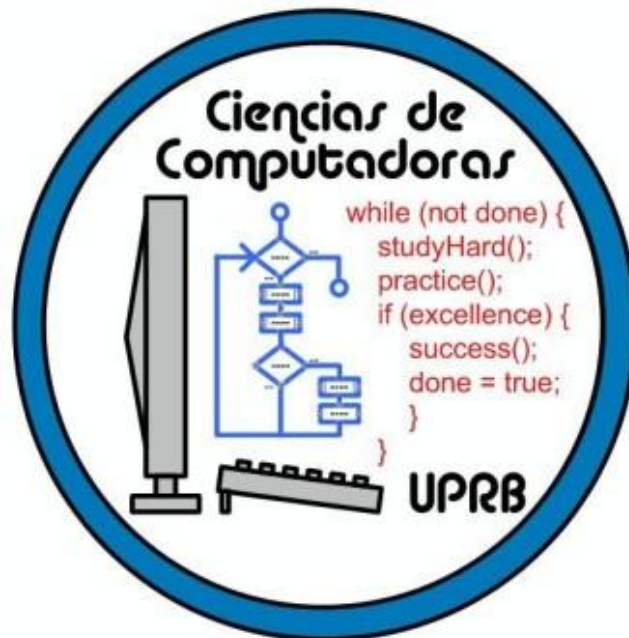


University of Puerto Rico at Bayamón

Computer Science Department



Continuous Improvement Report
Computer Science Program

Accreditation and Assessment Committee
Cycle 2011-2013

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INTRODUCTION

This document presents the assessment of the data gathered for the Computer Science program for the 2011-2012 cycle. The document is divided into two sections. The first section summarizes the things that happened during the previous cycles of 2005-2008 and 2008-2011. During these periods the Department started contemplating the idea of pursuing ABET accreditation. The second section details the analysis of the student outcomes.

ASSESSMENT BACKGROUND

The purpose of this section is to present the continuous improvement process in place at the Computer Science Department for the cycles on academic years 2005-2006 through 2007-2008 and academic years 2008-2009 through 2010-2011. These cycles took place before sending the request for consideration for accreditation to ABET on January 2012. The Assessment and Accreditation Committee decided that the information presented here provides a much needed background for the Evaluation Team.

Assessment for the 2005-2008 Cycle

During the first year of this cycle, the Board of Trustees of the University of Puerto Rico approved a document submitted by then President Antonio García-Padilla entitled *Ten to the Decade (Diez para la Década*, in Spanish). This document contained ten broad goals for the university for the 2006-2016 years, among them the aim to attain accreditation for all eligible programs, including Computer Science and Information Systems. At that time, the Computer Science Department at Bayamón offered a bachelor's degree that was a hybrid between Computer Science and Information Systems. This program could contain more advanced coursework in both areas. The Committee decided that an assessment process was needed in order to determine the requirements for a future revision of the program. Students, alumni and employers were surveyed for this purpose and the data were collected and analyzed. This cycle concluded when recommendations for curricula modifications were made on academic year 2007-2008 as a result of these analyses. These modifications resulted in the implementation of

two programs. These programs were known at the time as Applied Computing Science and Information Systems & Technology.

Assessment for the 2008-2011 Cycle

The objective of this cycle was to assess the new programs so that two goals could be met: (1) confirmation of institutional accreditation by the Middle States Commission on Higher Education, and (2) paving of the way for a future request for accreditation by ABET. This cycle was crucial since, as a result of the implementation of the two new programs, the Department recruited two professors with a Ph.D. in Computer Science or closely related fields. These professors would be in charge for the development of new advanced coursework and for performing research. The Information Systems & Technology program was coordinated by a professor with a doctorate in this discipline. Also, the Department established an External Advisory Board during these years. This board is composed of students, alumni and employers and had their first meeting on academic year 2010-2011. The Accreditation and Assessment Committee submitted a set of educational objectives to the External Advisory Board for consideration. Modifications proposed by the board were integrated to the objectives after approval by the faculty of the Department. These educational objectives became effective immediately.

It is important to note that during academic year 2009-2010 there was a transition in leadership positions at the university, campus and departmental levels. This situation, coupled with a two-month student strike, caused a disruption in the assessment process of the new programs. Fortunately, it was also during this academic year that the chairman of the Department established a new Assessment and Accreditation Committee. The cycle goals were met. The institution received confirmation of accreditation by the Middle States Commission on Higher Education. Also, a revision of our Continuous Improvement Plan was implemented so that a more systematic assessment process could be achieved.

COMPUTER SCIENCE PROGRAM -STUDENT OUTCOMES DATA ANALYSIS

This section presents the analysis of the Student Outcomes for the Computer Science Program at the University of Puerto at Bayamón. Each outcome was further divided into performance indicators and was analyzed using at least two instruments: one direct measurement and one indirect measurement. The main direct measurement for the majority of the outcomes was the post-test given¹ to all students enrolled in our Capstone course for the past three semesters. The other outcomes were assessed using rubrics¹. The main indirect measure was a survey that the students in our Capstone course completed. Whenever a discrepancy was found, relevant materials from the courses were analyzed.

For the post-test, the analysis assumed the following scale:

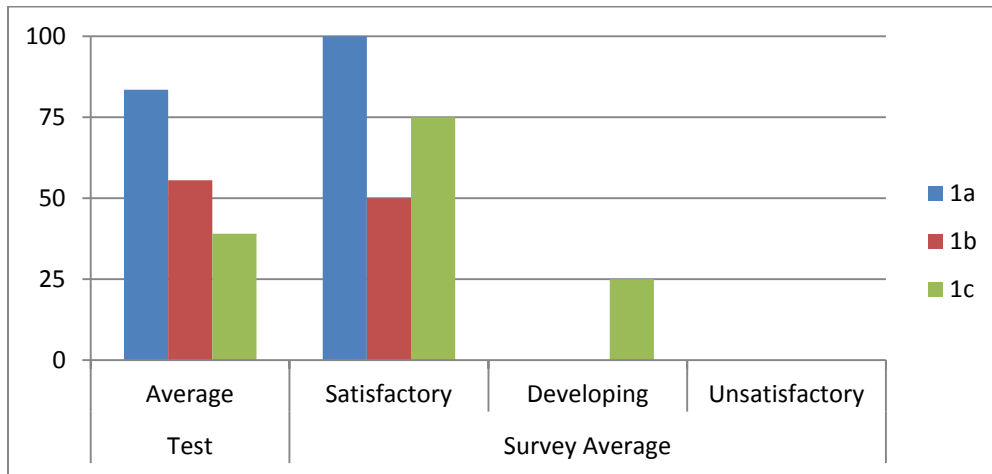
- Satisfactory – the question was correctly answered by at least 75% of the students.
- Developing – the question was correctly answered by at least 50% of the students but less than 75%.
- Unsatisfactory – the question was correctly answered by less than 50% of the students.

For the student survey, the analysis assumed the following scale:

- Satisfactory – the indicator was graded as A or B by the student.
- Developing – the indicator was graded as C by the student.
- Unsatisfactory – the indicator was graded as D or F by the student.

¹ Available to ABET's visiting team

1. An ability to apply knowledge of computing and mathematics appropriate to the discipline.



a. Select the appropriate algorithm for a specific situation.

Two questions in the post-test were about this performance indicator. On average, 84% of the students answered the questions correctly, implying a satisfactory assessment for this indicator. All the students that completed the survey gave this indicator a satisfactory grade. Therefore, the achievement level for this performance indicator was met.

b. Analyze the asymptotic running time of simple algorithms using big-O notation.

Two questions in the post-test were about this performance indicator. On average, 56% of the students answered the questions correctly, implying a developing assessment for this indicator. 50% of the students that completed the survey also gave this indicator a satisfactory grade but 50% did not give a grade for this indicator. This is not surprising since algorithm analysis was not taught in the curriculum until the year 2010-2011. The Assessment Committee decided to analyze material from the Data Structures (SICI 4036) course. Data had to be used from current semester since the instruments we had from previous semesters did not provided us with enough information to measure this performance indicator efficiently. Thus we analyzed Parts I and II of Quiz #3 of SICI 4036. On average, 64% of our students answered questions concerning this indicator in a satisfactory manner. The committee concluded that the achievement level for this performance indicator is on a developing level.

c. Apply mathematical concepts in the solution of a given problem.

Two questions in the post-test were about this performance indicator. On average, 39% of the students answered the questions correctly, implying an unsatisfactory assessment for this indicator. However, 75% of the students that completed the survey gave this indicator a satisfactory grade and 25% gave a developing grade. Since there is a discrepancy, the Assessment Committee decided to analyze material from the first exam of the Operations Research (SICI 4028) course. The mean grade of all students in two sections of the Operations Research course on this first test was 72.5%. The committee concluded that the achievement level for this performance indicator is met.

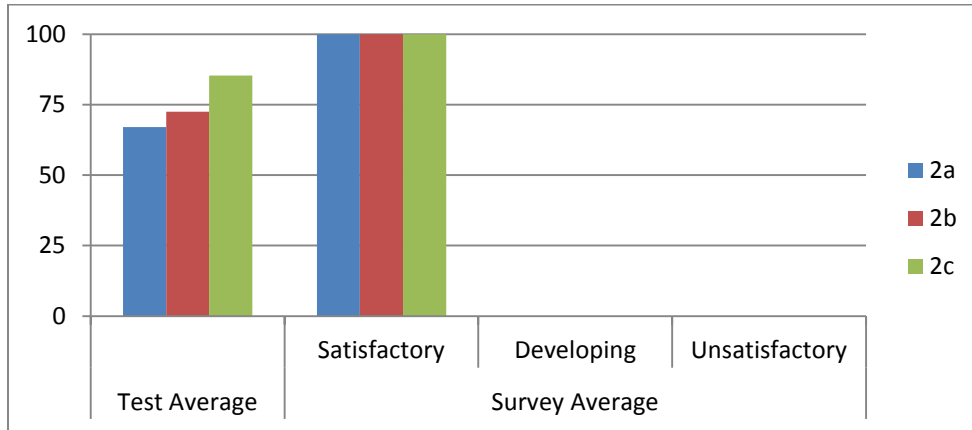
CONCLUSIONS AND RECOMMENDATIONS

The committee concluded that this outcome was met. The committee recommends:

- A course in Analysis of Algorithm (COTI 4XXX) to reinforce indicator 2b.
- During the academic year 2012-2013 we have strengthened the material related to indicator 2b. This has been achieved through the Data Structure course (SICI 4036).
- Performance indicator 2c could be reinforced. The committee recognizes that it must revise the wording of the questions in the post-test. We realized that the cause of low performance in the post-test may be the consequence of poor drafting of the exam.

The committee expects that these modifications to the courses' topics will enhance the level of achievement for this outcome. The committee envisions that these changes could be implemented in academic year 2013-2014.

2. An ability to analyze a problem, identify and define the computing requirements appropriate to its solution.



a. Analyze a problem.

Two questions in the post-test were about this performance indicator. On average, 67% of the students answered the questions correctly, implying a developing assessment for this indicator. However, all of the students that completed the survey gave this indicator a satisfactory grade. Since there was a discrepancy, the Assessment Committee decided to analyze material from the Systems Analysis and Design (SICI 3015) course. A rubric was used to analyze this performance indicator on the projects that the students submitted in this class. On average, 73% of the students demonstrate attainment of this indicator. The committee concluded that the achievement level for this performance indicator is met.

b. Identify and define the computational requirements needed in a real situation.

Two questions in the post-test were about this performance indicator. On average, 73% of the students answered the questions correctly, implying a developing assessment for this indicator. However, all of the students that completed the survey gave this indicator a satisfactory grade. Since there is a discrepancy, the Assessment Committee decided to analyze material from the Systems Analysis and Design (SICI 3015) course. A rubric was used to analyze this performance indicator on the projects that the students submit in this class. As in indicator 2a, 73% of the students demonstrate attainment on this indicator. The committee concluded that the achievement level for this performance indicator is at a robust developing level.

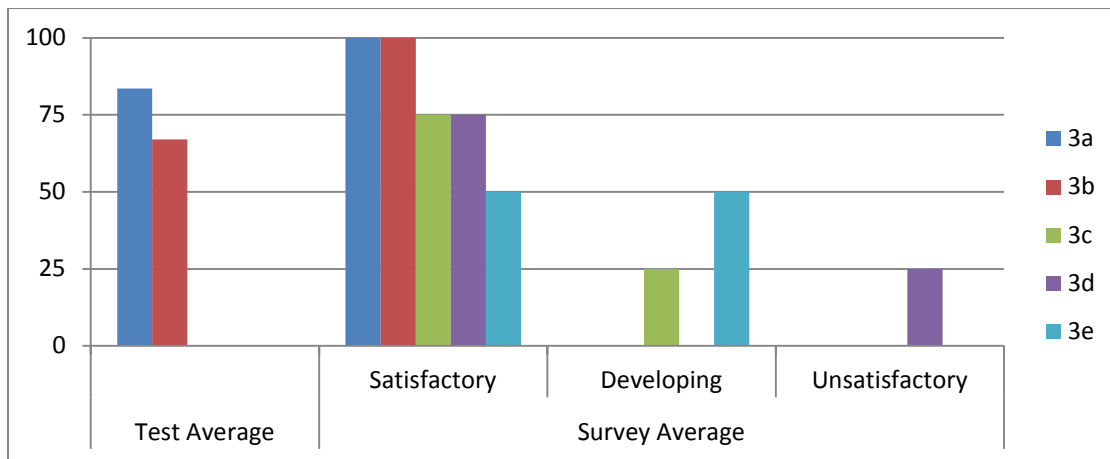
c. Choose the appropriate software and/or hardware tools to meet the desired goals.

Three questions in the post-test were about this performance indicator. On average, 85% of the students answered the questions correctly, implying a satisfactory assessment for this indicator. All the students that completed the survey gave this indicator a satisfactory grade. Therefore, the achievement level for this performance indicator was met.

CONCLUSIONS AND RECOMMENDATIONS

The committee concluded that this outcome was met.

3. An ability to design, implement and evaluate a computer-based system, process, component or program to meet desired needs.



a. Design a solution for a given problem using the structured approach.

Two questions in the post-test were about this performance indicator. On average, 84% of the students answered the questions correctly, implying a satisfactory assessment for this indicator. 75% of the students that completed the survey gave this indicator a satisfactory grade. Therefore, the achievement level for this performance indicator was met.

b. Design a solution for a given problem using the object-oriented approach.

One question in the post-test was about this performance indicator. 67% of the students answered the questions correctly, implying a developing assessment for this indicator. However, all of the students that completed the survey gave this indicator a satisfactory grade. Since there is a discrepancy, the Assessment Committee decided to analyze material from the Data

Structures (SICI 4036) course. A programming assignment (Assignment #1) was used to measure this performance indicator. The Computer Programming Grading Rubric was the instrument used to evaluate this assignment. Among the 40 students enrolled in two sections of the SICI 4036, a random sample of 10 assignments was chosen. The point average obtained by the students was 91%. This indicates a satisfactory achievement level. Therefore, this performance indicator was met.

c. Implement an algorithm using the appropriate programming language.

75% of the students that completed the survey gave this indicator a satisfactory grade. The Assessment Committee decided to analyze material from the Algorithms and Program Development II (COTI 3102) and the Data Structures (SICI 4036) courses. The instruments to measure the level of achievement of this performance indicator were a selection of exercises from the final exam related to the course Algorithms and Program Development II (COTI 3102) and the first homework of the Data Structures (SICI 4036) course. After analyzing the data obtained from COTI 3102 we obtained an average of 56% on these exercises. The analysis of the data obtained from course SICI 4036 showed that 85% of the students mastered this outcome. Therefore, the committee concludes that students are reaching this indicator since SICI 4036 is a sophomore course. The committee concluded that the achievement level for this performance indicator is met.

d. Implement abstract solutions using pseudo code, flowchart or natural language.

One question in the post-test was about this performance indicator. None of the students answered the question correctly, implying an unsatisfactory assessment for this indicator. However, 75 % of the students that completed the survey gave this indicator a satisfactory grade. Since there is a discrepancy, the Assessment Committee decided to analyze material from the Algorithms and Program Development I (COTI 3101) course. In this course three exams are administered (Test 1, Midterm and Final). Questions relevant to implement abstract solutions using pseudo code, flowchart or natural language were chosen from Test1 and Midterm. The students' achievement level for those questions on both exams was satisfactory (88%, 79%). Therefore, this performance indicator was met.

e. Perform both unit and systems testing.

50% of the students that completed the survey gave this indicator a satisfactory grade. The other 50% did not give a grade for this indicator. The Assessment Committee decided to analyze material from the Capstone course (Research Seminar Workshop, SICI 4038). The professors that teach this course told the Committee that they require students to perform on-the-spot testing at the moment they do their final presentation of their project but they are not required to present a testing plan nor a testing report. Therefore, the achievement level for this performance indicator was not met.

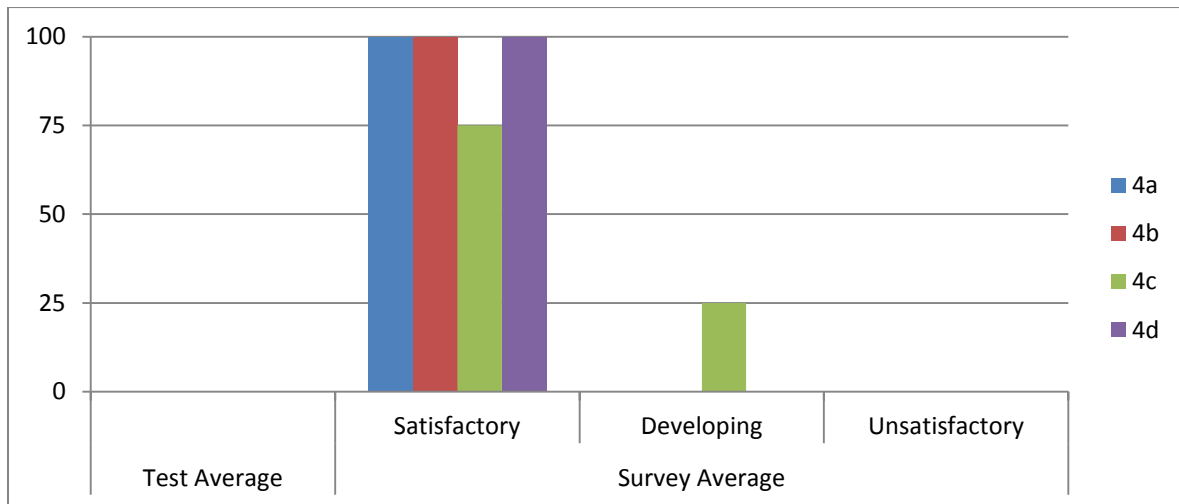
CONCLUSIONS AND RECOMMENDATIONS

The committee concluded that this outcome is partially met. The committee recommends:

- Unit and system testing plans and reports should become a requirement for programming courses (due to findings in indicator 3e).
- The committee asked the professors of the Systems Analysis and Design course (SICI 3015) and the Capstone course (Research Seminar Workshop, SICI 4038) to strengthen the material about testing in these courses (indicator 3e).

The committee expects that these modifications to the courses' topics will enhance the level of achievement for this outcome. The committee envisions that these changes could be implemented in academic year 2013-2014.

4. An ability to function effectively on teams to accomplish a common goal.



a. Evaluate a given problem within a team environment.

All of the students that completed the survey gave this indicator a satisfactory grade. Since this indicator was not included on the post-test, the Assessment Committee decided to analyze material from the Systems Analysis and Design (SICI 3015) and the Data Communications (SICI 4037) courses. When the rubric for the final project of the Systems Analysis and Design course was analyzed, it was found that 76% of the students were graded as satisfactory. In addition, when the rubric for group class work of the Data Communications (SICI 4037) course was analyzed, it was found that 72% of the students were graded as satisfactory. The committee concluded that the achievement level for this performance indicator is met.

b. Perform the tasks assigned when working on a team.

All of the students that filled the survey gave this indicator a satisfactory grade. Since this indicator was not included on the post-test, the Assessment Committee decided to analyze material from the Systems Analysis and Design (SICI 3015) and the Data Communications (SICI 4037) courses. When the rubric for the final project of the Systems Analysis and Design course was analyzed, it was found that 76% of the students were graded as satisfactory. In addition, when the rubric for the group class work of the Data Communications course was analyzed, it was found that 80% of the students were graded as satisfactory. The committee concluded that the achievement level for this performance indicator is met.

c. Assist its teammates when needed.

75% of the students that completed the survey gave this indicator a satisfactory grade. Since this indicator was not included on the post-test, the Assessment Committee decided to analyze material from the Systems Analysis and Design (SICI 3015) and the Data Communications (SICI 4037) courses. When the rubric for the final project of the Systems Analysis and Design course was analyzed, it was found that 78% of the students were graded as satisfactory. In addition, when the rubric for group class work of the Data Communications course was analyzed, it was found that 74% of the students were graded as satisfactory. The committee concluded that the achievement level for this performance indicator was met.

d. Complete its duties assigned within a team environment.

All of the students that completed the survey gave this indicator a satisfactory grade. Since this indicator was not included on the post-test, the Assessment Committee decided to analyze material from the Systems Analysis and Design (SICI 3015) and the Data Communications (SICI 4037) courses. When the rubric for the final project of the Systems Analysis and Design course was analyzed, it was found that 73% of the students were graded as satisfactory. However, when the rubric for group class work of the Data Communications course was analyzed, it was found that 64% of the students were graded as satisfactory. The committee concluded that the achievement level for this performance indicator was partially met.

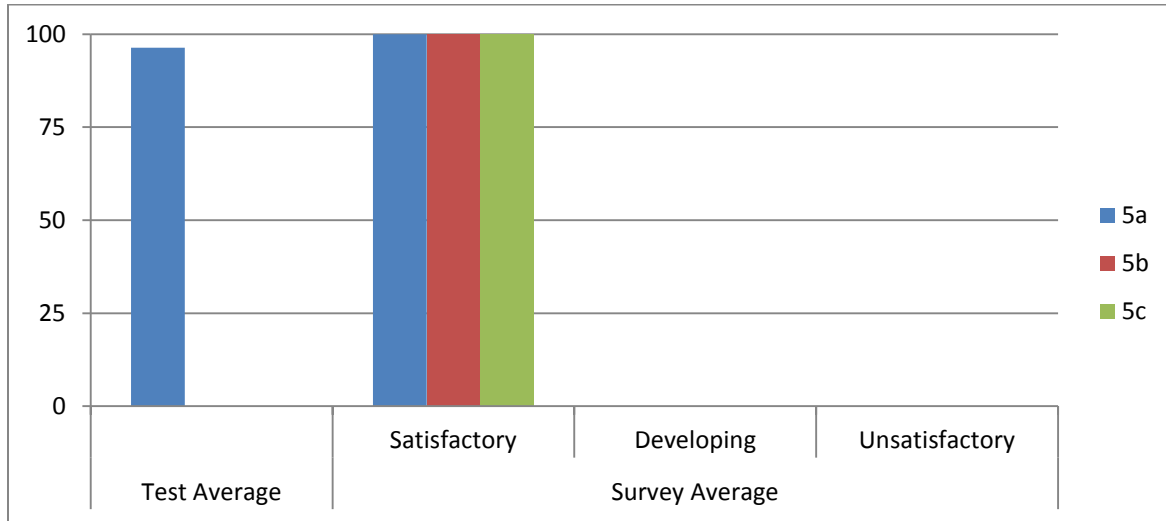
CONCLUSIONS AND RECOMMENDATIONS

The committee concluded that this outcome was met. The committee recommends:

- A time management and team building skill workshop should be developed and offered to the freshmen and sophomore students. This 3-hour workshop will be offered on the first semester 2013-2014.

The committee expects that these modifications to the courses' topics will enhance the level of achievement for this outcome. The committee envisions that these changes could be implemented in academic year 2013-2014.

5. An understanding of professional, ethical, legal, security and social issues and responsibilities.



a. Evaluate the ethical implications of an issue in the computing discipline.

Three questions in the post-test were about this performance indicator. On average, 96% of the students answered the questions correctly, implying a satisfactory assessment for this indicator. All of the students that completed the survey gave this indicator a satisfactory grade. Therefore, the achievement level for this performance indicator was met.

b. Evaluate the social impact of a given computing technology.

All of the students that completed the survey gave this indicator a satisfactory grade. Since this indicator was not included on the post-test, the Assessment Committee decided to analyze material from the Algorithms and Program Development (COTI 3101-3102), Database Applications Programming (SICI 4030), Web Programming (COTI 4210) and the Data Communications (SICI 4037) courses. The Assessment Committee found out that, although material relevant to this indicator is covered in the courses mentioned, there were no proper measuring instruments. During the second semester for the academic year 2012-2013, 10 questions on the first test of in the Web Application Development course (COTI 4210) were used to measure this indicator. The students' average was 71.4%, which means that there is a developing level for this indicator.

c. Recognize the responsibilities inherent to the profession of computing.

All of the students that completed the survey gave this indicator a satisfactory grade. Since this indicator was not included on the post-test, the Assessment Committee decided to analyze material from the Systems Analysis and Design (SICI 3015) course. A rubric was used to analyze this performance indicator on the projects that the students submit in this class. On average, 82% of the students demonstrate attainment of this indicator. The committee concluded that the achievement level for this performance indicator is met.

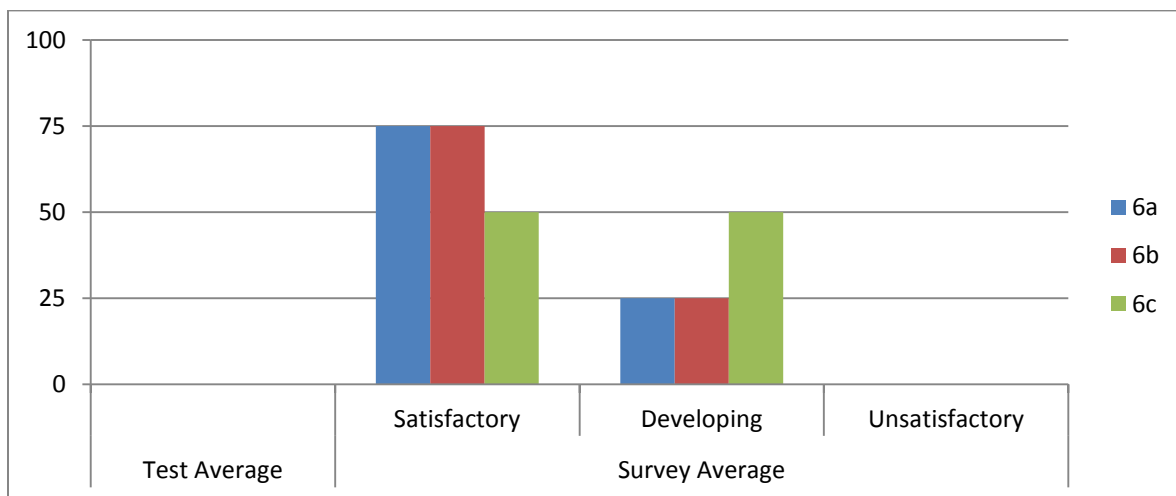
CONCLUSIONS AND RECOMMENDATIONS

The committee concluded that this outcome was partially met. The Committee recommends:

- A course in this area should be offered as part of the Computer Science program. We recommended a seminar that includes the topics of ethics and social impact of computing technology. This course has been named *Information, Computers and Society Seminar* (COTI 4XXX). Its syllabus has been drafted. The course is in the process of creation and it will be part of our curriculum revision.
- Developing proper instruments for measuring the social impact of computing technology through the courses. This change will be implemented in Data Communications (SICI 4037) course.

The committee envisions that these changes be implemented in academic year 2013-2014.

6. An ability to communicate effectively with a range of audiences.



a. Present different topics both orally and in writing.

75% of the students that completed the survey gave this indicator a satisfactory grade. Since this indicator was not included on the post-test, the Assessment Committee decided to analyze material from the Systems Analysis and Design (SICI 3015) course for oral communication skills and Computer Architecture (SICI 4019) for writing skills. When the rubric from the Systems Analysis and Design course was analyzed, 87% of the students showed a satisfactory performance. The rubric from the Computer Architecture course showed a 77% satisfactory level. The committee concluded that the achievement level for this performance indicator was met.

b. Explain technical concepts using the correct terminology.

75% of the students that completed the survey gave this indicator a satisfactory grade. The Assessment Committee decided to analyze material from the Systems Analysis and Design (SICI 3015) course for oral communication skills and Computer Architecture (SICI 4019) for writing skills. When the rubric from the Systems Analysis and Design course was analyzed, 73% of the students showed a satisfactory performance. The rubric from the Computer Architecture course showed a 77% satisfactory level. The committee concluded that the achievement level for this performance indicator was met.

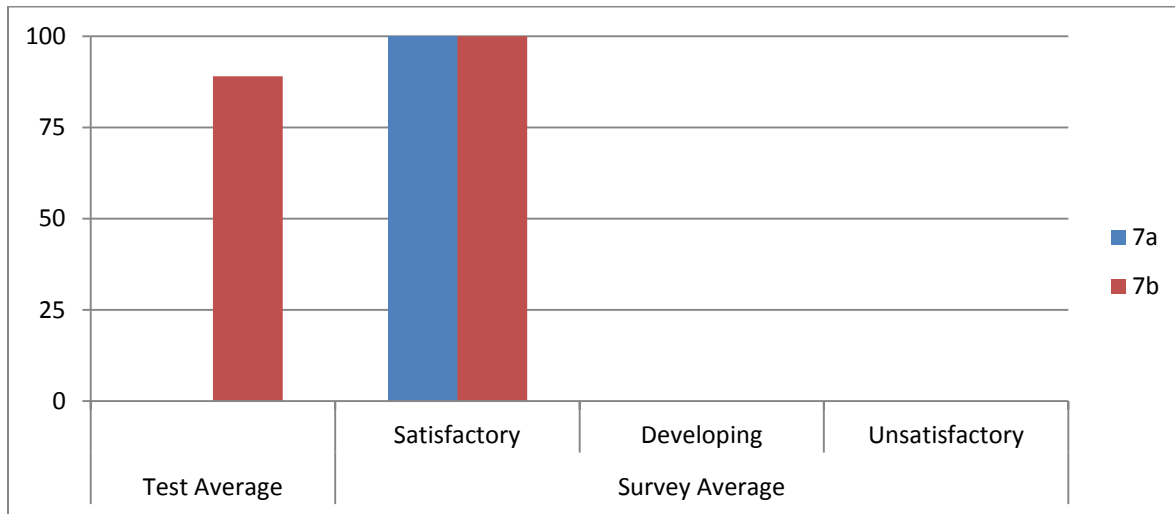
c. Display knowledge of technical report writing skills.

50% of the students that completed the survey gave this indicator a satisfactory grade. The Assessment Committee decided to analyze material from the Computer Architecture (SICI 4019) and the Capstone courses (Research Seminar Workshop, SICI 4038). The rubric from the Computer Architecture course shows a 60% satisfaction on this indicator. The rubric from the Research Seminar Workshop, SICI 4038, shows 92% satisfaction on this indicator. The committee concluded that the achievement level for this performance indicator was met.

CONCLUSIONS AND RECOMMENDATIONS

The analysis from the Research Seminar Workshop SICI 4038 course is very conclusive that the students meet this outcome.

7. An ability to analyze the local and global impact of computing on individuals, organizations and society.



a. Identify the contribution of computing and other related professionals to society.

All of the students that completed the survey gave this indicator a satisfactory grade. The committee recognizes professors do cover the contribution made by the many computer science pioneers in many courses through the program. However, at present we do not have the appropriate evidence to analyze more thoroughly this indicator.

b. Understand computational or technological advances and their impact to the profession.

One question in the post-test was about this performance indicator. 89% of the students answered the questions correctly, implying a satisfactory assessment for this indicator. All of the students that completed the survey gave this indicator a satisfactory grade. Therefore, the achievement level for this performance indicator was met.

CONCLUSIONS AND RECOMMENDATIONS

The committee concluded that this outcome was partially met. The Committee recommends:

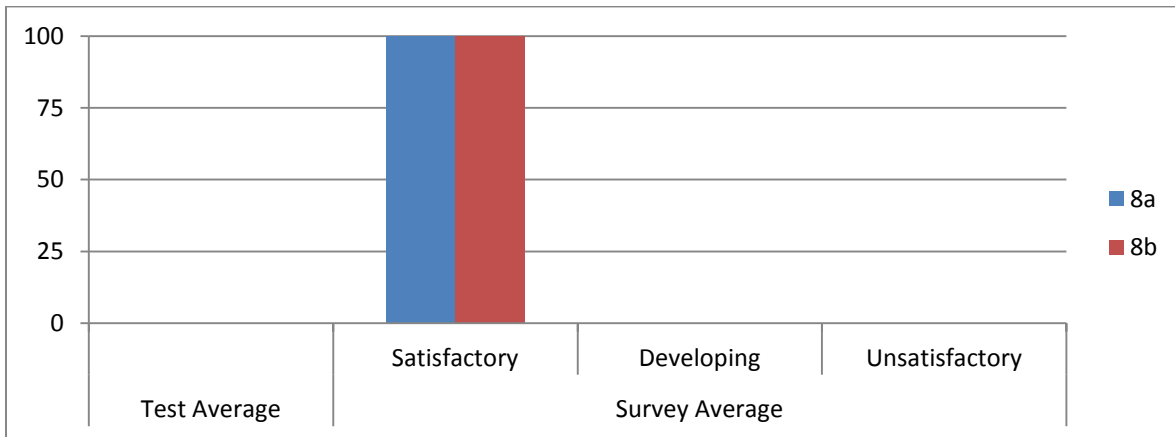
- Developing suitable instruments to measure indicator 7a. As part of the assessment analysis, the committee found out that this indicator was not measured in all courses that were indicated in the self-study. We recommend that professors measure the indicator as part of the coursework for a smaller number of courses, such as Information Systems Analysis and Design (SICI 3015), Computer Architecture (SICI 4019), Database

Programming (SICI 4030), Data Communications (SICI 4037). This will make it easier for the committee to analyze the relevant data.

- Developing more post-test questions to measure indicator 7b. This would be implemented for the next assessment cycle, preferably starting with the post-test that students in the Capstone course (SICI 4038) would be taking at the end of this semester.
- Developing a seminar that includes the topics of ethics and social impact of computing technology as part of the curriculum. We recommended to include the course *Information, Computers and Society Seminar* (COTI 4XXX) to address the issues on outcome 5. The course is in the process of creation and it will be part of our curriculum revision. The committee understands that this course may also be used to address the issues on outcome 7.

The committee envisions that these changes be implemented in academic year 2013-2014.

8. Recognition of the need for and an ability to engage in continuing professional development.



All of the graduating students that completed the survey gave this indicator a satisfactory grade. It is important to note that our students continually receive orientations about their possibilities of continuing graduate studies. The Computer Science Graduate Program of the Polytechnic University of Puerto Rico as well as the Computer and Information Science and Engineering Graduate Program of the University of Puerto Rico at Mayaguez have held annual orientations about their programs. Also, we have compiled sufficient recommendation letters written by faculty members that endorse students for graduate school. Moreover, some of our students have

participated in the NSF programs of Summer Research for Undergraduates Program on some of the universities at the States. Those alumni that answered their survey indicated that 24% have pursuit graduate studies and 56% have engaged in continuing professional development. Therefore, the achievement level for this outcome was met.

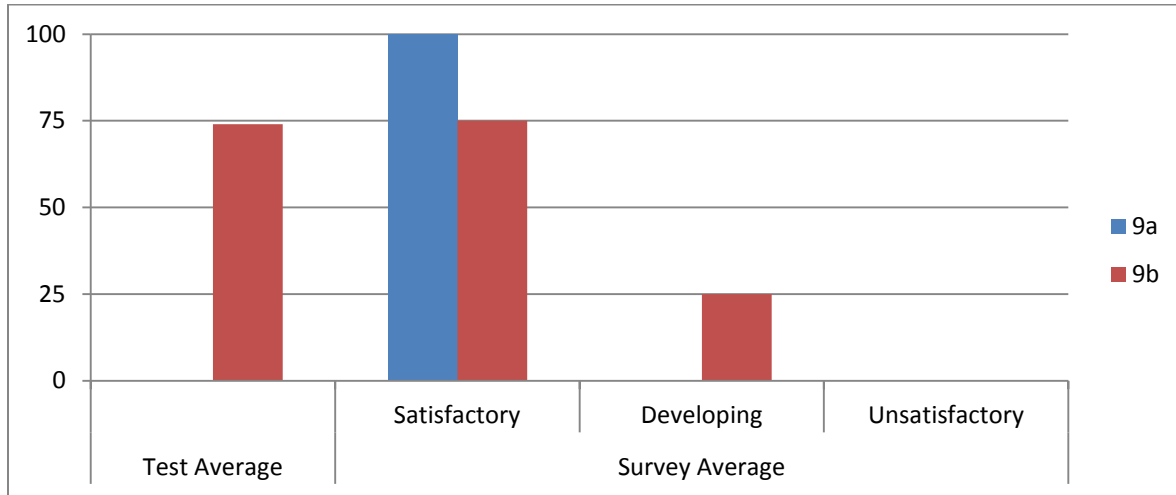
CONCLUSIONS AND RECOMMENDATIONS

The committee concluded that this outcome was met. The Committee recommends:

- Reviewing the syllabi for relevant courses to address this issue. Although this outcome was met, the committee recognized that there are no appropriate tools to measure this outcome efficiently in the following courses: Information Systems Analysis and Design (SICI 3015), Introduction to Numerical Analysis (SICI 4009), Computer Architecture (SICI 4019), Fundamentals of Operating Systems (SICI 4029), Data Communications (SICI 4037), and Research Workshop (SICI 4038). It seems that we are providing the necessary knowledge to students throughout the program, but we are not measuring them on these courses.
- Review the performance indicators that are part of this outcome.
- Developing suitable instruments to measure this outcome. As part of the assessment analysis, the committee found out that this indicator was not measured in all courses that were indicated in the self-study. This will make it easier for the committee to analyze the relevant data.

The committee envisions that these changes be implemented in academic year 2013-2014.

9. An ability to use current techniques, skills and tools necessary for computing practices.



a. Use hardware and software tools currently available.

All of the students that completed the survey gave this indicator a satisfactory grade. The Assessment Committee decided to analyze material from SICI 4036. A rubric was used to collect the observations of professors who teach this course. 93% of students demonstrated mastery on using the hardware and software tools. Therefore, the achievement level for this outcome was met.

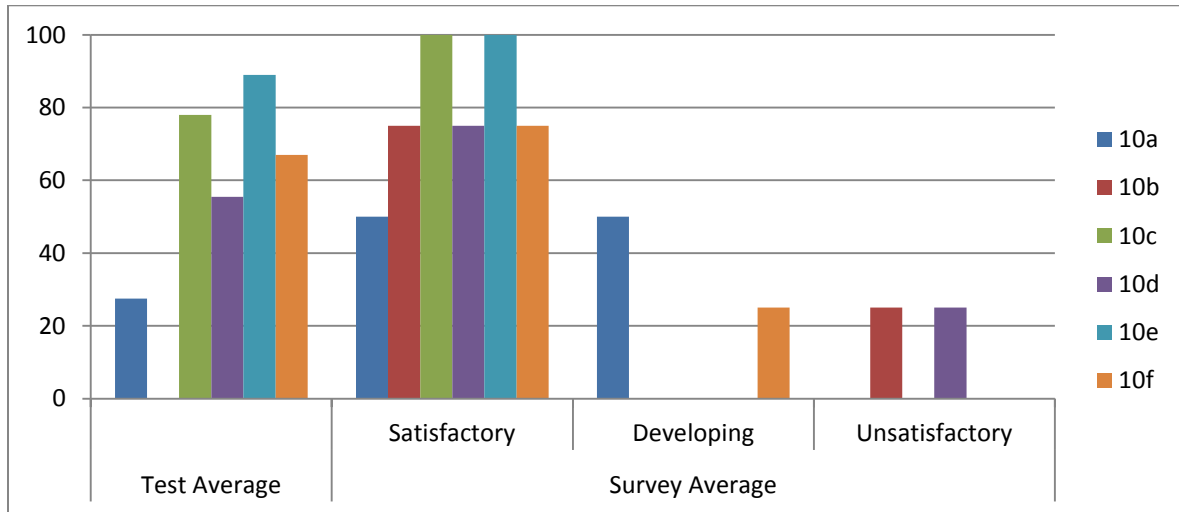
b. Recognize emerging technologies and their implication to the practice of the profession.

Three questions in the post-test were about this performance indicator. On average, 74% of the students answered the questions correctly, implying a developing assessment for this indicator. 75% of the students that completed the survey gave this indicator a satisfactory grade. Therefore, the achievement level for this outcome was met.

CONCLUSIONS AND RECOMMENDATIONS

The committee concluded that this outcome is met.

10. 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 trade-offs involved in design choices.



a. Solve problems using the principles from discrete and continuous mathematics.

Two questions in the post-test were about this performance indicator. On average, 28% of the students answered the questions correctly. 50% of the students that completed the survey gave this indicator a satisfactory grade. This means that more assessment is needed. The Assessment Committee decided to analyze material from Introduction to the Theory of Computing (COTI 4250) course and Numerical Analysis (SICI 4009) courses. The first exam of the COTI 4250 course was used since this exam covers a review from Discrete Mathematics. The students' average was 68.3% which shows a developing level for this indicator. The first exam of the SICI 4009 course was used since this exam covers roots of non-linear equations and function approximation, which requires the application of many topics of continuous mathematics. The students' average was 77.3%, which shows a satisfactory achievement level for this indicator.

b. Perform basic algorithmic analysis using big-O notation.

Two questions in the post-test were about this performance indicator. On average, 56% of the students answered the questions correctly, implying a developing assessment for this indicator. 50% of the students that completed the survey also gave this indicator a satisfactory grade but 50% did not give a grade for this indicator. This reflects an unsatisfactory assessment but is not

surprising since algorithm analysis was not taught in the curriculum until the year 2010-2011. Therefore, the achievement level for this performance indicator was not met. The Assessment Committee decided to analyze material from the Data Structures (SICI 4036) course. Data had to be used from current semester since the instruments we had from previous semesters did not provide us with enough information to measure this performance indicator efficiently. Thus we analyzed Parts I and II of Quiz #3 of SICI 4036. On average, 64% of our students answered questions concerning this indicator in a satisfactory manner. The committee concluded that the achievement level for this performance indicator is on a developing level.

c. Determine the most appropriate data structure needed to solve a given problem.

Two questions in the post-test were about this performance indicator. On average, 78% of the students answered the questions correctly, implying a satisfactory assessment for this indicator. All of the students that completed the survey gave this indicator a satisfactory grade. Therefore, the achievement level for this performance indicator was met.

d. Demonstrate basic knowledge of scientific computing using numerical analysis.

Two questions in the post-test were about this performance indicator. On average, 56% of the students answered the questions correctly, implying a developing assessment for this indicator. 75% of the students that completed the survey gave this indicator a satisfactory grade. Since there is a discrepancy, the Assessment Committee decided to analyze material from the Numerical Analysis (SICI 4009) course. The first exam of the course was used. The students' average was 78%, implying a satisfactory assessment for this indicator. Therefore, the achievement level for this performance indicator was met.

e. Appraise whether a given problem has a computational solution.

One question in the post-test was about this performance indicator. 89% of the students answered the questions correctly, implying a satisfactory assessment for this indicator. All of the students that completed the survey gave this indicator a satisfactory grade. Therefore, the achievement level for this performance indicator was met.

f. Determine the most appropriate programming paradigm needed to solve a problem.

Two questions in the post-test were about this performance indicator. On average, 67% of the students answered the questions correctly, implying a developing assessment for this indicator. 75% of the students that completed the survey gave this indicator a satisfactory grade. Since, there is a discrepancy, the Assessment Committee decided to analyze material from the Comparative Programming Language (SICI 3039) course. Two questions from quizzes 1,3,4,7 and one question from quiz 2 were analyzed. The students' average was 84%, implying a satisfactory assessment for this indicator. Therefore, the achievement level for this performance indicator was met.

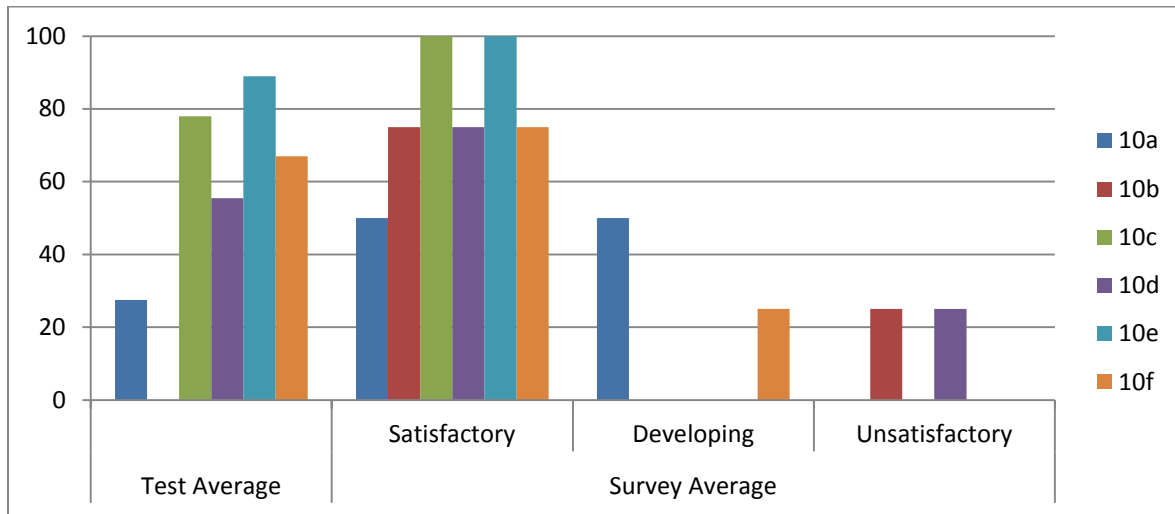
CONCLUSIONS AND RECOMMENDATIONS

The committee concluded that this outcome was met. The Committee recommends:

- That a discussion of the results of indicator 10a be held between the Department of Computer Science and the Department of Mathematics so that they may evaluate courses in these areas, such as Discrete Mathematics (MATE 3175) and Calculus (MATE 3031-3032). During the next assessment cycle, data from these courses should be assessed in order to demonstrate an improvement for indicator 10a.
- Developing a course in Analysis of Algorithms (COTI 4XXX) to reinforce indicator 10b.
- That material related to indicator 10b be strengthened in the Data Structure course (SICI 4036) during the academic year 2012-2013.

The committee envisions that these changes be implemented in academic year 2013-2014.

11. An ability to apply design and development principles in the construction of software systems of varying complexity.



a. Determine the feasibility of a proposed software system.

All of the students that completed the survey gave this indicator a satisfactory grade. Since this indicator was not included on the post-test, the Assessment Committee decided to analyze material from the Systems Analysis and Design (SICI 3015) and the Capstone (Research Seminar Workshop, SICI 4038) courses. On average 64% of the students from the System Analysis and Design courses did not meet this indicator. 94% of the students from the Research Seminar Workshop (SICI 4038) met this indicator satisfactory. Therefore, the committee concludes that students are reaching this indicator since SICI 3015 is a sophomore course. Therefore we classified this indicator as developing.

b. Perform object-oriented and structured analysis and design of software systems.

All of the students that completed the survey gave this indicator a satisfactory grade. Since this indicator was not included on the post-test, the Assessment Committee decided to analyze material from the Algorithms and Program Development (COTI 3101-3102) and Data Structures (SICI 4036) course. After analyzing the course material for Algorithm and Program Development (COTI 3101-3102) the committee found that there were no appropriate instruments to measure this indicator. Therefore, the committee decided to use the rubrics for the course Data Structures (SICI 4036). All of the students demonstrated a satisfactory level for this performance

indicator on this course. Therefore, the achievement level for this performance indicator was met.

c. Analyze and evaluate alternatives for acquiring or developing a software system.

All of the students that completed the survey gave this indicator a satisfactory grade. Since this indicator was not included on the post-test, the Assessment Committee decided to analyze material from the Systems Analysis and Design (SICI 3015) and the Capstone (Research Seminar Workshop, SICI 4038) courses. After analyzing the data gathered from the Systems Analysis and Design course, 64% of the students demonstrated considerable knowledge in the skill of analyzing and recommending whether it is more convenient to acquire or develop a system. These results are similar from the ones obtained after analyzing the data from the course Research Seminar Workshop which was a 70%. Therefore, the committee classified this indicator as developing.

d. Construct a complete software system.

75% of the students that completed the survey gave this indicator a satisfactory grade. Since this indicator was not included on the post-test, the Assessment Committee decided to analyze material from and the course Research Seminar Workshop (SICI 4038)². A rubric was used to measure the performance indicators that are part of the course SICI 4038. After analyzing the section where the indicator 11d is measured, we concluded that the grade obtained by the students is on average 80%. For this same reason, the committee concludes that this indicator is met.

CONCLUSIONS AND RECOMMENDATIONS

The committee concluded that this outcome was partially met. The committee recommends:

- Including a feasibility study workshop in the SICI 3015 course to strengthen performance indicator 11a.
- That appropriate measuring tools be develop for performance indicator 11b, although the achievement level for performance indicator was met.

² This is a Capstone course

- Developing case studies to give students more experience analyzing and evaluating alternatives for acquiring or developing a software system (indicator 11c).

The committee envisions that these changes be implemented in academic year 2013-2014.