ABET
Computing Accreditation Commission

FINAL STATEMENT
BS Computer Science Program

to

UNIVERSITY OF HOUSTON-CLEAR LAKE
Houston, TX

Dates of Visit:	November 11-13, 2007
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UNIVERSITY OF HOUSTON-CLEAR LAKE

FINAL STATEMENT
2007-2008 EVALUATION

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I. INTRODUCTION

The University of Houston–Clear Lake is an upper division state supported institution in the Clear Lake community of the Houston, Texas metropolitan region. There are 7,709 FTE students and 296 faculty members at the university.

The Computer Science (CS) program is one of three undergraduate programs in the Division of Computing and Mathematics in the School of Science and Computer Engineering. The other two undergraduate programs are Computer Information Systems (CIS), and Mathematics (MA). In addition to the three undergraduate programs, the division offers four masters programs in CS, CIS, MA, and Statistics. Other computing programs exist within the school, in computer systems engineering and software engineering. All programs are properly differentiated in official documents.

The Division of Computing and Mathematics has a total of 152 undergraduate students and 133 masters students. The equivalent of 13 faculty members in the Division of Computing and Mathematics are responsible for two undergraduate programs in CS and CIS as well as two masters programs in CS and CIS. The undergraduate CS program has 55 FTE students; the undergraduate CIS program has 47 FTE students. The masters programs in CS and CIS have a total of 109 FTE students.

The Computer Science Program at the University of Houston-Clear Lake was evaluated by the Computing Accreditation Commission (CAC) of ABET in the 2001-2002 cycle and was accredited at that time.

The Computing Accreditation Commission (CAC) of ABET evaluated the BS Degree in Computer Science of University of Houston-Clear Lake during the 2007-08 cycle for possible accreditation under the CAC/ABET "Criteria for Accrediting Computing Programs", dated March 17, 2007.

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. However, there are concerns with respect to Standards I-1, I-3, I-5 and I-6 that constitute a weakness with respect to the Objectives and Assessments Category.

The program's objectives include expected outcomes for graduating students (Standard I-2). The extent to which each program objective is being met is periodically assessed (Standard I-4). The program uses a number of instruments for assessment. The program has an active advisory board drawn from local industry that provides valuable input for assessment and program improvement. All faculty members are involved in the assessment of course outcomes.

Although the program has documented objectives which include expected outcomes for students, these objectives are not consistently documented. Objectives presented in the self study are not consistent with those contained in the catalog. This is a concern with respect to Standard I-1 that contributes to a weakness in this category.

While data relative to the objectives is routinely collected, not all data collected is clearly documented. Data relative to course-level assessments is documented and has been used mainly in course-level improvements; however, the team did not find documented evidence of data being aggregated and used in overall program assessments. This is a concern with respect to Standard I-3 that also contributes to a weakness in this category. While some program changes have been made, these improvements were not tied back to the program's periodic assessments very well. Most of the changes were reported to be based upon recommendations from the prior CAC/ABET visit. Evidence provided did not make it clear how the results of the program's

periodic assessments were used to identify program improvements nor was there clear and consistent documentation of the results and actions taken. Therefore, there are concerns with respect to Standards I-5 and I-6 that further contribute to a weakness in this category.

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. However, there is a concern relative to Standard II-5 that constitutes a weakness in the Student Support Category.

Courses are offered with sufficient frequency for students to complete the program in a timely manner (Standard II-1). Required courses are offered at least annually, and a number of advanced electives are offered annually. Students were complimentary of the willingness of the faculty members to offer courses with smaller enrollments in order to ensure timely completion of the program.

Computer Science courses are structured in order to ensure effective interaction between faculty members and students (Standard II-2). Class sizes are limited to 30 students, and most classes have less than 20 students. Students stated that the smaller class sizes and student to faculty ratio are strengths of the program. Guidance on how to complete the program is available to all students, and all students have access to qualified advising in making both course decisions and career choices (Standards II-3 and II-4). Students are advised by both the Division-level professional advisors and by faculty advisors. Students commented that UHCL advisors are accessible for students planning to transfer from community colleges and are looking at course decisions.

Professional advisors assist students in developing a Candidate Plan of Study that indicates the courses that have been accepted for transfer and those courses that must be completed in order to meet the requirements of the program. The professional advisors also conduct a preliminary, mid-term, and final audit for graduating seniors. While there are established standards and procedures to ensure that graduates meet the requirements of the program, the team identified two transcripts where students had failed to take a required science laboratory course that is needed to meet the science requirements of the *Criteria*. This is a concern with respect to Standard II-5 that constitutes a weakness in the Student Support Category.

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. However, there is a concern relative to Standard III-2.

There are the equivalent of thirteen faculty members shared between the Computer Science and Computer Information Systems programs. The five faculty members who have primary commitment to the Computer Science program and the remaining equivalent of eight, who provide support by teaching either required or elective courses, are adequate to provide continuity and stability of the program (Standard III-1). Faculty members from the Computer Systems Engineering and Software Engineering programs provide additional support. Full-time faculty members cover most of the classroom instruction (Standard III-3). The faculty is well qualified and capable of teaching a variety of courses and planning and modifying both the courses and the program (Standard III-4). Students complimented the dedication of the faculty to the students.

All faculty members are current in the discipline, and a number have received or have been nominated for prestigious teaching and/or research awards (Standard III-5). All faculty members have a level of competence that would normally be obtained through graduate work in Computer Science, and half of the faculty members have a PhD in Computer Science (Standards III-6 and III-7). Faculty members have sufficient time for scholarly activities and professional development (Standard III-8). Advising duties are recognized as a part of the faculty members' workloads (Standard III-9).

While full-time faculty members provide oversight for all coursework, the team found inconsistencies in the course coverage by adjuncts. Such inconsistencies could affect the quality of the educational experience received by students in the program. This is a concern with respect to Standard III-2.

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.

At the time of the visit, the intent of the Curriculum Category was not met. Standards IV-5, IV-6, IV-7, IV-8, IV-9, IV-15, IV-16, and IV-17 were not satisfied, and the institution did not

demonstrate that the intent of this category was met by some alternate means. This is a deficiency with respect to the Curriculum Category.

General

The curriculum requires a total of 54 hours of computer science courses (Standard IV-1). Even after six of the listed 42 hours of mathematics and science were excluded (Electronic Circuits I and II), the curriculum was determined to have 36 hours of study in mathematics and science (Standard IV-2). The curriculum includes 33 hours of study in humanities, social science, arts and other disciplines, which broadens the background of the student (Standard IV-3). The curriculum is consistent with the documented objectives of the program (Standard IV-4).

Computer Science

Two problems, one with the self-study and another with the course material display, made it impossible for the team to confirm that the standards in this portion of the category were satisfied.

From the self-study, those courses categorized as Computer Science Core and Computer Science Advanced courses in the Course Requirements of Curriculum (term by term and year by year) table in the self-study are not consistent with those listed for core materials basic coverage of algorithms, data structures, software design, concepts of programming languages, and computer organization and architecture; nor are they consistent with those listed for core materials coverage of theoretical foundations, problem analysis, and solution design. Thus, the team was unable to determine that Standards IV-6 and IV-7 were satisfied. This is a deficiency in the Curriculum Category.

The course materials display usually provides evidence of breadth and depth of coverage in single courses, proficiency over several courses, application of grading standards, assessment of skills such as writing, presentations, and teaming, and coverage of social and ethical implications of computing. Although the physical layout of materials was organized, the course materials for individual courses were incomplete and unorganized. The team attempted to gain understanding from what was available, but, because of the inconsistencies and incompleteness, it was not possible to determine breadth of coverage in the core. Standard IV-5 was not satisfied, and this is a deficiency with respect to the Curriculum Category.

The team examined the available, albeit incomplete, course material displays for any evidence related to programming language coverage. Although students were exposed to a large number of programming languages, including C, C++, Java, Assembly, and Pascal (or Visual Basic), and systems, the advanced programming course in C, Java, and OO Design and Programming in C++ did not appear to build upon the basic programming concepts from Pascal (or Visual Basic)—from the available course display materials, each appears to be delivered as though it were a first programming course studied. Furthermore upper level courses such as Data Structures allowed students to choose among C, C++, and Java for assignment completion, rather than specifying one so that proficiency could be developed. Without corroborating evidence from the course

material display, the team could not determine whether or not students become proficient in one language. Standard IV-8 was not satisfied; this is a deficiency with respect to the Curriculum Category.

Some of the courses counted within the category table as advanced computer science content did not appear to be advanced, in particular the programming course – OO Design and Programming in C++. Moreover, students could select from four additional programming courses (Advanced Java, C# and .Net, Unix, and Web Development) 6 hours of advanced computer science elective coursework. The course display was insufficient to determine conclusively whether or not these courses provide breadth and build upon the core. For example, the team could not determine the depth of coverage relationships between the elective computer science network protocol course and the required computer engineering telecommunication and between the required computer science Computer Architecture and Assembly course and the required computer engineering Computer Architecture course. Standard IV-9 was not satisfied; this is a deficiency with respect to the Curriculum Category.

Mathematics and Science

The curriculum includes 24 hours of mathematics (Standard IV-10). The program provides a very solid preparation in mathematics and includes course work in Calculus I, II, and III, Linear Algebra, Differential Equations, Discrete Math, and Probability and Statistics (Standard IV-11). According to the self study, the program requires 18 hours of science. Twelve of these hours consist of courses in Chemistry I, Physics I and Physics II, and the remaining six hours consist of Electronic Circuits I and II. Although the courses in Chemistry and Physics satisfy the requirement for courses in science or courses that enhance the student's abilities in the application of the scientific method, the coursework in Electronic Circuits does not meet this requirement. Nevertheless, there is sufficient science, including a lab science sequence, required in the program (Standards IV, 12, IV-13 and IV-14).

Additional Areas of Study

Because of the incompleteness of the course display, it could not be confirmed that the oral and written communications were developed and applied in the program. From the student interview session, those present stated that they had done very few presentations but had submitted several written assignments. Standards IV-15 and IV-16 were not satisfied; this is a deficiency with respect to the Curriculum Category.

The self-study reported coverage of social and ethical implications of computing among several courses rather than the solution proposed in the final statement from the previous visit, namely a required course: CSCI 4837, Social, Ethical and Security-Related Issues in Computing. Because of the incompleteness and the lack of organization of the display materials associated with these courses, it could not be determined if there was sufficient coverage of social and ethical implications of computing. Standard IV-17 was not satisfied; this is a deficiency with respect to the Curriculum Category.

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.

Computer Science students have access to institutional labs maintained by the university as well as five specialized teaching labs for computer science and computer information systems: a Unix lab, a Windows lab, a Systems Administration lab, a Distributed Computer Security Laboratory, and a Capstone lab (Standard V-1). Web pages provide readily accessible documentation for both institutional labs and the five specialized computing labs (Standard V-2). Each faculty member has access to adequate computing facilities for both class preparation and for scholarly activities; many have more than one computer system for office use. Office computers are replaced every three to four years (Standard V-3). Personnel from the University Computing and Telecommunications group maintain the institutional labs; a half-time systems administrator and a half-time technology specialist maintain the five specialized computing labs (Standard V-4). Laboratory assistants provide instructional support in the institutional laboratories; teaching assistants provide assistance in the five specialized computing labs (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.

Many faculty members have received or have been nominated for awards of teaching excellence and have been awarded university support for faculty research projects. Faculty maintain their competence as teachers and scholars through attendance and presentations at national professional meetings and conferences, publications, internally/externally funded projects, and collaboration with high-tech industries affiliated with NASA's Johnson Space Center (Standards VI-1, VI-2, and VI-3).

Office support is adequate for the type of program, the level of scholarly activity, and the needs of the faculty members (Standard VI-4). Although no formal release time is provided for program administration, other release time and flexible teaching scheduling for the administrators affords adequate time to administer the program (Standard VI-5). Upper levels of administration provide the program with the resources and atmosphere needed to function effectively with the rest of the university (Standard VI-6). Resources are provided to acquire, maintain, and operate excellent

laboratory facilities that meet the needs of the program (Standard VI-7). Resources are provided to support library and related information retrieval facilities that meet the needs of the program (Standard VI-8). There is evidence that the Institutional support and financial resources will remain in place throughout the period of accreditation (Standard 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.

Interviews with a library representative and faculty indicate satisfaction with the library resources. The library is adequately staffed with professional librarians and support personnel (Standard VII-1). The library's technical collection is adequate to support the program (Standard VII-2). The library supports a number of systems for locating and obtaining electronic information online, including ACM. IEEE, Computing Reviews Online, Web of Science, Ebrary, Safari Tech Books Online, NetLibrary,, and Applied Science Full-Text (Standard VII-3). Classrooms are well-equipped with workstation access to the internet as well as projectors and audio/video equipment (Standard VII-4), and faculty offices are satisfactory for interaction with students and for their professional needs (Standard VIII-5).

H. ABET Policies and Procedures

The ABET Policies and Procedures, section II.E.c.(10) requires that the institution exhibit samples of student work that reveal the spectrum of educational outcomes, including sufficient examples of student work in technical courses and to demonstrate compliance with the requirement for student competence in written and oral communication. The course displays provided to the team lacked compliance with this provision, as they were incomplete and not organized effectively to allow the team to determine compliance with several elements of the Curriculum Category. This is a deficiency with respect to the ABET Policies and Procedures.

I. Observations

The following is a summary of observations made during the visit:

1. Consideration should be given to explicitly recognizing administrative responsibilities of the department and division chairs.

III. ACTIONS SINCE THE VISIT

1. At the time of the visit, there was a deficiency in the Curriculum Category. Inadequacy of the course materials provided to the team resulted in Standards IV-5, IV-6, IV-7, IV-8, IV-9, IV-15, IV-16 and IV-17 not being satisfied. The display problem also resulted in a deficiency with respect to the ABET Policies and Procedures Manual.

   The following is a summary of the program's response to these deficiencies.
   a. The response described a redefinition for core and advanced courses that list 33 semester hours of core coverage. Some of these hours involved parts of elective courses. Removal of the partial assignment of electives to core reduces the core coverage to 30 semester hours.
   b. Plans were noted to teach the Java course as an introductory course to compensate for the perceived lack of rigor in transfer introductory programming courses and then to build upon Java in the CSCI 3333 Data Structures course.
   c. A CD consisting of course display materials for the program was provided for review.

   The course display materials in (c) were incomplete. Nevertheless, from the course materials provided, there is a broad-based core of fundamental computer science consisting of at least 16 hours (Standard IV-5); there is basic coverage of algorithms, data structures, software design, concepts of programming languages, and computer organization and architecture (Standard IV-6), theoretical foundations, problem solving, and solution design are stressed within the program's core materials (Standard IV-7), and there is at least 16 semester hours of advanced course work in computer science that provides breadth and builds on the core (Standard IV-9). However, the redefinition of the core as described in (a) continues to be inconsistent with data in the course materials. This results in inconsistent accounting of core and advanced course coverage in the program, and mitigates the ability to determine the strength of compliance with Standards IV-5, IV-6, IV-7 and IV-9. Therefore, although these standards are satisfied there are concerns with respect to each of them that contribute to a weakness in the Curriculum Category.

   Even if the plans described in (b) are implemented, allowing majors the choice of C++ in CSCI 3333 may not insure that all graduates become proficient in at least one high-level language. Standard IV-8 is satisfied, but there is a concern with respect to this standard that also contributes to a weakness in this category.

   Although the course display materials in (c) were incomplete, there were sufficient materials to conclude that oral, written communication are developed and applied in the program (Standards IV-15 and IV-16). Moreover, the course display materials provide evidence that there is sufficient coverage of social and ethical implications of computing to give students an understanding of a broad range of issues in this area (Standard IV-17).

   The course materials provided in the CD are sufficient to remove the deficiency with respect to the ABET Policies and Procedures Manual (APPM). However, because at the time of the

visit these materials were incomplete and poorly organized, and since even the additional materials provided were not complete, a concern remains with respect to the APPM.

2. At the time of the visit there was a weakness in the Objectives and Assessment Category, associated with Standards I-1, I-3, I-5 and I-6. Program objectives were not consistently stated, data relative to program-level assessment was not documented, program improvements were not clearly tied to assessment activity, and there was not clear and consistent documentation of the results and actions taken based on assessment.

   Since the visit, the program has updated the objectives on the CS website and has submitted the same set of objectives to update the 2008-2009 catalog to be distributed in the Fall of 2008. However, these objectives do not appear to include statements related to the accomplishments expected of graduates of the program (i.e., program educational objectives). Thus, the concern relative to Standard I-1 remains, and continues to contribute to a weakness in this category.

   The program also has implemented a password protected, intranet for CS and CIS for assessment documentation. The format uses a multi-column format, collecting information related to specific learning outcomes and program outcomes: Assessment Methods, Criteria for Successes, Assessment Results, Use of Results, and Funds needed. From the samples in the response to the draft, the intranet is also used to collect faculty meeting minutes. A sample of the faculty meeting minutes documents a faculty discussion of data collected from a CIS survey (rather than a CS survey). Although this represents an improvement in data collection and documentation, and offers some evidence that data collected are used in assessment, there is no specific plan for periodic collection and review of the data. Nor does there appear to be data collected relative to program educational objectives; this may be tied to the concern above relative to Standard I-1. Thus, the concern with respect to Standard I-3 also remains, and continues to contribute to a weakness in this category.

   While the response shows some documentation of program assessments and their use in identifying opportunities for improvement, there is a lack of systematic evidence of this nature. Moreover, the lack of apparent assessment of program educational objectives limits the effectiveness of the procedures in use. Therefore, the concerns with respect to Standards I-5 and I-6 remain, and continue to contribute to a weakness in this category.

3. At the time of the visit, there also was a weakness in the Student Support Category. Transcripts were discovered that permitted students to graduate without having completed a required lab associated with one of the science courses; this lab is needed to meet the science requirements of the criteria.

   Since the visit, advisors are being informed of the 12 hours of science requirement, and the 2+2 community college transfer plans are being updated with specific statements regarding the lab requirement.

These actions may positively address the weakness, but until they are implemented and their effects observed, the concern with respect to Standard II-5 remains and continues to contribute to a weakness in this category.

4. At the time of the visit, there also was a concern with respect to Standard III-2. The response did not address this concern. Hence, this concern remains.

IV. CONCLUSIONS

The following is a summary of the current status of the program relative to the continuing concerns from the 2001-2002 visit:

1. (Standard III-9) Advising must be a recognized part of faculty members' workloads. In the recent past, some faculty members have had extremely heavy advising loads without any offsetting reduction in teaching loads. An assignment procedure put into place to correct this concern needs to be evaluated.

   Status: No longer a concern.

2. (Standards IV-15, IV-16, and IV-17) Oral and written communications skills must be developed and applied in the program, and there must be sufficient coverage of the social and ethical implications of computing. Program changes were implemented in the spring of 2002 semester to address this concern, but the effectiveness of these changes needs to be evaluated.

   Status: No longer a concern.

3. (Standard VI-5) Adequate time must be provided for the administration of the program. The program chair has not had a teaching load reduction adequate to offset the burden of important administrative duties. Steps taken to correct this concern need to be evaluated for effectiveness.

   Status: No longer a concern.

The program meets the intent for all of the seven categories in the *Criteria*.

However, there are concerns with respect to Standards I-1, I-3, I-5 and I-6 that contribute to a weakness in the Objectives and Assessment Category, a concern with respect to Standard II-5 that contributes to a weakness in the Student Support Category, and concerns with respect to Standards IV-5, IV-6, IV-7, IV-8, IV-9 that contribute to a weakness in the Curriculum Category.

1. (Standard I-1) Delineation of program educational objectives on the website and the 2008-2009 course catalog should be clearer.

2. (Standard I-3) While there is some evidence that data collected are used in assessment, specific plans for periodic collection and review of data relative to the program educational objectives are limited.

3. (Standard I-5) There is a lack of systematic use of assessment data to identify opportunities for program improvement. Moreover, the lack of apparent assessment of program educational objectives limits the effectiveness of the procedures in use.

4. (Standard I-6) There is a lack of systematic documentation of the results of their assessment and the actions taken based on those results. Moreover, the lack of apparent assessment of program educational objectives limits the effectiveness of the documentation procedures in use.

5. (Standard II-5) The new procedures to help ensure that graduates of the program meet all requirements have yet to be fully implemented and their effectiveness observed.

6. (Standard IV-5) The inconsistent definitions of core and advanced coverage in the program, and the resulting inconsistent accounting of broad-based core courses, mitigate the ability to determine the strength of compliance with this standard.

7. (Standard IV-6) The inconsistent definitions of core and advanced coverage in the program, and the resulting inconsistent accounting of core material coverage of algorithms, data structures, software design, concepts of programming languages, and computer organization and architecture, mitigate the ability to determine the strength of compliance with this standard.

8. (Standard IV-7) The inconsistent definitions of core and advanced coverage in the program, and the resulting inconsistent accounting of how theoretical foundations, problem analysis, and solution design are stressed in the program's core materials, mitigate the ability to determine the strength of compliance with this standard.

9. (Standard IV-8) Allowing majors the choice of C++ in CSCI 3333 may not insure that all students become proficient in at least one high-level language.

10. (Standard IV-9) The inconsistent definitions of core and advanced coverage in the program and the resulting inconsistent accounting of advanced course work that provides breadth and builds on the core to provide depth, mitigate the ability to determine the strength of compliance with this standard.

The program met the intent for all other categories in the *Criteria* by satisfying the associated standards. However, the following concerns associated with one of the standards and with respect to the ABET Policies and Procedures were identified.

1. (Standard III-2) While full-time faculty members provide oversight for all coursework, there were inconsistencies in the course coverage by adjuncts.

2. (ABET Policies and Procedures) Incomplete and ineffectively organized course display materials may compromise the ability of the team to determine compliance with the criteria.

These weaknesses and concerns may affect the stability, quality, or future accreditation of the program and will be of special interest in the next evaluation.