CIS Assessment Plan

27 March 2018

Learning Outcomes

At program graduation, students will

LO1. have demonstrated technical mastery of the main areas of computer science, including theoretical foundations, computer systems design, programming languages, and software development;

LO2. be able to draw on a broad knowledge of computer science to design, implement, and test software solutions to significant problems in a variety of areas;

LO3. have an awareness of the broad applicability of computing; be proficient in one or more subareas of computer science or applied computer science;

LO4. be able to adapt and extend fundamental knowledge and skills to new problem domains and emerging technologies;

LO5. be able to communicate and collaborate with others as part of a project team, and express ideas orally and in writing.

Background

The CIS degree requires that students complete the following core courses:

- CIS 210 – Computer Science I (Computational Thinking)
- CIS 211 – Computer Science II (Object-oriented Programming)
- CIS 212 – Computer Science III (Introductory Data Structures)
- MATH 231,232 – Elements of Discrete Mathematics I & II
- CIS 313 – Intermediate Data Structures
- CIS 314 – Computer Organization
- CIS 315 – Intermediate Algorithms
- CIS 322 – Introduction to Software Engineering
- CIS 330 – C/C++ & Unix
- CIS 415 – Operating Systems
- CIS 422 – Software Methodology
- CIS 425 – Principles of Programming Languages

Assessment Methods

The assessment methods will differ for each learning outcome. We will develop and refine the assessment methods over time and with experience, but here is our first estimate of measures, nature of assessment, collection and sources of data, and the nature of sampling.

LO1. Successful completion of the core courses listed above is required to meet this learning objective. Assessment of L01 is described in more detail below. This will be assessed annually.

LO2. The two primary courses where students demonstrate their ability to solve large problems using a variety of techniques are CIS 330 and CIS 415. In both cases, the ability to achieve 75% or greater on the assessed programming projects is an indication that students have met this particular learning outcome. Two sections, of approximately equal size, of each course are taught each year; we will sample the results of student performance in one section of each, CIS 330 and CIS 415 in the Spring quarter, guaranteeing that we are not assessing any students twice (CIS 330 is a pre-requisite for CIS 415).

LO3. Each student must specialize in a particular track with their elective courses. We are in the process of determining from the faculty in charge of each track how best to assess the student performance in each track. This will be done prior to the start of the 18-19 academic year, so the results can be reported in the fall of 2019.

LO4. Many of our elective courses enable students to do programming projects on topics of their own choosing. We are in the process of determining from those faculty who provide this option how best to addess the performance on these projects. This will be done prior to the start of the 19-20 academic year, so the results can be reported in the fall of 2020.

LO5. All students are required to complete either WR 320 (Scientific and Technical Writing) or WR 321 (Business Communications). We are in the process of determining from the instructors who deliver those courses how best to address the performance on this learning objective. This will be done prior to the start of the 20-21 academic year, so the results can be reported in the fall of 2021.

Assessment Processes

Our initial plan for assessing each outcome is shown in the table below; this shows a 4-year cycle for assessing outcomes LO2-LO5, with an annual cycle for LO1. If a particular outcome assessment indicates a need for a change in the curriculum or particular course syllabi to address an issue, we will revisit that particular outcome 2 years hence.

Learning Outcome	AY 17-18	AY 18-19	AY 19-20	AY 20-21
LO1 – technical mastery	X	X	X	X
LO2 – software development	X			
LO3 – area proficiency		X		
LO4 – adaptation to new problems			X	
LO5 – communication skills				X

L01 assessment details

L01 (technical mastery) has several facets. Here we break it down by area and level, i for introductory (basic familiarity and some ability to reason informally), d for developing (growing ability to reason formally and apply knowledge), and m for mastery to the degree expected in the undergraduate degree, which includes using the foundational knowledge gained in the B.S. or B.A. degree as a basis for continued learning during a professional career.

	210	211	212	313	315	314	330,322	415	425	422
L01a: theoretical foundations	i	i	i	d	m				m	
L01b: computer systems design		i				d		m		
L01c: programming languages	i	i	i						m	
L01d: software development	i	i	i				d	m		m

Assessment criteria, L01a: At the conclusion of CIS 210, a student should will be able to distinguish between a linear-time algorithm and an algorithm of higher complexity, although their reasoning will be informal. At the conclusion of CIS 313, a student will be able to reason formally about the asymptotic performance of algorithms involving standard data structures (lists, queues, heaps, etc). At the conclusion of CIS 315 a student will be able to select and reason formally about performance properties of advanced algorithms, and will be able to use knowledge of algorithmic strategies such as dynamic programming to devise and analyze algorithms suited to a given problem. These proficiencies will be assessed through performance on final examinations.

Assessment criteria, L01b: At the conclusion of CIS 211, students will have a basic familiarity with the von Neumann computer architecture in which both programs and data are stored as binary numbers in a linearly addressed memory. This will be assessed by performance on a series of projects in which students complete a simple simulation of a computer, including encoding and interpreting instructions encoded bit fields in an integer. At the conclusion of CIS 314, students will understand modern computer organization including pipelining and caches. This will be assessed by projects and by exam questions. At the conclusion of CIS 415, students will be able to design, implement, and reason about a component of a modern operating system, such as a device driver or virtual memory page replacement algorithm. This will be assessed through successful completion of projects and by exam questions that test ability to reason about the consequences of computer system design decisions.

Assessment criteria, L01c: The CIS 21x series introduces basic programming language concepts including variable scope, the stack and the heap, classes and objects. Students finishing CIS 210 will be able to use these concepts construct programs in a single programming language, and to predict the behavior of programs based on these programming language concepts. This will be assessed primarily by exam questions that require students to write program fragments and to predict the output of programs. Students finishing CIS 211 will add object-oriented constructs (classes and objects) to their knowledge of basic programming language constructs in a single programming language. Students finishing CIS 212 will learn a second programming language, and will show ability to generalize concepts learned in CIS 210 and 211 to the second language while adding static typing. Proficiency will be measured primarily through exam questions in which students distinguish correct from incorrect program fragments, predict the behavior of program fragments, or devise short program fragments to solve a problem. In CIS 425 students will develop and demonstrate ability to formally reason about the programming language constructs introduced in prior courses, generalizing them (e.g., distinguishing between static and dynamic typing, between static and dynamic scoping) sufficient to recognize the same basic computational and definitional strategies in new programming langauges. Proficiency will be assessed primarily through exam questions that require predicting the consequences of design decisions in a programming language.

In each of these areas L01a through L01c, we will assess overall success in the program by comparing performance on matched (but not identical) exam questions. For example, a similar question requiring a student to predict program output by understanding variable scope can be asked in multiple years, so that differences in class performance on matched questions indicate differences in level of proficiency.

Assessment criteria, L01d: Mastery of techniques and approaches to software development is closely related to criterion L02. Initial levels of proficiency in the CIS 21x series and developing proficiency in CIS 332 will be measured primarily through project work. In the CIS 21x series, we can measure the proportion of students who were able to earn at least 75% of possible points in the last three (and most

challenging) projects. In CIS 322 we will measure overall performance similarly. Although some projects may change from year to year, we will be able to match some projects from the second half of the academic term to compare performance from one year to the next.

Status, Outcomes and Results

Over the summer, the Head of Department and Chair of the Undergraduate Education Committee will generate a preliminary report of the assessments of LO1 and the other LO that is to be assessed in the preceding academic year. This report is distributed to the department faculty in advance of our annual retreat prior to the start of the new academic year, and the report will be discussed by the faculty at the retreat. If action is required, a sub-committee of faculty will be formed to investigate and to report back to the faculty for discussion at our regularly-scheduled faculty meeting in October. Any resulting changes will be factored into curriculum and syllabi as necessary; syllabi changes can be implemented by the time of the next delivery of the affected course, whereas curriculum changes may require that they be introduced in the next academic year.

The results of the assessment and any actions triggered will be delivered to the College of Arts and Sciences in the fall quarter.