Outcomes Assessment Plan

This document describes the program outcomes for the undergraduate program in computer science and an assessment plan to evaluate these outcomes. The primary purpose of the assessment is to ascertain the effectiveness of the undergraduate program and to improve the instructional process and curriculum in order to enhance student learning. To that end, this document specifies the desired outcomes, identifies the procedures used to assess these outcomes, and describes the manner in which the results of the assessment are used for continuous improvement.

The program outcomes are the A-K outcomes as defined by the ABET Computing Accreditation Commission guidelines.

A. An ability to apply knowledge of computing and mathematics appropriate to the discipline.
B. An ability to analyze a problem and identify and define the computing requirements appropriate to its solution.
C. An ability to design, implement, and evaluate a computer-based system, process, component or program to meet desired needs.
D. An ability to function effectively on teams to accomplish a common goal.
E. An ability to understand professional, ethical, legal, security, and social issues and responsibilities.
F. An ability to communicate effectively with a range of audiences.
G. An ability to analyze the local and global impact of computing on individuals, organizations, and society.
H. An ability to engage in continuing professional development.
I. An ability to use current techniques, skills, and tools necessary for computing practices.
J. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems that demonstrate comprehension of the tradeoffs involved in design choices.
K. An ability to apply design and development principles in the construction of software systems of varying complexity.

Bodies that Administer the Program

The principal bodies that administer the program are: the Administrative Committee, the Undergraduate Committee, the Assessment Team, and the Faculty.

Administrative Committee: This committee is comprised of the department chair, three associate chairs, and the administrative assistant and has responsibility for department administration. Most significant curricular decisions typically receive input from the administrative committee before going to the Undergraduate Committee.

Undergraduate Committee: This committee is typically what others may refer to as the Curriculum Committee. Membership in this committee rotates or refreshes every year and members are appointed by the department chair. The general responsibilities of this committee include dealing with issues involving the undergraduate curriculum, requirements for the baccalaureate degree, and requirements for accreditation. Some of the typical charges of this committee include planning undergraduate requirements for the catalog, reviewing the numbering of courses, reviewing the status of cross-listed courses, and serving as a screening body for new course proposals. The department chair and the
academic advisor are non-voting ex-officio members of this committee. The undergraduate committee serves as an advisory committee to the department chair and the faculty.

Assessment Team: This team is comprised of the chair of the Undergraduate Committee and three faculty members appointed by the department chair. The responsibility of the assessment team is to (a) collect and distill date necessary for assessing program outcomes, (b) evaluate the extent to which program objectives are achieved, and (c) make recommendations to the Undergraduate Committee regarding any curricular changes made apparent through the review of collected data.

Members of the External Advisory Board (2010-Present): John Gustafson, Director, Intel Labs, Santa Clara; Tom Miller, Microsoft Research; John Paule, IT Vice President, FBL Financial Group; George Strawn, Director, NITRD; Ron Wolf, Principal at Appropriate Process.

How Assessment Information is Obtained

Tools for assessing program educational objectives and program outcomes use a combination of direct and indirect methods, some of which are quantitative and some of which are qualitative. These methods depend on assessment information from three types of sources: employers, faculty, and students. We use a single tool to evaluate the extent to which program educational objectives are achieved and this tool is a survey of individuals who have graduated from our program within the last 5 years.

How Information Distillation is Transformed into Curricular Correction

The processes used to transform information distillation from measurements into curricular correction are illustrated in Figure 1.

Fig. 1: The Com S Curricular Correction Process

Pre-Graduation Measurement

The program outcomes are identical to the ABET A-K outcomes and are listed above. Several methods, direct and indirect, and qualitative and quantitative, are used to assess the program outcomes.

- The single-most important process we use to assure that graduates are achieving the program outcomes is the continuous monitoring of student work by the faculty who teach the respective
classes. The faculty are usually those involved in preparing course objectives and outcomes, so that the assessment is a part of their ongoing responsibility. These data are reflected in homework, projects, laboratory work, and examinations that the students take regularly. Faculty tend to recognize that if one or two people in a class do not master a major concept, then there probably is a difficulty that can be attributed to the student. If, however, a substantial fraction of a class fails to master a major concept, then remedial action by the instructor is in order. While informal, this assessment is rapid and important in our activity.

- Another assessment tool is the exit survey of graduating students. Prior to graduation, all graduating seniors are required to complete an exit questionnaire and an outcomes assessment survey. This provides students with the opportunity to assess, from their personal learning experiences, the effectiveness of the program in achieving the program outcomes relative to their own expectations.

- A third assessment tool is an online survey that is sent to employers who recruit our students for internships and jobs. It allows employers to reflect on the students they hire and to assess the effectiveness of the undergraduate program in achieving its outcomes.

- A fourth assessment tool is a portfolio assessment and student interviews conducted by EAB members.

- Student Forums: Students are encouraged in an open, friendly manner to comment on strengths and to express concerns. Faculty and administration also attend. While the format is anecdotal, the intent of the forum is to find out where problems exist in a way that we simply could not do otherwise. Meeting notes from these forums are given to the department’s undergraduate committee and distributed to the faculty.

- Faculty members compare ideas regularly, and our undergraduate committee facilitates this comparison. Members of the undergraduate committee carry forward ideas to the larger group of faculty when appropriate. Problems are generally not allowed to continue. A similar facilitation also happens with our equipment committee for continuous improvement of instructional laboratories.

- Recommendations from the Computing Accreditation Commission are used to periodically guide changes to our curriculum and program. The Bachelor of Science program is nationally accredited by the Computing Accreditation Commission of ABET. The process of accreditation requires periodic external reviews of the undergraduate program by computer science educators and professionals. The content and quality of subject matter in each course required of majors is ascertained through an examination of course descriptions, textbooks, and sample homework and examinations. From personal vitae, university data, classroom and laboratory visits, and interviews with students, faculty, advisors, and administrators, the quality of the supporting infrastructure is examined – including required supporting coursework in other disciplines, faculty resources, and laboratory space and equipment. The objectives and outcomes are also periodically evaluated by an External Advisory Board. The quality of the program is contrasted with nationally established standards for accreditation. In addition, Iowa State University is periodically accredited by the Higher Learning Commission of the North Central Association of Colleges and Schools.

- The department chair speaks regularly with graduating seniors each semester and takes their comments to the various departmental committees. One outcome of this process has been an upgrade of both the computing equipment and the policies for using it.
Student Survey

The survey form used to gather data from graduating seniors is produced below.

Outcomes Assessment Form
(Fall 2009 onwards)

To our seniors:

The Department of Computer Science requests your opinion on two questions that are relevant to our accreditation and to our efforts to continually improve our program in Computer Science. The rows describe the program outcomes of our undergraduate program. The columns are places that we ask for your opinion on the two questions in the respective columns.

Please note also that there is a comment space at the end.

Thank you very much.

Gurpur Prabhu
Accreditation Coordinator for the Dept. of Computer Science

| (A) An ability to apply knowledge of computing and mathematics appropriate to the discipline | Very Well | Well | Adequately | Not at All | High Importance | Medium Importance | Low Importance |
| (B) An ability to analyze a problem and identify and define the computing requirements appropriate to its solution |
| (C) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired goals |
| (D) An ability to function effectively on teams to accomplish a common goal |
| (E) An ability to understand professional, ethical, legal, security, and social issues and responsibilities |
| (F) An ability to communicate effectively with a range of audiences |
| (G) An ability to analyze the local and global impact of computing on individuals, organizations, and society |
| (H) An ability to engage in continuing professional development |
| (I) An ability to use current techniques, skills, and tools necessary for computing practices |
| (J) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems that demonstrate comprehension of the tradeoffs involved in design choices |
| (K) An ability to apply design and development principles in the construction of software systems of varying complexity |

1. In your opinion, how well did your total educational program at Iowa State University develop each of the indicated program outcomes?

2. In your opinion, how important is the program outcome to you as a computer scientist?
1. Would you have liked an introductory course in computing before you took Comp Sci 227 (i.e., your first programming course)?

2. What were you satisfied with in the curriculum?

3. List some improvements that can be made in the curriculum.

4. Do you plan to attend graduate school right after you graduate? If yes, how well do you think the program prepared you for graduate school?

5. Do you plan to work in the computer industry right after you graduate? If yes, how well do you think the program prepared you to get your job?

Any Other Comments:

Continuous Improvement: Analysis of student survey data and distillation of responses from students

The Assessment Team collects and distills data to assess program outcomes from pre-graduation measurements and data to evaluate the extent to which program objectives are achieved from post-graduation measurements. Following distillation of these data, the Assessment Team provides conclusions and recommendations to the Undergraduate Committee. The Undergraduate Committee considers these conclusions and recommendations from the Assessment Team and passes them on to the appropriate course coordinators and faculty for implementation.

In analyzing the data, the responses are converted to numerical values according to the scale: Very Well = 3, Well = 2, Adequately = 1, Not at All = 0. Let \(\text{response}(i, q)\) denote the numerical value of student \(i\)’s response to question \(q\). Let \(N(q)\) denote the number of respondents responding to question \(q\).

For each semester, an average score, \(\text{score}(q)\), is computed for each survey question, by summing up the numerical responses of all respondents divided by the number of respondents:

\[
\text{score}(q) = \frac{\sum_{i} \text{response}(i, q)}{N(q)}
\]

Outcomes that consistently score less than 1.5 are examined closely to see how they could be improved. The exit questionnaire given to graduating seniors gives additional information about our students.

In addition, an employer survey is sent out every two years to follow up on the program outcomes. Our External Advisory Board meets every year and examines representative student portfolios to provide feedback on the program outcomes and the educational objectives.
EXIT QUESTIONNAIRE FOR GRADUATING SENIORS
Department of Computer Science

1. Career prospects were a major factor in my decision to major in computer science.
   (a) strongly agree   (b) agree
   (c) neutral or don't know
   (d) disagree   (e) strongly disagree

2. Computer science is interesting to me, and this was a major factor in my decision to major in computer science.
   (a) strongly agree   (b) agree
   (c) neutral or don't know
   (d) disagree   (e) strongly disagree

3. I plan to spend most of my career working as a computer scientist in industry.
   (a) strongly agree   (b) agree
   (c) neutral or don't know
   (d) disagree   (e) strongly disagree

4. I plan to start graduate school in computer science within one year of graduation.
   (a) strongly agree   (b) agree
   (c) neutral or don't know
   (d) disagree   (e) strongly disagree

5. I plan to attend graduate school in computer science someday, but not within one year of graduation.
   (a) strongly agree   (b) agree
   (c) neutral or don't know
   (d) disagree   (e) strongly disagree

6. I would like to spend at least part of my career teaching computer science at some level.
   (a) strongly agree   (b) agree
   (c) neutral or don't know
   (d) disagree   (e) strongly disagree

7. I would like to spend at least part of my career doing original research in computer science.
   (a) strongly agree   (b) agree
   (c) neutral or don't know
   (d) disagree   (e) strongly disagree

8. If I work in industry and it makes no difference to my salary, I would prefer a technical position to a management position.
   (a) strongly agree   (b) agree
   (c) neutral or don't know
9. Overall, the instruction I received in lower division (100-200 level) computer science courses was
(a) excellent   (b) good   (c) fair
(d) adequate   (e) poor

10. Overall, the instruction I received in upper division (300-400 level) computer science courses was
(a) excellent   (b) good   (c) fair
(d) adequate   (e) poor

11. Compared with the university as a whole, the quality of teaching in the computer science department was
(a) excellent   (b) good   (c) fair
(d) adequate   (e) poor

12. My coursework gave me a good understanding of the fundamental concepts and theories of computer science.
(a) strongly agree   (b) agree
(c) neutral or don't know
(d) disagree   (e) strongly disagree

13. My laboratory experiences in the computer science program taught me to apply computer science concepts to the synthesis and analysis of computing systems.
(a) strongly agree   (b) agree
(c) neutral or don't know
(d) disagree   (e) strongly disagree

14. The computer science department has good computing facilities for undergraduate students.
(a) strongly agree   (b) agree
(c) neutral or don't know
(d) disagree   (e) strongly disagree

15. Overall, my undergraduate education helped me develop good communication skills.
(a) strongly agree   (b) agree
(c) neutral or don't know
(d) disagree   (e) strongly disagree

16. My coursework in computer science included valuable experience working in teams on problems and projects.
(a) strongly agree   (b) agree
(c) neutral or don't know
(d) disagree   (e) strongly disagree

17. The computer science academic advising office was helpful to me.
(a) strongly agree   (b) agree
(c) neutral or don't know
18. I believe that I now have the necessary education to begin a professional career in computer science.
   (a) strongly agree  (b) agree
   (c) neutral or don't know
   (d) disagree  (e) strongly disagree

19. I believe that I now have the necessary education to begin graduate study in computer science.
   (a) strongly agree  (b) agree
   (c) neutral or don't know
   (d) disagree  (e) strongly disagree

20. Based on my experience, I would encourage entering freshmen to consider pursuing a B. S. in computer science.
   (a) strongly agree  (b) agree
   (c) neutral or don't know
   (d) disagree  (e) strongly disagree

21. At this time, I have
   (a) at least one job offer
   (b) been accepted for graduate studies
   (c) both (a) and (b)
   (d) none of the above

22. Please add any comments that you believe may be helpful.