Assessment of Student Learning Plan (ASLP): Computer Science

2014-15 Academic Year

A. College, Department/Program, Date

College ___Science Technology and Health
Department/Program ___Computer Science_____
Date ___June 5, 2015_____

B. Contact Person for the Assessment Plan

Name and title __Dr. Bruce MacLeod, Department Chair
__If needed, Dr. Charles Welty, Prof. Emeritus

C. Degree Program

*Name of Degree Program*___Bachelor of Science in Computer Science

D. Assessment of Student Learning in Your Program

***Step 1: Identify Student Learning Outcomes* (What are students able to do by the end of your program?)**

a. *List 3-5 of the most important student learning outcomes for your program.* We have 11 student outcomes mandated by our accreditation body, ABET.
b. *Then, identify which student learning outcomes were assessed this past academic year.* *(One or more of the outcomes and corresponding assessment plans could come from your department's CORE Course Blueprint(s).*

Summary of assessment results for fall 2014 and spring 2015

The following seems to address both parts D.1.a. and D.1.b.

We assess all of the following in a two year span. What follows is the first of the two years. The missing assessments will be done in the Fall 2015 and Spring 2016.

	Percentages						
Student Outcome/ Score	**5**	**4**	**3**	**2**	**1**	**Sum of 4 and 5**	**Meets 80% Criterion?**
(a) An ability to apply knowledge of computing and mathematics appropriate to the discipline	**To be done Spring 2016**						
(b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution	53.3%	23.3%	13.3%	0.0%	10.0%	76.7%	No (but close)
(c) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs	**To be done Spring 2016**						
(d) An ability to function effectively on teams to accomplish a common goal	**To be done Fall 2015**						
(e) An understanding of professional, ethical, legal, security and social issues and responsibilities	71.4%	19.0%	9.5%	0.0%	0%	90.4%	Yes
(f) An ability to communicate effectively with a range of audiences	53.3%	13.3%	3.3%	6.7%	23.3%	66.7%	No
(g) An ability to analyze the local and global impact of computing on individuals, organizations, and society	85.6%	9.5%	4.8%	0%	0%	95.1%	Yes
(h) Recognition of the need for and an ability to engage in continuing professional development (weighted average of COS 360 and COS 398 results)	71%	22%	4%	0%	0%	93%	Yes

(i) An ability to use current techniques, skills, and tools necessary for computing practice.	**To be done Fall 2015**						

(j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.	0%	25%	42%	33%	0%	25%	No
(k) An ability to apply design and development principles in the construction of software systems of varying complexity.	**To be done Fall 2015**						

Step 2: How and When were the Learning Outcomes assessed?

a. *Briefly describe the assessment tools, measures, or forms of evidence that were utilized to demonstrate students' accomplishment of the learning outcomes selected.*

b. *Briefly describe when and how you implemented the assessment activity.*

Much of this is given in part D.1. The following is a complete assessment done in the spring 2015.

COS 485 Spring 2015 Assessment Report

1. Student outcomes mapped to student sub-outcomes

COS 485 directly addresses Student Outcome (j). It was decided to use the following student sub-outcomes.

Student Outcome	**student sub-outcomes**
(j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the	1. Mastery of a variety of algorithm design techniques and able to design new algorithm 2. Understanding important algorithms/recognize similar problems 3. Able to analyze runtime of algorithms using mathematical

tradeoffs involved in design choices.	notation

2. Assessment Evaluation Matrix

Each Student Outcome is subdivided into student sub-outcomes and the graded course activities that measure these sub-outcomes are specified here.

Student sub-outcome	Specific assignment, test problem or other work evaluated, number of points and percentage of grade.
j1: Mastery of a variety of algorithm design techniques and able to design new algorithms	This is assessed based on exam questions asking students to design algorithms. j1a: Midterm 2, Question 3-b: Design of a greedy algorithm (10 points of 100 point exam) j1b: Midterm 2, question 4-b,c,d: Design of a backtracking algorithm (15 points of 100 point exam)
j2: Understanding importar algorithms/recognize simila problems	This is assessed based on exam questions asking student to demonstrate important algorithm learned in class and on the final exam in which students are given statements of five algorithmic problems that are disguised and described in terms of some specific everyday human example. Students are then asked to recognize the similarity to the correct underlying computational problem that we have studied in class. j2a: Midterm 2, Question 1: Dijkstra's shortest paths algorithm (25 points of 100 point exam) j2b: Final, Question1: Identifying similar problems (20 points of 100 point exam)
j3: Able to analyze runtime of algorithms using mathematical notation	This is assessed based on midterm and final exam questions asking students to analyze an algorithm implementation. j3a: Midterm 2, Question 2: Analyzing a new Minimum Spanning Tree

	algorithm (20 points of 100 point exam) j3b: Final. Question 2-b (5 points) & Question 6-b (5 points). Analyzing run times of two algorithms they design on the final. Question 2-b can be solved with breadth first search or a shortest paths algorithm. Question 6-b is solved with a backtracking algorithm.

3. Grading Rubric for each Student Sub-outcome

For each assignment or exam question that participates in this assessment there must be a rubric stating how the grade was determined. Preferably, when the aspect of the course to be used for assessment is selected, the corresponding grading rubric should be created, as shown below.

j1a (Mid2, Q3-b)	Design and describe a greedy algorithm (10 points) 7 points for describing a greedy algorithm that addresses the problem 3 point if it will find an optimal solution
j1b (Mid2, Q4b,c,d)	Design and describe a backtracking algorithm (15 points) 5 points English description 5 points drawing top levels of search tree 5 points showing the state space vector
j2a (Mid2, Q1)	Demonstrate Dijkstra's algorithm (25 points) 10 points draw first 4 edges added to shortest paths tree 5 points identify candidate vertices 5 points identify candidate edges 5 points identify next to be chosen candidate vertex
j2b (Final, Q1)	Identify similar problems. (20 points total, 5 problems, 4 points each). Each part: 2 points for NP-Complete (Yes/No) 2 points for explanation
j3a (Mid2, Q2)	They analyze a new minimum spanning tree algorithm (20 points) 5 points analyze edges to be removed 5 points testing for disconnection of graph 10 points analysis of run time
j3b (Final, Q2-b & Q6-b)	They are analyzing run times of two algorithms they design for the final. 5 points each

4. Assessment Rubric Normalization of outcomes. **All results are normalized on a 5 point scale for ease of** comparison. This Assessment Rubric uses the point totals from the Grading Rubric for each Student sub-outcome**,** above**,** and normalizes them.

Score □	Excellent	Very Good	Good	Fair	Poor

Outcome □ **(Student sub-outcome.)**	**5** (Number of points on which the score is based.)	**4** (Number of points on which the score is based.)	**3** (Number of points on which the score is based.)	**2** (Number of points on which the score is based.)	**1** (Number of points on which the score is based.)
j1a, Mid2, Q3-b	10	9	8	7	<= 6
j1b, Mid2, Q4b,c,d	15	13-14	11-12	9-10	<= 8
j2a, Mid2, Q1	25	22-24	19-21	15-18	<= 14
j2b, Final, Q1	20	18-19	16-17	14-15	<= 13
j3a, Mid2, Q2	20	18-19	16-17	14-15	<= 13
j3b, Final, Q2b,Q6b	10	9	8	7	<= 6

5. Assessment Summary Sheet

Student	J1. Algorithm Design		J2. Understanding & Recognizing		J3. Analysis		Average
	j1a	j1b	j2a	j2b	j3a	j3b	
Average Score / Outcome *Based or participatory students*	4.5	2.8	3.6	2.5	3.1	1.9	3.0
Distribution:							
Excellent (4.5 - 5.0]							0%
Very Good (3.5 - 4.5]							25%
Good (2.5 - 3.5]							42%
Fair (1.5 - 2.5]							33%
Poor [1.0 - 1.5]							0%

6. Changes to the course due to assessment

I am satisfied with any student that performs at the level of "good" or better. The overall class assessment average was 3.0, which meets that criteria on average, but individually 33% of the students did not meet the criteria.

Some problem areas can be identified by the individual sub-assessments. Many students had difficulty with sub-assessment j2b "Identifying similar problems", where I ask students to recognize a problem that has been disguised with a different context and also to identify if it is NP-Complete. This has always been a difficult final exam problem for students in this class. I have few homework questions of this nature, and I would like to add more when I revise the homework assignments. More practice should help the students.

Most students also had difficulty with sub-assessment j3b "analysis of execution time". This has also always been an area of difficulty for students. In the past I have tried to improve my teaching of analysis, but many students seem to have poor analytical abilities. Based on my assessments from past years, the department decided to change this course from 3 credits to 4 credits starting with the next offering in Spring 2016. This will give me more time to work on analysis. I plan to do more thorough analysis in class (analysis has often been rushed or skipped due to time limits), and add more class activities where students must do analysis in class.

7. Final Overall Assessment Results

The final result for outcome (j) is that while 67% performed at the level of "good" or better, and 33% ranked as fair. The departmental goal is 80% getting a 4 or 5. This was very poor result but there are plans to improve it given above.

Score %	5	4	3	2	1	Sum of 4 and 5	Meets 80% criterion?
(j)	0%	25%	42%	33%	0%	25%	No

Step 3: Process of Using the Assessment results to Improve Student Learning

a. *Briefly describe your unit's process of reviewing the program assessment results, and how you expect to improve student learning.*

Computer Science Dept. Faculty Meeting, May 13, 2015, Ping-Pong room

Attending: Dave Bantz, Bob Boothe, David Briggs, Stephen Houser, Bruce MacLeod, Tiffany Rad, Charles Welty

Agenda:

- Assessment reports of COS 360 (Welty), COS 398 (Rad, by Skype), COS 450 (Houser) and COS 485 (Boothe)
- David Bantz's note about courses at Community colleges
- Reducing the work load/assignment size in our intro courses.

Minutes:

- **Assessment Reports:**

The common goal was that 80% of students receive a 4 or 5 on a 5 point maximum scale.

(b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution

COS 450 Operating Systems (Houser) Steve's students achieved only 76.7% values of 4 or 5 out of 5 on the assessment. Steve mainly attributes this to his giving the problems too early in the class, before the students really understood his grading system.

(e) An understanding of professional, ethical, legal, security and social issues and responsibilities

COS 398 Professional Ethics and Social Impact of Computing (Rad) Tiffany's students did very well on these questions from the midterm given fairly late in the semester. The final was a project. She improved her overall scores from two years ago. Her students achieved 90.4% scores of 4 or 5 out of 5.

(f) An ability to communicate effectively with a range of audiences

COS 450 Operating Systems (Houser) These students achieved only 66.7% 4s and 5s. The main problem was students had a difficult time with the required design document. Instead of writing up the first design project as part of the assessment, it should have been the second when the students had more familiarity with the form and content needed. Next time the design document for project 2 will be assessed.

(g) An ability to analyze the local and global impact of computing on individuals, organizations, and society

COS 398 Professional Ethics and Social Impact of Computing (Rad) 90.4% of Tiffany's students got 4 or 5.

(h) Recognition of the need for and an ability to engage in continuing professional development (weighted average of COS 360 and COS 398 results)

COS 360 Programming Languages (Welty for Suad Alagic, laid-off) 100% of students realized the necessity of lifelong learning at the 4 or 5 level. Students mainly lost a point due to brevity of response. All had the right idea.

COS 398 Professional Ethics and Social Impact of Computing (Rad) 90.4% of students got 4 or 5.

The weighted average of COS 360 and COS 398 was that 93% of students achieved 4 or 5 out of 5.

(j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.

COS 485 (Boothe) Analysis of Algorithms Only 25% of Bob's students got 4 out of 5 and no students got 5 out of 5. For example, students had a hard time recognizing whether stated problems were NP-complete or not. This has always been a difficult question and more time will be spent on it in the future. Also, analysis of execution time was difficult. In spring 2016 this course will be 4 credits. The extra time available will be used to aid students in conquering these and other complex aspects of the course. The time will not be used to cover more material or go into unnecessary depth.

At this point the minutes show the table from the **Summary of assessment results for fall 2014 and spring 2015**, above.

- Dave Bantz's note about courses at Community colleges

Dave has been working closely with SMCC (Southern Maine Community College) and YCCC (York County Community College) on courses they will need to offer in order for their students to participate in a 2 plus 2 program for a B.S. in CS from USM. They are primarily concerned that they will have taken all the 100 and 200 courses needed for the program. COS 280 (Discrete Math II) presents a problem. It did not seem that these students would be able to fit COS 280 into their first two years because there is no one at those schools to teach it. We assured Dave that many USM students delay taking it due to its difficulty and are not overly delayed by its delay. We also discussed whether or not a 300 level course could be offered at the CC level. We discussed COS 399 (Autonomous Robots) but said they would have to coordinate with Stephen Houser who teaches our course to be sure theirs is equivalent.

- Reducing the work load/assignment size in our intro courses.

The attrition rate is just too high in COS 160. Even good students complain about the amount of programming required, especially the more complex assignments at the end of the semester. Bruce MacLeod and Bob Boothe will work on this over the summer. Obviously this will affect COS 161 and COS 285. They will have to change too.

E. Are there "community engagement" activities integrated in your departmental curriculum?

a. Please indicate which of the components, listed below, are <u>included</u> in your program's curriculum, and then indicate if the activities are <u>required or optional</u> for students in your major.

<u>Community Engagement Activity</u>	*<u>Included</u>*	*<u>Required/Optional</u>*	
Student Research (related to a community-based problem)	___	R	O
Student-Faculty Community Research Project	___	R	O
Internship, or a Field Experience	_I__	R	**<u>O</u>**
Independent Study (community-related project)	___	R	O
Capstone Course (community-related project)	___	R	O
Service-Learning (a component of a course)	___	R	O
Study Abroad, or an International Program	___	R	O
Interdisciplinary Collaborative Project (community related)	___	R	O
Student Leadership Activities (related to a team project)	_I__	**<u>R</u>**	O
Students/Faculty Community Leadership (advisory boards, committees, conference presentations)	___	R	O
Other Activities (not mentioned above):			

b. Please list the courses (i.e. EDU 400) that have a "community engagement" activity in your program:

Upper-level courses: COS 420, COS 498