Supplementary Departmental Assessment Report
21 May 2021

Department or Program: Computer and Information Science (CIS), CIS and MACS undergraduate degrees
Academic Year of Report: 2019 and 2020
Department Contact Person for Assessment: J Sventek

N.B. The annual assessment report was abandoned by the university for academic year 2019 due to the Covid pandemic. Service duties during academic year 2020 were reduced to essential duties. The curriculum committee in CIS determined that an assessment report for 2020, as for 2019, was not required. On 10 May 2021 the committee learned that a supplementary report was required by 21 May 2021. In order to be able to provide a report by the deadline, and since we operated during both 2019 and 2020 academic years under the assumption that no report would be required, we are reproducing the analysis performed for academic 2018 using data from courses taught in 20W, 20S, and 20F.

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 this supplementary report 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 and MACS/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. Due to the pandemic, we did not work with the 422 instructors so that we could include measures from that course for this assessment.

We focus on the last three projects from the Spring 2020 and Fall 2020 sections 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 Spring 2020 class consisted of 77 students (**50** CIS, 5 MACS, 22 OTHER); the Fall 2020 class consisted of 86 students (**51** CIS, 11 MACS, 22 OTHER); each project was worth 50 points. The statistics for these three projects were as follows:

Spring 2020			
Project	**Mean**	**Standard Deviation**	**# > 75%**
6	34.3	19.4	48 (62%)
7	37.0	17.0	49 (63%)
8	36.5	20.1	54 (70%)

Fall 2020			
Project	**Mean**	**Standard Deviation**	**# > 75%**
6	39.1	13.5	60 (70%)
7	42.5	14.2	70 (81%)
8	43.2	15.8	73 (85%)

Both cohorts demonstrated improved performance with each weekly project. The Fall 2020 cohort results are quite similar to the same measure for the 2018 academic year, even though the course was delivered remotely. The Spring 2020 cohort shows poorer performance; this is not surprising as students were attending remotely for the first time and the end of the quarter was significantly affected by the demonstrations associated with “Black Lives Matter”. 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 and 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 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 are attempting to revise our tracking methods to enable our ability to better assess quantification of this learning outcome. Unfortunately, this was not seen as an essential service duty during the period under discussion. In the short time available to prepare this assessment, we are unable to come up with a proxy measure.

MACS/LO6

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

Section 3: Actions Taken Based on Assessment Analysis

CIS/LO1 and 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.

CIS/LO3 and 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 CIS major is pursuing. Failing that, we will maintain a separate database for each CIS and MACS major with the track[s] being pursued by each student.

MACS/LO6

See MATH supplementary assessment report.

Section 4: Other Efforts to Improve the Student Educational Experience

The CIS faculty have tried a number of techniques to improve the student educational experience during this pandemic-affected time.

- A shared GE across CIS 210 and 211 to provide additional 1-1 support for students.
- A shared GE across CIS 313 and CIS 314 to support transfer students with a Python bootcamp and the opportunity to meet other transfer students.
- Both CIS 210 and 211 participate in Class Encore; CIS 212 will begin participating in Fall 2021.
- Liberal use of undergraduate learning assistants to provide significant additional office hours beyond those from the GEs and the instructor.

Section 5: Plans for Next Year

Due to the disruption caused by the pandemic, we will reset our assessment plans to begin the 4-year cycle again.

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MACS

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For CIS/LO1 and MACS/LO1, we will assess the first sub-outcome with respect to technical mastery - "At the conclusion of CIS 212, a student should be able to distinguish between a linear-time algorithms 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 examination questions."

For CIS/LO2 and MACS/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."

For MACS/LO5, we will rely upon the Math Department's assessment of that learning outcome.