

**CAC SUPPLEMENTAL  
QUESTIONNAIRE FOR REVIEW**  
**of the**  
**COMPUTER SCIENCE AND ENGINEERING PROGRAM**

submitted by

**The University of California at Berkeley**  
*Institution*

**5 June 2006**  
*Date*

to the

**Computing Accreditation Commission**

**Primary contact:** Paul N. Hilfinger  
**Telephone number:** (510) 642-8401 **FAX Number:** (510) 642-5775  
**Electronic mail:** Hilfinger@cs.berkeley.edu

ABET, Inc.  
Engineering Accreditation Commission  
111 Market Place, Suite 1050  
Baltimore, Maryland 21202-4012  
Phone: 410-347-7700  
Fax: 410-625-2238  
e-mail: cac@abet.org  
www: <http://www.abet.org/>

## **I. Objectives and Assessments**

### *I.A. Items that support or precede the objectives:*

Please see *ABET ECE Self-Study Report*, §B.2 and §B.3

### *I.A.2. Objective's alignment with institution's mission:*

The University's stated mission is

“...to serve society as a center of higher learning, providing long-term societal benefits through transmitting advanced knowledge, and function as an active, working repository of organized knowledge. That obligation...includes undergraduate education, graduate and professional education, research and other kinds of public service...”

The correspondence with our stated educational objectives is, we think, clear. Specifically, these objectives call for our students to acquire an ability to “analyze and solve...computer science and engineering problems through the application of fundamental knowledge of mathematics, science, and engineering” and an understanding of “conceptual foundations and emerging applications.”

### *I.B: Implementation of Objectives:*

As indicated in the *ABET ECE Self-Study Report*, §B.3 (4), we take the achievement of all desired program outcomes as implying that we meet our objectives. The same report, §B.3 (5, 5.1, 5.2), then elaborates in detail the relationship between courses and these desired outcomes. Finally, §B.3 (6) describes the various assessments made to monitor these outcomes.

## **I.E. Program Evolution**

### *I.E.1. Changes in philosophy and direction of computer science:*

There have been no major changes of philosophy since the last assessment. To a large extent, we have been digesting the major shift documented in that assessment.

### *I.E.2. Major developments not included in ABET Self-Study:*

None.

## **I.F. Program Current Status**

### *I.F.1. List the strengths of the unit offering the computer science program.*

The department attracts extremely good students, allowing us to present an ambitious course of instruction. Our status as a well-regarded research department informs our choice of curriculum and allows us to provide opportunities for undergraduate involvement in cutting-edge research. This is of particular importance given that exit surveys collected by the College over the period 2000–2005 indicate that approximately 20% of our graduates go directly to graduate school and that an additional 41% express an intention to return to school later for an advanced degree. The quality of our graduate program also feeds the quality of undergraduate teaching support in the form of graduate-student teaching assistants.

### *I.F.2. Weaknesses:*

We are part of a large state university with a popular program that attracts large numbers of students, leading to larger classes than we would ideally prefer to teach, with all the attendant problems. This limits our ability to offer labor-intensive courses where students can get in-depth feedback from the faculty.

We have had a continuing problem with giving students effective exposure to ethical issues (please see also §B.3 (9) of the *ABET ECE Self-Study Report*). Dropping isolated units on “ethics” into courses, while it can be made to sound appealing in the context of an executive summary, is pedagogically naïve. Some of the smaller programs (NE, BioE) in the College have started to require an ethics course, and two such courses are now offered in the College. However, these courses are taught by a small number of engineering faculty with specific interests and expertise in these areas. The College does not have the dedicated personnel necessary to regularly offer the sort of focused, probably case-based, approach that is likely to make a lasting impression at the scale required to serve the EECS department (as indicated in *Appendix II, Table II-8*, enrollment in the CSE and ECE programs is three times that of the undergraduate NE and BioE programs combined). The program continues to explore approaches to introduce increased ethics-related coursework into the curriculum. However, as yet this remains one of the most challenging areas in which to meet the program’s objectives.

### *I.F.3. Significant plans for future development:*

Recently, we have begun discussion of the curricular changes that might be indicated by the move to multi-core processors, a very significant architectural trend. The industry appears to have accepted that future increases in processor performance will have to come from the use of multi-processing, and as a result,

the emerging generation of commodity chips is multi-core, a situation that is probably permanent. Of course, one way to exploit such chips is to seek out “embarrassing parallelism”—tasks that are completely independent of each other, and can therefore be assigned to processors in a straightforward fashion. This approach is limited: while it has obvious applications to time-sharing services, it is hard to see how current desktop software could make embarrassing use of more than a few processors, and many scientific or graphical applications really require communicating processes.

While some of our courses—including CS61A, CS61B, and CS162—have parallel-programming topics, there is no systematic effort at training students in either the theory or practice of parallel computation. Our architectural faculty is moving its research into the area, and we have begun weekly discussions of the implications of current trends for software research and for possible reorganizations of or additions to undergraduate course content, beginning in the lower division.

## **II. Student Support**

### **II.A. Frequency of Course Offerings**

#### *II.A.1. Required courses not offered yearly:*

None.

#### *II.A.2. Courses allowed, not required, for the major:*

All undergraduate and graduate EECS courses that are offered for a grade (as opposed to Pass/Fail) are allowed toward the major. Certain of these courses, however, count only toward fulfillment of the overall unit requirements of 120 units overall or 45 in the College of Engineering, and others restrict credit to certain situations. These exceptions are detailed in catalog descriptions and the *Undergraduate Notes*.

All graded lower-division courses are offered at least yearly. In general, we have been able to offer upper-division CS courses at least once a year. Among upper-division EE courses (which also satisfy requirements of the CSE program), EE 117 (electromagnetic fields and waves) is difficult to staff, although we have been able to offer it once a year. (In reviewing EE courses, please be aware that there is a tendency to keep courses in the catalog even after they have stopped being offered regularly.)

Graduate courses are offered only in response to sufficient interest from both graduate students and suitable faculty members. However, they are not commonly used to satisfy degree requirements; generally, only highly motivated

undergraduate students who have taken the necessary prerequisite upper-division courses take them.

*II.B.1–2. Interaction with Faculty:*

TAs are typically the front line of contact with students as leaders of discussion sections and lab sections (of typically 30 or fewer students). All faculty and TAs are expected to hold weekly office hours. Increasingly, much of the interaction between students and instructors is via e-mail. We also maintain electronic bulletin boards for most classes, which instructors monitor.

### **III. Faculty**

*III.A. Difficulties in offering required or optional courses frequently enough due to faculty size:*

We have not had serious problems staffing required courses. The upper-division CS 160 course on user interfaces has become somewhat problematic with the departure of two faculty in that area. The upper-division computer architecture course (CS 152) has also presented problems, and we are actively hiring in that area. The main troubles on the EE side are in the upper-division courses EE 122 (Networking) and the EM Fields and Waves course (EE 117). The situation with EE 122 is evolving, since within the last year there has been discussion about substantially reorganizing the material in this course.

#### **III.B. Faculty with Primary Commitment**

*III.B.1. Primary Commitment:*

The number of faculty who devote the majority of their activities to direct support of the program: 83.49 FTE

*III.B.2. Faculty with primary commitment by academic rank and tenure status:*

Full Professors: 55.49 FTE  
Associate Professors: 12 FTE  
Assistant Professors ( untenured): 12 FTE  
Lecturers with SOE: 4 FTE  
Lecturers without SOE: 0 FTE

*III.C. Courses with sections not taught by full-time faculty during 2004–2005 academic year, with coordinators:*

CS 3	M. Clancy
CS 152	D. Culler, J. Wawrzynek, J. Kubiatawicz
CS 160	J. Canny
EE C125	S. Sastry
EE 128	S. Sanders
EE 100*	L. Chua
EE 141	J. Rabaey
EE C145B	T. Budinger
EE C145M	S. Derenzo

\* EECS majors do not normally take this course.

Deleted: ¶  
¶  
Formatted: Indent: Left:  
84 pt

*III.D. Interests, Qualifications, Scholarly Contributions:*

Please see the biographies in our *ABET ECE Self-Study Report*.

*III.F. Support for Advising:*

Please see our *ABET ECE Self-Study Report*, §B.1.

*III.G. Information Regarding Faculty Members:*

Please see faculty bio-bibliography forms provided in the *ABET ECE Self-Study Report*.

## **IV. Curriculum**

### *IV.A. Title of Degree Program:*

On transcript: Computer Science and Engineering

On diploma: Bachelor of Science in Engineering.

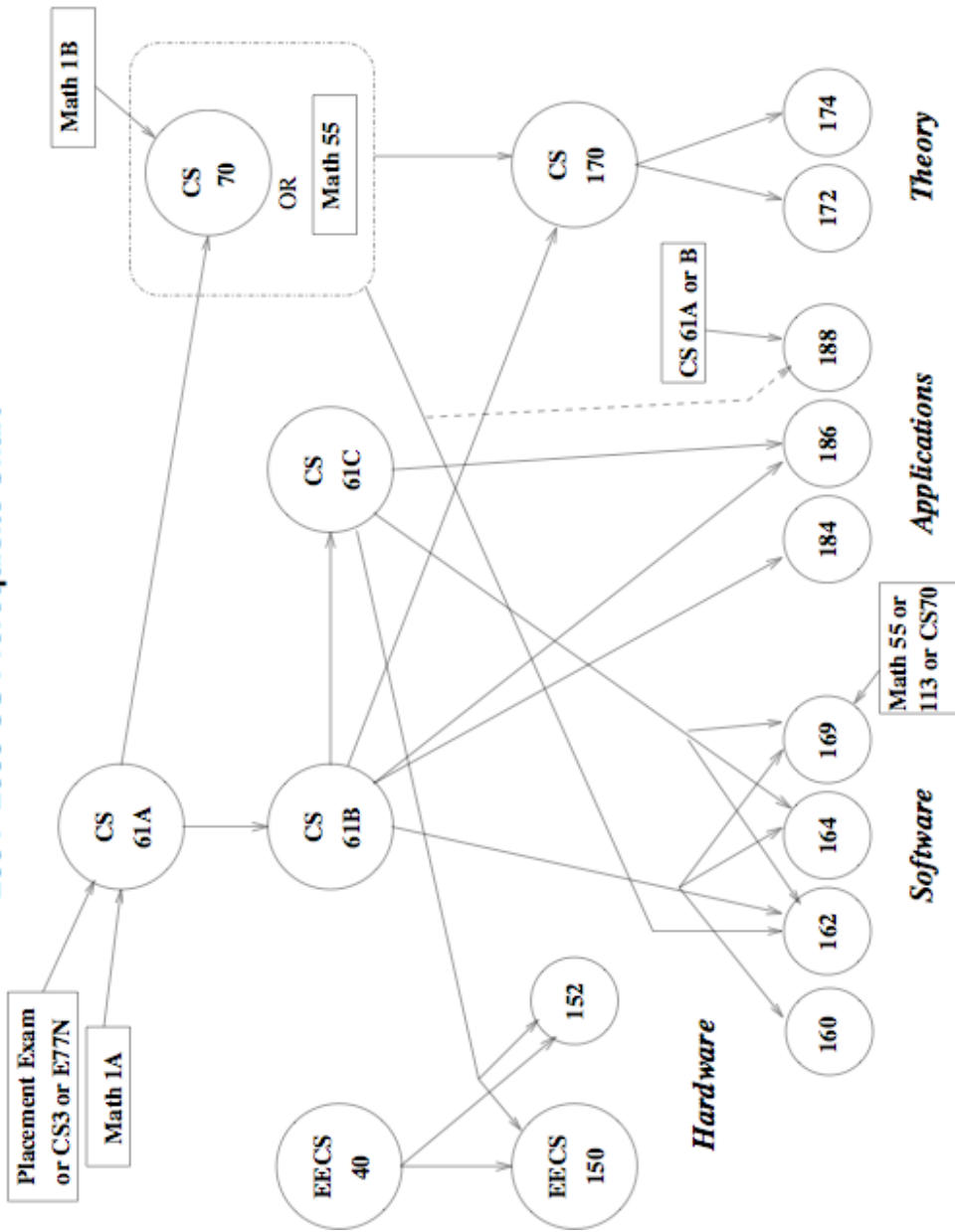
### *IV.B. Definition of "credit hour":*

One "unit" is intended to denote 3 hours work or attendance. A normal load is 15 units. An academic year consists of 30 weeks of instruction, exclusive of final exams.

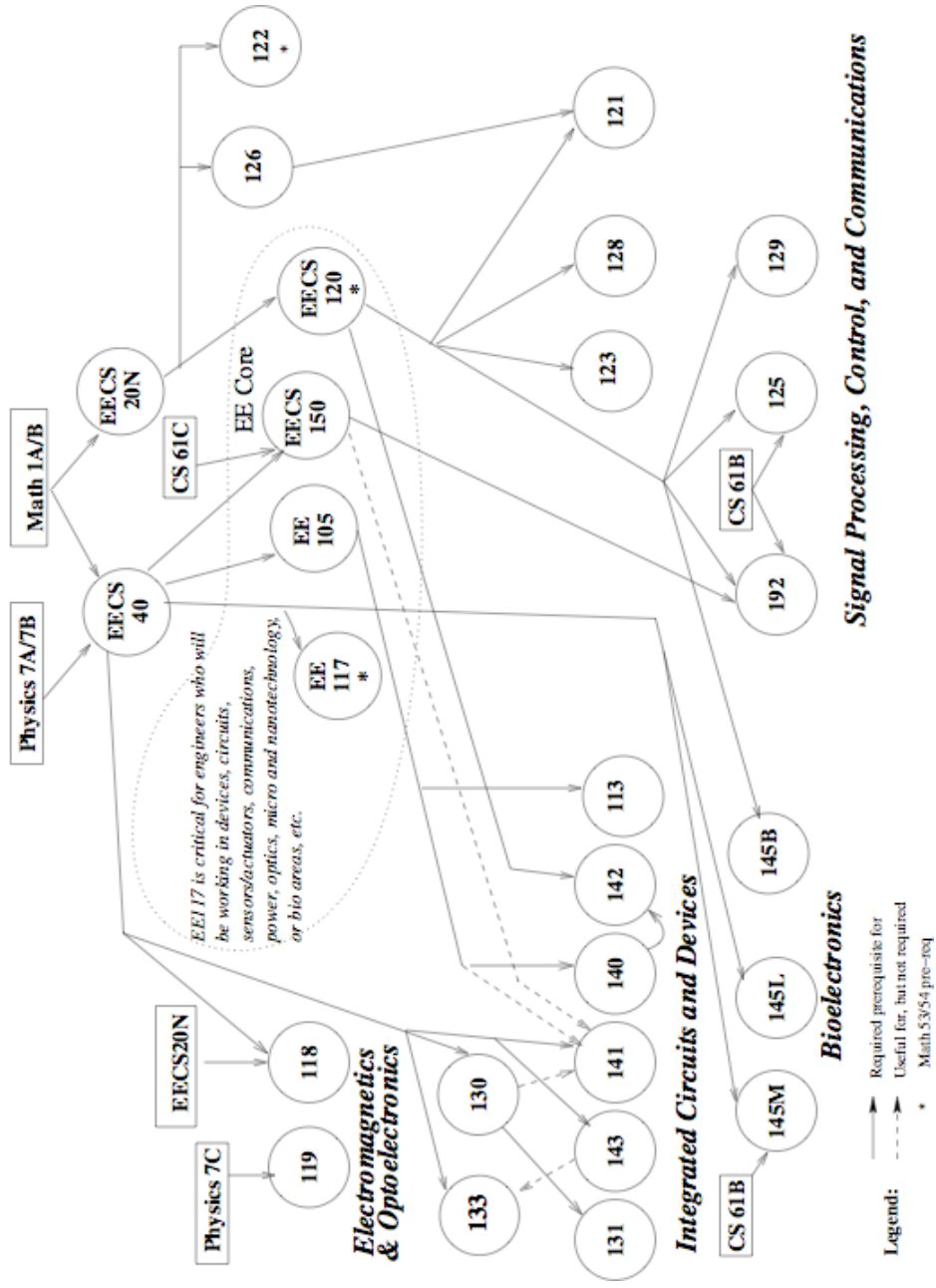
### *IV.C. Prerequisite Flow Chart:*

The diagrams on the next two pages come from our on-line *Undergraduate Notes*:

## 2004–2005 CS Prerequisite Chart



## 2004–2005 EE Prerequisite Chart



*IV.D. Course Requirements of Curriculum:*

Our program is not strictly dictated semester by semester. The specifically required courses are marked with an asterisk in the following sample program, taken from our *EECS Undergraduate Notes*, which shows how a student in computer science might choose to satisfy our requirements.

Sample Curriculum for Option IV: Computer Science

School Year	IV: Computer Science	
	Fall	Spring
Freshman	*Math 1A (4 units)	*Math 1B (4 units)
	Science (4 units)	*Physics 7A (4 units)
	*CS 61A (4 units)	*CS 61B (4 units)
	Humanities (4 units)	Humanities (3 units)
Sophomore	*Math 53 (4 units)	*Math 54 (4 units)
	*Physics 7B (4 units)	*Math 55 or CS 70 (4 units)
	*CS 61C (4 units)	*EECS 20N (4 units)
	Humanities (3 units)	Humanities (3 units)
Junior	Physics 7C (4 units)	CS 164 (4 units)
	*EECS 40 (4 units)	CS 170 (4 units)
	CS 162 (4 units)	Engineering (4 units)
	*E 190 (3 units)	Humanities (3 units)
Senior	CS 169 (4 units)	EECS 150 (5 units)
	Engineering (4 units)	Engineering (4 units)
	Humanities (3 units)	Humanities (3 units)
	Elective (4 units)	Elective (3 units)

sample4.xls

Page 24

In addition to the specific courses flagged above, our program requires:

1. At least 11 units of natural science from a specific list, including the required courses.
2. A total of at least 30 units of natural science, mathematics, and statistics, including the required courses.
3. A total of 45 units of engineering-topics courses, including required courses (these courses need not be in EECS). These must include at least 20 units of upper-division EECS courses, of which at least 16 units are upper-division CS courses.
4. A minimum of 6 courses in humanities or social studies, each of at least 3 units, including 2 upper-division courses. There are a number of additional

requirements for courses in particular groups, documented in the aforementioned *Undergraduate Notes*, but not germane to ABET/CAC.

*IV.D.1. Explain why not 40 semester hours of computer science:*

Our departmental requirement is for at least:

- 12 units of courses specifically in Computer Science,
- An additional 28 units of courses in EECS, of which 16 must be upper-division computer science for this program.
- An additional 2 units in the College of Engineering (any department).
- Engineering 190 (Technical Communication, 3 units).

Students are considered to be “in computer science” as indicated on their transcripts if they so designate (by choosing Program IV) and (as at the last accreditation) take at least 16 upper-division units in the Computer Science Division.

Our philosophy is that the electrical-engineering side of the department, and its engineering orientation in general, have something to offer any student in the area. We try to introduce a “systems” orientation in our curriculum so that students see computers and programs in one broader setting. Thus, the core course EECS 40 (Introduction to Microelectronic Circuits) is specifically an EE course, though one that concentrates on the “bridge” area of digital electronics. The core course EECS 20N (Structure and Interpretation of Systems and Signals) is an “introduction to mathematical modeling techniques used in the design of electronic systems,” but this includes finite-state models, which have direct applications in computer science.

We would not consider any increase in these requirements. Increasing the CS component to 40 units, while keeping other specific requirements intact would, in practice, account for 104 of the student's standard 120 units (this is assuming that humanities courses average 4 units), which leaves roughly a single semester (16 units) of free choice, which we regard as unacceptable.

*IV.D.2. Hours of study in mathematics and science:*

Curriculum includes required hours.

*IV.D.3. Explanation of unit requirements in the humanities:*

Our requirements are unchanged from the last accreditation cycle. We require six courses of at least 3 units (in practice, 4 units is the typical value) subject to certain distribution requirements. We also require an additional course in Technical Communication, which is a hybrid composition/engineering-topics

course. In the six years since the last accreditation, we have found no reason for further alteration of these requirements.

*IV.D.4. Broad-based core of fundamental computer science material:*

Please see item IV.D.1 above. Our lower-division requirement is specifically for 11 units (Introductory Programming, Data Structures, Machine Structures) of computer-science, plus 4 units on mathematical modeling techniques for electronic systems, plus 4 units of introductory microelectronics.

*IV.D.5. Approximate hours in core devoted to basic areas:*

Of the 12 units in CS core courses, the breakdown is roughly as follows:

- Algorithms: 1.5
- Data Structures: 2
- Software Design: 2
- Programming Language Concepts: 2
- Computer organization and architecture: 3

*IV.D.6. Course numbers in the core embodying theoretical foundations, problem analysis, and solution design:*

Theoretical Foundations: Math 55/CS 70, EECS 20, CS 61A, CS 61B

Problem Analysis: CS 61A, CS 61B

Solution Design: CS 61A, CS 61B

*IV.D.7. Typical languages and operating systems:*

Languages: Scheme, Java, C++, C.

Operating systems: Training in specific operating systems is not part of the curriculum, but students typically see Unix and Windows. Those who compute at home (a large number) will typically see Windows, Linux, and MacOS X.

*IV.D.8. Languages in which students become proficient:*

Java.

*IV.D.9. Hours of advanced computer science:*

16 hours of upper-division CS courses are required.

*IV.D.10. List of advanced areas:*

Our curricular requirements make no mention of specific “advanced areas;” there is simply a unit requirement in upper-division EECS courses. We offer advanced courses in graphics, databases, programming languages and implementation, operating systems and networks, software engineering, user interfaces, theoretical computer science, computer security, and artificial intelligence.

*IV.D.11. Hours devoted to mathematics:*

The curriculum described in preceding sections clearly includes the necessary number of units.

*IV.D.12. Comments on courses containing mathematics material:*

Discrete mathematics and probability are the subjects of the alternative courses CS 70 and Math 55.

*IV.D.13. Hours devoted to science:*

The official standard is 11 hours for certain technical reasons, but three science courses that include Physics 7A,B and the other lower-division science courses used by our students are all 4-unit courses, so that students invariably take 12 units of science.

*IV.D14. Two-semester laboratory science sequence:*

This is Physics 7A,B.

*IV.D.15. Additional science courses or courses that enhance the student’s abilities in the application of the scientific method:*

This should be clear from IV.D above.

*16. Oral and written communication skills:*

Oral: E 190

Written: E 190, English 1A.

*17. Social and ethical implications of computing:*

The University imposes a requirement for a course in “literature and values,” but we do not at present have a required concentrated treatment of the subject. See the section on program weaknesses for further discussion.

*IV.E. Course Descriptions:*

Please see the course syllabi in the *ABET ECE Self-Study Report*.

**V. Laboratories and Computing Facilities**

*V.A. Computer facilities available for computer science programs:*

Please see the *ABET ECE Self-Study Report*, §B.6.

*V.A.2. Labs, courses, or policies that require two or more students to share a lab station:*

Aside from courses purposely electing to have students work in teams, there are no such situations.

*V.C. Availability of software and hardware documentation:*

Documentation is generally on-line, available from web pages, or distributed in course readers.

*V.D. Faculty access to computing facilities:*

All faculty have 24/7 access to all facilities. All faculty offices have computer access. There is also wireless access available throughout Soda and Cory Halls.

*V.F. Instructional support available to students in laboratories:*

Assistance is available during scheduled lab periods from teaching assistants, for classes that use scheduled periods. For large lower-division programming classes, we generally recruit undergraduates to serve as additional lab assistants.

VI. Institutional Support and Financial Resources

VI.A Faculty retention:

Please see §B.7 in the ABET ECE Self-Study Report.

Year	Total Faculty	Resignations	Retirements	New Hires
2006–2007	83.49			4
2005-2006	83.74	3	2.75	5.5
2004-2005	85.24	2	2	2.5
2003-2004	82.74	1	2	5.5
2002-2003	81.74	0	2	3

VI.B. Summarize the professional activities of your faculty, attendance at meetings, university and professional honors won by individuals, etc. Just summarize here; details should appear in individual faculty vitas.

The list of faculty honors and memberships is extensive. Over the years, EECS faculty have received two National Medals of Science, three ACM Turing Awards, three IEEE Medals of Honor, 11 Sloan Foundation Fellowships, and 12 UC Berkeley Teaching Awards (the campus's highest teaching award). We've had seven Members of the National Academy of Sciences, 36 Members of the National Academy of Engineering, 14 Members of the American Academy of Arts and Sciences, 66 IEEE Fellows, and 23 ACM Fellows. These are only a small sample of the complete set of honors received by the faculty. For a full accounting, please see the compilation at URL:

<http://www.eecs.berkeley.edu/Faculty/Awards> .

VI.C. Level and adequacy of office support;

Please see ABET Table II-6 and also comments in §B.7 of the ABET ECE Self-Study Report.

VI.D. Describe the adequacy of the time assigned for the administration of the program.

Please see the attached memo: *EECS Departmental Administrative Plan*.

VI.E. Adequacy of the resources and the atmosphere provided by the upper administration:

Please see the ABET ECE Self-Study Report, §B.7.

*VI.F. Positive and constructive leadership at the college/school level and within the program's department are especially important to the program's quality. Evaluate college-level and departmental leadership and their interaction:*

EECS has supplied the current Dean of Engineering, as well as his two predecessors. We have no reason to complain.

*VI.H. Library Resources:*

Please see ABET Appendix II, pages 3–5.

*VI.I. Discussion and evidence of continuity of institutional support, including past and anticipated problems:*

Please see the *ABET ECE Self-Study Report*, §B.7.

## **VII. Institutional Facilities**

*VII.A.1–3. Library:*

Please see the *ABET Self-Study* Appendix II, pages 3–5.

*VII.B. Classroom Equipment:*

All classrooms have chalkboards or whiteboards, and typically have projection screens. Classrooms with video facilities are not universal, but we have so far had no problem with scheduling classes with specific needs into appropriately equipped rooms.

*VII.C. Adequacy of faculty offices:*

All active faculty have individual offices, which have proven adequate for our needs.

## Appendix II. General Information on the Unit Responsible for the Computer Science Program

### AII.A. Type of unit

AII.A.1.	Name of computer science program unit:	Computer Science Division, Department of Electrical Engineering and Computer Sciences
	URL	<a href="http://www.cs.berkeley.edu">http://www.cs.berkeley.edu</a>

### AII.E. Computer-Related Undergraduate Degree Programs:

Program Title	Years Req'd	Degree Awarded	Admin. Unit	If accredited, by whom
Computer Science and Engineering	4	BS	EECS Dept.	ABET/CAC
Electrical and Computer Engineering	4	BS	EECS Dept.	ABET
Computer Science	4	AB	EECS Dept. (College of Letters and Sciences)	None

The entry for Electrical Engineering and Computer Sciences in the *General Catalog* describes the three programs. Likewise, the on-line *Undergraduate Notes* describe all three programs and give detailed descriptions of their requirements.

## Appendix III. Finances

Please see the *ABET ECE Self-Study Report*, Appendix II, Tables II-5 and II-7. The finances specifically supporting the Computer Science and Engineering Program are not broken out of general EECS support, since the faculty, staff, courses, and equipment involved are the same for all our instructional programs.

