

Computer Science 2005 Annual Report Assessment Report

Indiana University South Bend
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New format base on Barbara Walvoord 2005 Assessment Workshop

a) Program name:

Department of Computer and Information Sciences

b) Report prepared by:

Hossein Hakimzadeh and William Knight

c) Who is the current Assessment contact for your department?

Hossein Hakimzadeh, Chair

d) Should assessment information be sent to anyone else in your department?

William Knight, Associate Chair

1. What are the program's educational goals? (Please take goals directly from your program's assessment plan, and highlight any changes made this year.)

The primary goal of our program is to prepare our graduates to understand the field of computing, both as an academic discipline and as a profession within the larger context of society. We try to achieve this goal in several ways.

General Knowledge Objectives:

- A) Ability to Understand Technical Material
- B) Written and Verbal Communication
- C) Dealing with Complexity

Disciplinary Knowledge Objectives

- 1) Hardware
- 2) Data Representation
- 3) Machine Language
- 4) Interpreters and Compilers
- 5) Concepts of Programming Languages
- 6) Principles of Structure and Object Oriented Programming
- 7) Performance and Optimization of Algorithms
- 8) Operating System Concepts

2. What assessment techniques did the program use? (Please take assessment techniques directly from your program's assessment plan and highlight any changes made this year.)

The Department of Computer and Information Sciences uses several methods to assess our students; these include:

- Capstone Course
- Performance Reviews
- Faculty Inventory
- Alumni Survey
- Program Reviews
- GRE's and Graduate School Admissions
- Instructor/Course Evaluations

The Capstone course, Performance Reviews, Alumni survey and Instructor/Course evaluations were the primary techniques used during the past academic year.

Capstone Course (C435)

This course has more computer science prerequisites than any other in our curriculum. It is typically taken by students after they have completed most of their course work in computer science. Dr. Wolfer has taught this course since 2001, so he is well-positioned to assess the skills of the students who enter this course and to compare them with students who have taken the course in the past. Dr. Wolfer reports that the majority of students seem to arrive with their fundamental programming skills intact.

In prior years he noted that while students seem generally motivated, many seem to lack the self-confidence necessary to aggressively approach a problem independently. This

issue was discussed and confirmed by other faculty and measures have been implemented in an attempt to remedy it. Such remedies include assigning more independent programming assignments in which the students are required to produce a complete solution. Dr. Wolfer reports that this appears to be improving in the most recent capstone class, but continues to be an issue in earlier classes. Other problems still remain, but they are probably intractable: a few students arrive with weak programming skills, and some students try to let others on their teams do all the work on large projects.

Performance Reviews

A number of courses in the recent past have required students to present the results of significant projects to the instructor or to the class. The courses are C308 (System Analysis and Design), Y398 (Internship - Professional Practice), C463 Artificial Intelligence, C490 (Biomorphic Computing), C490 (Game Programming & Design), C490 (Computer Vision) and C442 (Data Base Systems).

C308 is a team/project oriented class and acts as a gateway to several of our upper level courses. Drs. Hakimzadeh, Schwartz and Gao who have taught this course in the recent past report that they have been able to refine and add a number of new components to this course. These include tutorials on Computer Aided Software Engineering, Visual Basic and Database management. In addition, the course involves 6 to 8 hours of in class group discussion and brainstorming. These sessions are highly interactive and simulate an analysis and design session common in industry. The brainstorming sessions are used to provide hands-on help on issues related to the final project. The project in this course is a substantial undertaking for the students to plan, analyze, design and implement a large scale and complex information system. Students are required to present their final implementation in front of the entire class. Many of the students in this course express a greater interest in systems analysis and design or at least an appreciation for the people doing the design work.

Students in Y398 Internship are required to be fairly far along in the computer science curriculum. They are placed in jobs in various high-tech firms in the Michiana region and required to perform work that uses the latest in computer technology. Benefits of an internship are two fold. First, the students begin to see the relationship between theory and its application in a real world setting. Second, directing interns and observing the IT needs of our regions provides valuable feedback to our Computer Science faculty allowing us to adjust our curriculum when necessary and feasible. Most of the students report initially that they feel overwhelmed but they quickly discover (in almost every case) that they are quite capable of performing high level useful work for their company.

Students in *C463 Artificial Intelligence* were introduced to the following major AI topics: intelligent agents, search/problem solving, game playing, logic/reasoning, and machine learning. In addition, students were exposed to ‘classic AI philosophy’: the mind/body problem, the strong AI debate (including the Turing Test and Searle’s Chinese Room argument). There were ten homework assignments and a half-semester class project. One purpose of the class project was to demonstrate that typical AI research problems are easily understood, but difficult to solve. Poker was used because it fits these criteria. The class was divided into four 4-person teams and each team was charged with developing a poker agent capable of “considerably better than random play”. There were five weekly competitions to determine the strongest poker agent. Each team also produced a final report and gave a class presentation detailing their efforts. One team experimented substantially with machine learning techniques in their agent. Another team experimented with Monte Carlo techniques and very basic ‘player profiling’ in their agent. The two strongest agents adopted a ‘rule-based’ approach to poker play. The stronger of these two played reasonable poker, but sometimes still made stupid mistakes. Observations such as this showed students that substantial progress can be made on ‘real’ AI problems, even while complete solutions remain elusive. (Details of this class project may be found in the SIGCSE ’06 proceedings, pp. 548-552.)

The *C490 (Biomorphic Computing)* class, taught by Dr. Wolfer, was a seminar/project class which explores models of computing inspired by nature. Examples include artificial neural networks, genetic and evolutionary algorithms, socially inspired computing such as ant colony optimization, artificial immuno-systems, and molecular/DNA computing concepts. Students were engaged in projects ranging from self-learning game players to neural networks and swarm technology for pattern recognition. The results of selected projects were featured in an autumn semester seminar on Biomorphing Computing and the IUSB Mutable Body theme. Student presentations included "A Swarm Intelligence Approach to Counting Stacked Symmetrical Objects", "Genetic Evolution of a Neural Controller", and "Image Data with a Trained Neural Network". Finally, the Swarm paper, was subsequently published as a regular paper at the International Association for Science and Technology for Development (IASTED) Artificial Intelligence Applications.

Students in *C490 (Computer Vision)* were introduced to the basics of image formation, image processing, and image analysis/understanding. Human vision was also briefly introduced. With respect to image analysis/understanding, early course emphasis was placed on techniques for analyzing/understanding binary images. Later in the course, emphasis shifted to grayscale and color image analysis/understanding. There were six homework assignments, a take-home midterm, and a semester project with class presentation. Homework problems on image processing included ‘Frankenfaculty’

(writing a Matlab program to morph photos of two faculty members) and motion detection of a moving minivan in a sequence of images using image subtraction. Homework problems on image analysis/understanding included counting holes, counting objects, applying various edge detection filters to several images, and building a complete vision system (for binary images) to recognize/classify several distinct shapes. Students were allowed to pick their own semester project topic. In one project, the student investigated effects of histogram equalization on motion detection. In another project, the student further investigated properties and performance of various edge detectors on several images. In the best project, the student built a system that detected a human in a video sequence and identified the precise region of the camera's 'visual field' in which the human face appeared.

Students in *C442 (Database Systems)* were involved in a multi-phased design and implementation of an ALUMNI Database system. At the end of the course students were required to demonstrate the functionality of their system. The ALUMNI data model developed during this course, is currently being used by a number student interns to develop a prototype ALUMNI information system for the campus.

Alumni Survey

The alumni survey is an important feedback mechanism. Last year, a number of surveys were completed by our students. In general the students were happy with the quality of education they received at IUSB. Specifically, when asked, "Are there computer science topics that were not covered when you were a student and that you now wish you had been able to study while at IU South Bend?" they cited computer security, business and technical writing, and Web Design.

When asked, "What suggestions do you have for improving the computer science program at IUSB?" the indicated: Senior project which gives students a hands-on practice in system development, less theory, more hands on, more scholarships, grants, research opportunities offered at SB, and improving the technology labs/infrastructure that students require for their work and learning.

Instructor/Course Evaluation Forms

Our college requires that all faculty use the department's official Instructor/Course Evaluation Form at the end of each semester. Appropriate information obtained from these forms is shared with other faculty members in the course of discussions of the kind reported under Faculty Inventory. This is one of our most powerful instruments for assessing how our students view our curriculum.

Electronic Course Evaluation: The department has been using a home grown electronic evaluation system named (IU-EVAL). Although this system is an improvement over the traditional paper method, the department is experimenting with methods by which one can increase student participation. Survey results seem to show that an overwhelming majority of students are in favor using electronic course evaluations.

3. What has your program done with assessment information this year? (i.e. communicated results to faculty, staff, alumni and students, made changes in the curriculum, made changes in the budget, added new courses. . .)

In response to the above comments, and in accordance to the departmental mission and its five year plan, the department has tried for two years to hire a faculty position in computer security. We have hired a new faculty member in software engineering and another one in networking. We offer a course in web design on a yearly basis. Also, a number of courses such as:

- C308 - Systems Analysis and Design
- C335 - Computer Structures
- Y398 - Internship - Professional Practice
- C435 - Operating Systems
- C442 - Database Systems
- C463 - Artificial Intelligence
- B481 - Interactive Computer Graphics
- C490 - Object Oriented Programming (Advanced Java Techniques)

have increased their hands-on and software development components. In addition, last year, the department replaced all of its laboratory workstations, creating an up-to-date computing facility for our students.

Also, in 2004, the computer science department proposed a new initiative to develop the ***Center for Internship, Volunteerism and Entrepreneurship (CIVECS) internship***. This proposal had three major objectives. First, to improve and expand the scope of the internship program in computer science to include and promote volunteerism and service learning. Second, to address the problem of 'Brain Drain' which exists in the state of Indiana. Third, to increase and enhance the high-tech job opportunities by developing an incubator for new software engineering startups in Indiana.

The initiative has been quite successful. We have been able to work on a number of important projects including IU-EVAL, IU-RETAIN and IU-ALUMNI, and we are currently evaluating a new project for the Studebaker National Museum. Approximately 15 student interns have

benefitted from working on these projects. Funds from Lilly Foundation Grant, IUSB Assessment Grant, College of Liberal Arts and Sciences, and the Department of Computer and Information Sciences have helped fund these projects.

4. What are two concerns about student learning you identified this year?

	Goal	Expectation
General Knowledge	A) Ability to Understand Technical Material	Meets Expectation
	B) Written and Verbal Communication	Below Expectation
	C) Dealing with Complexity	Below Expectation
Disciplinary Knowledge	1) Hardware	Meets Expectation
	2) Data Representation	Meets Expectation
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	8) Operating System Concepts	Meets Expectation