SCHOOL OF COMPUTING & INFORMATION SCIENCES

Annual Assessment Summary 2013-2015
for the
Bachelor of Science in Computer Science

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I. INTRODUCTION

This report is prepared in accordance with the intent of the Assessment Plan originally adopted by the School of Computing & Information Sciences (then the School of Computer Science) in spring 2003. Its purpose is to summarize the results of the various assessment mechanisms utilized by SCIS in support of the BS in Computer Science program, and to present the resulting findings and recommendations to the Undergraduate Committee, the Undergraduate Program Director, the Faculty of the School, and the Director.

In spring 2015, this plan and its associated mechanisms and procedures document were modified to adapt to our changed operations. The salient modifications deal with:

- Changed Assessment cycle from an annual to a biennial one.
- Modifying timelines for various actions based on the new assessment cycle.
- Introducing additional assessments; e.g., Survey of SCIS Industrial Advisory Board Members, Survey of Employers, and Recommendations from student group STARS.
- Including new courses in the subject area Computer Systems.

The goals of the assessment process are to assess the extent to which the Student Outcomes and Program Educational Objectives of the BS in Computer Science program have been attained in the period under review, to identify specific areas of the program where a need for improvement is indicated, and to present a set of recommendations for achieving those improvements.

This review is conducted for the period from Summer 2013 to Spring 2015.

II. OVERVIEW

A. Terminology

The BS in Computer Science *Program Educational Objectives* (Appendix A-1) document describes the overriding goals of the program relating to the cumulative persistent effects of the students' educational experiences. The objectives are broad in nature and define expected general characteristics of the program's graduates within some years after graduation.

The BS in Computer Science *Student Outcomes* (Appendix A-2) are more specific in nature. These describe characteristics of students at the time of graduation, and define the specific knowledge, skills, and behaviors that they are expected to acquire as they complete the requirements of the program. Attainment of each Student Outcome enables the attainment of one or more of the Program Educational Objectives.

In Fall 2014, the Undergraduate Committee of the School vetted the *Program Educational Objectives* and essentially reorganized them for better consolidation. Further, the UGC revised the *Student Outcomes* to align directly with the ABET guidelines. Both these changes were vetted by the two most important program constituencies; students via student chapters, and employers via the Industrial Advisory Board Membership. These changes were approved by the SCIS faculty in December 2014. The modified *Program Educational Objectives* and *Student Outcomes* are included in Appendices A-3 and A-4 respectively.

As the current Assessment Review is conducted for the period Summer 2013 to Spring 2015, the Student Outcomes and Program Objectives used in this report are the ones included in Appendices A-1 and A-2.

The syllabus of each required and elective course of the BS in Computer Science program presents a set of *Course Outcomes*. The Course Outcomes identify specific knowledge units and levels of attainment (mastery, familiarity, awareness) expected of a student completing the course. Attainment by students of Course Outcome enables attainment of one or more of the Student Outcomes.

B. Assessment Mechanisms & Procedures

Consistent with current educational practice, SCIS follows a systematic process of collecting and utilizing data on the degree of attainment of the Student Outcomes and Program Educational Objectives. The *SCIS Assessment Plan* (Appendix B-1) specifies the participants and schedule for this process, and the means of evaluating the data and enacting program changes indicated by the evaluation. The *SCIS Assessment Mechanisms & Procedures* document (Appendix B-2) specifies the implementation of the Assessment Plan. The SCIS Assessment Plan and Assessment Procedures and Mechanisms were adopted in 2003, amended in 2010 to incorporate additional direct assessment measures, and last amended in spring 2015 to align better with our changed operations.

The following indirect assessment mechanisms have been employed in this assessment cycle:

Mechanism	Target	Frequency
Course Outcomes Survey by Students	Course Outcomes	Semester
Course Outcomes Survey by Instructors	Course Outcomes	Semester
Graduating Student (Exit) Survey	Student Outcomes	Semester
Alumni Survey	Program Educational Objectives	Continual
IAB Members and Employers Survey	Program Educational Objectives	Continual

The following direct assessment mechanisms have been employed since spring 2010:

Mechanism	Target	Frequency
Course Embedded Assessment	Course Outcomes and Student Outcomes	At least once in the Assessment Period
Capstone Project Assessment	Student Outcomes	Semester

Important Notes: (a) *Beginning in this Assessment cycle, the frequency of the Course Embedded Assessments for Course and Student Outcomes is changed from "semester" to "once in the Assessment period." (b) Beginning in this Assessment cycle, we are introducing a survey of the Employers and members of our Industrial Advisory Board to gauge the preparedness of our graduated students to measure the level of achievement of our Program Objectives.*

Additional input is solicited and may be received from other program constituents including:

- ACM Student Chapter,
- Upsilon Pi Epsilon Honor Society Chapter,
- SCIS Women In Computer Science group,
- STARS Student Chapter,
- Linux Group,
- Programming Team, and
- SCIS Industry Advisory Board.

C. Process

The required and elective courses of the BS in Computer Science are each assigned, based on subject area, to one of six groups: Professional Development, Computer Organization, Computer Systems, Foundations, Programming, and Software Engineering.

Each subject area group is managed by a faculty Subject Area Coordinator (SAC). Periodically, the assessment data and comments from Student and Instructor Course Outcome Surveys are considered by the Subject Area Coordinators. These provide the information for the Subject Area Coordinators' reports.

The SAC reports and assessment data from all other sources are evaluated by the SCIS Assessments Coordinator whose evaluations and recommendations are presented in an assessment report.

The assessment report is considered by the SCIS Undergraduate Committee, and by the SCIS Undergraduate Program Director. The Undergraduate Committee's curricular recommendations are presented to the SCIS faculty for approval. Responsibility for enactment of approved recommendations rests with the SCIS Undergraduate Program Director.

III. DATA

A. Course Outcomes Survey by Students

This survey is completed by students in each section of a required or elective CS class. For each course outcome, the student states the extent to which (s)he agrees with the following two assertions:

1: *I believe that this is a valuable outcome for this course*, and
2: *The subject matter of this outcome was covered adequately in class*

To each assertion, the student responds on a 5-point scale as follows:

5: I agree strongly, 4: I agree moderately, 3: I am not sure, 2: I disagree moderately, 1: I disagree strongly

For each outcome, a weighted mean of the responses to each question is calculated. The means are provided for each course, cumulatively over all semesters of the period under review.

BS in Computer Science Required or Elective Course		# Responding	Value of Outcome	Coverage Adequacy
CAP 4710	Principles of Computer Graphics	8	4.66	4.09
CAP 4770	Introduction to Data Mining	30	4.39	4.33
CDA 3103	Fundamentals of Computer Systems	339	4.46	4.37
CDA 4101	Structured Computer Organization	182	4.44	4.19
CEN 4010	Software Engineering I	100	4.61	4.39
CEN 4021	Software Engineering II	18	4.67	4.38
CEN 4072	Software Testing	38	4.52	4.18
CEN 4083	Cloud Computing	8	4.53	4.58
CGS 1920	Introduction to Computing	320	4.70	4.68
CGS 3095	Ethics & Social Issues in Computing	296	4.69	4.74
CIS 4911	Senior Project	70	4.75	4.45
CNT 4713	Net-Centric Computing	78	4.61	4.34
COP 2210	Computer Programming I	200	4.68	4.52
COP 3337	Computer Programming II	405	4.56	4.32
COP 3530	Data Structures	204	4.60	4.21
COP 4226	Advanced Windows Programming	14	4.03	4.02
COP 4338	Computer Programming III	206	4.61	4.21
COP 4520	Introduction to Parallel Computing	12	4.68	4.52
COP 4534	Algorithm Techniques	40	4.87	4.77
COP 4555	Principles Programming Languages	137	4.45	4.39
COP 4604	Advanced Unix Programming	NOT	TAUGHT	
COP 4610	Operating Systems Principles	88	4.63	4.40
COP 4710	Database Management	121	4.74	4.56
COP 4722	Survey of Database Systems	73	4.39	4.19

COT 3541	Logic for Computer Science	26	4.53	4.65
MAD 2104	Discrete Mathematics			
MAD 3512	Theory of Algorithms			
		======	======	======
		3005	4.59	4.42

Table 1: Value & Adequacy of Coverage of Course Outcomes 05/13 – 04/15

Notes: (1) Unfortunately, data is not available for the reporting period for MAD 2104 and MAD 3512. These courses are taught by faculty of the Department of Mathematics and Statistics. Students in these sections complete the surveys on-line voluntarily, unlike students in most CS sections who do so in class. (2) *The overall scores for Value of Outcomes (4.59) and Coverage Adequacy (4.42) are essentially the same as found in the last Assessment Report (4.59 and 4.42 respectively).* (3) COP 4604 was not taught during the period of this assessment.

The semester data for each course are presented here grouped under the six subject areas. The Subject Area Coordinator (SAC) reports are included in Appendix C.

Subject Area: Professional Development (SAC: Rick Blazek)

CGS 1920 Introduction to Computing
CGS 3095 Technology in the Global Arena
ENC 3249 Professional and Technical Writing for CS (Taught by English Department)

CGS 1920 -- Introduction to Computing

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2013	2	5.00	4.86
FALL 2013	120	4.68	4.67
SPR 2014	11	4.60	4.61
SUM 2014	N/A		
FALL 2014	163	4.74	4.71
SPR 2015	24	4.60	4.53
	=======	=======	=======
	320	4.70	4.68

Table 2-CGS 1920: Student Rating of Course Outcomes

CGS 3095 -- Prof. Ethics & Social Issues in Computing

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2013	26	4.77	4.83
FALL 2013	38	4.70	4.76
SPR 2014	46	4.83	4.81
SUM 2014	41	4.65	4.73

FALL 2014	61	4.62	4.71
SPR 2015	84	4.64	4.69
	=======	=======	=======
	296	4.69	4.74

Table 2-CGS 3095: Student Rating of Course Outcomes

Subject Area: Computer Organization (SAC: Nagarajan Prabakar)

CDA 3103 Fundamentals of Computer Systems
CDA 4101 Structured Computer Organization
CNT 4713 Net-centric Computing
COP 4610 Operating Systems Principles

CDA 3103 -- Fundamentals of Computer Systems

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2013	18	4.85	4.85
FALL 2013	59	4.56	4.49
SPR 2014	90	4.41	4.10
SUM 2014	25	4.65	4.60
FALL 2014	71	4.46	4.41
SPR 2015	76	4.29	4.36
	=======	=======	=======
	339	4.46	4.37

Table 2-CDA 3103: Student Rating of Course Outcomes

CDA 4101 -- Structured Computer Organization

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2013	11	4.30	3.88
FALL 2013	25	4.28	3.81
SPR 2014	47	4.33	3.75
SUM 2014	3	5.00	5.00
FALL 2014	44	4.46	4.41
SPR 2015	52	4.60	4.61
	=======	=======	=======
	182	4.44	4.19

Table 2-CDA 4101: Student Rating of Course Outcomes

CNT 4713 – Net-Centric Computing

	# Responding	Value of Outcome	Coverage Adequacy
FALL 2013	7	4.69	4.55

SPR 2014	16	4.67	4.36
SUM 2014	17	4.69	4.54
FALL 2014	22	4.42	4.07
SPR 2015	16	4.70	4.40
	=======	=======	=======
	78	4.61	4.34

Table 2-CNT 4713: Student Rating of Course Outcomes

COP 4610 -- Operating Systems Principle

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2013	11	4.61	4.59
FALL 2013	18	4.80	4.81
SPR 2014	24	4.63	4.10
SUM 2014	20	4.48	4.35
FALL 2014	5	5.00	4.48
SPR 2015	10	4.42	4.26
	=======	=======	=======
	88	4.63	4.40

Table 2-COP 4610: Student Rating of Course Outcomes

Subject Area: Computer Systems (SAC: Shu-Ching Chen)

CAP 4710 Principles of Computer Graphics
CAP 4770 Principles of Data Mining
CEN 4083 Cloud Computing
COP 4604 Advanced UNIX Programming
COP 4710 Database Management systems
COP 4722 Survey of Database Systems

CAP 4710 – Principles of Computer Graphics

	# Responding	Value of Outcome	Coverage Adequacy
SPR 2014	3	4.46	4.38
SPR 2015	5	4.78	3.92
	=======	=======	=======
	8	4.66	4.09

Table 2-CAP 4710: Student Rating of Course Outcomes

CAP 4770 -- Principles of Data Mining

	# Responding	Value of Outcome	Coverage Adequacy
FALL 2013	5	4.43	4.37

SPR 2014	5	4.43	4.37
FALL 2014	20	4.37	4.31
	=======	=======	=======
	30	4.39	4.33

Table 2-CAP 4770: Student Rating of Course Outcomes

CEN 4083 – Cloud Computing

	# Responding	Value of Outcome	Coverage Adequacy
SPR 2015	8	4.53	4.58
	=======	=======	=======
	8	4.53	4.58

Table 2-CEN 4083: Student Rating of Course Outcomes

COP 4604 -- Advanced UNIX Programming

	# Responding	Value of Outcome	Coverage Adequacy
FALL 2014	N/A		
	=======	=======	=======

Table 2-COP 4604: Student Rating of Course Outcomes

COP 4710 -- Database Management Systems

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2013	11	4.84	4.53
FALL 2013	18	4.70	4.57
SPR 2014	6	4.74	4.63
SUM 2014	18	4.74	4.56
FALL 2014	27	4.75	4.70
SPR 2015	41	4.73	4.45
	=======	=======	=======
	121	4.74	4.56

Table 2-COP 4710: Student Rating of Course Outcomes

COP 4722 -- Survey of Database Systems

	# Responding	Value of Outcome	Coverage Adequacy
FALL 2013	17	4.75	4.39
SPR 2014	16	4.16	4.09
FALL 2014	9	4.29	4.22
SPR 2015	31	4.33	4.12
	=======	=======	=======

	73	4.39	4.19

Table 2-COP 4722: Student Rating of Course Outcomes

Subject Area: Foundations (SAC: Xudong He)

COP 4534 Algorithm Techniques
COP 4555 Principles of Programming Languages
COT 3541 Logic for Computer Science
MAD 2104 Discrete Mathematics (No data is available)
MAD 3512 Introduction to Theory of Algorithms (No data is available)
Set 2 (Math) Electives (**MAD 3305**, **MAD 3402**, **MAD 4203**, **MHF 4302**)

COP 4534 – Algorithm Techniques

	# Responding	Value of Outcome	Coverage Adequacy
FALL 2013	18	4.93	4.77
FALL 2014	17	4.86	4.80
SPR 2015	5	4.67	4.67
	=======	=======	=======
	40	4.87	4.77

Table 2-COP 4534: Student Rating of Course Outcomes

COP 4555 -- Principles of Programming Languages

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2013	9	4.56	4.26
FALL 2013	31	4.61	4.57
SPR 2014	25	4.44	4.55
SUM 2014	6	4.61	4.61
FALL 2014	29	4.18	4.20
SPR 2015	37	4.47	4.26
	=======	=======	=======
	137	4.45	4.39

Table 2-COP 4555: Student Rating of Course Outcomes

COT 3541 -- Logic for Computer Science

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2013	8	4.16	4.39
FALL 2013	18	4.69	4.77
	=======	=======	=======
	26	4.53	4.56

Table 2-COT 3541: Student Rating of Course Outcomes

Set 2 (Math) Electives
MAD 3305 Graph Theory
MAD 3402 Numerical analysis
MAD 4203 Introduction to Combinatorics
MHF 4302 Mathematical Logic

The Set 2 Elective courses are taught by faculty of the Mathematics Department. There are no assessment data for these courses.

Subject Area: Programming (SAC: Norman Pestaina)

COP 2210 Computer Programming I
COP 3337 Computer Programming II
COP 3530 Data Structures
COP 4226 Advanced Windows Programming
COP 4338 Computer Programming III
COP 4520 Introduction to Parallel Computing

COP 2210 – Computer programming I

	# Responding	Value of Outcome	Coverage Adequacy
FALL 2013	1	5.00	5.00
SPR 2014	69	4.81	4.66
FALL 2014	57	4.57	4.42
SPR 2015	73	4.65	4.46
	=======	=======	=======
	200	4.68	4.52

Table 2-COP 2210: Student Rating of Course Outcomes

COP 3337 -- Computer Programming II

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2013	16	4.87	4.60
FALL 2013	90	4.50	4.05
SPR 2014	86	4.67	4.57
SUM 2014	14	4.40	4.23
FALL 2014	122	4.55	4.37
SPR 2015	77	4.48	4.26
	=======	=======	=======
	405	4.56	4.32

Table 2-COP 3337: Student Rating of Course Outcomes

COP 3530 -- Data Structures

	#	Value of	Coverage

	Responding	Outcome	Adequacy
SUM 2013	2	5.00	5.00
FALL 2013	40	4.39	4.05
SPR 2014	44	4.61	3.88
SUM 2014	31	4.69	4.53
FALL 2014	53	4.61	4.28
SPR 2015	34	4.74	4.39
	=======	=======	=======
	204	4.60	4.21

Table 2-COP 3530: Student Rating of Course Outcomes

COP 4226 -- Advanced Windows Programming

	# Responding	Value of Outcome	Coverage Adequacy
FALL 2013	8	3.81	3.85
FALL 2014	6	4.33	4.24
	=======	=======	=======
	14	4.03	4.02

Table 2-COP 4226: Student Rating of Course Outcomes

COP 4338 -- Computer Programming III

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2013	14	4.45	4.52
FALL 2013	34	4.79	4.67
SPR 2014	39	4.71	4.25
SUM 2014	17	4.57	3.73
FALL 2014	39	4.44	3.95
SPR 2015	63	4.59	4.16
	=======	=======	=======
	206	4.61	4.21

Table 2-COP 4338: Student Rating of Course Outcomes

COP 4520 -- Introduction to Parallel Computing

	# Responding	Value of Outcome	Coverage Adequacy
SPR 2014	9	4.81	4.56
SPR 2015	3	4.28	4.38
	=======	=======	=======
	12	4.68	4.52

Table 2-COP 4520: Student Rating of Course Outcomes

Subject Area: Software Engineering (SAC: Masoud Sadjadi)

CEN 4010 Software Engineering I
CEN 4021 Software Engineering II
CEN 4072 Software Testing
CIS 4911 Senior Project

CEN 4010 -- Software Engineering I

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2013	4	4.53	4.56
FALL 2013	20	4.77	4.55
SPR 2014	21	4.36	3.98
SUM 2014	16	4.88	4.63
FALL 2014	20	4.48	4.31
SPR 2015	19	4.67	4.51
	=======	=======	=======
	100	4.61	4.39

Table 2-CEN 4010: Student Rating of Course Outcomes

CEN 4021 -- Software Engineering II

	# Responding	Value of Outcome	Coverage Adequacy
SPR 2014	11	4.56	4.23
FALL 2014	1	5.00	5.00
SPR 2015	6	4.83	4.54
	=======	=======	=======
	18	4.67	4.38

Table 2-CEN 4021: Student Rating of Course Outcomes

CEN 4072 -- Software Testing

	# Responding	Value of Outcome	Coverage Adequacy
FALL 2013	19	4.37	4.11
SUM 2014	7	4.63	4.02
FALL 2014	12	4.70	4.39
	=======	=======	=======
	38	4.52	4.18

Table 2-CEN 4072: Student Rating of Course Outcomes

CIS 4911 -- Senior Project

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2013	5	4.31	4.17
FALL 2013	22	4.86	4.39
SPR 2014	4	4.50	4.45
SUM 2014	9	4.84	4.61
FALL 2014	22	4.89	4.54
SPR 2015	8	4.39	4.33
	=======	=======	=======
	70	4.75	4.45

Table 2-CIS 4911: Student Rating of Course Outcomes

B. Course Outcomes Survey by Instructors

This survey, called the Instructor Course Appraisal (ICA), is completed by each instructor of a required or elective CS course section.

- The Instructor separately rates the individual course outcomes in respect of two criteria
  - Appropriateness: *Essential* *Very Appropriate* *Appropriate* *Inappropriate*
  - Coverage: *Extensive* *Adequate* *Not Enough* *Not At All*
- The Instructor separately rates the course prerequisites in respect of two criteria
  - Relevance: *Irrelevant* *Incidental* *Useful* *Highly Useful*
  - Student Mastery: *Good* *Adequate* *Deficient* *Non-existent*
- The Instructor rates the students' overall preparation for taking the course
  - Student Preparation: *Good* *Adequate* *Deficient* *Non-existent*
- In addition, the Instructor may append general comments and suggestions specific to each course prerequisite or outcome.

These responses, comments and suggestions from the ICAs, together with the data from the Student Course Outcomes surveys (see **Table 1**), form the basis of the Subject Area Coordinators' reports. The summaries included in this section are mostly based on these SAC reports, with occasional augmentation directly from the ICAs. As noted in the preceding section, the complete SAC reports from which these observations are taken are included in Appendix C. **Note:** The data here are qualitative; no numeric scores are assigned to responses.

Subject Area: Professional Development (SAC: Rick Blazek)

CGS1920 Introduction to Computing

- *All academic objectives were covered on an assignment or guest lectures or research activities. All objective were considered essential.*
- *More than half of the students in this course are not pursuing SCIS degrees (100% SU13, 59% FA13, 36.36% SP14, 60% FA14, 54% SP15), and view the outcome: "Be familiar with the scope of degree programs in the computing field" very favorably. A minority who appeared to have already chosen a computer major felt that the course did not provide enough technical detail.*

CGS 3095 Technology in the Global Arena

- *All objectives were covered in assignments, projects, or in class discussions.*
- *All objectives were covered either extensively or adequately.*
- *A minority [of students] objected to the course and felt its position in their major was not adequately justified. The majority strongly felt the course was beneficial. Both groups commended the quality of the instruction.*
- *One instructor commented: "This course attempts to be too broad and thus adequate coverage is a challenge."*
- *A few students felt that there were too many assignments and activities.*

ENC 3249 Professional and Technical Writing

- *ENC 3249 is taught by the English Department and consequently is not subject to the School's assessment mechanisms.*

Subject Area: Computer Organization (SAC: Nagarajan Prabakar)

CDA 3103 Fundamentals of Computer Systems

- *For all five outcomes of the course, most of the students (more than 80%) agree either strongly or moderately.*
- *There is no significant concern expressed in the Students Suggestions section.*

CDA 4101 Structured Computer Organization

- *For all five outcomes of the course, most of the students (more than 80%) agree either strongly or moderately.*
- *There is no significant concern expressed by the students or faculty.*

CNT 4713 Net-centric Computing

- *For all seven outcomes of the course, most of the students (more than 80%) agree either strongly or moderately.*
- *There is no significant concern expressed by the students or faculty.*

COP 4610 Operating Systems Principles

- *For all five outcomes of the course, most of the students (more than 80%) agree either strongly or moderately.*
- *There is no significant concern expressed by the students or faculty.*

Subject Area: Computer Systems (SAC: Shu-Ching Chen)

CAP 4710 Principles of Computer Graphics

- *Summary of Assessment: This course has eight outcomes, all of which has been indicated by the instructors as essential.*

CAP 4770 Principles of Data Mining

- *Summary of Assessment: This course has seven outcomes, all of which has been indicated by the instructors as essential.*

CEN 4083 Cloud Computing

- *Summary of Assessment: This course has four outcomes, all of which has been indicated by the instructors as essential.*

COP 4604 Advanced UNIX Programming

- *Summary of Assessment: It is not available. No outcomes are specified.*

COP 4710 Database Management systems

- *Summary of Assessment: This course has seven outcomes, all of which have been indicated by the instructors as either essential or appropriate.*

COP 4722 Survey of Database Systems

- *Summary of Assessment: This course has five outcomes, all of which has been indicated by the instructors as either essential or appropriate.*

Subject Area: Foundations (SAC Xudong He)

COP 4534 Algorithm Techniques

- Several students mentioned the course was hard in Fall 2013, while there was no such comment in Fall 2014. It is obvious [that the instructor] made some adjustment to address the problem.
- Students' preparation for this course ranges from adequate (Fall 14 and Spring 15) to good (Fall 13).
- [An instructor] commented to have more exercises from the recommended book and to study more classical problems from computational geometry.

COP 4555 Principles of Programming Languages

- *Students' preparation for this course ranges from deficient (Fall 13, Spring 14, and Fall 14), adequate (Summer 14 and Spring 15), to good (Summer 13). [One instructor] commented on many students routinely obtaining homework solutions elsewhere without making real effort and started to make closed note exams. [This instructor] also changed the grading criteria of homework from correctness to efforts to discourage the wide spread cheating on homework assignments starting in Spring 2014. [This instructor] noted the positive effect of grading based on effort in Spring 2015, but the disappointing student performance on the final exam. [Another instructor] adopted a new textbook for this course in Summer 2014, and reduced the coverage of F# to half of the semester. More broad topics of programming language design and implementation were covered in the other half of the semester.*

- *A common [student] comment was about covering less F# language and covering other programming languages also in this class. Some students commented on having a text book. Several students commented the short summer session was not enough to learn the materials well.*

COT 3541 Logic for Computer Science

- *[Two instructors, I1 and I2,] noted that the students did not have adequate preparation. I1 commented on the continual deterioration of student quality and lack of motivation. I2 commented on that student's lack of understanding of induction and essential concepts of propositional logic forced [the instructor] to sacrifice the coverage of first order logic, but students appreciated [the instructor's] examples on logical agents from AI courses.*

MAD 2104 Discrete Mathematics

- *...there are no instructor appraisals*

MAD 3512 Theory of Algorithms

- *...there are no instructor appraisals*

Set 2 (Math) Electives (**MAD 3305**, **MAD 3402**, **MAD 4203**, **MHF 4302**)

- *(Assessments Coordinator :) These courses are taught by the Math department faculty and consequently are not subject to the School's assessment mechanisms.*

Subject Area: Programming (SAC: Norman Pestaina)

COP 2210 Computer Programming I

- *All course objectives were covered in every semester, often in multiple assignments, and in tests.*
- *The appropriateness of all course outcomes is routinely rated as Essential. With the exception of Problem Solving outcome, the coverage of all outcomes is consistently rated as Extensive. The coverage of the Problem Solving outcome is more usually rated as Adequate. In fact, the difference between the student-rated weighted averages of Course Evaluation Survey value and coverage ratings is 0.25 (4.65 – 4.40) for outcome O5 (Problem Solving), the highest for any COP 2210 Course Outcome.*
- *Student Preparedness has been rated as Deficient in three ICA Semester summaries; Fall '13, Spring '14, and Spring '15. The Instructors' suggestions from the ICA semester summaries support these ratings:*
  - *Many students are uncomfortable with such basic arithmetic concepts as fractions, decimals, and percentages. It would be nice if students had to pass College Algebra (or equivalent) with at least a C (or even a B) before taking this class.*
  - *Students lack general motivation to put adequate time in their studies. Perhaps this can be addressed by a concerted departmental effort to increase awareness of time requirements for Computer Science courses.*
- *Students completing COP 2210 rate their preparedness for taking COP 2210 in the CES Survey of Course Delivery. It should be considered that the CES survey populations excludes those students who have dropped or withdrawn earlier in the semester. Some relevant students' comments from the CES summaries are included here:*

- *Sure as hell was not prepared in the least bit for this course*
- *I'm minoring in computer science with no programming experience, I would have preferred to be in programming 1 class that took that into consideration.*
- *Have a more in depth classes before this course*
- *I think there should be a course before this one that it will allow you to develop the logic needed to program*

COP 3337 Computer Programming II

- *All objectives are always covered in assignments and tests.*
- *All COP 3337 prerequisite outcomes were rated as either Useful of Highly Useful by all instructors.*
- *Students rate their preparation for COP 3337 as a quite high (89%, 4.48/5). However, two instructors found students preparation Deficient in all prerequisite outcomes except Fundamental Data Types and Control Structures.*

  The following comments relating to student preparedness were offered by one instructor:
  - *Students ought to be familiar with the algorithmic process and problem solving in general*
  - *A significant number of students are quite unprepared. Many appear incapable of designing solutions and are plainly deficient even in understanding how to use basic control structures.*

- *The following suggestions by students are relevant:*
  - *Could have more concepts from programming 1 covered during it. We spent a few days going over ideas that should have been taught in that class, such as arrays.*
  - *I think programming 1 should of prepared me more for this course. It was expected by the professor that we knew arrays but I was only taught array lists in programming 1*
  - *Programming one needs to focus more problem solving which requires use of programming concepts more profoundly whereas instead it focuses more on syntax which requires very superficial knowledge on programming concepts.*
  - *The difficulty curve from programming 1 and programming 2 was amazingly big. I would suggest making programming 1 be a little similar to how programming 2 would be in terms of assignments and tests.*

COP 3530 Data Structures

- *All course objectives are covered extensively in assignments or tests except for Course Outcomes 6 (Graph Algorithm) and 7 (Data Structure Libraries) which are covered adequately.*
- *All course objectives are consistently rated Essential or Appropriate.*
- *The following Instructors' recommendation may be pertinent here: "COP-3530 Data Structure is a very important course for computer science and IT students. I consider that it is important to be able to find time to solve, in class, more exercises from the recommended book."*
- *All COP 3530 Prerequisite Outcomes are rated as Highly Useful or Useful by all instructors.*

- *Student mastery of all but 2 prerequisite outcomes (PO5 – "Familiarity with Stacks and Queue Data Structures" and PO6 – "Exposure to Java Collection Interface") was rated as Deficient by two COP 3530 instructors. Mastery of PO5 and PO6 were rated Deficient by one COP 3530 instructor. With one exception, all other prerequisite outcome ratings were Adequate only.*
- *The following comment relating to student preparedness was offered by one instructor: "In this large class there was a low success rate. Those who did well did very well. The others demonstrates a general lack of overall programming and problem solving ability not easily captured in the prerequisite objectives."*

COP 4226 Advanced Windows Programming

- *All objectives were covered in multiple assignments and in at least one test or quiz.*
- *All objectives were rated as Essential, Very Appropriate, or Appropriate, and all were covered Extensively or Adequately.*
- *All prerequisites were rated at least Useful, and student preparation was rated as Good.*
- *Instructors rated Student preparation as Good or Adequate.*
- *Students rate their preparation or taking COP 4226 at 93% (4.64/5).*

COP 4338 Computer Programming III

- *All course objectives were covered in every semester, often in multiple assignments.*
- *All objectives were rated as Appropriate, Very Appropriate or Essential and their coverage rated as Adequately or Extensively.*
- *Students rate their preparedness for taking COP 4338 at over 88% (4.41/5).*
- *Prerequisite Outcome PO2 (Basic Knowledge of UNIX Systems) is not enabled by the BS-CS curriculum. This is reflected in numerous student comments in the CES surveys.*
- *The ICA survey instruments do not yet reflect the modified prerequisite outcomes of COP 4338. Accordingly, several instructor ratings of the prerequisites are Incidental or Irrelevant.*

COP 4520 Introduction to Parallel Computing

- *All objectives were covered in at least one assignment and in at least one test or quiz.*
- *All objectives were rated as Essential or Very Appropriate, and all were covered Extensively or Adequately.*
- *Students rate their preparedness for taking COP 4520 at over 88% (4.41/5).*

Subject Area: Software Engineering (SAC: Masoud Sadjadi)

CEN 4010 Software Engineering I

- *All objectives were covered in assignments and tests.*
- *According to all the instructors of this course, the relevancy of the prerequisites was rated from useful to highly useful.*
- *The mastery of the students was rated from adequate to good.*
- *Students' preparedness was indicated as good or adequate.*
- *Instructor Comments:*
    - *Students need to learn how to work in teams.*

- *Students should have a similar background.*

CEN 4021 Software Engineering II

- *All objectives were covered in assignments and tests.*
- *According to one of the instructors of this course, the relevancy of the prerequisites was rated useful and mastery of the students was rated from deficient to adequate and good.*
- *Students' preparedness was indicated as adequate.*
- *Instructors' comments:*
  - *Better diagramming, white boarding skills and better presentation skills.*
  - *Linking this course with Sr. Project would be nice as students can continue what they design in this class and get it implemented in Sr. Project the right way as I have seen a lot of example where students implement thing in Sr. Project the wrong way and just develop bad habits.*
- *Students' comments:*
  - *Very real world oriented with real life type project.*
  - *IT teaches about current technologies in the field.*
  - *There should be more courses like this one that relate to actual jobs.*

CEN 4072 Software Testing

- *All objectives were covered in assignments and tests.*
- *According to the instructor of this course, the relevancy of the prerequisites was rated as useful and mastery of the students was rated as good.*
- *Students' preparedness was indicated as adequate.*
- *Instructors' comments:*
  - *The debugging topic needs to be removed from the syllabus. There is not enough time to cover debugging in the class.*
- *Students' comments:*
  - *This course should be mandatory because testing in a big part of the software development cycle.*
  - *The amount of work for the deliverable is pretty extreme.*
  - *Feel like the class should be more interactive as opposed to just theory.*
  - *A lot of Students do not know how to use tomcat and MySQL when they come into the course. Professor should teach/train us how use them.*

CIS 4911 Senior Project

- *According to the instructor of this course, the relevancy of the prerequisites was rated from useful to highly useful.*
- *The mastery of the students was rated from deficient to adequate and good.*
- *Students' preparedness was indicated from deficient to adequate and good.*
- *Instructors' comments:*
  - *Many of students lack the knowledge and application of software engineering, especially how to use UML diagrams properly.*
  - *We practice Scrum, a popular agile software development approach, in our senior project, which is not being taught in CEN 4010. So, our students do not know how to develop software using this new agile method.*
- *Many student comments are included in the SAC Report.*

C. Graduating Student (Exit) Survey of Student Outcomes

The Student Outcomes Survey is completed by students in the semester in which they expect to graduate. The student rates each outcome with respect to two criteria, attainment and relevance.

Attainment: *This program outcome has been met for me personally*

5: I agree strongly	*2: I disagree somewhat*
4: I agree moderately	*1: I disagree moderately*
3: I agree somewhat	*0: I disagree strongly*

Relevance: *How meaningful do you consider this outcome to be for you personally?*

5: Extremely meaningful	*2: Somewhat meaningless*
4: Moderately meaningful	*1: Moderately meaningless*
3: Somewhat meaningful	*0: Extremely meaningless*

Data was collected (number of responses is in parenthesis) for Summer 2013 (6), Fall 2013 (18), Spring 2014 (27), Fall 2014 (24), and Spring 2015 (23) for a total of 98 responses during the period of this Assessment. [Note that Spring 2014 was the demarking semester when we switched our survey instrument, and hence, for that term, we have two sets of raw data, one each for the old and new survey instruments.] Raw data and calculation of statistics for each semester is presented in Appendix D-1. The summary of the whole is presented in Appendix D-2.

The following table summarizes the responses of 98 graduating students completing the survey between summer 2013 and spring 2015. The mean responses are expressed as percentages of 5, the maximum rating.

Exit Survey (Graduating Students) 98 Respondents	*Outcome Attainment*		*Perceived Relevance*	
Student Outcomes	*Mean*	*Percentage*	*Mean*	*Percentage*
a: Proficiency in foundation areas	4.39	87.8	4.53	90.6
b: Proficiency in core areas	4.46	89.2	4.68	93.6
c: Proficiency in problem solving	4.20	84.0	4.59	91.8
d: Proficiency in a programming language	4.64	92.8	4.76	95.2
e: Understanding of social & ethical issues	4.18	83.6	4.26	85.2
f: Ability to work cooperatively in teams	4.28	85.6	4.67	93.4
g: Effective communication skills	4.36	87.2	4.72	94.4
h: Experience with contemporary environments & tools	4.17	83.4	4.66	93.2
	====	====	====	====
Average Ratings of Student Outcomes	4.34	86.8	4.61	92.2
	====	====	====	====
Overall Satisfaction for CS Areas, Outcomes 'a' to 'e':	4.38	87.6	4.56	91.2

Table 3: Exit Survey of Attainment & Relevance of Student Outcomes

The Average Rating Scores of Student Outcomes with respect to attainment (4.34) and perceived relevance (4.61) are almost identical to those found in the previous Assessment cycle (4.33 and 4.61 respectively).

D. Alumni Survey of Program Educational Objectives

Alumni responding to the survey are asked to rate the contribution of their broad educational experience at FIU to their personal growth, capacity for life-long learning, communication skills, social and ethical awareness, career preparation, and preparation for graduate study. They rate their preparation in the major areas of the BS-CS curriculum. The respondents also provide "overall" ratings of their FIU educational experience and the student's preparation at graduation. Finally, the alumni provide a rating of their overall satisfaction with the BS in CS program.

Responses to the survey questions are on a the following scale

4: Excellent, 3: Good, 2: Satisfactory, 1: Poor and 0: Unsatisfactory

The table below summarizes the responses to this survey. The means for the current survey cycle, 5/7/2015 through 10/30/2015 are compared with corresponding means for earlier cycle, 5/26/2007 through 8/2/2013. The numbers in the first column refer to the BS-CS Program Objectives included in Appendix A-1. The raw data for the current cycle along with the statistical results for the current assessment period are presented in Appendix E-1.

		5/7/2015 10/30/2015		5/26/2007 8/2/2013	
	Alumni Survey of Program Objectives	117 Respondents		19 Respondents	
		Outcome Attainment		*Outcome Attainment*	
	Program Educational Objective	*Average*	*Percentage*	*Average*	*Percentage*
1	Capacity for personal growth	3.21	80.25	3.32	83.00
1	Capacity for life-long learning	3.25	81.25	3.16	79.00
3	Development of communication skills	2.92	73.00	3.00	75.00
3	Awareness of social, ethical responsibility	3.00	75.00	3.26	81.50
4	Preparation for career in CS	3.01	75.25	3.16	79.00
4	Preparation for graduate study	2.88	72.00	3.00	75.00
4	Overall preparation upon graduation	2.90	72.50	3.00	75.00
2	Computer Programming	3.04	76.00	3.11	77.75
2	Systems Development	2.67	66.75	2.74	68.50
2	Data Structures & Algorithms	3.10	77.50	3.32	83.00
2	Computer Architecture & Organization	2.78	69.50	2.84	71.00
	Overall FIU educational experience	3.04	76.00	3.15	78.75

Overall satisfaction with BS-CS program	3.02	75.50	3.09	77.25

Table 4: Alumni Survey of Attainment of Program Educational Objectives

E. Employer Survey of Program Educational Objectives

Beginning in this cycle of the Assessment, we initiated a survey of the Employers of our students and the members of the Industrial Advisory Board of the School (many employ our graduates). The survey instrument is included in Appendix E-2. The raw data along with statistical results is included in Appendix E-3, and the results are included in the table below.

	Employer Survey of Program Objectives	19 Respondents	
		Outcome Attainment	
	Program Educational Objective	*Average*	*Percentage*
1	Ability to learn new Emerging Concepts (an important component of Capacity for life-long learning)	3.14	78.50
2	Mastery of CS concepts & ability to solve problems	3.00	75.00
3	Ability to communicate verbally	2.69	67.25
3	Ability to communicate in written form	2.56	64.00
3	Understanding of social, ethical concerns	2.85	71.25
4	Ability to work cooperatively in a team (an important aspect of Preparation for a career in CS)	3.38	84.50
4	(Will you consider hiring our graduates – 18-YES, 0-NO) (an important gauge of Preparation for career in CS)	4.00	100.00
	OVERALL ATTAINMENT OF PROGRAM OBJECTIVES	2.92	

Table 5: Employer Survey of Attainment of Program Educational Objectives

F. Course Embedded Assessment

SCIS began applying course-embedded assessment of the BS in CS program in fall 2010 in order to supplement the direct measures obtained via capstone assessment in the Senior Project (see the following section). This strategy was applied using either multiple-choice (M-C) quizzes or observing student assignments and/or projects. Appendix-F contains the Direct Assessment Summaries for all courses subject to this direct assessment excluding the Senior Project. Most of the student ratings are based on their performance in M-C quizzes and a few observations are derived from their assignment work.

The evaluation of these assessments is included in section IV.B (Evaluation – Student Outcomes).

G. Capstone Project Assessment

Current requirements of the BS in Computer Science include completion of a capstone course, CIS 4911, Senior Project. Beginning with the first offering of CIS 4911, SCIS has performed assessment of all Student Outcomes via evaluation of the presentations and artifacts of all completed projects. Each project is rated by 2 or more evaluators according to a rubric *Senior Project Assessment of Student Outcomes of the BS in Computer Science*, and scored on the following scale:

Rating	Criterion
n/a	The project does not provide clear evidence about this particular outcome
1	The project demonstrates **poor** attainment of this outcome
2	The project demonstrates **fair** attainment of this outcome
3	The project demonstrates **good** attainment of this outcome
4	The project demonstrates **very good** attainment of this outcome
5	The project demonstrates **excellent** attainment of this outcome

The current version of the rubric was finalized in spring 2011. The rubric and associated check-list and score grid are included as Appendix G-1 of this report.

The data from these semester-wise assessment events are summarized in Appendices G-2 through G-7. The summary evaluation of these assessments is included in Appendix G-8, and is presented in Section IV.B (Evaluation – Student Outcomes).

IV. EVALUATION

In this section of the report, the data presented in the previous section are evaluated. For quantitative data, the threshold value at which SCIS deems a measured item to satisfy its criteria is 75% of the maximum attainable rating.

Measured Item	Scale	Threshold
Course Outcomes	1 to 5	3.75
Student Outcomes	0 to 5	3.75
Program Objectives	0 to 4	3.00

A. Course Outcomes

The Subject Area Coordinator (SAC) reports (Appendix C) present the data obtained for each course via surveys by students and instructors. The Course Outcomes for each required or elective course of the BS in Computer Science program are evaluated for relevance and attainment by the SAC. Their evaluations are contained in the SAC reports.

The evaluation of the Course Outcomes by the Assessment Coordinator (AC) is based on the student ratings of the course outcomes summarized in Table 1.

AC-Evaluation-01: The data for Course Outcomes by Student Surveys for COP 4604 (Advanced Unix Programming – taught only once during the period of evaluation) and the MAD courses (2104 and 3512) are not available.

AC-Evaluation-02: The Value of Course Outcomes rating of every course for which data are available, exceeds the 3.75 acceptability threshold. In fact, students ascribe at least **high** value (4.00 or higher) to the outcomes of every course with the rating of the Value of Course Outcomes of a 75% of courses (18 out of 24) is **very high** (4.50 or higher). The overall rating for the Value of Course Outcomes is 4.59 which is essentially the same as observed in the last Assessment cycle (4.54).

AC-Evaluation-03: The student rating of the Adequacy of Coverage of Course Outcomes for every course exceeds the acceptability threshold of 3.75. In fact, students ascribe at least **high** value (4.00 or higher) to the adequacy of coverage of every course with the rating of **very high** (4.50 or higher) for CEN 4083, CGS 1920, CGS 3095, COP 2210, COP 4520, COP 4534, COP 4710, and COT 3541. The overall rating for the Adequacy of Coverage of Course Outcomes is 4.42 which is essentially the same as observed in the last Assessment cycle (4.39).

B. Student Outcomes

Evaluation of the level of attainment of the BS in CS Student Outcomes utilizes data obtained via several direct and indirect assessment mechanisms listed below:

Indirect Mechanisms:

- The Graduating Student (Exit) Survey,
- Course Outcomes Surveys by Students and by Instructors.

Direct Mechanisms:

- Capstone Project Assessment via CIS 4911 Senior Project presentations,
- Course-embedded Assessment by multiple-choice questions in several required courses taken by the BS-CS majors: MAD 2104 (Discrete Mathematics), MAD 3512 (Theory of Algorithms), COP 4338 (Programming III), COP 3530 (Data Structures), COP 4710 (Database Management), COP 4555 (Principles of Programming Languages), COP 4610 (Operating Systems), and CEN 4010 (Software Engineering I). Note that the Direct Assessment in COP 3337 (Programming II) was not conducted in this assessment period, but is reinstated in the next period.
- Course-embedded Assessment by portfolio inspection in CGS 3095 (Ethics and Social Issues in Computing).

The direct assessment events performed from summer 2013 to spring 2015 are documented in the summary provided in Appendix F. The rating sheet and the rubric used for evaluation of Senior Project for assessment of Student Outcomes is provided in Appendix G-1.

a) Demonstrate proficiency in the foundation areas of Computer Science including mathematics, discrete structures, logic and the theory of algorithms.

Indicators

1.	Graduating Student Ratings	Relevance 90.6%	Attainment 87.8%	Sample: 98
2.	Course Outcomes COT 3541	Value: 90.6%	Coverage: 93.0%	Sample: 26
3.	Course Outcomes MAD 2104	Data Not Available		
4.	Course Outcomes MAD 3512	Data Not Available		

5. Course-Embedded Assessment - MAD 2104

   Fall 2013 Event: 28 students completed a 16-question multiple choice quiz.
   Criterion: At least 75% of students should score 75% or higher.
   Observation: 17 out of 28 (60.7%) students scored at least 12 points.
   Summary Observation: 17 out of 28 (60.7%) students demonstrated proficiency in Discrete Mathematics. This is almost 8% better than the previous assessment.

6. Course-Embedded Assessment - MAD 3512

   Fall 2013 Event: 29 students completed a 20-question multiple choice quiz.
   Criterion: At least 75% of students should score 75% or higher.

Observation: 12 out of 29 (41.4%) students scored at least 15 points. 18 out of 29 (62.0%) students scored at least 14 points (70% or higher).

Summary Observation: 12 out of 29 (41.4%) students demonstrated proficiency in Theory of Algorithms. The result in the previous assessment was 41.8%, essentially the same.

7. Senior Project Assessment

Event: Artifacts of all completed Senior Projects are assessed, by application of the *Senior Project Assessment of Student Outcomes of the BS in Computer Science* rubric, for attainment of outcome a). This event was replicated in all semesters from summer 2013 to spring 2015.
Criterion: Attainment should be rated at **75% or 3.75** on a 1—5 scale, or better.
Observation: Summer 2013: 2.50 Fall 2013: 2.78 Spring 2014: 2.55
Summer 2014: 3.00 Fall 2014: 1.33 Spring 2015: 1.32
Weighted over the entire assessment period (55 projects): 1.98

Outcome Evaluation: Graduating students consider this Student Outcome highly relevant, and almost 88% believe that they have attained it. Indicator 2 substantially exceeds the acceptable threshold for the Value and the Coverage of Course Outcomes for COT 3541. Indicators 5 and 6 clearly show that students do not attain the desired acceptable level of proficiency for MAD 2104 and MAD 3512 although the performance has improved in MAD 2104. Finally, indicator 7 shows that although the results are better than the previous assessment, our Senior Projects have so far failed to incorporate this curriculum component to a significant level. Attainment of Student Outcome (a) is rated as **not acceptable**.

b) Demonstrate proficiency in various areas of Computer Science including data structures and algorithms, concepts of programming languages and computer systems.

Indicators

1.	Graduating Student Ratings	Relevance 93.6%	Attainment 89.2%	Sample: 98
2.	Course Outcomes CAP 4710	Value: 93.2%	Coverage: 81.8%	Sample: 8
2.	Course Outcomes CDA 4101	Value: 88.8%	Coverage: 83.8%	Sample: 182
3.	Course Outcomes CDA 3103	Value: 89.2%	Coverage: 87.4%	Sample: 339
4.	Course Outcomes CEN 4083	Value: 90.6%	Coverage: 91.6%	Sample: 8
5.	Course Outcomes COP 3530	Value: 92.0%	Coverage: 84.2%	Sample: 204
6.	Course Outcomes COP 4555	Value: 89.0%	Coverage: 87.8%	Sample: 137
7.	Course Outcomes COP 4710	Value: 94.8%	Coverage: 91.2%	Sample: 121

8. Course Outcomes COP 4610 Value: 92.6% Coverage: 88.0% Sample: 88

9. Course-Embedded Assessment - COP 4555

   Spring 2014 Event: 37 students completed a 10-question multiple choice assessment quiz.
   Criterion: 75% of students should score at least 75% or higher.
   Observation: **59.5%** of the students answered at least 8 questions correctly. 29 out of 37 (**78.4%)** students scored at least 7 points (70% or higher).

10. Course-Embedded Assessment - COP 3530

    Summer 2014 Event: 25 students completed a 17-question multiple choice assessment quiz.
    Criterion: 75% of students should score at least 75% or higher
    Observation: **76.0%** of the students answered at least 13 questions correctly.

11. Course-Embedded Assessment - COP 4710

    Spring 2014 Event: 21 students completed an 11-question multiple choice assessment quiz.
    Criterion: 75% of students should score at least 75% (8.25) or higher.
    Observation: **33.3%** of the students answered at least 9 questions correctly. 10 out of 21 (**47.6**%) of the students answered at least 8 questions correctly. *This seems to be an aberration as opposed to a truly poor performance by students*.

12. Course-Embedded Assessment – COP 4338 (Systems – Threads)

    Spring 2014 Event: 34 students completed a 12-question multiple choice assessment quiz.
    Criterion: 75% of students should score at least 9 points.
    Observation: **88.2%** of the students answered at least 9 questions correctly.

13. Course-Embedded Assessment – COP 4610 (Systems – Storage Management)

    Fall 2013 Event: The artifacts (submitted programs/projects) of 26 students were evaluated against the appropriate rubrics with the maximum possible score being 12.
    Criterion: 75% of students should score at least 9 points.
    Observation: **100%** of the students scored at least 9 points.

14. Course-Embedded Assessment – COP 4610 (Systems – Memory Management)

    Fall 2013 Event: The artifacts (submitted programs/projects) of 26 students were evaluated against the appropriate rubrics with the maximum possible score being 12.
    Criterion: 75% of students should score at least 9 points.
    Observation: **100%** of the students scored at least 9 points.

15. Senior Project Assessment

Event: Artifacts of all completed Senior Projects are assessed, by application of the *Senior Project Assessment of Student Outcomes of the BS in Computer Science* rubric, for attainment of outcome b). This event was replicated in all semesters from summer 2013 to spring 2015.
Criterion: Attainment should be rated at **75% or 3.75** on a 1—5 scale, or better.
Observation: Summer 2013: **2.50** Fall 2013: **3.33** Spring 2014: **3.04**
Summer 2014: **3.19** Fall 2014: **3.51** Spring 2015: **3.68**
Weighted over the entire assessment period (55 projects): 3.38

Evaluation: Graduating students consider this Student Outcome highly relevant, and almost 90% believe that they have attained it. Indicator 2, 3, 4, 5, 6, and 7 comfortably (rating of **Very High)** meet the acceptable threshold for the Value and the Coverage of Course Outcomes for all relevant courses. Except for COP 4710 (Indicator 11), the course-embedded assessments for relevant courses (Indicators 9, 10, 12, 13, and 14) clearly show that students have attained the desired level of proficiency (76.0 to 100% of students pass the criterion). The students' performance in COP 4710 seems to be more of an aberration than anything else. Finally, our Senior Projects Assessment (Indicator 15) shows that the students have not achieved the desired level of proficiency for this outcome. This is a bit of a worse performance than documented in the last Assessment Report, but seems to be a reflection of the types of projects undertaken than the actual understanding of the students. Attainment of Student Outcome (b) is rated as **acceptable**.

c) Demonstrate proficiency in problem solving and application of software engineering techniques.

Indicators

1.	Graduating Student Ratings	Relevance 91.8%	Attainment 84.0%	Sample: 98
2.	Course Outcomes CEN 4010	Value 92.2%	Coverage: 87.8%	Sample: 100
3.	Course Outcomes COP 3530	Value: 92.0%	Coverage: 84.2%	Sample: 204
4.	Course Outcomes CIS 4911	Value: 95.0%	Coverage: 89.0%	Sample: 70

5. Course-Embedded Assessment – CEN 4010

Spring 2014 Event: 24 students completed a 10-question multiple choice assessment quiz.
Criterion: 75% of students should score at least 7 points.
Observation: **66.67%** of the students answered at least 7 questions correctly.

6. Senior Project Assessment

Event: Artifacts of all completed Senior Projects are assessed, by application of the *Senior Project Assessment of Student Outcomes of the BS in Computer Science* rubric, for attainment of outcome c). This event was replicated in all semesters from summer 2011 to spring 2013.
Criterion: Attainment should be rated at **75% or 3.75** on a 1—5 scale, or better.

Observation: Summer 2013: **5.00** Fall 2013: **5.00** Spring 2014: **5.00**
Summer 2013: **5.00** Fall 2014: **5.00** Spring 2015: **5.00**
Weighted over the entire assessment period (55 projects): 5.00

Evaluation: All indicators suggest that attainment of Student Outcome c) is **excellent**.

d) Demonstrate mastery of at least one modern programming language and proficiency in at least one other.

Indicators

1.	Graduating Student Ratings	Relevance 95.2%	Attainment 92.8%	Sample: 98
2.	Course Outcomes COP 2210	Value: 93.6%	Coverage: 90.4%	Sample: 200
3.	Course Outcomes COP 3337	Value: 91.2%	Coverage: 86.4%	Sample: 405
4.	Course Outcomes COP 3530	Value: 92.0%	Coverage: 84.2%	Sample: 204
5.	Course Outcomes COP 4338	Value: 92.2%	Coverage: 84.2%	Sample: 206

6. Course-Embedded Assessment – COP 3337 (Exceptions/Java)

   Not done in this assessment period – reinstated in Fall 2015

7. Course-Embedded Assessment – COP 3337 (Inheritance/Java)

   Not done in this assessment period – reinstated in Fall 2015

8. Course-Embedded Assessment – COP 3530 (Abstractions/Java)

   Summer 2014 Event: The artifacts (submitted programs/projects) of 25 students were evaluated against the appropriate rubrics with the maximum possible score being 8.
   Criterion: 75% of students should score at least 6 points.
   Observation: 92**%** of the students scored at least 6 points.

9. Course-Embedded Assessment – COP 3530 (Linked Structures/Java)

   Summer 2014 Event: The artifacts (submitted programs/projects) of 25 students were evaluated against the appropriate rubrics with the maximum possible score being 8.
   Criterion: 75% of students should score at least 6 points.
   Observation: 84.0**%** of the students scored at least 6 points.

10. Course-Embedded Assessment – COP 3530 (Recursion/Java)

Summer 2014 Event: The artifacts (submitted programs/projects) of 25 students were evaluated against the appropriate rubrics with the maximum possible score being 8.
Criterion: 75% of students should score at least 6 points.
Observation: 92**%** of the students scored at least 6 points.

11. Course-Embedded Assessment – COP 3530 (Libraries/Java API)

    Summer 2014 Event: The artifacts (submitted programs/projects) of 25 students were evaluated against the appropriate rubrics with the maximum possible score being 16.
    Criterion: 75% of students should score at least 12 points.
    Observation: 92.0**%** of the students scored at least 12 points.

12. Course-Embedded Assessment – COP 4338 (C Language)

    Not done in this assessment period – reinstated in Fall 2015

13. Senior Project Assessment

    Event: Artifacts of all completed Senior Projects are assessed, by application of the *Senior Project Assessment of Student Outcomes of the BS in Computer Science* rubric, for attainment of outcome d). This event was replicated in all semesters from summer 2011 to spring 2013.
    Criterion: Attainment should be rated at **75% or 3.75** on a 1—5 scale, or better.
    Observation: Summer 2013: **4.50** Fall 2013: **3.83** Spring 2014: **4.10**
    Summer 2014: **4.63** Fall 2014: **3.88** Spring 2015: **4.09**
    Weighted over the entire assessment period (55 projects): 4.05

    Evaluation: All indicators suggest that attainment of Student Outcome d) is **very high**.

e) Demonstrate understanding of the social and ethical concerns of the practicing computer scientist.

Indicators

1. Graduating Student Ratings Relevance 83.6% Attainment 85.2% Sample: 98

2. Course Outcomes CGS 3095 Value: 93.8% Coverage: 94.8% Sample: 296

3. Course-Embedded Assessment CGS 3095 (Social and Ethical Concerns in Computing)

   Spring 2014 Event: Individual projects for 61 students were graded on a 4-point scale.
   Criterion: 75% of students should score at least 3 points.
   Observation: 91.8**%** of the students received at least 3 points.

4. Senior Project Assessment

Event: Artifacts of all completed Senior Projects are assessed, by application of the *Senior Project Assessment of Student Outcomes of the BS in Computer Science* rubric, for attainment of outcome e). This event was replicated in all semesters from summer 2011 to spring 2013.
Criterion: Attainment should be rated at **75% or 3.75** on a 1—5 scale, or better.
Observation: Summer 2013: **2.25** Fall 2013: **3.11** Spring 2014: **2.85**
Summer 2014: **2.25** Fall 2014: **3.29** Spring 2015: **3.71**
Weighted over the entire assessment period (55 projects): 3.19

Evaluation: Existing students rate this outcome as extremely relevant and feel that they have attained it (Indicator 1). Current students find this outcome to be Highly Valuable and believe that it is Very-well covered in the classroom (Indicator 2). Evaluation of student projects in CGS 3095 show that students demonstrate **excellent** understanding of social and ethical issues in computing (Indicator 3). Senior project assessment (Indicator 4) shows that there is not much in student projects that evaluates these topics. On balance, attainment of Student Outcome e) is rated as **high.**

f) Demonstrate the ability to work cooperatively in teams.

Indicators

1.	Graduating Student Ratings	Relevance 93.4%	Attainment 85.6%	Sample: 98
2.	Course Outcomes CEN 4010	Value: 92.2%	Coverage: 87.8%	Sample: 100
3.	Course Outcomes CEN 4021	Value: 93.4%	Coverage: 87.6%	Sample: 18
4.	Course Outcomes CIS 4911	Value: 95.0%	Coverage: 89.0%	Sample: 70

5. Senior Project Assessment

Event: Artifacts of all completed Senior Projects are assessed, by application of the *Senior Project Assessment of Student Outcomes of the BS in Computer Science* rubric, for attainment of outcome f). This event was replicated in all semesters from summer 2011 to spring 2013.
Criterion: Attainment should be rated at **75% or 3.75** on a 1—5 scale, or better.
Observation: Summer 2013: **5.00** Fall 2013: **5.00** Spring 2014: **5.00**
Summer 2014: **5.00** Fall 2014: **5.00** Spring 2015: **5.00**
Weighted over the entire assessment period (55 projects): 5.00

Evaluation: All indicators suggest that attainment of Student Outcome f) is **excellent**.

g) Demonstrate effective communication skills.

Indicators

1. Graduating Student Ratings Relevance 94.4% Attainment 87.2% Sample: 98

2. Course Outcomes CGS 3095 Value: 93.8% Coverage: 94.8% Sample: 296

3. Course Outcomes CEN 4010 Value 92.2% Coverage: 87.8% Sample: 100

4. Course-Embedded Assessment CGS 3095 (Effective Communication Skills)

   Spring 2014 Event: Presentation of projects for 61 students were graded on a 4-point scale.
   Criterion: 75% of students should score at least 3 points.
   Observation: 98.4**%** of the students received at least 3 points.

5. Senior Project Assessment

   Event: Artifacts of all completed Senior Projects are assessed, by application of the *Senior Project Assessment of Student Outcomes of the BS in Computer Science* rubric, for attainment of outcome g). This event was replicated in all semesters from summer 2011 to spring 2013.
   Criterion: Attainment should be rated at **75% or 3.75** on a 1—5 scale, or better.
   Observation: Summer 2013: **5.00** Fall 2013: **5.00** Spring 2014: **5.00**
   Summer 2014: **5.00** Fall 2014: **5.00** Spring 2015: **5.00**
   Weighted over the entire assessment period (55 projects): 5.00

   Evaluation: All indicators suggest that attainment of Student Outcome g) is **excellent**.

h) Have experience with contemporary environments and tools necessary for the practice of computing

Indicators

1. Graduating Student Ratings Relevance 93.2% Attainment 83.4% Sample: 98

2. Senior Project Assessment

   Event: Artifacts of all completed Senior Projects are assessed, by application of the *Senior Project Assessment of Student Outcomes of the BS in Computer Science* rubric, for attainment of outcome g). This event was replicated in all semesters from summer 2011 to spring 2013.
   Criterion: Attainment should be rated at **75% or 3.75** on a 1—5 scale, or better.
   Observation: Summer 2013: **5.00** Fall 2013: **5.00** Spring 2014: **4.90**
   Summer 2014: **4.67** Fall 2014: **4.92** Spring 2015: **5.00**
   Weighted over the entire assessment period (55 projects): 4.94

   Evaluation: All indicators suggest that attainment of Student Outcome h) is **excellent**.

C. Program Educational Objectives

The principal means of assessing attainment of the Program Educational Objectives of the BS in Computer Science program are the Alumni and Employer Surveys of Program Objectives.

The alumni responses are summarized in Table 4 (Section III.D) showing the averages of the 117 responses in the period from May 2015 to October 2015, and separately, 19 responses received in the previous survey cycle. The alumni responses provide ratings of the specific facets of each objective, and overall ratings of some objectives. The Alumni Survey raw data are included in Appendix E-1.

The employer survey was conducted for the first time in this assessment period, and its responses are summarized in Table 5 (Section III.E) showing the averages of the 19 responses in the period from May 2015 to December 2015. These responses provide ratings of specific facets of each objective and the overall rating of their combination. The relevant data is included in Appendix E-3.

Attainment of Student Outcomes enables attainment of the Program Educational Objectives, and so some Student Outcome data are again noted in this section where relevant. Additionally, the other constituent groups within the SCIS umbrella; WICS, ACM, STARS, UPE, Linux Users Group, Programming Team, and Industrial Advisory Board (IAB) may provide indicators of the attainment of the program objectives. The activity reports of the student organizations are included in Appendix H, and the minutes of the IAB meetings during the assessment period are included in Appendix I. Note that beginning in 2015, the number of Board meetings is reduced to two per year as opposed to three in the past.

1. ***To provide our graduates with a broad-based education that will form the basis for personal growth and life-long learning.***

Indicators

- Alumni Survey of Program Educational Objectives:
  Please rate how your educational experience at FIU contributed to your capacity for personal growth
  May 2015 TO October 2015: **80.25%** Previous cycle: **83.00%**

  Please rate how your educational experience at FIU contributed to your capacity for lifelong learning
  May 2015 TO October 2015: **81.25%** Previous cycle: **79.00%**

- Employer Survey of Program Educational Objectives:
  Please rate the following skill of our graduates: Ability to learn new and Emerging Concepts and Technologies
  May 2015 to December 2015: **78.50%**

- ACM Chapter activities (Appendix H)

Organization of Workshops (Taking Laptops apart, Hadoop introduction, Machine Learning, HDFS ecosystem, etc.), Social Events, Appreciation Banquet, etc.

- UPE Activities (Appendix H)
  Organization of Workshops (Web Development), social events, collaborative projects with other student organizations in SCIS, meeting of students with the School's administration and faculty, and so on

- WICS Activities (Appendix H)
  Organizing many Java Tutoring Sessions in collaboration with other student organizations, Organizing Workshops (C++, Soldering, Creating a Programming Language, Writing Resume, etc.), Holding job information sessions (Intel, Hilton Software, IBM Watson group, State Farm, etc.), social events, and so on.

- STARS Activities (Appendix H)
  Providing Tutoring Services, and mentoring students, Scheduling Midterm and Final Exam Review Sessions, Hosting an online gaming event for a popular Xbox console game, Organizing Outreach programs with Schools, participation in FIU Engineering Expo for middle school students, participation in freshmen and transfer student orientations, and so on.

- Linux Users Group Activities (Appendix H)
  Organization of Workshops (JavaScript and Node.js, Python Scripting), Linux install Fests, and Presentations (Linux and Technology, LaTeX, Git source control, etc.).

- Programming Team Activities (Appendix H)
  Organization of Workshops (Computational Thinking for High School STEM Teachers, Problem Solving and Programming for High School Students, Five-day Computer Science Principles Training workshop for high school STEM teachers, MIT App Inventor training workshop for High School Teachers, etc.), Scheduled many Programming Competitions for High School Students, Sponsoring 3 teams of our students to ACM Southeast Regional Programming Competition, and so on.

Evaluation: It is not clear that attainment of this objective is directly enabled by specific courses in the Computer Science major. Rather, it is the collective breadth represented by the entire BS in Computer Science program that may have an enabling effect. In addition, the breadth component common to all FIU majors, the Core Curriculum and non-major elective courses, is a principal contributor to any graduated student's realization of personal growth and capacity for life-long learning.

Involvement with the School's student organizations is another excellent enabler of this objective, but these experiences are voluntary and are not exploited by a majority of our graduates, particularly night students.

Attainment of Program Educational Objective 1 is deemed **acceptable** with a rating of **good**.

2. ***To provide our graduates with a quality technical education that will equip them for productive careers in the field of Computer Science.***

Indicators

- Alumni Survey of Program Educational Objectives:
  Please rate the quality of your preparation upon graduation in Computer Programming
  May 2015 TO October 2015: **76.00%** Previous cycle: **77.75%**
  Please rate the quality of your preparation upon graduation in Systems Development
  May 2015 TO October 2015: **66.75%** Previous cycle: **68.50%**
  Please rate the quality of your preparation upon graduation in Data Structures & Algorithms
  May 2015 TO October 2015: **77.50%** Previous cycle: **83.00%**
  Please rate the quality of your preparation upon graduation in Computer Architecture & Organization
  May 2015 TO October 2015: **69.50%** Previous cycle: **71.00%**

- Employer Survey of Program Educational Objectives:
  Please rate the following skill of our graduates: Mastery of the fundamental computer science concepts and ability to solve computing problems using them
  May 2015 TO December 2015: **75.00%**

- Enabling Student Outcomes
  a) Proficiency in foundation areas – Graduating Student Rating: **87.8%**
  b) Proficiency in core CS areas – Graduating Student Rating: **89.2%**
  c) Proficiency in problem solving – Graduating Student Rating: **84.0%**
  d) Mastery of a programming language – Graduating Student Rating: **92.8%**

Evaluation: This Program Educational Objective is paramount. The ratings shown above for the current Alumni survey cycle are slightly lower but very close with those reported in the 2013 assessment report:

Alumni Survey Period	**5/15 to 10/15**	**5/07 to 6/13**
# Responses	**117**	**19**
Computer Programming	76.00	77.75
Systems Development	66.75	68.50
Data Structures & Algorithms	77.50	83.00
Architecture & Organization	69.50	71.00

The ratings for preparation in the Systems Development and Computer Organization & Architecture areas have been consistently slightly below acceptable while the ratings for Data Structures & Algorithms and Computer programming have consistently been high. *It is interesting to note that when they graduate, the students feel that they have attained proficiency in essentially all CS areas at a very high rating, but it diminishes considerably when they have worked in the industry for a while.*

Attainment of Program Educational Objective 2 is deemed **acceptable** with a rating of **good**.

3. To provide our graduates with the communication skills and social and ethical awareness requisite for the effective and responsible practice of their professions.

Indicators

- Alumni Survey of Program Educational Objectives:
  Please rate how your educational experience at FIU contributed to the development of your communication skills
  May 2015 TO October 2015: **73.00%** Previous cycle: **75.00%**
  Please rate how your educational experience at FIU contributed to the development of your awareness of social and ethical responsibility
  May 2015 TO October 2015: **75.00%** Previous cycle: **81.50%**

- Employer Survey of Program Educational Objectives:
  Please rate the following skill of our graduates: Ability to communicate verbally
  May 2015 TO December 2015: **67.25%**
  Please rate the following skill of our graduates: Ability to communicate in written form
  May 2015 TO December 2015: **64.00%**
  Please rate the following skill of our graduates: Understanding of Social and Ethical Concerns
  May 2015 TO December 2015: **71.25%**

- Enabling Student Outcomes
  a) Effective communication skills – Graduating Student Rating: **87.2%**
  b) Understanding social and ethical concerns – Graduating Student Rating: **83.6%**

Evaluation: As for the previous Program Outcome, it is interesting that the perspective on this outcome/objective should differ in the interim from graduation to employment. While the enabling outcomes are rated as high by seniors, the alumni and employers assign only acceptable ratings. It is reasonable to ascribe the adjustment to the real-world experiences of our graduates, but this is a conjecture. This circumstance underscores the need to have continuing communication and dialog with our alumni. The downward trend in the rating of *awareness of social and ethical responsibility* needs to be addressed.

Attainment of Program Educational Objective 3 is deemed **acceptable** with a rating of **average.**

4. To prepare students for BS level careers or continued graduate education.

Indicators

- Alumni Survey of Program Educational Objectives:
  Please rate how your educational experience at FIU contributed to your preparation for a career in computer science
  May 2015 TO October 2015: **75.25%** Previous cycle: **79.00%**

Please rate how your educational experience at FIU contributed to your preparation for graduate study

May 2015 TO October 2015: **72.00%** Previous cycle: **75.00%**

- Employer Survey of Program Educational Objectives:
  Please rate the following skill of our graduates: Will you consider employing our graduates in the future

  May 2015 TO December 2015: 100%

  This is at best a very indirect metric to gauge the overall attainment of this Program Objective from the employers' viewpoint.

- ACM Chapter activities (Appendix H)
  ACM Special Interest Groups, Company Visits

Evaluation: In the last Assessment Report, we stated that "There is a marked need for direct assessment of this objective." With the introduction of the new Employer Survey, this need is a little bit addressed.

Attainment of Program Educational Objective 4 is deemed **acceptable** with a rating of **good**.

V. RECOMMENDATIONS

A. Recommendations of the Subject Area Coordinators

Subject Area: Professional Development (SAC: Rick Blazer)

CGS 1920: No changes are recommended.

CGS 3095: The course reports are excellent, and no changes are recommended.

ENC 3249: No changes are recommended. However, emphasis on technical writing skills should be renewed in this course.

Subject Area: Computer Organization (SAC: Nagarajan Prabakar)

CDA 3103: From instructor course appraisals, students seem to be deficient in algorithmic process, basic logic and programming skills. These deficiencies need to be addressed in introductory CS courses.

CDA 4101: From instructor course appraisals, additional course outcomes need to be added on hardware (familiarity on I/O devices).

CNT 4713: No change is needed on the course outcomes or syllabus.

COP 4610: No change is needed on the course outcomes or syllabus.

Subject Area: Computer Systems (SAC: Shu-Ching Chen)

CAP 4710: No changes are recommended.

CAP 4770: No changes are recommended.

CEN 4083: No changes are recommended.

COP 4604: No changes are recommended.

COP 4710: No changes are recommended.

COP 4722: No changes are recommended.

Subject Area: Foundations (SAC: Xudong He)

MAD 2104 & MAD 3512: Neither student evaluations nor instructor appraisals are available for these courses. No changes are recommended.

COT 3541: Two instructors who taught this course noted that the students did not have adequate preparation (it was between "deficient" and "non-existent") for the class. One commented on the

continual deterioration of student quality and lack of motivation. Another commented on the students' lack of understanding of induction and essential concepts of propositional logic that mandated sacrificing the coverage of first order logic. One possible solution to address these concerns is to offer our own Discrete Math course, which covers some materials such as propositional logic and induction, thus complements COT 3541.

COP 4534: This course was offered three times during this assessment cycle (Fall 2013, Fall 2014, and Spring 2015). Some students suggested that the course was hard in Fall 2013 while there were no such comments in Fall 2014 after some adjustments were made by the instructor. Spring 2015 instructor commented to have more exercises from the recommended book and to study more classical problems from computational geometry. No changes are recommended.

COP 4555: The three instructors found that the students are in general, adequately prepared to enroll in this class. Widespread plagiarism was found as a serious problem earlier, and that led an instructor to change his grading criteria from correctness to effort. This produced a positive effect but a disappointing performance of students in the final exam. All instructors covered F# in the first half of the course, and broad topics of programming language design and implementation in the second half. No changes are warranted.

Subject Area: Programming (SAC: Norman Pestaina)

COP 2210:

- SCIS should provide a pre-programming course focused on problem-solving and logic skills, and that introduces the algorithmic process, abstraction and some computer programming using a minimal-syntax non-production programming language and IDE. Such a course must have clearly defined learning outcomes and evaluation methodologies.

- SCIS should require all students enrolled in COP 2210 to complete an evaluation no later than the first week of class, and preferably earlier, in order to recommend to the student whether to continue their COP 2210 registration, or in the pre-programming course instead.

- The COP 2210 common syllabus should be redesigned around carefully constructed learning outcomes that direct the focus of students and instructors towards abstraction, problem solving and the algorithmic process.

- SCIS should rethink the objectives and delivery mode of COP 2210 to reflect the role of this class as the introduction to the study and practice of Computer Science.

COP 3337:

- The COP 3337 common syllabus should be redesigned around carefully constructed learning outcomes that direct the focus of students and instructors towards abstraction, problem solving and the algorithmic process.

- The operational syllabi of COP 2210 and COP 3337 must be integrated to ensure a seamless transition from COP 2210 into COP 3337 for both students and instructors. This can be facilitated by various means including

1. Clear articulation of learning outcomes for both COP 2210 and COP 3337.
2. Clear articulation of expected programming experiences for students in both classes, including critical feedback on students' programming style and methodology:
3. Common exams for all sections of COP 2210 designed to test achievement of the learning outcomes. These need not be a complete final exam, but could be, for example, a ½ hour multiple-choice quiz. This must contribute towards the student's class grade, either as part of a final exam, or as a stand-alone activity.
4. Scheduled meeting(s) of instructors of both classes at least once towards the end of each semester.

COP 3530: Faculty who regularly teach COP 3530 should collectively review the COP 3530 syllabus with a view towards (re)defining content, emphasis, and time-allocation, and designing a complete set of attainable learning outcomes for this course.

COP 4226: The COP 4226 CES survey instrument is faulty (See Analysis (Outcomes) above) and must be updated.

COP 4338:

- *Basic knowledge of UNIX systems* should be removed as a Prerequisite Outcome of COP 4338, and the corresponding knowledge units incorporated into the operational syllabus of COP 4338 (or some prerequisite course).

- The COP 4338 ICA survey instrument must be updated to include the modified Prerequisite Outcomes.

COP 4520: *Programming experience in C or C++* is not enabled in the prerequisite chain of COP 4520 and should be removed. It may be worth considering adding COP 4338 as a co-requisite to COP 4520.

Subject Area: Software Engineering (SAC: Masoud Sadjadi)

CEN4010:

- Observations:
  - Our students expect to learn more about the real world problems and the state of the art software engineering practices being used in industry.
  - They do not want to be bugged down with plenty of homework assignments and extra documentations that would be of no use to them in the future.
  - Our professors would like our students to perform better in their groups.
- Recommendations:
  - Adopt the state-of-the-art practices of software development from industry.
  - Agile and more specifically, Scrum, is the solution.
  - Professors of this course should adopt an Agile/Scrum book.
  - Class lecture times should be spent more on practicing agile software engineering development than just giving lectures.
  - Learning by example and practice is the best way to transfer the knowledge and experience from the professor to the students.

CEN 4021: The following recommendations are made.

- Agile/Scrum software development management should be adopted.
- The students from this course should be asked to manage the projects in Introduction to Software Engineering and Senior Project courses taught in the same semester.

CEN 4072: The following recommendations are made.

- Test-driven development is one of the popular agile software development practices in industry. Students should be exposed to this approach.
- Debugging should stay in the syllabus as testing without debugging would not help with improving the quality of the software solution.
- The lectures time should be spent more on practicing the testing/debugging methods using state-of-the-art tools.

CIS 4911: The following observations and recommendations are made by the SAC.

- Agile software engineering, and more specifically, Scrum should be employed for all the projects in this class.
- Students should be better prepared for this class. In particular,
    - Students should better learn UML diagrams in CEN 4010 course.
    - Students should learn how to be a team member in a self-organizing Agile/Scrum development team.

B. Recommendations of the Assessments Coordinator

1. Course Related:

AC-01: The Course Outcomes Surveys for MAD 2104 and MAD 3512 are not conducted. The feasibility of doing in-class evaluations and better coordination with the Department of Mathematics and Statistics should be considered. Failing that, other assessment means must be employed for the MAD 2104 and MAD 3512 courses on a regular schedule. This is a continuing concern.

AC-02: In the Course Embedded Assessment for MAD 2104 for this assessment cycle, only 17 out of 28 (60.7%) students demonstrated proficiency in Discrete Mathematics. Although an improvement over the previous assessment cycle, this continues to be below the acceptable level. Also, the SAC recommendation for COT 3541 indicates that our students of MAD 2104 are not learning what they need to master the material taught in a subsequent course. Revamping MAD 2104 is extremely necessary and should be undertaken as early as possible. This is a continuing concern.

AC-03: Course Embedded Assessment results for MAD 3512 are also very poor (only 12 out of 29 (41.4%) students demonstrated proficiency at 75% level, 62.0% demonstrated proficiency at 70% level). We need to examine the reasons for this inadequate performance of students, and then coordinate the content and delivery of this course better with the Department of Mathematics and Statistics.

AC-04: From the SAC reports of various courses (CDA 3103, COP 2210, and COT 3541), it is clear that the students are quite deficient in the concepts related to algorithmic process, programming, and problem solving. One way to address this issue is to provide a pre-programming course focused on problem solving and logic skills. Students in COP 2210 should be evaluated in the first week of classes in order to recommend them to enroll in this pre-programming course before taking COP 2210. [**Important Note: We have already created COP 1000 but need to ascertain that it is more widely advertised to the student community through our advisers.]**

AC-05: Reiterating the recommendation of the SAC, Programming experience in C or C++ is not enabled in the chain of COP 4520 and hence, should be removed. It may be worth considering adding COP 4338 as a co-requisite to COP 4520.

AC-06: The Subject Area Coordinator for Software Engineering recommends the adoption of the state-of-the-art practices of software development from industry. In particular, Agile and Scrum should be used in CEN 4010, CEN 4021, and CIS 4911 (student projects must use these technologies).

AC-07: If approved by the faculty, then the recommendations related to modifications of Course Outcomes, Pre-Requisites etc. should be made in the Spring 2016 term as we will be undergoing the ABET Review in Fall 2016.

2. Procedure Related:

AC-08: There are some instances of survey instruments not matching the actual Course Outcomes (e.g., COP 4226). It is recommended that the Associate Director instruct our Systems Support people to ascertain this matching.

AC-09: Introduction of the new Employer Survey to measure attainment of Program Educational Objectives of our students is extremely heartening. However, the number of response (19 responses) was very low. It is recommended that meaningful steps be taken in the future to increase this response rate.

AC-10: The following is not a major issue, but is noted here for future reminder purposes more than anything else. The style of Course Embedded Assessments of different instructors for the same course is sometimes quite different. SCIS should make Subject Area Coordinators responsible to maintain the consistency of this assessment. Before designing and conducting the assessment for a particular class, instructors should consult the SAC.

3. Assessment Instrument Modifications Related:

AC-11: As the Program Educational Objectives and Student Outcomes are now modified and will be effective in the next Assessment cycle, it is imperative that the rubrics and rating sheet for evaluating the student projects in CIS 4911 be modified as soon as possible to reflect these changes. It is highly desirable to have this done prior to the evaluation of Fall 2015 projects, but should definitely be done before the evaluation of Spring 2016 projects.

AC-12: For the same reason, we need to update the format of our Exit (Graduating Student) Survey prior to conducting it in Spring 2016.

4. General:

AC-13: It is challenging to perform meaningful assessment of Student Outcome a) ***Demonstrate proficiency in the foundation areas of Computer Science including mathematics, discrete structures, logic and the theory of algorithms*** using the rubric of the Senior Project class because there are essentially no projects attempted by students that address the relevant topics. The point is made for discussion only; no recommendations are made.

AC-14: The student clubs continue to need additional space to conduct their activities. A couple of faculty advisors noted that due to the unavailability of space, the activities of their clubs are limited. SCIS administrators should seriously look into this and allocate some additional space for the student clubs.

AC-15: For a few years now, the meeting of the Industrial Advisory Board is conducted at the end of the Fall and Spring semesters when selected students present their Capstone Projects. Members have been suitably impressed with their work, and many now act as mentors and/or judges for these projects. This has proven to be very beneficial for the students. Likewise, we need to find more and better ways to engage the Board members in student activities.

Furthermore, we need to add a few Board members in 2016 to reflect the diversity of industries in South Florida and beyond.

VI. CONCLUSION

The BS in Computer Science program continues to deliver high quality preparation for entry into the computing work-force, or admission to graduate programs in computing. The delivery of its required coursework continues to receive very high ratings from students as expressed in the Surveys of Course Outcomes (4.42/5, 88.4%, Table 1). Evaluations of attainment of its Student Outcomes (87.6%, Table 3) and Program Educational Objectives (75.5%, Table 4) uniformly meet or exceed the minimum acceptability criteria.

In continuing to strive to ensure students' educational experiences are relevant to the reality of the work-force they enter, SCIS continues to offer capstone experience in the Senior Project course. This has been a phenomenal success as indicated by the students (Value of Outcome 4.75/5, 95.0%, Table 1) and showed in the measurements using the rubrics for that course. The Computer Systems track introduced instruction in Computer Graphics (CAP 4710) and Cloud Computing (CEN 4083) in the last cycle, and we continue to improve our offerings in other focus areas, too. The evaluation of Student Learning by various topics as part of the Course Embedded Direct Assessment Mechanism in many courses (COP 3337, COP 3530, COP 4338, and COP 4610) is providing us useful information to fine-tune our curriculum.

The ACM, WICS, STARS, and UPE student chapters, along with Linux Users Group and Programming Team have become very active (Appendix H) and continue expanding their sphere of influence among participating members. It is noteworthy that our industry partners Ultimate Software, IBM, State Farm, and others offer many opportunities to students to learn about industry jobs, skills necessary to be successful once they enter the workforce, and the importance of problem solving through their engagement in various student activities like support of Programming Teams, mentorship and/or evaluation of capstone projects, and the like. WICS has been partnering with the other student groups for the benefit of its membership.

The SCIS Industrial Advisory Board is increasingly involved in all facets of our operation as indicated by the minutes of its meetings included in Appendix I. This involvement will be enhanced in the future; both the Board members and the SCIS administration desire it very much.

The biennial assessment is working out well, and gives us more meaningful information from one report to the next. We will undergo the ABET Review of the BS in CS Program in Fall 2016. To make the SCIS Assessment and the ABET process more cohesive, in Spring 2015, we modified our Program Educational Objectives and the Student Learning Outcomes. The modified mechanisms will be effective in our next Assessment Report.