DEPARTMENT OF COMPUTER AND INFORMATION SCIENCES

INDIANA UNIVERSITY – SOUTH BEND

South Bend, Indiana

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A. INTRODUCTION

Indiana University – South Bend (IUSB) is a state-assisted regional university serving the surrounding region of South Bend, Indiana. IUSB is the third largest university among the Indiana University campuses whose mission is:

“...to create, disseminate, preserve, and apply knowledge. The campus is committed to excellence in teaching, learning, research, and creative activity; to strong liberal arts and sciences programs and professional disciplines; to acclaimed programs in the arts and nursing/health professions; and to diversity, civic engagement, and a global perspective. IU South Bend supports student learning, access, and success for a diverse residential and non-residential student body that includes under-represented and international students. The campus fosters student-faculty collaboration in research and learning. Committed to the economic development of its region and state, Indiana University South Bend meets the changing educational and research needs of the community and serves as a vibrant cultural resource.”

Founded in early 1960's along the St. Joseph River, the campus featured two buildings-Northside and Greenlawn Halls. The first class of 30 students graduated in 1967. Today, its 80-acre campus has grown to approximately 7,500 students and 12 buildings and it offers a wealth of choices, including more than 100 undergraduate programs, 17 graduate degrees. IUSB employs approximately 321 (IU Factbook, 2005-06) FTE faculty members. The university graduates approximately 1000 (actually it was 978 in 2004-05, IU-Factbook) students each year.

The College of Liberal Arts and Sciences is one of six schools and divisions of the university. The mission of the College is as follows:

“At the center of Indiana University South Bend’s educational mission lies the College of Liberal Arts and Sciences. The College creates an intellectual and civic-minded community that encourages our students to grow academically and become citizens of a global world. Through studies in the humanities, social sciences and natural sciences, students come to appreciate the complex intersection of nature, history, culture, social class, race, ethnicity, gender, religion, technology, and politics. At the same time, students acquire essential skills in writing, critical thinking, scientific investigation and languages. Such a liberally educated student is well prepared to meet the challenges of our ever-changing world. The faculty’s commitment to teaching, research, and service fosters an environment of collaborative inquiry, experiential learning, multidisciplinary study, and community engagement.”

The College sponsors majors in more than thirty programs, leading to the Bachelor of Arts, Bachelor of Science, Associate of Arts, and Associate of Science degrees. It also sponsors graduate programs in Applied Mathematics and Computer Science, Psychology, English, and Liberal Studies. The College offers opportunities for undergraduate and graduate research, faculty mentoring, and interdisciplinary studies.

The Department of Computer and Information Sciences is one of thirteen departments in the College. The department administers the B.S. in Computer Science program. It also administers
the A.S. in Computer Science, the B.S. in Informatics, the M.S. in Applied Mathematics and Computer Science, as well as four minors and certificate programs. The mission of the department is:

“... to inspire and educate the next generation of computer scientists, enabling them to apply their problem solving and software engineering skills to serve our society. We also seek to examine, challenge, create and disseminate new knowledge in computer and information sciences. Finally, we seek to provide the highest quality education in the most enjoyable and collegial atmosphere possible.”

The university began offering computer science degrees in 1984 through the Department of Mathematics, which was later renamed the Department of Mathematics and Computer Science. The program continued to grow between 1984 and 2000, graduating approximately 200 students. In 2000, the Computer Science separated from Mathematics into a distinct department. Almost immediately, the department began to expand its programs as well as increasing the number of faculty. The faculty grew from five members to eight members by 2001, and currently it stands at 9.5 (FTE). In the 2006-2007 academic year, the department is searching for two additional faculty members (one of which will be a replacement position). During the same six-year period, the department has introduced a number of new programs such as the B.S. in Informatics, M.S. in Applied Mathematics and Computer Science, as well as a number of certificate programs which provide computing courses for non-majors, and professional in the community. At the time of the visit, the department was serving 215 undergraduate students (175 in computer science and 40 in informatics), and 30 graduate (master) students.

The consultant evaluated the B.S. degree in Computer Science of the Indiana University – South Bend for possible accreditation under the CAC/ABET “Criteria for Accrediting Programs in Computer Science in the United States” dated October 2006 (criteria). The consultant notes that the Computing Accreditation Commission (CAC) of ABET has not previously accredited the program at the time of the evaluation.

B. REPORT OF FINDINGS FROM THE CAC EVALUATION VISIT

The criteria are divided into seven major categories. Each category contains a statement of intent that provides the underlying principles associated with the category. To be accreditable, a program must meet the intent of each category. Each category also contains standards that provide a detailed description of how a computer science program can meet the statement of intent. A program can meet an intent by satisfying all the associated standards or by demonstrating that an alternate implementation fully meets the intent.

This section contains the report of the consultant's findings at the time of the evaluation site visit. The CAC would consider the following comments to relate directly to its accreditation actions. The section is structured as follows. For each category, a summary statement as to whether the program meets the intent of the category follows the statement of intent. All deficiencies, weaknesses, and concerns related to the category are also summarized. Detailed findings are then presented. For better understanding, the reader should have a copy of the criteria for reference alongside this report.
I. Objectives and Assessments

Criteria 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.

At the time of the visit, the program did not meet the intent of the Objectives and Assessments category. The institution did not satisfy Standard I-1 through Standard I-4 and the institution did not demonstrate that it met the intent of this category by some alternative means. This is a deficiency with respect to the Objectives and Assessments category. In addition, there are two serious concerns relative to Standard I-5 and Standard I-6 that, in the absence of a deficiency, would have constituted a weakness with respect to the Objectives and Assessments category.

The institution has presented a mission statement that needed enhancement. The program did not define measurable program objectives in the self-study. They appeared neither on the departmental website nor in the university catalog. In fact, the department has yet to determine the constituencies to develop the objectives of the program. Hence, the situation does not satisfy the criteria (Standard I-1). The department has not developed expected outcomes for the program in any formal way and it is not clear which statements already are expected outcomes and whether they associate to program objectives (which do not yet exist). The situation does not satisfy Standard I-2 requiring objectives to include expected outcomes.

The department collects data from graduates regarding the program and employment and from employers. The frequency of collection is not clear, though the self-study indicates that most data collection occurs annually. The department has made a first attempt to collect these data routinely, documents the results, and has tried to use these data in program assessment. However, the department has collected a marginal amount of data over the past six years. Furthermore, the department did little to help ensure a more active response to its effort to do assessment and as a result, it did not satisfy the criteria in this regard (Standard I-3). The self-study used a standard matrix in an attempt to show periodic assessment. However, the department has not posed questions in the surveys and other outcome tools to measure the effectiveness of vacuous objectives through the expected outcomes. Surveys and their results are few and they address generalities rather than outcomes and objectives. Since objectives do not exist and since most of the fifteen stated outcomes seem disconnected with assessment processes and more associated with knowledge areas, the program does not satisfy Standard I-4 requiring the periodic assessment of each objective.

The department attempted to show ways to improve the program and it has implemented some of indications as verified by the consultant. However, the department did not engage itself in a forthright manner to address the activities of assessment; as a result, the Department has lost opportunities for continuous improvement of the program, which is a serious concern relative to Standard I-5. The department has documented some of its assessment policies and procedures, albeit minimally. The department needs to address this issue in a more complete and systematic manner and as a result, a serious concern exists relative to the criteria (Standard I-6).

Despite the negative overtones above relative to the criteria, the department has demonstrated an eagerness to modify its exiting assessment processes and to address in earnest
the issues at hand. The consultant recommends strongly that it abandon its current model and focus its attention to the proposed (new) ABET criteria for computer science programs, which will go into effect at within the next eighteen months.

II. Student Support

Criteria 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 the associated standards with one concern relative to Standard II-4.

Students seemed to be able to enroll in courses with no problem. The department offers required courses for the program approximately once per year and its plan of study allows students to complete the program within four years (Standard II-1). Classes generally have acceptable enrollments (fewer than thirty students) in all courses. Students are generally pleased with the faculty and their interaction with its students (Standard II-2).

Students can enter the computer science program, though some also achieve an associate degree. Students had no trouble receiving guidance from published materials or from a member of the faculty (Standard II-3). It appears that students do not have access to a permanent advisor for career guidance or for completion of course requirements. The advisement process seems disconnected and ad hoc, thought students feel that some member of the faculty is available to advise them when asked. The program uses the volunteer to do student advising while some members of the faculty have no advisee assigned to them. While most entering students (particularly freshmen) attend an orientation session to provide them with information to help them succeed at the institution, the overall advisement process is not clear. The overall advisement situation has created a concern relative to accessibility of qualified advisors (Standard II-4). The department chair ensures that graduating students have satisfied all program requirements before a student can graduate. The university certifies that students have met university requirements for graduation (Standard II-5).

III. Faculty

Criteria 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.

At the time of the visit, the program met the intent of the Faculty category by satisfying all the associated standards.
The department has nine energetic and talented full-time faculty members, seven of which have a primary commitment to the computer science program. The faculty includes three tenured associate professors, and six untenured assistant professors; one untenured laboratory supervisor and one lecturer play an active role in curriculum development and occasional teaching within the program. For the current size of the program, the program has enough faculty members (Standard III-1), though the growth of the master’s program and other expansions would require at least one more faculty position. Each course has a coordinator who is a full-time member of the faculty. Among the functions of the course coordinator is the selection of course materials (books and manuals) and oversight of adjunct/associate faculty members when they teach courses (Standard III-2). The data from the self-study and aggregate course schedules show that full-time members of the faculty cover most of the classroom instruction (Standard III-3).

The size and interests of the faculty appear sufficient to teach new courses and to modify existing ones (Standard III-4). Current full-time members have attended local and national conferences and all have a developed research output with refereed journal publications and conference proceedings and have a currency in the discipline (Standard III-5). All members of the full-time faculty have a doctorate in computer science and they all have achieved a level of competence in the field (Standard III-6 and Standard III-7).

All members of the faculty have a nine-hour teaching load and they have sufficient time for scholarly activities and professional development (Standard III-8). Since most of the faculty do not have formal advising functions, by default their advising duties do receive recognition as part of their workloads (Standard III-9).

IV. Curriculum

Criteria 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 program did not meet the intent of the Curriculum category. It did not satisfy Standards IV-2, IV-4, IV-10, IV-12, IV-13, IV-15, and IV-17 and the institution did not demonstrate that it met the intent of this category by some alternative means. This is a deficiency with respect to the Curriculum category. Furthermore, there are concerns with respect to Standards IV-11, IV-14, and IV-16.

General

The self-study and published material indicate that a typical student graduates with at least forty-four credits in computer science courses (Standard IV-1). The consultant has verified through the self-study and published material that the curriculum did not meet the one-year (30-semester-hour) requirement in mathematics and science. A sample of transcripts corroborates this fact (Standard IV-2). The university has a strong general education component for its
university programs, which satisfies the one-year requirement for humanities and social sciences (Standard IV-3). However, the institution has failed to show how it constructed the curriculum so that it would be consistent with the objectives of the program (that do not exist). This vacuous aspect of the self-study and the program does not satisfy the criteria that the curriculum must be consistent with the objectives of the program (Standard IV-4).

Computer Science

The self-study and the published curriculum demonstrate that the all students have at least sixteen semester hours in a broad-based core of fundamental computer science material (Standard IV-5). The self-study has demonstrated that basic coverage exists in algorithms, data structures, software design, concepts of programming languages, and computer organization and architecture (Standard IV-6). The self-study has demonstrated that the curriculum stresses theoretical foundations, problem analysis, and solution design within the curriculum of the program. Such emphasis for each area appears in at least six courses (Standard IV-7). The program exposes students to a variety of languages that include C++ in addition to other language areas. Students develop a level of proficiency in C++ and have exposure to computing systems such as Windows and Linux (Standard IV-8). After restructuring, the self-study and the published curriculum demonstrate that the all students have at least sixteen semester hours in required advanced computer science material (Standard IV-9).

Mathematics and Science

The self-study and published material indicate that all students must take fourteen credits in mathematics. The sample transcripts corroborate this fact, which does not satisfy the criteria of fifteen credits in mathematics (Standard IV-10). All students have exposure to discrete mathematics, differential and integral calculus, and probability and statistics. However, some of the courses in mathematics do not appear at a level expected of a computer science major, which leads to a concern relative to the criteria (Standard IV-11). The self-study and published materials indicate that all students should have three courses in science. However, not all students have fulfilled this requirement, as some of the courses are not at a level required of science majors (Standard IV-12). Furthermore, the program lacks a two-course laboratory sequence needed to satisfy the criteria (Standard IV-13). Additionally, the extra science course required to fulfill the science requirement may lack the depth needed to expose students further in the scientific method (Standard IV-14), which is a concern relative to the criteria.

Additional Areas of Study

It is not clear how students develop oral communication skills and the manner in which students apply such skills in the program is very inconsistent (Standard IV-15), which does not satisfy the criteria. All students take sufficient writing courses as part of their general education requirements to develop written communication skills. However, the department could not describe how students apply these skills in the program. This is a concern relative to the criteria (Standard IV-16). Coverage of social and ethical implications of computing is insufficient and likely totally lacking, which does not satisfy the criteria (Standard IV-17).
V. Laboratories and Computing Facilities

Criteria 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 the associated standards with one concern relative to Standard V-3.

Students do have adequate access to resource systems needed for their courses (Standard V-1). All documentation is available online for all systems used in the department (Standard V-2). All members of the faculty have adequate computing facilities in their offices for class preparation and scholarly activities. However, a concern exists relative to the criteria (Standard V-3) because the university did not maintain some of the special equipment some members of the faculty received, principally due from start-up funds. The university has provided adequate support personnel to install and maintain the departmental laboratories and computing facilities (Standard V-4). Student assistance is available in all laboratories of the department when needed (Standard V-5).

VI. Institutional Support and Financial Resources

Criteria 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 the associated standards with two concerns relative to Standard VI-2 and Standard VI-7.

The university has provided sufficient support to enable the program to attract and retain a high-quality faculty (Standard VI-1). The university provides travel support for faculty members to attend technical meetings and conferences at 80% for the first trip and 50% per trip thereafter. However, this amount seems marginal given the level of research activity of the faculty; hence, the situation borders on a concern relative to the criteria (Standard VI-2). The normal teaching load for the department is three courses. Sabbaticals are available every six years. Hence, the university has provided sufficient support and recognition of scholarly activities (Standard VI-3).

The self-study and the inspection by the consultant assure that office support is sufficient and consistent with the scholarly level of the program (Standard VI-4). One full-time secretary serves the needs of the department and the program. The department has a visionary chair who receives a two-course annual released time for exercising his duties, which appears sufficient for the proper administration of the program. In addition, the department also has an associate chair who receives no released time, though he receives a modest stipend. This arrangement appears
marginally adequate for the administration of the department and the program (Standard VI-5), though the associate chair should receive some released time for his services.

Support from upper administration appears adequate. The department chair fosters a positive atmosphere with the administration so that the department and the program function effectively within the rest of the university (Standard VI-6). The university plans to replace equipment every three years. However, the funding needed is approximately $30,000 but the university funds the replacement only at a level of $10,000. The situation is a concern relative to the criteria (Standard VI-7). Resources seem available to support the library and related retrieval facilities needed for the program (Standard VI-8). There is reason to believe that institutional support and financial resources would stay in place over the next six years (Standard VI-9).

VII. Institutional Facilities

Criteria 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 the associated standards with one concern relative to Standard VII-2.

The consultant visited the library used its resource retrieval system. The library seems adequate with a proper staff of professional librarians and personnel (Standard VII-1). The library holdings did not seem to include up-to-date materials in books and periodicals. Although the library has a full subscription to the ACM digital library, it lacks even a partial subscription to the IEEE Computer Society digital library. Therefore, the situation is a concern relative to the criteria (Standard VII-2). The library has adequate facilities for locating and obtaining electronic information. Computers are available throughout the library with printing facilities for academic use, including access from faculty offices and from off campus (Standard VII-3).

The consultant has inspected the majority of classrooms used by the program. All classrooms are modern with equipment that supports positively the attributes of the program. Additionally, special-purpose laboratories are available for special projects (Standard VII-4). Currently, each member of the faculty has a private office. Faculty offices are well appointed and spacious enough to accommodate the needs of the faculty members. Each has a workstation of his or her choice, the oldest being three years (Standard VII-5).

C. CONCLUSIONS

The department and the department chair have done a remarkable job over the past six years in developing a vibrant group of faculty members who are committed to excellence and who remain active in their teaching, research, and service. During the past six years, faculty members have added nearly twenty new courses and have published over eighty scholarly articles, with more than 10% coauthored by undergraduate and graduate students. Faculty members have obtained nearly twenty-five internal and external grants, including funding for assessment, research, and instruction.
Despite concerns over dropping computer science enrollments in the United States and beyond, enrollment in the program has remained strong. The alumni from the program appear to remain local, with 75% of them working and living in the region. Graduates from the program have been successful in finding suitable positions in the computing industry. To reinforce this success, the department has plans for ongoing development of its graduate program in computer science; it is contemplating the formation of concentrations in “smart” areas such as software engineering and computer security.

At the time of the external visit, the consultant found that the program met the intent statements for five of the seven categories in the criteria. The program did not meet the intent of Objectives and Assessment (category I) and Curriculum (category IV) of the criteria. These deficiencies with respect to the criteria associate to four standards of category I and five standards of category IV. Furthermore, two concerns in category I would have contributed to a weakness in the program if the category were not deficient. In addition to the stated deficiencies and potential weaknesses, a number of concerns loom over the program. These weaknesses and concerns may affect the stability, the overall quality, or the future accreditability of the program. A program that does not meet the intent of all categories in the criteria would be determined to be not accreditable.

To help develop an action plan, the consultant has identified some issues that require attention as soon as possible; these issues now follow.

- Create measurable educational program objectives.
- Define constituencies to formulate these objectives.
- Form an advisory board that would be helpful in formulating the program objectives and that could help the department to understand better the needs of industry.
- Develop measurable program outcomes that parallel ABET expectations.
- Refine the documentation and measurement of assessment activity.
- Document and measure how course outcomes contribute to program outcomes.
- Develop an effective assessment evaluation system.
- Demonstrate how each graduating student has been able to meet the program outcomes.
- Develop a mechanism for measuring and evaluating the knowledge and skills of its graduates.
- Improve course display materials to include graded assignments and tests.
- Support and retain qualified students in its programs.
- Restructure the science requirements to include at least 12 science credits in courses required of science majors.
- Ensure that students take a two-semester sequence of a science course with laboratories.
- Increase the mathematics requirements to 15 credits. Currently, the requirement is 14 credits. Student exposure must include discrete structures and should include some combination of calculus, linear algebra, and probability and statistics.
- Improve the development and application of oral and written communication skills of graduates through required courses of the program.
- Ensure that student advisement is a necessary component of faculty responsibility and make certain that the administration recognizes and supports that activity.
- Work to obtain library electronic access to IEEE publications.
- Recognize faculty scholarly activities through administrative incentives.
- Increase the laboratory budget to be consistent with a 2.5 to 3 year replacement cycle for laboratory equipment.

Despite the issues identified above, the state of the department is strong. Faculty members are active in their discipline; the students seem engaged and interested in learning; laboratory resources appear adequate. Administrative support for the program seems to have been very good in recent years. The department has been successful in developing new programs and has been able to attract talented faculty members who can only make the program better.

D. RECOMMENDATIONS

In addition to the aforementioned, the consultant makes the following recommendations relative to the program.

(a) Satisfy all standards in category I and in category IV as previously mentioned that contributed toward a deficiency.
(b) Ensure the removal of any cited concern related to a standard in the aforementioned categories.
(c) For all standards in all categories, review and strengthen each standard to ensure that elements of the program make the program robust relative to the current criteria.
(d) Consider the proposed (new) CAC/ABET criteria that appears on the ABET website (www.abet.org). With that consideration, begin migrating away from the current criteria and modify the program so it conforms to the proposed (new) criteria. Note that many elements of the current criteria are useful toward the proposed (new) criteria.
(e) Consider rewriting the current mission statement of the department to make it more robust and to keep it in harmony with the mission of the college.
(f) Begin identifying constituencies, including a professional advisory board, to formulate program objectives based on the eleven expected program outcomes stated in the proposed (new) criteria and to link them to the new mission of the department.
(g) Ensure that course outcomes are in harmony with the program outcomes. Map these connections in the best (optimal) manner possible to ensure that all students satisfy the program outcomes by the time of graduation.
(h) Postpone any thought of seeking ABET accreditation for at least two or three years. It is important to complete at least one assessment cycle, but preferably two assessment cycles, before an official ABET visit.
(i) Accreditation visits take place in the fall. Before having an official accreditation visit, consider inviting two consultants for a mock visit six to twelve months before the visit. This would ensure sufficient time to modify the program should the consultants identify problematic areas. The assessment portion of the criteria is particularly vulnerable.
(j) The consultant discussed many ideas with faculty and administration members during the time of the current visit such as use of graduate TAs and obtaining external grants to increase the fiscal base of the program. It would be beneficial to consider these ideas in improving the program and the department.