Annual Departmental Assessment Report

Department or Program: Computer and Information Science
Academic Year of Report: 2018
Department Contact Person for Assessment: J Sventek

Section 1: Learning Objectives Assessed for this Report
The learning outcomes for the **CIS** and **MACS** degrees are listed below, with those outcomes being evaluated for the 2018 academic year highlighted.

CIS

LO1 - have demonstrated technical mastery of the main areas of computer science, including theoretical foundations, computer systems, 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.

MACS

LO1 – have demonstrated proficiency in the main areas of computer science, including data structures and algorithms, computer systems, programming languages, and software development;

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

LO3 – have demonstrated in-depth understanding of some area of computer science (theoretical foundations, computer systems, software development);

LO4 – have demonstrated proficiency with the calculational techniques and applications of calculus and linear algebra;

LO5 – be able to read and write mathematical proofs, producing arguments that are logically and syntactically correct;

LO6 – have demonstrated an in-depth understanding of some area of mathematics;

LO7 – be able to communicate and collaborate with others, and express ideas orally and in writing.

Section 2: Assessment Activities

CIS/LO1

CIS/LO1 actually consists of 4 sub-learning objectives. In this assessment, we have evaluated mastery of techniques and approaches to software development. Initial levels of proficiency in the CIS 21x series and developing proficiency in CIS 422 are measured primarily through project work. In CIS 212, we 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 422 we measure overall performance similarly.

As this is the first time that we have assessed this learning outcome, we focus on the last three projects from the Spring 2019 section of CIS 212.

Project 6: students had to create and submit two working programs: a) a data-driven program, written in the C language, that exercised the methods on a stack; and b) a data-driven program, written in the C language, that used a stack to check the balance of a variety of parenthetical expressions.

Project 7: students had to create and submit two working programs: a) a data-driven program, written in the C language, that exercised the methods on a queue; and b) an implementation of a Queue abstract data type in the C language using a linked list as the underlying data structure.

Project 8: students had to create and submit one working program: a data-driven program, written in the C language, that broke input files into individual words, counted the number of occurrences of each word, and displayed the results in a variety of formats. They were required to use a map to keep track of the word frequencies.

The class consisted of 79 students (**54** CIS, 5 MACS, 20 OTHER); each project was worth 50 points. The statistics for these three projects were as follows:

Project	Mean	Standard Deviation	# CIS > 75%
6	34.4	17.1	50 (63%)
7	38.9	15.5	59 (75%)
8	42.1	15.9	67 (85%)

As we can see, the cohort performance improved with each weekly project, finishing with 85% of the students achieving >= 75% mastery of the project. Project 8 was particularly challenging, and required the students to master the use of a new data structure (hashmap) and write > 150 lines of intricate source code. Most of the points were allocated to the programs performing correctly when executed against seen and unseen data.

CIS/LO3
The degree plan for all students requires following one of the defined tracks in our upper-division electives, and each student must complete at least one of the defined tracks in order to graduate. We had hoped to be able to quantify the number of students in each of the tracks in this assessment.

This quantification has been difficult, since the software used by advisors does not permit us to capture each student's chosen track. We will consider revising our tracking methods in the coming year to enable our ability to better assess quantification of this learning outcome.

As a proxy, we have noted increasing enrollment pressure for CIS 471, Artificial Intelligence, and CIS 472, Machine Learning, over the past few years; these are courses in the Database and Informatics Track. In academic year 2018 we introduced two sections of CIS 471 to begin to address this enrollment pressure, and have introduced a second section of CIS 472 in academic year 2019.

The following table shows the enrollment, number of passing grades, number of failing grades, and withdrawals for these three sections.

Section	Enrolled	A-C & P	D, F, N	W
Fall 2017	33	29	2	2
Fall 2018	38	36	1	1
Winter 2019	27	23	2	2
Total 2018	65	59	3	3

As can be seen, more than twice as many students took and passed the AI course in academic 2018 over 2017. Preliminary tracking shows that most of them also took and passed the Machine Learning course, thus completing 2 of the 3 required courses in the Database and Informatics Track.

We usually graduate ~120 CIS + MACS students each academic year, so this shows that 60% of last year's graduating class completed this track, thus establishing proficiency in one or more subareas of computer science or applied computer science.

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The class consisted of 79 students (54 CIS, **5** MACS, 20 OTHER); each project was worth 50 points. The statistics for these three projects were as follows:

Project	Mean	Standard Deviation	# > 75%	# MACS > 75%
6	34.4	17.1	50 (63%)	3 (60%)
7	38.9	15.5	59 (75%)	5 (100%)
8	42.1	15.9	67 (85%)	4 (80%)

As we can see, the variability for the MACS students is a bit greater than for the CIS cohort, but still a significant percentage of the students score greater than 75%. Project 8 was particularly challenging, and required the students to master the use of a new data structure (hashmap) and write > 150 lines of intricate source code. Most of the points were allocated to the programs performing correctly when executed against seen and unseen data.

MACS/LO3

The degree plan for all students requires following one of the defined tracks in our upper-division electives, and each student must complete at least one of the defined tracks in order to graduate. We had hoped to be able to quantify the number of students in each of the tracks.

This quantification has been difficult, since the software used by advisors does not permit us to capture each student's chosen track. We will consider revising our tracking methods in the coming year to enable our ability to better assess quantification of the learning outcome.

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MACS/LO6
The Math Department assessed this outcome as part of the Math Major.

Section 3: Actions Taken Based on Assessment Analysis
CIS/LO1
The results of our assessment are satisfactory. Future assessments of this sub-outcome will also include analysis of software development aspects of CIS 422.

CIS/LO3
We have initiated discussions with advisors in Tykeson and in the department to capture in the Navigate tool the track[s] that each CIS major is pursuing.

MACS/LO1
The results of our assessment are satisfactory. Future assessments of this sub-outcome will also include analysis of software development aspects of CIS 422.

MACS/LO3
We have initiated discussions with advisors in Tykeson and in the department to capture in the Navigate tool the track[s] that each MACS major is pursuing.

MACS/LO6
See MATH assessment report for Academic 2018.

Section 4: Other Efforts to Improve the Student Educational Experience
None this year.

Section 5: Plans for Next Year
The assessment plans for the two majors call for the following assessments in Academic 2019.

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

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

MACS
LO1 – have demonstrated proficiency in the main areas of computer science, including data structures and algorithms, computer systems, programming languages, and software development;

LO4 – have demonstrated proficiency with the calculational techniques and applications of calculus and linear algebra;

LO7 – be able to communicate and collaborate with others, and express ideas orally and in writing;

For CIS/LO1, we will assess the third sub-outcome with respect to programming language concepts. At the conclusion of CIS 425, students will develop and demonstrate the ability to formally reason about the programming language concepts introduced in prior courses, generalizing them sufficiently to recognize the same basic computational and definitional strategies in new programming languages. This is assessed through exam questions that require predicting the consequences of design decisions in a programming language.

For CIS/LO5, each student must demonstrate collaboration and the ability to express ideas orally and in writing in their projects for CIS 422.

For MACS/LO1, we will assess the third sub-outcome with respect to programming language concepts. At the conclusion of CIS 425, students will develop and demonstrate the ability to formally reason about the programming language concepts introduced in prior courses, generalizing them sufficiently to recognize the same basic computational and definitional strategies in new programming languages. This is assessed through exam questions that require predicting the consequences of design decisions in a programming language.

For MACS/LO4, we will rely upon the Math Department's assessment of that learning outcome.

For MACS/LO7, each student must demonstrate collaboration and the ability to express ideas orally and in writing in their projects for CIS 422.