and Sciences
Western Carolina University

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Preface to the Computer Science Response to the Program Review Standards

Computing has been and will continue to be a major transformative force in society economically, culturally and intellectually. We want to awaken the students at this University to the excitement and potential of this transformation. In one sentence, that is our mission. We fully support the Quality Enhancement Program (QEP) and the adoption of the Boyer Model for scholarship because they align perfectly with our vision of how to achieve our mission. That support is reflected in our adoption of student portfolios, a two-semester capstone course sequence, and an increased emphasis on summer cooperative experiences.

With this external review, we are interested in constructive feedback on topics fundamental to any program review overall, such as: Are we serving our students and mission as best we can? Is our curriculum appropriate? Are we wisely using our faculty members and facilities? In addition, to help focus the review, a summary of strengths and weaknesses of the Computer Science Program and concerns of the Computer Science faculty from our report appears below.

Strengths of the Computer Science Program:

- Strong job demand and high salaries in the field of computing currently and in the future according to recent national surveys
- The return to three tenure-line faculty
- Student portfolios, a two-semester capstone course sequence, and an increased emphasis on summer cooperative experiences
- Recent growth in interest in the major (as indicated by first-year course enrollments) and in the number of graduates
- Aligned with University mission, serves a wide range of students and the region
- A quality physical work environment and facilities
- Substantial external funding by faculty members, almost all involving students

Weaknesses of the Computer Science Program:

- Need additional growth in number of majors, number of students taking our non-major courses, and in our student credit hour production
- Need sufficient faculty members to seek accreditation
- Funding of Department computing facilities by the University has been limited and sporadic

Concerns of the Computer Science Faculty:

- We have sought, without success, to increase the number of women and other under-represented groups within the program by participating in the Distributed Mentorship Program of Computing Research Association (CRA)-Women and having the only university-sponsored, high school programming contest in the state. Any suggestions on how to be more successful?
- Western North Carolina is a high growth region with increasing desire for our expertise in computing. How can we better serve the region?

Institution Setting of University and Department: Western Carolina University (WCU) enrolls about 9000 students, is a Regional Comprehensive University, and is a member of the University of North Carolina System. The Department of Mathematics and Computer Science is housed within the College of Arts and Sciences and offers a B.S. in Computer Science and a Minor in Computer Science (supported by three full-time faculty members), a B.S. in Mathematics, a M.S. in Applied Mathematics, and a Minor in Mathematics (supported by eighteen full-time faculty members). The Mathematics Program also offers, in collaboration with the College of Education and Applied Professions, a B.S.Ed. in Secondary School Mathematics, a M.A.Ed. in Mathematics (with two options: secondary school teaching and community college teaching), a M.A.T. in Mathematics, and a Second Academic Concentration in Mathematics (for students majoring in elementary education, middle school education, or physical education).

List of Tables, Figures, and Appendices for Computer Science Program Review

In Report, Response to Program Review Standards

Appendices, Numbering is keyed to *Standard*s
(OIRP is the Office of Institutional Research and Planning)

Contents of CD and Computer Science Program Review Website (http://polaris.cs.wcu.edu/~holliday/ProgramReview/CSProgramReview/)

When a citation to the CD appears in the narrative, the document is located in the section of the CD corresponding to the standard number in which the citation is found.

- Report
- Appendices (as above)
- Standard 2: *Planning*
  - 2004 Strategic Plan for Department of Mathematics and Computer Science
- Standard 3: *Curriculum and Assessment of Student Learning*
  - Catalog Entries for Degree Requirements for Major and Minor in Computer Science
  - Computer Science Course Syllabi (available only on department website: `http://cs.wcu.edu/8741.asp`)
  - B.S. Degree in Computer Science Advising Handouts
  - Junior/Senior Majors in Computer Science
- Standard 4: *Faculty Resources*
  - Proposed Department Collegial Review Document
  - Computer Science Course Offerings, Sections, and Student Credit Hours
- Standard 5: *Students*
  - Computer Science Student Portfolio Template
  - Program Profile Information
    - Student Quality Indicators and Total Number of Majors
    - Junior/Senior Majors in Computer Science
    - Degrees Conferred
  - Senior Exit Group Interview Responses

Academic Program Review is a component of Western Carolina University's Strategic Planning and Institutional Effectiveness System. The primary purpose of this document is to advance the quality of core teaching and learning, research, professional/creative activity, and public service/academic outreach functions in our Program through a periodic system of review. The remainder of this document is structured as follows: Standard One describes the purpose of the Computer Science Program and how that purpose supports the mission and strategic vision of the University, the College, and the Department. Standard Two describes the Program's ongoing planning efforts and how those efforts align with the University's priorities. Standard Three explains the Program's curriculum and its focus on student learning. Standard Four discusses faculty resources and their ability to meet the goals of the Program. Standard Five outlines how we attract and retain high-quality students. Standard Six describes the administrative structure of the Program and how that structure helps the Program to meet its objectives. Finally, Standard Seven discusses how we manage our available resources within the Program.

Standard 1. The purpose of the program reflects and supports the mission and strategic vision of Western Carolina University and the mission of its College.

The mission statements of the University (Appendix 1.1), of the College of Arts and Sciences (Appendix 1.2), and of the Department of Mathematics and Computer Science (Appendix 1.3) contain some common themes. Those themes also appear in the University's Quality Enhancement Plan (QEP), the University's response to the UNC Tomorrow report, and in the Boyer model of scholarship which has been supported by the Faculty Senate and is incorporated in our Department Collegial Review Document (DCRD) (Appendix 4.6). The purpose of the Computer Science Program reflects and supports those themes as seen in our program mission statement (Appendix 1.4). Two key themes are "Western Carolina University creates engaged learning opportunities that incorporate teaching, research and service" and the "University focuses its academic programs … to … enhance economic … development" (Appendix 1.1).

Our responses to Standards Three (Curriculum) and Five (Faculty Resources) provide more detail, but here we highlight some key points about how the Computer Science Program supports the theme of engaged student learning. Our philosophy is that when our Computer Science students leave WCU they should have a deep understanding of how software systems work and how they can develop quality software systems themselves. As a result, our graduates are well-prepared to become professional software engineers as well as to pursue graduate work in Computer Science. Such preparation requires not only technical skills, but also oral and written communication skills, the ability to work with others, and an understanding of ethical issues.

To ensure our graduates have these skills, as stated in our program mission statement, "Our courses focus on problem-solving skills in applied topics using state-of-the-art technologies that are widely used in industry." Distinctive features of our program include that in our early programming courses we use small class size, in-class group-work, weekly closed labs with pair programming, and upper-level Computer Science student helpers to create a learning environment where each student receives individual attention and the students learn by doing. As the students progress we use writing-based student portfolios that are incorporated into many of our courses for self-reflection. Further distinctive features that provide additional opportunities for engaged learning are undergraduate research experiences through our two-course capstone sequence and summer cooperative experiences.

That the faculty members are active scholars is essential to the success of this approach. We involve our students in our scholarship partly through our capstone course sequence. We have also involved our students in many of the external grants we have received. In some cases, this has resulted in students co-authoring refereed publications.

The second theme identified above is support for economic development. Computer Science plays an important role in this area because the technical skills of our graduates prove very useful for economic development. Consequently, there is strong demand for our graduates. For example, according to a survey conducted by the National Association of Colleges and Employers (NACE), Computer Science ranks 4th among the top ten most desired majors as of October 2008. In the same NACE survey, computer science majors earned the highest average starting salary among the top ten majors. Also, a fall 2008 survey in CNNMoney.com listed the top ten job titles with respect to projected job demand; most are in the field of computing.

Standard 2. The program engages in ongoing, systematic planning that is reflective of the University's strategic priorities.

The Computer Science Committee serves as a standing committee within the Department and consists of the three full-time computer science faculty members (Andrew Dalton, Mark Holliday, and William Kreahling) and one mathematics faculty (Shan Manickam). The main goal of our program is to provide our students with a high-quality education that prepares them for careers in industry and academia. To accomplish this goal the committee meets regularly with long-term planning addressed once or twice a year. A formal strategic plan is developed less frequently with one developed this fall (Appendix 2.1) and the previous one developed during spring 2004 (on CD). Both of these strategic plans identified six broad areas: (1) Enrollment; (2) Teaching Effectiveness; (3) Retention and graduation; (4) Quality improvement and program assessment; (5) Engagement, outreach, applied research, and regional service; and (6)

Scholarship and sponsored programs. Implementing our plan at times involves curriculum changes which follow the university approval process, but often simply involves actions that can be taken directly by the program faculty members.

As discussed in our responses to Standard Three (Curriculum) and Standard Four (Faculty Resources) we have made substantial progress in Areas 2, 4, and 5. As discussed also in our response to Standard Four we have made good progress in Area 6. Making progress in Areas 1 and 3 has been more difficult due to a national trend of decreased interest in computer science. This is discussed further in our response to Standard Five (Students).

Standard 3. The program provides and evaluates a high quality curriculum that emphasizes student learning as its primary purpose.

We strive to educate students who are well-prepared within the computer science discipline both with respect to technical competencies in software engineering, computer systems, and algorithms, but also in the important complementary areas of communication skills, working well in teams, and having a strong social and ethical foundation. These six areas comprise the student learning objectives of the program. They form the framework for both the computer science curriculum and our program assessment. Three features of the curriculum are the integration of self-reflection-focused student portfolios in many of the courses, the encouragement of regional engagement through summer cooperative experiences, and the inclusion of undergraduate research through our two semester capstone course sequence. As discussed in our response to Standard 1, these learning objectives and the resulting curriculum support the mission of the University. The precise Computer Science Program student learning objectives are:

> At the time of graduation, students who receive a bachelor's degree in computer science will:
>
> - be able to design, implement, and analyze a non-trivial algorithm
> - be able to use all of the steps of the software development process to create high quality software
> - when given an observed behavior of a single computer or of a distributed system, be able to identify and explain the key internal events that cause that behavior
> - be able to articulate a well thought-out judgment on legal, social, and ethical issues associated with computing
> - be able to express ideas effectively in oral and written form
> - be able to work well with others

The Computer Science Program curriculum follows the curriculum requirements specified by our accreditation organization, ABET, for computer science programs. It is also influenced by the curriculum guidelines of the Joint Task Force of the ACM and the IEEE Computer Society. Thus, we require at least

40 hours of computer science content and 30 hours of mathematics and science content. The degree requirements for the major and minor in computer science are in Appendix 3. The computer science courses for the major start with a two course sequence, CS 150 and CS 151 that introduce software development using an objects-early approach to programming with the Java programming language. Those two courses are four credit hours and include a weekly closed lab that uses pair programming. A large number of required computer science courses follow, including such key courses as Social and Ethical Issues, Software Engineering, Data Structures and Algorithms, Organization of Programming Languages, and Computer Organization. The students choose two elective computer science courses with recent electives offered including Linux Tools, Grid Computing, Information Security, and Database Management Systems. A number of students also enroll in a summer cooperative course, which we encourage. A two semester senior capstone course completes the computer science curriculum. The department website (`http://cs.wcu.edu/8741.asp`) contains the syllabi for all recently offered computer science courses.

Our first course in the major, CS 150, requires a mathematics co-requisite of pre-calculus to ensure that students have sufficient mathematical maturity. After the student has completed the first two computer science courses (CS 150 and CS 151), the remaining computer science courses can be taken in any order except that the two capstone courses must be taken during the senior year.

Our curriculum incorporates multi- and inter-disciplinary strengths, as appropriate. As required by ABET we include 30 hours of mathematics and science content. We contend that a strong foundation in mathematics is important in a computer science major. We require two semesters of calculus and one semester of statistics. Our discrete mathematics course is a junior-level course and not a freshman-level course as often is the case in a computer science program. The final required mathematics course, Logic and Proof, provides a challenging introduction to rigorous, logical reasoning. We note that all of these courses are also required to complete a major in mathematics. Additionally, we count one of the hours of our required computer graphics course as mathematics content because one third of the course covers some basics of applied linear algebra. Many of our computer science majors take one additional mathematics course to complete a minor in mathematics. A sizeable number of our majors take the small number of additional mathematics courses needed to complete a second major in mathematics. We also require 12 hours of science courses —courses taken by majors in the science fields— with all 12 hours including weekly labs.

In addition to mathematics, the Computer Information Systems Program in the College of Business and several of the programs in the Department of Engineering and Technology in the Kimmel School offer courses related to the computer science major. We encourage computer science students to

supplement the courses required for the computer science major by completing a minor in CIS. Several courses offered by the Department of Engineering and Technology count as computer science electives.

As shown in the table in Appendix 3.10, most students who enroll at Western as computer science majors complete their degree in four years. Though the major requires 72 hours, 9 of those hours also satisfy Liberal Studies requirements and the entire degree requires only 120 hours. Furthermore, once the beginning sequence of two courses is completed, the remaining computer science courses can be taken in any order except that the Capstone two-course sequence must be done during the senior year.

Providing courses for students not majoring in computer science is an important part of our mission and benefits the University as a whole. For many years we have taught two service courses: CS 130 and CS 140. CS 130 is intended for a general audience of students interested in learning about programming and computing. It focuses on the programming of websites using Javascript. CS 140 is an introduction to the C programming language and is required by the Electronics and Computer Engineering Technology (ECET) major. We have recently received approval to teach two Liberal Studies courses: a First-Year Seminar titled Privacy, Speech, and the Internet and a Humanities Perspectives (P4) Category titled Internet Security and Ethics.

The Computer Science Program has developed a program assessment plan (Appendix 3.3) and submits an annual program assessment report (Appendices 3.4 – 3.6). Two key aspects of our assessment procedure are the senior exit group interview (on CD) and the student portfolio. Appendix 5.3 contains the requirements for the portfolio and a template is on the CD. We also use the student portfolio for individual student assessment as it is a required part of five of our computer science courses. Each student prepares two versions of his or her portfolio: one while taking courses in the middle of the curriculum and a second as part of the capstone. The portfolio sections correspond to the six student learning outcomes. We insist on substantial writing and self-reflection in the portfolios.

Standard 4. The program has sufficient faculty resources to meet its mission and goals.

We need to offer a complete curriculum for an undergraduate degree in computer science as well as an appropriate selection of courses for the non-major students at Western. We also need to remain active scholars to ensure that the courses are taught well. We are meeting these requirements while maintaining teaching loads that are not excessive (as measured by the number of classes as well as by class size).

Temporary conditions have created an excessive service load during the most recent two and one-half years. During the first two years of that period, one of the three positions was held by a fixed-term person who provided only very limited service. During the most recent year and one-half, one of the computer science faculty members, Mark Holliday, has been the Interim Department Head. Those temporary conditions should be resolved by the end of the current academic year, in that Andrew Dalton has been

hired as our third tenure-line faculty member and we are actively searching for a permanent Department Head.

As a result, we expect the service load to return to a reasonable level. At that point we believe that we will have sufficient faculty to complete our mission. However, three faculty members are fewer than recommended for a Computer Science Program. Therefore, increasing student demand in order to justify additional faculty is a priority for us. Furthermore, one of our primary goals is to have the program accredited by ABET. We believe that our program meets all the requirements of accreditation with the exception of the requirement for the number of full-time faculty.

The faculty distribution by gender, ethnicity, rank, age, and tenure status is another important feature of our program (Appendices 4.3, 4.4). Recruiting women faculty has been a priority for us for many reasons, including the positive impact of having a woman role model when attracting and retaining women students. We have faced a very competitive market for hiring women computer science faculty. One strength of our department is the large number of women faculty in the Mathematics Program; we are hopeful that will help us in our future recruitment of women computer science faculty. Currently there is no ethnic diversity among the three computer science faculty, however recently we have been more ethnically diverse (Appendix 4.4). Two of the computer science faculty are relatively new (one is in his first-year and one is his fourth-year) and have not yet received tenure. The third faculty member is tenured and has been at Western for fifteen years (and a faculty member at another institution for an additional eight years). The fresh ideas and energy the newer faculty members bring to our program, we see as strengths.

Recent renovations to the Stillwell building have made it a more productive and positive work environment. The departmental computing lab, located directly across from the computer science faculty offices, encourages student-faculty interactions. An additional closed computing lab provides space for specialized teaching and research in the areas of networking, security, and operating systems.

WCU enjoys a strong reputation for promoting faculty development, particularly in the area of teaching. The Coulter Faculty Center offers group and one-on-one development opportunities as well as financial support for faculty seeking pedagogical development from specialized activities. The Department is supportive of any faculty member's desire to enhance his or her teaching and scholarship, sharing or co-developing course materials, serving as sounding boards for new research or teaching ideas, and recognizing and celebrating individual or group achievements.

The remainder of our response to this standard addresses two issues identified above: "Is the teaching load excessive?" and "Are the faculty well-qualified and active scholars?"

Our teaching load is three courses per semester and is not excessive. Most courses are three credit hours. Our first two courses in the major are four credit hours because they involve three hours of lecture

and a weekly two hour closed laboratory. A faculty member typically has at most one course section of these two courses which results in a teaching load of nine or ten credit hours per semester. An upper-level computer science major assists in the laboratory sessions. We intentionally keep class sizes small, with the maximum enrollments of our first two courses typically set at 24; typical sizes for our upper-level course sections being in the teens. As an illustration of teaching load, Table 1 shows the Student Credit Hour (SCH) generation of each of the faculty who taught during the last academic year. Hrishi Goradia held a one-year appointment in the position now held by Andrew Dalton. Mark Holliday carried a half-time teaching load due to his administrative duties as Interim Department Head.

To ensure the quality of the educational experience that we provide our students, it is important that the computer science faculty be well-qualified and active scholars. All but one of the faculty members who have taught computer science full-time during the last five years have doctorates in computer science. The mathematics faculty members who have taught some computer science courses during that time have had sufficient graduate work in computer science to be officially academically qualified in the field. A complete list of all these faculty including their academic credentials and research interests appear in Appendix 4.1.

Table 1: Computer Science faculty Student Credit Hours (SCH) and Full-Time-Equivalent (FTE) faculty generated, 2007-2008 academic year. Appendix 4.2 provides the teaching load data for previous years.

Last Name	**First Name**	**Fall 2007 Total SCH**	**Fall 2007 Total FTE***	**Spring 2008 Total SCH**	**Spring 2008 Total FTE**	**2007-08 Total SCH**	**2007-08 Total FTE**
Goradia	Hrishi	133	0.3273927	120	0.2953919	253	0.6283529
Holliday	Mark	135	0.3323159	42	0.1033872	177	0.4357030
Kreahling	William	171	0.4209334	194	0.4775502	365	0.8984837
Totals		**439**	**1.0806420**	**356**	**0.8763292**	**795**	**1.9569712**

***FTE generated is calculated in the UNC system as the number of SCH (course credit multiplied by student enrollment) divided by the expected SCH per faculty for a Category 3 (e.g., most sciences) degree program. This value is about 400 SCH per faculty per year.

Here we focus on the scholarship of the current faculty. Current faculty members have identified two strategic goals in their scholarship: 1) to develop a critical mass of expertise in the development of software systems and 2) to complement that expertise with recognition that the scholarship of teaching and learning is a valid and important form of scholarship. Our focus on software systems is seen in William Kreahling's research on back-end compiler optimizations, in Andrew Dalton's research on the software engineering of wireless sensor networks, and in Mark Holliday's research on grid computing. Our focus on the scholarship of teaching and learning is seen through current and planned refereed

publications in respected venues such as the Proceedings of the Annual Conference of the Special Interest Group on Computer Science Education.

Three indicators mark external recognition of our scholarship: awards, refereed publications, and external funding. With respect to awards, in 2007, which was Andrew Dalton's final year as a graduate student at Clemson University, he won awards given at each level to the Outstanding Graduate Researcher for the School of Computing, for the College of Engineering, and for the University as a whole. That such a talented researcher would choose to join our Computer Science Program is an important validation of the quality of our program.

We have been active in scholarship as indicated by the number of refereed publications during the past five years. In the past five years over 29 refereed journal articles and refereed conference papers were published by our current faculty along with two posters presented at professional meetings (Appendix 4.7). In the same five-year period, five students coauthored three of these refereed publications (Appendix 5.2).

The final external indicator is external funding. We have been quite successful by this measure as well with computer science faculty receiving grants that have brought nearly $264,000 to Western through competitive, peer-reviewed selection processes (Appendix 4.5).

The members of the computer science faculty are assisted ably by the strengths of the two members of the mathematics faculty who have taught computer science courses. Dr. Erin McNelis, who specializes in scientific computing and computational biology, frequently teaches a course on scientific computing. Dr. Shan Manickam, who helped found our Computer Science Program in 1980, serves on the Computer Science Committee and is heavily involved in the direction of the Computer Science Program.

Standard 5. The program attracts, retains, and graduates high quality students.

The average SAT score of our new students is one of the highest of any program at Western (on CD). We see this as the most accurate measure of our success in attracting high quality students. That the students who graduate from our program are of a high quality can be seen through several measures; one reason is our curriculum. The curriculum of any Computer Science Program, such as ours, that follows the ABET accreditation requirements and the recommendations of the Joint Task Force will be challenging as discussed in our response to Standard 3. A second reason is the external validation students experience through their successes in their summer cooperative employment. Yet another external validation comes to us through the success of our students in co-authoring refereed publications. See Appendix 5.2 for a list of these publications as well as a list of the capstone undergraduate research projects from this year.

What has been more challenging for us is the number and demographics of our students. Nationwide enrollment in Computer Science programs has been very cyclical for almost 40 years (Figure 1). The last five years have been the downward slope of one of these cycles. The student numbers in our program are consistent with this pattern (Table 2). Anecdotally, this year appears to be the start of a new upswing across the country. We have also observed this pattern in the number of students enrolling in the fall semester offering of our first course in the major. Also, the number of graduates in our program this year (assuming all complete their final semester) will be substantially higher as well. The increase in student demand as well as their excellent job prospects, as shown by recent national surveys, demonstrates the future viability of the program.

We have been involved in a number of recruitment and retention efforts. For recruitment, we have been working to attract new students both through the Admissions Office and through our high school programming contest. For retention, we emphasize student-centered learning with small class sizes, student portfolios, undergraduate research experiences, and summer cooperative employment as key features. Our first two courses in the major require weekly closed laboratories using pair programming and an upper-level computer science student assisting to ensure that each new student experiences as many one-on-one interactions as possible. Our computer science student organization hosts co-curricular activities. Additional co-curricular activities are done jointly with the mathematics student organization.

Figure 1: Freshman planning on majoring in computer science nationally.

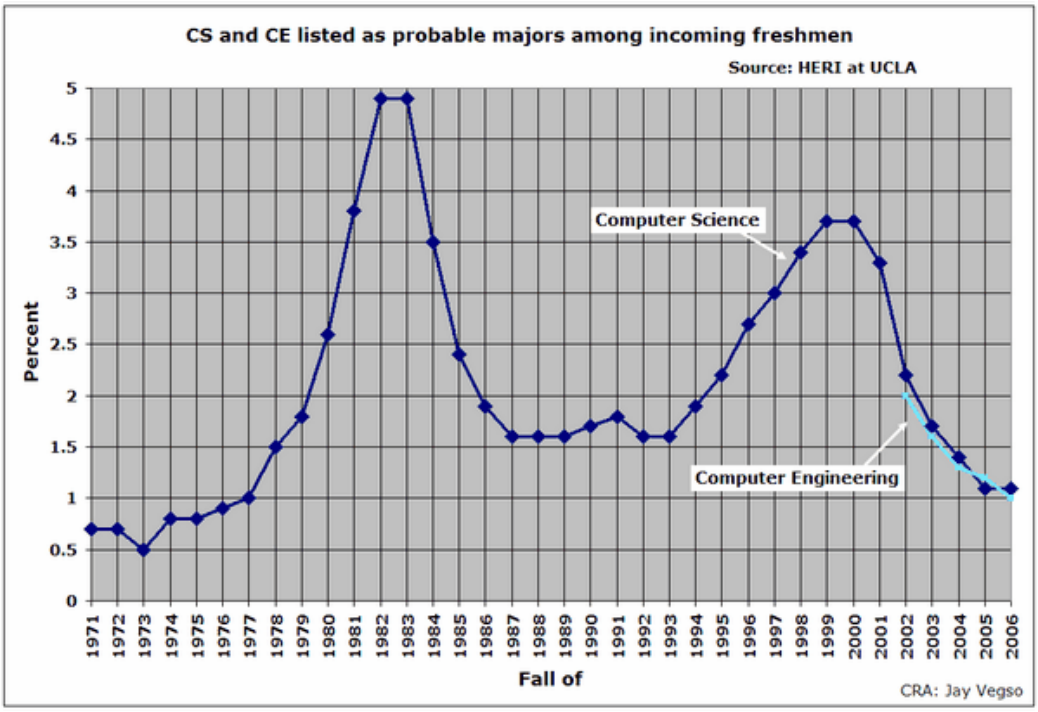

Table 2: Student Data

Academic Year	CS1 Enrollments	All Majors*	Junior-Senior Majors*	Graduates	SAT Scores
01 - 02	NA	73	40	9	NA
02 - 03	NA	55	47	8	NA
03 - 04	56	92	30	10	NA
04 - 05	49	78	23	19	1207
05 - 06	44	62	27	15	1133
06 - 07	41	70	24	4	1148
07 – 08	30	72	29	4	1148
08 – 09	41	NA	NA	10^{+}	NA

* indicates fall semester.

+ Assumes all students currently enrolled in the capstone course will graduate.

Our Computer Science Program has established and maintained a reputation for high quality advising founded on a commitment to advising as a partnership between student and advisor. Not only have we established a strong technical advising strategy, but we have also created a collegial environment that enhances the quality and timeliness of student advising. Students meet with their academic advisors formally at least once each semester, informally more often. We have created and maintain effective advising handouts, facilitating appropriate planning for each student (on CD). Colloquia, seminars, and yearly panel discussions with practicing mathematicians and computer scientists are arranged by the Department to ensure that our students have the most up-to-date information on career options and alumni contacts.

Increasing the number of woman computer science majors has also been a priority for us; see the CD for student gender and ethnicity statistics. Too few women are involved in computing at the high school level. For example, last spring only one participant in our high school programming contest was a woman. That student did decide to come to Western and is now a computer science major. Two of our recent women students have participated in the Distributed Mentorship Program of the Computing Research Association (CRA)-Women organization. We see this as one way to retain our women students and to encourage them to attend graduate school.

Standard 6: The program has an administrative structure that facilitates achievement of program goals and objectives.

The administrative structure of the Department of Mathematics and Computer Science has evolved to meet the goals of efficiently handling its day-to-day administrative activities, ensuring that specific areas

of the Department, such as the Computer Science Program, are addressed by the proper faculty, and that all the faculty of the Department have a voice in decisions that affect the Department as a whole.

In addition to the Department Head, the administrative structure consists of:

- two Associate Department Heads;
- six standing committees whose members and chairs are appointed by the Department Head in consultation with the faculty. These standing committees consist of the four curriculum committees (Computer Science, Mathematics Education, Undergraduate Mathematics, and Graduate Mathematics), the Steering Committee, and the Contest and Awards Committee;
- three standing committees whose members are elected by the faculty. These committees address faculty evaluation and are the Annual Faculty Evaluation (AFE) Committee, the Tenure, Promotion, and Reappointment (TPR) Committee, and the Post-Tenure Review (PTR) Committee;
- annual service assignments for individual faculty members which are made by the Department Head in consultation with the faculty; and
- ad-hoc committees, the membership of which is usually chosen by the faculty and approved by the Department Head. These include both faculty search committees and committees to address specific topics.

A central part of the Department's administration is regular department-wide meetings. We convene these monthly and schedule additional meetings as needed. Motions from the department committees are considered, responses to external requests are determined, and any other department-wide decisions are made at these meetings. The decisions made in the department meetings and in all department committees and of the faculty in other settings are advisory to the Department Head.

The above-mentioned Computer Science Committee meets as needed to address the concerns of the Computer Science Program. These areas include curriculum, computing facilities, student recruitment, the activities of our computer science student organization, our high school programming contest, selection of computer science student workers, selection of the recipients for the Computer Science Scholarship and of the Sophomore and Senior Computer Science Awards. If an action of the Computer Science Committee requires action at the department level, a motion is brought by the committee to a department meeting. The committee consists of the three full-time computer science faculty members and one mathematics faculty member. For many years Shan Manickam has been the mathematics representative on this committee. He has an extensive background in computer science and has taught many of the courses in the Computer Science curriculum.

In 2008 our department established a formal internal mentorship program for all first-year and second-year faculty (both fixed-term and tenure-line). Every August the Office of the Provost conducts a half-day workshop for new Department Heads and later conducts five half-day workshops for all

Department Heads addressing relevant issues. The Dean of the College of Arts and Sciences chairs bi-weekly meetings with all the Department Heads in the College attending.

Each department has a DCRD (Appendix 4.6) that must follow guidelines specified by the University. This year, all departments in the University were required to make a major revision to that document; the proposed DCRD is on CD. This revision to the DCRD was motivated by a desire to develop more consistency across the University to incorporate the Boyer model of scholarship into faculty evaluation. Untenured and tenure-line faculty members are considered for reappointment annually. Once tenured, faculty members undergo post-tenure review every five years. The TPR Committee, composed of six tenured department faculty members, meets with the Department Head (non-voting chair) to discuss each candidate's case and make a recommendation. Both the Committee's and Head's recommendations for the reappointment of faculty members are then forwarded to the Dean for a final review. Faculty members who submit their credentials for tenure and/or promotion have their files reviewed and voted on by Department, College and University committees.

All faculty members, regardless of appointment, participate in an AFE each spring by preparing a file following guidelines set forth in the DCRD: each file is reviewed by the AFE committee and the Department Head. The AFE committee consists of four tenured department faculty members; the Department Head is not present at their meetings. The AFE committee writes a brief report for each faculty member based on the information contained in the submitted document and student evaluations. Independently, the Department Head also writes a brief report based on the same information. The AFE committee reports are then given to the Department Head who gives both evaluations to the faculty member. The faculty member then meets with the Department Head to discuss the evaluation. A faculty member may attach a letter to this AFE statement that clarifies or rebuts its contents. Information from this review process plays a key role in how the Department Head determines salary recommendations for the next year. The DCRD may be revised annually with approval of the Dean and Provost

Department faculty members complete an anonymous, written evaluation of the Department Head on an annual basis and this evaluation is submitted to the Dean of the College of Arts and Sciences. The Department Head and Dean meet to discuss the views that are expressed in these evaluations. We currently have an Interim Department Head and we are conducting an external search for a permanent Department Head.

Standard 7. The program has adequate resources to meet its goals and objectives.

The Computer Science Program shares the Department's operating budget with the Mathematics Program. The total budget has been relatively stable for the last three years but with substantial changes in

categories of expenses. Our return to the newly renovated Stillwell Building caused a large one year expense for office furniture. More recently the amount needed for operational expenses has decreased as has the office furniture category thus allowing a sizeable increase in faculty travel funding. Faculty search costs have increased partly due to increased advertising but also due to increased Homeland Security charges for H1-B visas.

Technology expenses have varied and have recently been mainly for hardware and software used by the Mathematics Program. These expenses include service contracts for the software packages Matlab and Mathematica, a smart board, a video camera, and hand-held devices. During the last year there have been two significant changes in the technology budget: 1) the Department now has an account separate from our operating budget which is funded from the Education and Technology Fee, and 2) the Office of the Provost has paid for our two service contracts, as it has paid for service contracts in other departments.

The budget does not show:

- an important one-time expenditure which was the funding of a complete replacement of the servers and client machines in our department's computer lab from end-of-the-year money during spring 2006;
- our non-annual department accounts. These include one computer science scholarship fund (one award per year of approximately $750) and a computer science development fund account; and
- the funding for our student workers. These students work a few hours a week either doing system administration on our department's servers and computer lab or by helping in the lab sessions of our beginning programming courses.

Table 3: Budget Information

Fiscal Year (July 1-June 30)	**2005-06**	**2006-07**	**2007-08**	**Notes**
Department Operating Budget				
Operational	$11,572	$12,290	$8,890	Paper, phone, instructional supplies, copier/printer maintenance, new color printer, award plaques, maintenance work orders, MAA dept membership
Faculty Travel	$5,946	$7,661	$13,860	
Office Furniture	$11,754	$3,280	$1,980	New furniture for renovated department office in 05-06
Job Searches	$948	$1,865	$4,622	Homeland security expenses in 07-08
Educational Technology	$648	$3,206	$2,722	Mathematica service contract (06-07) and Active Board (07-08); Matlab and Mathematica service contracts paid by Office of the Provost in 07-08
Education and Technology (E&T) Account				

			$721	Hand-held devices for teaching Mathematics
Total	**$30,869**	**$28,302**	**$32,795**	
Computer Science full-time faculty	4	3	3	
Mathematics full-time faculty	17(2)	15(2)	17(2)	"()" is the number of phased-retirement math faculty.

The Department moved into a renovated wing of the Stillwell Building in the summer of 2006. The renovated building has technology carts and digital projectors in the classrooms and laboratories. The wing included space for our department computer lab (ten client machines dual booting Linux and Windows) and a department server room (with two Linux servers). As mentioned above, end-of-the-year funds allowed us to replace all of our client and server machines. Until then the primary funding of our department computer lab and servers had been by external grants awarded to computer science faculty. All the software used by the Computer Science Program is free and open-source. In the summer of 2008 the renovation of the other wing of Stillwell was completed and our Department received one additional room. That room is used by the Mathematics Program to teach with a smart board and is used by the Computer Science Program to teach operating systems, computer networking, and information security using a stand-alone network of machines acquired by external grants of computer science faculty. A specific list of all of the hardware and software used by the Computer Science Program is shown in Appendix 7.1. Receiving more consistent support from the University for the Department's computing facilities would be helpful. The recent creation of an account funded from the Education and Technology Fee is a positive step.

Both of the newer computer science faculty members did receive some start-up funds that were used for specialized research equipment: a Sun workstation for Bill Kreahling and a sensor network testbed for Andrew Dalton. Rolling faculty members computer upgrades are supposed to occur every fourth year but have been unreliable.

Program-related travel for computer science students has been limited recently to a few local trips by our student organization. We are interested in expanding to further trips including possibly arranging for a group of students to attend a conference within driving distance to make presentations or to participate in the ACM Programming Contest. Very limited support, if any, for these travel expenses can come from the Department's operating budget. The Honor's College awards limited funds for travel expenses for students to present at conferences.

In addition to funding from the Department's operating budget, the funding of travel by faculty members is augmented by the WCU Chancellor's Travel Fund, which will cover up to $1000 of expenses when presenting research at a meeting and by micro-grants offered through the Coulter Faculty Center for Teaching and Learning.

We enjoy excellent resources for a small university (Appendix 7.2) with campus-wide online access to the ACM Digital Library and the IEEE Digital Library as a key resource. A small number of computing related journals and magazines are available in print. The University library also provides significant funds each year to be used to acquire new computing books for their collection based on our recommendations.

During the past four years the number of full-time computer science faculty has decreased from four to three due to decreased student demand for our courses. That decrease is consistent with national trends. We are fortunate in that our course offerings have been augmented by a Scientific Computing course that a mathematics faculty member, Erin McNelis, teaches every spring semester. We hope to increase our student credit hour generation as well as the number of graduates to warrant an increase to five full-time computer science faculty. At that point we expect we will have sufficient faculty members to seek accreditation.

The substantial job demand and high salaries offered to computer science graduates, as reported frequently in the national press, we hope will increase interest in our computer science major. Our first course in the major is taken only by students interested in majoring in computer science. Enrollment in that course, CS150, increased 50% this fall over last fall (from 27 to 41). That increase plus a recent national trend of increased interest are encouraging. Increasing our number of tenure-line faculty to three, with the addition of Andrew Dalton, was an important step. Our focus on student portfolios, undergraduate research projects, and summer cooperative experiences should also help.

Increased demand for computer science courses by non-majors is an essential part of the growth of the Computer Science Program. Consequently we have added two Liberal Studies courses and modified CS130 to make it more attractive to students interested in multimedia.

Conclusion. The Computer Science Program effectively serves both the University and its students. Our rigorous curriculum readies students for careers in industry and academia. Our administrative structure is appropriate to meet the Program's current and future needs. Our resources, including faculty, staff, equipment, and budget, are currently sufficient to meet the goals and objectives of the Program; however, current trends suggest that enrollment will continue to increase, and resource requirements will likely grow accordingly. The faculty members of the Computer Science Program would like to thank the reviewers for their time and effort, and welcome any comments or suggestions that they may have.