

Memorandum

To: ABET

From: IIT Computer Science Department

Subject: Response to “Draft Statement for Review and Comment”

Date: February 25, 2009

We would like to thank Professors Richard Helps and Leemon Baird for their thorough and professional review of the Computer Science Program, identifying its strengths and weaknesses. This document is our response to their Draft Statement for Review and Comment.

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Our response focuses on the single “weakness” that was identified in the Statement, but also addresses briefly the two “concerns.” Note that the one “observation” (involving the specific wording of the ABET accreditation statement on the Departmental Web site and the Undergraduate Catalog) was addressed during the actual visit and therefore not further mentioned in this response.

Response to Weakness

We were found to have a weakness with regard to Criterion 4. Two sections of that criterion were cited by the evaluation team as areas in need of improvement. First, the program must “regularly assess its program educational objectives and program outcomes and to evaluate the extent to which they are being met”; and, second, that “the results of the evaluations are documented and used to effect continuous improvement of the program through a documented plan.”

With regard to the first citation, the evaluators noted that “Although the department administers surveys related to objectives and outcomes, it does not evaluate the extent to which the objectives and outcomes are met.” Prior to the visit, we recognized that this criterion may be an issue, and a direct assessment of course materials would be necessary to augment the alumni surveys and indirect assessments that we already conduct. We also determined that our previous process fell short in evaluating the extent to which our program objectives and outcomes were being met. At the time of our visit, this new direct assessment process and metric goals for objectives and outcomes had been approved by our Department, but unfortunately, we were not able to apply them immediately as some of the necessary data collection could only be done at semester boundaries (i.e., after the ABET visit).

To demonstrate that this weakness has been addressed, we offer the following assessment results from this past semester (Fall 2008). Our results are obtained by using five different measurement tools, which are now part of our regular assessment process.

1. Program objectives are measured with a new Employer Survey (completed by eight supervisors of our recent alumni).
2. Program objectives are measured with a redesigned Alumni Survey (completed by 68 alumni).
3. Program outcomes are measured with a redesigned Survey of Graduating Seniors (completed by 10 graduating seniors).
4. Program outcomes continue to be indirectly measured by student assessments completed at the end of each semester.

- Program outcomes are directly measured with a new direct assessment process based on specific graded tasks required in a course. For the most recent completed semester (Fall 2008), five courses were used to map to all of our program outcomes.

Measurement Tool #1: Program Objectives using the Employer Survey

Satisfaction of program objectives is a major component of our employer survey. For each objective, we asked if the employer strongly agreed, agreed, was neutral, disagreed, or strongly disagreed that our graduates had achieved each objective. Our goal was to obtain a minimum 75% agreement (or strong agreement) with each objective from our employers. The summary of survey results is given in the table below.

Table 1: Employer Survey Results

Program Educational Objective	Strongly Agree or Agree	Neutral, Disagree, Strongly Disagree
O1: Robust Problem Solving Skills	100%	0%
O2: Substantial knowledge of a broad class of problem-solving techniques (e.g.; this includes algorithms, heuristics, and design techniques).	87.5%	12.5%
O3: Substantial understanding of the fundamentals of Computer Science.	100%	0%
O4: Ability to clearly communicate technical concepts both orally and in writing.	100%	0%
O5: Ability to readily work with other disciplines.	87.5%	12.5%

It can be seen from Table 1, that all five outcomes were found to be above our threshold for employer evaluations. While this is a small sample size (8 employers) we see the value in conducting this survey every 2 years as it is the best way to measure the extent to which our students are meeting the program objectives. If the goal of 75% agreement is not met for an objective, our CS Undergraduate Studies Committee will investigate possible program or course changes. As we collect more data, we will revisit the 75% threshold to ensure that employer feedback is collected and analyzed appropriately, and also be used when review and update our program objectives as necessary (addressed later in this memo).

Measurement Tool #2: Program Objectives using the Alumni Survey

The Alumni Survey contains a number of questions that are directly related to each program objective or pair of program objectives. (Some objectives were grouped to reduce question redundancy). Since this survey was conducted before we had finalized our evaluation process, responses were limited to excellent, good, fair, and poor. For consistency, we have mapped these responses as strongly agree (excellent), agree (good), and neutral/disagree/strongly disagree (fair and poor). Clearly, for future surveys we will use the same Likert scale for all surveys. Our goal was to obtain a minimum 75% agreement (or strong agreement) with each objective from our alumni. The following table summarizes the responses for all of the questions that pertain to each objective.

Table 2: Alumni Survey Results

Program Educational Objective	Strongly Agree or Agree	Neutral, Disagree, Strongly Disagree
O1: Robust Problem Solving Skills	83%	17%
O2: Substantial knowledge of a broad class of problem-solving techniques (e.g.; this includes algorithms, heuristics, and design techniques).		
O3: Substantial understanding of the fundamentals of	75%	25%

Computer Science.		
O4: Ability to clearly communicate technical concepts both orally and in writing.	72%	28%
O5: Ability to readily work with other disciplines.	79%	21%

It can be seen that objective O4 falls below our threshold and O3 is precisely at our threshold. Based on these results (more accurately the detailed, question level results), the Undergraduate Studies Committee will identify the areas in the Computer Science Curriculum that might be modified in order to improve the fundamentals of Computer Science and communication skills of our students. As we collect more data, we may revisit the 75% threshold to ensure that alumni feedback is collected and analyzed appropriately, and future results will also be used when reviewing and updating our program objectives (addressed later in this memo).

Measurement Tool #3: Program Outcomes using Graduating Senior Survey

Graduating seniors were asked several questions that were mapped to program outcomes. Ten students responded to the survey. The students were asked if they strongly agreed, agreed, were neutral, disagreed, or strongly disagreed with survey statements. Our goal was to obtain a minimum 75% agreement with each objective from our graduating seniors. The following table averages the responses for all of the questions that pertain to each outcome.

Table 3: Graduating Senior Survey Results

Program Outcome	Strongly Agree, Agree	Neutral, Disagree, Strongly Disagree
a. An ability to apply knowledge of computing and mathematics appropriate to the discipline	79%	21%
b. An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution	62%	38%
c. An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs	58%	42%
d. An ability to function effectively on teams to accomplish a common goal	55%	45%
e. An understanding of professional, ethical, legal, security, and social issues and responsibilities	83%	17%
f. An ability to communicate effectively with a range of audiences	68%	32%
g. An ability to analyze the local and global impact of computing on individuals, organizations and society	76%	24%
h. Recognition of the need for, and an ability to engage in, continuing professional development	62%	38%
i. An ability to use current techniques, skills, and tools necessary for computing practices.	70%	30%
j. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices	95%	5%
k. An ability to apply design and development principles in the construction of software systems of varying complexity.	80%	20%

I. Be prepared to enter a top-ranked graduate program in Computer Science.	100%	0%
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Clearly, outcomes *b*, *c*, *d*, *f*, *h* and *i* are causes for concern (as least for this small sample size of 10 graduating seniors). Our CS Department Undergraduate Studies Committee will look more into these specific results in context with other measurement tools, in order to understand why the results for these outcomes are lower than our goal. Taken together, the survey results about objectives and the survey results about outcomes indicate a need to concentrate on communication, design and teamwork.

Measurement Tool #4: Program Outcomes using Student Course Assessments

At the end of each course, students are surveyed on their perceived achievement of each course outcome, which we map to program outcomes. Our goal was to obtain 75% perceived achievement with each course outcome from our students. Summarizing these results for the required CS courses during the Fall 2008 semester, we obtain the following table. It should be noted that with our new online course assessment system, over 65% of all students registered in these courses completed these surveys. The following table averages the responses for all of the questions that pertain to each outcome.

Table 4: Student Course Assessments Results (see Table 3 for a Program Outcome key)

Program Outcome	Course Outcomes at or above goal	Course Outcomes below goal
a	91%	9%
b	82%	18%
c	87%	13%
d	86%	14%
e	86%	14%
f	83%	17%
g	80%	20%
h	100%	0%
i	45%	55%
j	96%	4%
k	90%	10%
l	80%	20%

The results for Program Objective *i* (an ability to use current techniques, skills, and tools necessary for computing practices) indicate that we must investigate how current techniques, skills, and tools necessary for computing practices is taught in our required courses.

Measurement Tool #5: Program Outcomes using Direct Assessment of Five Courses

As the employer and alumni surveys are direct assessments on the program objectives, we also wanted to add a direct assessment on Program Outcomes. In the Fall 2008 semester, we added a new measurement tool to our assessment process that ties student performance on specific course assignment/exam components (direct assessments) to program outcomes. Our Committee chooses five courses each semester whose assignments “cover” all of our program outcomes. A mapping of all required courses to outcomes is given in our self-study on page V-7 through V-9.

The five courses chosen for Fall 2008 and Spring 2009 are:

- CS201 Accelerated Introduction to Computer Science (required course)
- CS331 Data Structures and Algorithms (required course)
- CS485 Computers and Society (required course)
- CS425 Database Organization (elective course)
- CS429 Introduction to Information Retrieval Systems (elective course, Fall 2008) and

- CS422 Introduction to Data Mining (elective course, Spring 2009)

The CS Undergraduate Studies Committee will evaluate how well the process is working at the end of each academic year. The set of courses to evaluate will be reconsidered for the 2010-11 academic year after the evaluation procedure has stabilized. Although evaluation procedures may be refined with experience, the underlying process and purpose stay the same - to measure directly student success on our program outcomes via fine-grained performance analysis.

Our current direct assessment methodology contains the following:

- For all CS 1xx and 2xx courses, assessments will have a goal of an A, B, or C for at least 80% of the students.
- For all CS 3xx courses, assessments will have a goal of an A, B, or C for at least 75% of the students.
- For all CS 4xx courses, assessments will have a goal of an A, B or C for at least 70% of the students.

The following Direct Assessments Results tables average the responses for all of the questions that pertain to each outcome (see Table 3 for a Program Outcome key).

Table 5A: CS201 - Accelerated Introduction to Computer Science (required course)

Program Outcome	%A	%B	%C	%D	%E
a.	62%	25%	11%	2%	0%
b.	63%	25%	12%	0%	0%
c.	64%	28%	8%	0%	0%
i.	61%	30%	9%	0%	0%
j.	55%	26%	15%	4%	0%
k.	64%	28%	8%	0%	0%
l.	45%	27%	9%	18%	0%

Table 5B: CS331 - Data Structures and Algorithms (required course)

Program Outcome	%A	%B	%C	%D	%E
b.	76%	7%	7%	2%	8%
c.	74%	5%	2%	2%	17%
d.	63%	25%	12%	0%	0%
i.	56%	22%	16%	6%	0%
j.	76%	7%	6%	2%	9%
k.	63%	25%	12%	0%	0%
l.	55%	25%	13%	7%	0%

Table 5C: CS485 - Computers in Society (required course)

Program Outcome	%A	%B	%C	%D	%E
d.	57%	18%	7%	5%	14%
e.	49%	24%	8%	3%	16%
f.	54%	18%	10%	5%	14%
g.	70%	11%	5%	5%	10%
h.	54%	18%	10%	5%	14%
l.	77%	9%	0%	5%	9%

The two elective courses are reported on a mean/median percent scale instead of an A-E percent. These courses have been collecting data in this format to show support for course outcomes for two years due to an NSF grant to develop the courses, so we continued that collection method. Our goal is for both mean

and median above 75%. We are still deciding which collection method is best, considering that different instructor grading scales may skew the above results.

Table 5D: CS425 - Database Organization (elective course)

Program Outcome	Median	Mean
a.	80%	78%
c.	84%	78%
d.	85%	77%
f.	85%	77%
i.	81%	78%
j.	81%	77%
k.	84%	78%
l. A=30% B=43% C=11% D=9% E=7%		

Table 5E: CS429 - Introduction to Information Retrieval Systems (elective course)

Program Outcome	Median	Mean
a.	86%	79%
c.	86%	73%
d.	80%	72%
f.	80%	72%
i.	86%	73%
j.	78%	70%
k.	86%	73%
l. A=19% B=62% C=14% D=5% E=0%		

The following table contains results rolled up from this initial semester for all program outcomes.

Table 5F: Summary of Direct Assessment of Program Outcomes

Program Outcome	Courses at or above goal	Courses below goal	Courses NA to outcome
a	3	0	2
b	2	0	3
c	3	1	1
d	3	1	1
e	1	0	4
f	2	1	2
g	1	0	4
h	1	0	4
i	3	1	1
j	3	1	1
k	3	1	1
l	3	2	0

This table shows that we are able to measure “the extent to which [our outcomes] are being met.” After one more semester of collection, we will consider if A-E percentages or mean/median percentages are appropriate ways of measuring success in an outcome, and we will also consider a different subset of courses in the future to ensure more data points for each outcome. (We have fixed a set of courses to stabilize the process of evaluation design and refinement.) Finally, in reviewing the raw data collected and analyzed, we realized we could choose a sample of assignment and exam components and still cover all program outcomes sufficiently, which will make future data collection easier.

We believe that the combination of improved employer, alumni, and graduating senior surveys (Measurement Tools 1, 2, 3), the integration of regular course assessments with program outcomes achievement (Measurement Tool 4), and with the new direct assessment methodology (Measurement Tool 5), we are able to address the extent to which our program outcomes and objectives are met.

With regard to the second part of weakness in Criterion 4 (“The results of the evaluations are documented and used to effect continuous improvement of the program through a documented plan”), the evaluators agreed that “the program changes are documented” but continued that “the documentation does not relate the changes to the evaluation findings for the program’s documented outcomes and objectives.” We note that, although, since 2002 a variety of program changes have been well documented, we readily acknowledge that the prior documentation does not “relate the changes to the evaluation findings for the program's documented outcomes and objectives.” In the past, our department simply published all the assessment results and analysis for a semester. Additionally, we then published the changes implemented.

Now that we have a more objective assessment process in place, assessment findings will now directly drive future course and program changes. Our new system of mapping courses to their objectives and outcomes and our new system of measuring performance for each of these objectives and outcomes gives us a straightforward way to identify the specific components of the Curriculum that require remediation.

Response to Concerns

Two concerns were noted, one related to the breadth of our program objectives, and the other related to ensuring we will continue to have the support and resources necessary for the program to retain its strength.

Since IIT has recently embarked on a new strategic planning effort “Many Voices, One Vision”, we have an opportunity to revisit our program objectives as related to this new plan. Some of the key words in the new vision that may help drive new program objectives are: “Professional and Technology Oriented”, “Education and Research”, “Innovation and Transformational”, “Foster Leadership”, and “Diversity and Excellence”. We also plan to undertake a review of other top Computer Science programs and their objectives to ensure our thoughts are supportive for the kind of program the CS dept. and IIT wants to achieve.

With regards to the second concern, the CS Dept. has assurances from our new administration, Dr. Russell Betts (Dean of College of Science and Letters) and Dr. Alan Cramb (Provost) that a CS chair search, and new faculty search, will be undertaken in the near future, with the highest standards held for all new faculty. Also, support and processes at the Dean’s level will be developed to ensure faculty will have the resources to further their educational and research objectives to be involved in conferences and other activities which require funding.

Summary

We have articulated that we measure the extent to which we meet our objectives and outcomes. With the new requirements in the self-study document and with the observations from our evaluation team it has been made clear to us that we needed to more tightly map our measurement tools to our objectives and outcomes. We defined a process to do this last summer and we have applied that process over the last few months as a demonstration of its effectiveness. The results in this letter simply show that the process, as defined, is in place and is being executed. We are following this process again in the Spring 2009 semester, and results will be available shortly after the semester is completed. Detailed appendices of assessment results are available on <http://www.cs.iit.edu/~abet/>. Should you have any questions, please do not hesitate to contact Dr. David Grossman, the chair of our Undergraduate Studies Committee either by e-mail at grossman@iit.edu or 312-399-1165. Additionally, Dr. Bogdan Korel, the acting department chair can be contacted as well at his e-mail at korel@iit.edu or 312-567-5145.