SCHOOL OF COMPUTING & INFORMATION SCIENCES

Annual Assessment Summary 2011-2013
for the
Bachelor of Science in Computer Science

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I. INTRODUCTION

This report is prepared in accordance with the Assessment Plan 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 the 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.

This assessment was an annual event, but beginning with this cycle, it is now going to be a biennial event. 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 2011 to Spring 2013.

II. OVERVIEW

A. Terminology

The BS in Computer Science *Program Educational Objectives* document (Appendix A-1) 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.

Additionally, 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, the 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, and amended in 2010 to incorporate additional direct assessment measures.

The following indirect assessment mechanisms have been employed since spring 2003:

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

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

Mechanism	**Target**	**Frequency**
Course Embedded Assessment	Course and Student Outcomes	Semester
Capstone Project Assessment	Student Outcomes	Semester

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,
- 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 4770	Introduction to Data Mining	15	4.60	4.37
CDA 3103	Fundamentals of Computer Systems	178	4.64	4.65
CDA 4101	Structured Computer Organization	76	4.35	4.20
CEN 4010	Software Engineering I	93	4.56	4.39
CEN 4021	Software Engineering II	23	4.64	4.08
CEN 4072	Software Testing	38	4.75	4.21
CGS 1920	Introduction to Computing	222	4.70	4.65
CGS 3095	Ethics & Social Issues in Computing	231	4.66	4.72
CIS 4911	Senior Project	64	4.58	4.18
COP 2210	Computer Programming I	0	0.00	0.00
COP 3337	Computer Programming II	253	4.46	4.30
COP 3530	Data Structures	138	4.49	4.14
COP 4226	Advanced Windows Programming	28	4.70	4.67
COP 4338	Computer Programming III	104	4.54	4.23
COP 4520	Introduction to Parallel Computing	9	4.56	3.80
COP 4555	Principles Programming Languages	79	4.25	4.32
COP 4604	Advanced Unix Programming	18	4.08	3.76
COP 4610	Operating Systems Principles	82	4.56	4.39
COP 4710	Database Management	60	4.70	4.49
COP 4722	Survey of Database Systems	36	4.48	4.28
COT 3420	Logic for Computer Science	99	4.25	3.93
MAD 2104	Discrete Mathematics	0	0.00	0.00
MAD 3512	Theory of Algorithms	0	0.00	0.00
		======	======	======
		1846	4.54	4.39

Table 1: Value & Adequacy of Coverage of Course Outcomes 05/11 – 04/13

Note: Unfortunately, data is not available for the reporting period for COP 2210, CNT 4713, COP 4534, MAD 2104, and MAD 3512. MAD 2104 and MAD 3512 are taught by Math faculty. Students in these sections complete the surveys on-line voluntarily, unlike students in CS sections who do so in class.

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

Subject Area: Professional Development (SAC: Alex Pelin)

CGS 1920 Introduction to Computing
CGS 3092 Professional Ethics and Social Issues in Computer Science (1-credit)
Replaced by
CGS 3095 Technology in the Global Arena (3-credits)
ENC 3249 Professional and Technical Writing for CS (Taught by English Department)

CGS 1920 -- Introduction to Computing

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2011	3	4.62	4.67
FALL 2011	60	4.76	4.67
SPR 2012	46	4.59	4.55
SUM 2012	1	5.00	5.00
FALL 2012	56	4.72	4.66
SPR 2013	56	4.69	4.68
	=======	=======	=======
	222	4.70	4.65

Table 2-CGS 1920: Student Rating of Course Outcomes

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

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2011	42	4.82	4.82
FALL 2011	61	4.68	4.75
SPR 2012	47	4.57	4.67
SUM 2012			
FALL 2012	39	4.57	4.58
SPR 2013	42	4.66	4.74
	=======	=======	=======
	231	4.66	4.72

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
COP 4610 Operating Systems Principles
CNT 4713 Net-centric Computing (No data is available)

CDA 3103 -- Fundamentals of Computer Systems

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2011			
FALL 2011	45	4.66	4.66
SPR 2012	38	4.51	4.57
SUM 2012	21	4.79	4.75
FALL 2012	36	4.77	4.78
SPR 2013	38	4.54	4.52
	=======	=======	=======
	178	4.64	4.65

Table 2-CDA 3103: Student Rating of Course Outcomes

CDA 4101 -- Structured Computer Organization

	# Responding	Value of Outcome	Coverage Adequacy
FALL 2011	15	4.47	4.43
SPR 2012	27	4.37	4.23
FALL 2012	16	4.04	3.78
SPR 2013	18	4.48	4.34
	=======	=======	=======
	76	4.35	4.20

Table 2-CDA 4101: Student Rating of Course Outcomes

COP 4610 -- Operating Systems Principle

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2011	7	4.24	3.71
FALL 2011	16	4.66	4.34
SPR 2012	6	4.43	4.20
SUM 2012	16	4.76	4.67
FALL 2012	17	4.51	4.55
SPR 2013	20	4.50	4.37
	=======	=======	=======
	82	4.56	4.39

Table 2-COP 4610: Student Rating of Course Outcomes

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

COP 4710 Database Management systems
CAP 4770 Principles of Data Mining
COP 4604 Advanced UNIX Programming
COP 4722 Survey of Database Systems

COP 4710 -- Database Management Systems

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2011	12	4.68	4.56
FALL 2011	13	4.70	4.72
SPR 2012	17	4.73	4.24
SUM 2012	3	4.57	4.43
FALL 2012	8	4.79	4.68
SPR 2013	7	4.61	4.38
	60	4.70	4.49

Table 2-COP 4710: Student Rating of Course Outcomes

CAP 4770 -- Principles of Data Mining

	# Responding	Value of Outcome	Coverage Adequacy
FALL 2012	15	4.60	4.37
	15	4.60	4.37

Table 2-CAP 4770: Student Rating of Course Outcomes

COP 4604 -- Advanced UNIX Programming

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2011	18	4.08	3.76
	18	4.08	3.76

Table 2-COP 4604: Student Rating of Course Outcomes

COP 4722 -- Survey of Database Systems

	# Responding	Value of Outcome	Coverage Adequacy
FALL 2011	2	5	4.4
SPR 2012	11	4.67	4.39
FALL 2012	12	4.22	4.1
SPR 2013	11	4.47	4.36
	=======	=======	=======
	36	4.48	4.28

Table 2-COP 4722: Student Rating of Course Outcomes

Subject Area: Foundations (SAC: Xudong He)

COP 4555 Principles of Programming Languages
COP 4534 Algorithm Techniques (No data is available)
COT 3420 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 4555 -- Principles of Programming Languages

	# Responding	Value of Outcome	Coverage Adequacy
FALL 2011	16	3.77	4.14
SPR 2012	16	4.33	4.17
FALL 2012	21	4.53	4.61
SPR 2013	26	4.27	4.30
	=======	=======	=======
	79	4.25	4.32

Table 2-COP 4555: Student Rating of Course Outcomes

COT 3420 -- Logic for Computer Science

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2011	18	3.68	3.42
FALL 2011	19	4.59	4.18
SPR 2012	8	4.50	3.69
SUM 2012	8	3.77	3.65
FALL 2012	19	4.24	4.32
SPR 2013	27	4.46	3.99
	=======	=======	=======
	99	4.25	3.93

Table 2-COT 3420: 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 (No data is available)
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 3337 -- Computer Programming II

	# Responding	Value of Outcome	Coverage Adequacy
FALL 2011	67	4.33	4.26
SPR 2012	55	4.40	4.11
SUM 2012	26	4.50	4.51
FALL 2012	49	4.62	4.48
SPR 2013	56	4.53	4.27
	=======	=======	=======
	253	4.46	4.30

Table 2-COP 3337: Student Rating of Course Outcomes

COP 3530 -- Data Structures

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2011	2	3.93	3.64
FALL 2011	28	4.22	3.45
SPR 2012	20	4.89	4.71
SUM 2012	20	4.78	4.53
FALL 2012	37	4.37	4.12
SPR 2013	31	4.45	4.19
	=======	=======	=======
	138	4.49	4.14

Table 2-COP 3530: Student Rating of Course Outcomes

COP 4226 -- Advanced Windows Programming

	# Responding	Value of Outcome	Coverage Adequacy
FALL 2011	18	4.69	4.69
FALL 2012	10	4.71	4.66
	=======	=======	=======
	28	4.70	4.68

Table 2-COP 4226: Student Rating of Course Outcomes

COP 4338 -- Computer Programming III

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2011	13	4.75	4.69
FALL 2011	23	4.22	3.86
SPR 2012	20	4.18	3.85
SUM 2012	8	4.77	4.09
FALL 2012	11	4.71	4.45
SPR 2013	29	4.82	4.55
	=======	=======	=======
	104	4.54	4.23

Table 2-COP 4338: Student Rating of Course Outcomes

COP 4520 -- Introduction to Parallel Computing

	# Responding	Value of Outcome	Coverage Adequacy
SPR 2012	9	4.56	3.80
	=======	=======	=======
	9	4.56	3.80

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 2011	17	4.51	4.37
FALL 2011	14	4.54	4.46
SPR 2012	24	4.53	4.14
SUM 2012	13	4.51	4.42
FALL 2012	17	4.81	4.71
SPR 2013	8	4.36	4.32
	=======	=======	=======
	93	4.56	4.39

Table 2-CEN 4010: Student Rating of Course Outcomes

CEN 4021 -- Software Engineering II

	# Responding	Value of Outcome	Coverage Adequacy
SPR 2012	9	4.58	3.61
SPR 2013	14	4.68	4.38
	=======	=======	=======
	23	4.64	4.08

Table 2-CEN 4021: Student Rating of Course Outcomes

CEN 4072 -- Software Testing

	# Responding	Value of Outcome	Coverage Adequacy
FALL 2011	17	4.72	4.03
FALL 2012	21	4.78	4.35
	=======	=======	=======
	38	4.75	4.21

Table 2-CEN 4072: Student Rating of Course Outcomes

CIS 4911 -- Senior Project

	# Responding	Value of Outcome	Coverage Adequacy
SUM 2011	3	4.70	4.55
FALL 2011	21	4.59	3.98
SPR 2012	7	4.05	3.84
SUM 2012	8	4.59	4.56
FALL 2012	6	4.38	3.69
SPR 2013	19	4.79	4.45
	=======	=======	=======
	64	4.58	4.18

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 as Appendix C. **Note:** The data here are qualitative; no numeric scores are assigned to responses.

Subject Area: Professional Development (SAC: Alex Pelin)

CGS1920 Introduction to Computing

- *All academic objectives were covered on an assignment or guest lectures or research activities. All objective were considered essential.*
- *According to the students, the course objectives were considered worthwhile and were covered adequately. The comments of the students were laudatory.*

CGS 3095 Technology in the Global Arena

- *All objectives were covered on an assignment or in class discussions.*
- *Most objectives were covered extensively except for a couple.*
- *The students feel that the instruction was delivered adequately, and the course objectives were reached.*
- *Most prerequisite objectives currently listed include specific programming skills that were considered irrelevant by one instructor and useful by the other.*

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 75%) 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 75%) agree either strongly or moderately.*

CNT 4713 Net-centric Computing

- *This new course was approved by the University effective from spring 2012. The first course offering in spring 2013 did not have the course outcome survey data as well as the faculty course appraisal data.*

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

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.*

CAP 4770 Principles of Data Mining

- *Summary of Assessment: It is not available.*

COP 4604 Advanced UNIX Programming

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

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 4555 Principles of Programming Languages

- *The most common comment was about the usefulness of covering F# language in this class. Some students commented on the difficulty of some later assignments.*
- *Both instructors noted that students were adequately prepared.*

COT 3420 Logic for Computer Science

- *Two instructors, I1 and I2, noted that the students did not have adequate preparation, from deficient to non-existent, for the class. I1 commented on the continual deterioration of student quality and lack of motivation. I2 commented on the students' lack of*

understanding of induction and essential concepts of propositional logic that resulted in sacrificing the coverage of first order logic.

COP 4534 Algorithm Techniques

- *This is a new course. It was offered first time in Spring 2013. There are no overall valuation of the outcomes and no adequacy of coverage of the outcomes. As a result no quantitative data can be shown.*

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.*
- *The overall student preparation for this course was deemed Adequate.*

COP 3337 Computer Programming II

- *All objectives are always covered in assignments and tests.*
- *All course objectives are consistently rated as Essential. The coverage of the course outcomes is predominantly rated as Adequate or Extensive.*
- *Student preparation received 13 ratings of Adequate, and 6 of Deficient.*

COP 3530 Data Structures

- *All course objectives are covered in assignments or tests except for the Sub-Quadratic Sorting and Graph Algorithm outcomes in fall 2012. This appears to be inconsistent with the reporting of the coverage of those outcomes for the same semester as Extensive and Adequate respectively.*
- *All course objectives are consistently rated Essential or Appropriate, and their coverage as Extensive or Adequate.*
- *Student preparation received 1 Good rating, 6 ratings of Adequate, and 4 of Deficient.*

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 or Appropriate, and all were covered Extensively or Adequately.*
- *All prerequisites were rated at least Useful, and student preparation was rated as Good.*
- *Student preparation was rated as Good.*

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.*
- *Overall student preparation for taking the course was deemed Adequate or Good.*

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 Appropriate, and all were covered Extensively or Adequately.*
- *All prerequisites were rated at least Useful, and student preparation was rated as Good.*
- *Student preparation was rated as Adequate.*

Subject Area: **Software Engineering** (SAC: Masoud Sadjadi)

CEN 4010 Software Engineering I

- *All objectives were covered in assignments and tests.*
- *All objectives were rated Essential, and all were covered Extensively or Adequately.*
- *This course was taught six times during the past two years. According to all the instructors of this course, the relevancy of the prerequisites was rated from useful to highly useful and mastery of the students was rated from adequate to good. Students' preparedness was indicated as adequate.*

CEN 4021 Software Engineering II

- *All objectives were covered in assignments and tests.*
- *All objectives were rated Essential or Appropriate, and all were covered Extensively or Adequately.*
- *This course was taught twice during the past two years. According to the instructors of this course, the relevancy of the prerequisites was rated from useful to highly useful and mastery of the students was rated from deficient to adequate and good. Students' preparedness was indicated as adequate.*

CEN 4072 Software Testing

- *Except for the objective "Be familiar with debugging techniques," all objectives were covered in assignments and tests.*
- *All objectives were rated Essential or Appropriate, and all were covered Extensively or Adequately (Exception was "Debugging").*
- *This course was taught twice during the past two years. 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.*

CIS 4911 Senior Project

- *All objectives were covered in assignments and tests.*
- *All objectives were rated Essential, and all were covered Extensively.*
- *This course was taught six times during the past two years. According to all the instructors of this course, the relevancy of the prerequisites was rated from useful to highly useful and mastery of the students was rated from deficient to adequate and good.*

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*

The following table summarizes the responses of 87 graduating students completing the survey between summer 2011 and spring 2013. The mean responses are expressed as percentages of 5, the maximum rating. The raw data from 87 completed surveys are provided in Appendix D-1.

Exit Survey (Graduating Students) 87 Respondents	*Outcome Attainment*		*Perceived Relevance*	
Student Outcomes	*Mean*	*Percentage*	*Mean*	*Percentage*
a: Proficiency in foundation areas	4.46	89.2	4.52	90.4
b: Proficiency in core areas	4.51	90.2	4.77	95.4
c: Proficiency in problem solving	4.54	90.8	4.69	93.8
d: Proficiency in a programming language	4.67	93.4	4.71	94.2
e: Understanding of social & ethical issues	4.33	86.6	4.33	86.6
f: Ability to work cooperatively in teams	4.41	88.2	4.67	93.4
g: Effective communication skills	4.34	86.8	4.67	93.4
h: Experience with contemporary environments & tools	4.20	84.0	4.48	89.6
	====	====	====	====
Average Ratings of Student Outcomes	4.33	88.7	4.61	92.1
	====	====	====	====
Overall Satisfaction for CS Areas, Outcomes a to e:	4.50	90.0	4.60	92.1

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

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 following table summarizes the responses to this survey. The means for the current survey cycle, 5/26/2007 through 8/2/2013 are compared with corresponding means for earlier cycles, 2/11/2004 through 2/28/2007. 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 are provided in Appendix D-2.

		2/11/2004 2/28/2007		5/26/2007 8/2/2013	
	Alumni Survey of Program Objectives	125 Respondents		19 Respondents	
		Outcome Attainment		*Outcome Attainment*	
	Program Educational Objective	*Average*	*Percentage*	*Average*	*Percentage*
1	Capacity for personal growth	3.35	83.75	3.32	83.00
1	Capacity for life-long learning	3.45	86.25	3.16	79.00
3	Development of communication skills	2.90	72.50	3.00	75.00
3	Awareness of social, ethical responsibility	2.94	73.50	3.26	81.50
4	Preparation for career in CS	3.18	79.50	3.16	79.00
4	Preparation for graduate study	3.08	77.00	3.00	75.00
4	Overall preparation upon graduation	3.10	77.50	3.00	75.00
2	Computer Programming	3.37	84.25	3.11	77.75
2	Systems Development	2.82	70.50	2.74	68.50
2	Data Structures & Algorithms	3.29	82.25	3.32	83.00
2	Computer Architecture & Organization	2.94	73.50	2.84	71.00
	Overall FIU educational experience	3.15	78.75	3.15	78.75
	Overall satisfaction with BS-CS program	3.14	78.50	3.09	77.25

Table 4: Alumni Survey of Attainment of Program Educational Objectives

E. 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 multiple-choice (M-C) quizzes as shown below. Appendix-E contains the Direct Assessment Summaries as follows:

Appendix E-1: Course-Embedded Assessment Summaries (Fall 2011)
Appendix E-2: Course-Embedded Assessment Summaries (Spring 2012)
Appendix E-3: Course-Embedded Assessment Summaries (Fall 2012 and Spring 2013)
Appendix E-4: Course-Embedded Assessment Summaries (Summer 2011 and Summer 2012)

The link to the raw data is available in Appendix F. The evaluation of these assessments is included in section IV.B (Evaluation – Student Outcomes).

F. 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

Based on the experience gained with the application in the previous Assessment cycle, the rubric was finalized to its current version in spring 2011. The spring 2011 version of the rubric, and associated check-list and score grid are included as Appendix G of this report.

The data from these assessment events are summarized in the previously cited Appendices, E-1 through E-4. Once again, the raw data are provided through the link included in Appendix F.

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 Coordinators (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 2210 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 majority of courses is **very high** (4.50 or higher).

AC-Evaluation-03: The student rating of the Adequacy of Coverage of Course Outcomes for every course exceeds the acceptability threshold of 3.75. The student rating of the Adequacy of Coverage of Course Outcomes for COP 4520, COP 4604, and COT 3420 is **acceptable** (between 3.50 and 3.99). For all other CS courses, students rate the Adequacy of Coverage of Course Outcomes as at least **high**, with four courses, CDA 3103, CGS 1920, CGS 3095, and COP 4226, being rated as **very high** (4.50 or higher).

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 3337 (Programming II), 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).
- Course-embedded Assessment by portfolio inspection in CGS 3095 (Ethics and Social Issues in Computing).

The direct assessment events performed from summer 2011 to spring 2013 are documented in summaries provided in Appendix E (E-1 through E-4). The raw data is available through the link provided in Appendix F. The rubric used for evaluation of Senior Project for assessment of Student Outcomes is provided in Appendix G.

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 90.4%	Attainment 89.2%	Sample: 87
2.	Course Outcomes COT 3420	Value: 85.0%	Coverage: 78.6%	Sample: 99
3.	Course Outcomes MAD 2104	Data Not Available		
4.	Course Outcomes MAD 3512	Data Not Available		

5. Course-Embedded Assessment - MAD 2104

   Fall 2011 Event: 7 students completed a 16-question multiple choice quiz.
   Criterion: At least 75% of students should score 75% or higher.
   Observation: 6 out of 7 (85.7%) students scored at least 12 points.

   Spring 2012 Event: 8 students completed a 16-question multiple choice quiz.
   Criterion: At least 75% of students should score 75% or higher.
   Observation: 6 out of 8 (75.0%) students scored at least 12 points.

Fall 2012 Event: 19 students completed a 16-question multiple choice quiz.
Criterion: At least 75% of students should score 75% or higher.
Observation: 6 out of 19 (31.6%) students scored at least 12 points.

Summary Observation: 18 out of 34 (52.9%) students demonstrated proficiency in Discrete Mathematics.

6. Course-Embedded Assessment - MAD 3512

Spring 2012 Event: 23 students completed a 7-question multiple choice quiz.
Criterion: At least 75% of students should score 75% or higher. With a 7-question quiz, modify the criterion for students to score at least 5 points (71%).
Observation: 16 out of 23 (69.6%) students scored at least 5 points.

Fall 2012 Event: 32 students completed a 20-question multiple choice quiz.
Criterion: At least 75% of students should score 75% or higher.
Observation: 7 out of 32 (21.9%) students scored at least 15 points.

Summary Observation: 23 out of 55 (41.8%) students demonstrated proficiency in Theory of Algorithms.

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 2011 to spring 2013.
Criterion: Attainment should be rated at **75% or 3.75** on a 1—5 scale, or better.

Observation:	Summer 2011: **1.00**	Fall 2011: **1.08**	Spring 2012: **1.83**
	Summer 2012: **1.50**	Fall 2012: **2.33**	Spring 2013: **1.89**

Evaluation: Graduating students consider this Student Outcome highly relevant, and almost 90% believe that they have attained it. Indicator 2 comfortably meets the acceptable threshold for the Value and the Coverage of Course Outcomes for COT 3420. Indicators 5 and 6 clearly show that students do not attain the desired acceptable level of proficiency for MAD 2104 and MAF 3512. Finally, indicator 7 shows that 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 95.4%	Attainment 90.2%	Sample: 87
2.	Course Outcomes CDA 4101	Value: 87.0%	Coverage: 84.0%	Sample: 76

3. Course Outcomes CDA 3103 Value: 92.8% Coverage: 93.0% Sample: 178

4. Course Outcomes COP 3530 Value: 89.8% Coverage: 82.8% Sample: 138

5. Course Outcomes COP 4555 Value: 85.0% Coverage: 86.4% Sample: 79

6. Course Outcomes COP 4710 Value: 94.0% Coverage: 89.8% Sample: 60

7. Course Outcomes COP 4610 Value: 91.2% Coverage: 87.8% Sample: 82

8. Course-Embedded Assessment - COP 4555

   Fall 2011 Event: 15 students completed a 10-question multiple choice assessment quiz.
   Criterion: 75% of students should score at least 7 points.
   Observation: **6.7%** of the students answered at least 7 questions correctly.

   Spring 2013 Event: 30 students completed a 10-question multiple choice assessment quiz.
   Criterion: 75% of students should score at least 7 points.
   Observation: **53.3%** of the students answered at least 7 questions correctly.

9. Course-Embedded Assessment - COP 3530

   Spring 2012 Event: 14 students completed a 14-question multiple choice assessment quiz.
   Criterion: 75% of students should score at least 10 points.
   Observation: **71.4%** of the students answered at least 10 questions correctly.

   Spring 2013 Event: 17 students completed a 14-question multiple choice assessment quiz.
   Criterion: 75% of students should score at least 10 points.
   Observation: **70.6%** of the students answered at least 10 questions correctly.

10. Course-Embedded Assessment - COP 4710

    Fall 2011 Event: 15 students completed a 5-question multiple choice assessment quiz.
    Criterion: 75% of students should score at least 4 points.
    Observation: **66.7%** of the students answered at least 10 questions correctly.

    Spring 2013 Event: 20 students completed a 5-question multiple choice assessment quiz.
    Criterion: 75% of students should score at least 4 points.
    Observation: **95%** of the students answered at least 10 questions correctly.

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

    Summer 2011 Event: 21 students completed a 12-question multiple choice assessment quiz.
    Criterion: 75% of students should score at least 9 points.

Observation: **85.7%** of the students answered at least 9 questions correctly.

Spring 2012 Event: 35 students completed a 12-question multiple choice assessment quiz.
Criterion: 75% of students should score at least 9 points.
Observation: **94.3%** of the students answered at least 9 questions correctly.

Spring 2013 Event: 15 students completed a 12-question multiple choice assessment quiz.
Criterion: 75% of students should score at least 9 points.
Observation: **80%** of the students answered at least 9 questions correctly.

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

Spring 2012 Event: The artifacts (submitted programs/projects) of 7 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: **71.4%** of the students answered at least 9 questions correctly.

Fall 2012 Event: The artifacts (submitted programs/projects) of 21 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: **90.5%** of the students answered at least 9 questions correctly.

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

Fall 2012 Event: The artifacts (submitted programs/projects) of 22 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 answered at least 9 questions correctly.

14. 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 2011 to spring 2013.
Criterion: Attainment should be rated at **75% or 3.75** on a 1—5 scale, or better.
Observation: Summer 2011: **5.00** Fall 2011: **4.50** Spring 2012: **4.67**
Summer 2012: **4.75** Fall 2012: **3.21** Spring 2013: **3.17**

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 4555 (Indicator 8), the course-embedded assessments for relevant courses (Indicators 9, 10, 11, 12, and 13) clearly show that students have attained the desired level of proficiency (66.7 to 100% of students pass the criterion).

Finally, our Senior Projects Assessment (Indicator 14) shows that the students have achieved the desired level of proficiency for this outcome. 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 93.8%	Attainment 90.8%	Sample: 87
2.	Course Outcomes CEN 4010	Value 91.2%	Coverage: 87.8%	Sample: 93
3.	Course Outcomes COP 3530	Value: 89.8%	Coverage: 82.8%	Sample: 138
4.	Course Outcomes CIS 4911	Value: 91.6%	Coverage: 83.6%	Sample: 64

5. Course-Embedded Assessment – CEN 4010

   Spring 2013 Event: 8 students completed a 10-question multiple choice assessment quiz.
   Criterion: 75% of students should score at least 7 points.
   Observation: **87.5%** 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 2011: **5.00** Fall 2011: **5.00** Spring 2012: **5.00**
   Summer 2012: **5.00** Fall 2012: **4.75** Spring 2013: **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 94.2%	Attainment 93.4%	Sample: 87
2.	Course Outcomes COP 2210	Data Not Available		
3.	Course Outcomes COP 3337	Value: 89.2%	Coverage: 86.0%	Sample: 253
4.	Course Outcomes COP 3530	Value: 89.8%	Coverage: 82.8%	Sample: 138

5. Course Outcomes COP 4338 Value: 90.8% Coverage: 84.6% Sample: 104

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

   Spring 2012 Event: The artifacts (submitted programs/projects) of 14 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: 71.4**%** of the students answered at least 6 questions correctly.

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

   Spring 2012 Event: The artifacts (submitted programs/projects) of 15 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: 93.3**%** of the students answered at least 6 questions correctly.

   Spring 2013 Event: The artifacts (submitted programs/projects) of 19 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: 73.7**%** of the students answered at least 6 questions correctly.

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

   Spring 2012 Event: The artifacts (submitted programs/projects) of 14 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: 100**%** of the students answered at least 6 questions correctly.

   Spring 2013 Event: The artifacts (submitted programs/projects) of 17 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: 88.2**%** of the students answered at least 6 questions correctly.

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

   Spring 2012 Event: The artifacts (submitted programs/projects) of 16 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: 81.3**%** of the students answered at least 6 questions correctly.

   Spring 2013 Event: The artifacts (submitted programs/projects) of 16 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: 100**%** of the students answered at least 6 questions correctly.

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

    Spring 2012 Event: The artifacts (submitted programs/projects) of 17 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: 100**%** of the students answered at least 6 questions correctly.

    Spring 2013 Event: The artifacts (submitted programs/projects) of 17 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: 100**%** of the students answered all questions correctly.

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

    Spring 2012 Event: The artifacts (submitted programs/projects) of 14 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: 92.9**%** of the students answered at least 12 questions correctly.

    Spring 2013 Event: The artifacts (submitted programs/projects) of 17 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: 100**%** of the students answered at least 12 questions correctly.

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

    Summer 2011 Event: The artifacts (submitted programs/projects) of 25 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: 80.0**%** of the students answered at least 9 questions correctly.

    Spring 2012 Event: The artifacts (submitted programs/projects) of 35 students were evaluated against the appropriate rubrics with the maximum possible score being 10.
    Criterion: 75% of students should score at least 7 points.
    Observation: 100**%** of the students answered at least 8 questions correctly.

    Spring 2013 Event: The artifacts (submitted programs/projects) of 15 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 answered at least 9 questions correctly.

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 2011: **5.00** Fall 2011: **4.67** Spring 2012: **4.50**
Summer 2012: **5.00** Fall 2012: **4.67** Spring 2013: **4.00**

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 86.6% Attainment 86.6% Sample: 87

2. Course Outcomes CGS 3095 Value: 93.2% Coverage: 94.4% Sample: 231

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

   Spring 2012 Event: Individual projects for 22 students were graded on a 4-point scale.
   Criterion: 75% of students should score at least 3 points.
   Observation: 100**%** of the students received 4 points.

   Fall 2012 Event: Individual projects for 31 students were graded on a 4-point scale.
   Criterion: 75% of students should score at least 3 points.
   Observation: 100**%** of the students received 4 points.

4. Course-Embedded Assessment CGS 3095 (Ethical Concerns in Computing)

   Spring 2012 Event: Individual projects for 22 students were graded on a 4-point scale.
   Criterion: 75% of students should score at least 3 points.
   Observation: 72.7**%** of the students received 4 points.

   Fall 2012 Event: Individual projects for 31 students were graded on a 4-point scale.
   Criterion: 75% of students should score at least 3 points.
   Observation: 25.8**%** of the students received 4 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 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 2011: **3.50** Fall 2011: **2.50** Spring 2012: **3.17**
   Summer 2012: **4.25** Fall 2012: **2.67** Spring 2013: **3.89**

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 issues in computing, but only an **average** understanding of ethical issues in computing (Indicators 3 and 4). Senior project assessment (Indicator 5) shows that there is not much in student projects that evaluates these topics. On balance, attainment of Student Outcome e) is rated as **acceptable.**

f) Demonstrate the ability to work cooperatively in teams.

Indicators

1.	Graduating Student Ratings	Relevance 93.4%	Attainment 88.2%	Sample: 87
2.	Course Outcomes CEN 4010	Value: 91.2%	Coverage: 87.8%	Sample: 93
3.	Course Outcomes CEN 4021	Value: 92.8%	Coverage: 81.6%	Sample: 23
4.	Course Outcomes CIS 4911	Value: 91.6%	Coverage: 83.6%	Sample: 64

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 2011: **4.50** Fall 2011: **4.83** Spring 2012: **4.33**
Summer 2012: **5.00** Fall 2012: **4.60** Spring 2013: **4.22**

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

g) Demonstrate effective communication skills.

Indicators

1.	Graduating Student Ratings	Relevance 93.4%	Attainment 86.8%	Sample: 87
2.	Course Outcomes CGS 3095	Value: 93.2%	Coverage: 94.4%	Sample: 231
3.	Course Outcomes CEN 4010	Value 91.2%	Coverage: 87.8%	Sample: 93

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 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 2011: **5.00** Fall 2011: **5.00** Spring 2012: **5.00**
Summer 2012: **5.00** Fall 2012: **5.00** Spring 2013: **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 89.6% Attainment 84.0% Sample: 87

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 2011: **5.00** Fall 2011: **5.00** Spring 2012: **5.00**
Summer 2012: **5.00** Fall 2012: **5.00** Spring 2013: **4.89**

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 is the Alumni Survey of Program Objectives. The alumni responses are summarized in Table 4 (Section III.D) showing the averages of the 19 responses in the period from May 2007 to August 2013, and separately, all 125 responses received in earlier survey cycles. 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 D-2.

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, and IAB may provide indicators of the attainment of the program objectives.

It must be noted that the number of responses to this survey, 19, is only 3 more than the 16 who responded during the preceding assessment cycle from May 2007 to June 2011.

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 2007 to August 2013: **83.00%** Previous cycles: **83.75%**

  Please rate how your educational experience at FIU contributed to your capacity for lifelong learning
  May 2007 to August 2013: **79.00%** Previous cycles: **86.25%**

- ACM Chapter activities (Appendix H)
  Volunteer Tutoring Program, ACM Special Interest Groups (general SIG, Games, Robotics, Crypto & Security and Panther/Linux User Group), High School Programming Competition, "Building a Computer" Workshop, and so on
- UPE Activities (Appendix H)
  Workshops, 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)
  Participation with ACM and UPE
- STARS Activities (Appendix H)
  Tutoring and mentoring students, Outreach programs with Schools, participation in freshmen orientation, 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 rated as **acceptable**.

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 2007 to August 2013: **77.75%** Previous cycles: **84.25%**
  Please rate the quality of your preparation upon graduation in Systems Development
  May 2007 to August 2013: **68.50%** Previous cycles: **70.50%**
  Please rate the quality of your preparation upon graduation in Data Structures & Algorithms
  May 2007 to August 2013: **83.00%** Previous cycles: **82.25%**
  Please rate the quality of your preparation upon graduation in Computer Architecture & Organization
  May 2007 to August 2013: **71.00%** Previous cycles: **73.50%**

- Enabling Student Outcomes
  a) Proficiency in foundation areas – Graduating Student Rating: **89.2%**
  b) Proficiency in core CS areas – Graduating Student Rating: **90.2%**
  c) Proficiency in problem solving – Graduating Student Rating: **90.8%**
  d) Mastery of a programming language – Graduating Student Rating: **93.4%**

Evaluation: This Program Educational Objective is paramount. The ratings shown above for the current survey cycle are consistent with those reported in the 2011 assessment report:

Alumni Survey Period	**5/07 to 6/13**	**5/07 to 6/11**	**2/04 to 2/07**
# Responses	**19**	**16**	**125**
Computer Programming	77.75	78.25	84.25
Systems Development	68.50	70.25	70.50
Data Structures & Algorithms	83.00	86.00	82.25
Architecture & Organization	71.00	72.00	73.50

The ratings for preparation in the Systems Development and Computer Organization & Architecture areas have been consistently below acceptable while the ratings for Data Structures & Algorithms have consistently been high. The Computer Programming rating is acceptable.

Attainment of Program Educational Objective 2 is rated as **acceptable**.

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 2007 to August 2013: **75.00%** Previous cycles: **72.50%**
  Please rate how your educational experience at FIU contributed to the development of your awareness of social and ethical responsibility
  May 2007 to August 2013: **81.50%** Previous cycles: **73.50%**

- Enabling Student Outcomes
  a) Effective communication skills – Graduating Student Rating: **86.80%**
  b) Understanding social and ethical concerns – Graduating Student Rating: **86.60%**

Evaluation: 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 assign only acceptable ratings. It is reasonable to ascribe the adjustment to the real-world experiences of our graduates, but this is conjecture. This circumstance underscores the need to have continuing communication and dialog with our alumni. The upward trend in the rating of *awareness of social and ethical responsibility* is welcomed.

Attainment of Program Educational Objective 3 is rated as **acceptable.**

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
  Current cycle: **79.00%** Previous cycles: **79.50%**
  Please rate how your educational experience at FIU contributed to your preparation for graduate study
  Current cycle: **75.00%** Previous cycles: **77.00%**

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

Evaluation: There is a marked need for direct assessment of this objective.
Attainment of Program Educational Objective 4 is rated as **acceptable**.

V. RECOMMENDATIONS

A. Recommendations of the Subject Area Coordinators

Subject Area: Professional Development (SAC: Alex Pelin)

CGS 1920: No changes are warranted.

CGS 3095: This course has fully replaced the previous 1-credit course (CGS 3092). The course reports are excellent, and no changes are warranted.

ENC 3249: The SAC talked with the professor who indicated that he was pleased with the work of the students. No changes are warranted.

Subject Area: Computer Organization (SAC: Nagarajan Prabakar)

CDA 3103: No changes are recommended.

CDA 4101: No changes are recommended.

CNT 4713: This is a new course offered only once during this cycle (spring 2013). As no data is available for Course Outcomes Surveys by students and the Instructor Course Appraisal, no recommendations are made at this stage.

COP 4610: Enforce the prerequisite Programming III for all students enrolled in the course (including Computer Engineering majors). Repetition of this problem for several years requires ECE Undergraduate Program Director to enforce this prerequisite. Also, the faculty needs to specify clearly about the expected C proficiency at the very first class. Furthermore, students may be given a quiz (about 10-20 short questions) in C during the first week of the term so that each students can gauge his/her ability to cope with the projects.

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

COP 4710: No changes are recommended.

CAP 4770: During this assessment period, the course was taught only once, and the Instructor Course Appraisal as well as Summary of Assessment are not available. No changes are recommended at this stage.

COP 4604: The course appraisal for summer 2011 and the student evaluations for summer 2012 are missing. Available information indicates that no changes are warranted.

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 3420: 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 3420.

COP 4555: The two instructors found that the students are adequately prepared to enroll in this class. However, some students found difficult to handle some of the later assignments. Widespread plagiarism was found as a serious problem. To address this, one instructor suggested that the homework assignments should not be counted in grading, thereby discouraging copying.

COP 4534: This new course was offered only once during this assessment cycle (spring 2013) and no quantitative data is available (Valuation of the Outcomes and Adequacy of Coverage). Some students suggested that the course needs to be made harder and more theoretical homework assignments should be given. No changes are recommended.

Subject Area: Programming (SAC: Norman Pestaina)

COP 2210: There are no Course Outcomes Survey data available for this reporting period. The corrective action has been already initiated. SAC recommends that (1) the course outcomes survey must be re-implemented expeditiously, and (2) it might be useful to attempt a correlation between the ratings of the value of COP 2210 course outcomes and the students' written suggestions on the content of the course.

COP 3337: Classroom instruction for this course could be supplemented by providing resources such as closed labs or peer tutoring, or some other mechanism to provide students with additional opportunities for mastering the course outcomes. Furthermore, there may be a need to synchronize the outcomes of COP 2210 with the prerequisites of COP 3337 in order to afford students a smoother transition.

COP 3530: No changes are recommended.

COP 4338: The original course outcomes are still listed in the common syllabus for this course. The syllabus must be revised to reflect the revision of the course outcomes.

COP 4226: Instructors should evaluate the homework component of this course as the students expressed concern about the time required to complete the assignments.

COP 4520: The SAC feels that the scarcity of data, and the fact of having only a single offering of this course in the current Assessment Cycle, do not lend to a high degree of confidence in the analysis. Nonetheless, it may be worth considering whether the course prerequisites, COP 3530

and CDA 4101, provide adequate preparation; perhaps students taking this course lack sufficient (academic) maturity.

Subject Area: Software Engineering (SAC: Masoud Sadjadi)

CEN4010: The pre-test based on this course material given by an instructor to the Senior Project class showed that the students are under-prepared with respect to their theoretical and practical knowledge of Software Engineering. A majority of our students have learned how to hide behind their teammates in group projects and pass SE I on the shoulders of their friends. Therefore, I strongly suggest that each individual student becomes responsible to perform his/her share of the project and practice all the different software engineering activities by himself/herself.

The following suggestions are made for the instructors of this course.

- As the process of choosing projects by students becomes time consuming and it may not be easy for the instructor to understand all the details of all the projects, I suggest that one or more projects to be chosen and predefined by the instructor before the semester starts. Note that the total number of the functional requirements for all the chosen projects should be equal or greater than the number of students enrolled in the class.
- Each student should be randomly assigned to one (or more) specific functional requirement(s) of one of the chosen projects.
- Each student must be responsible to practice all the different software engineering activities using his/her assigned functional requirement(s).
- As the load for the software engineering activities are more than enough for a 3-credit course, and as project management is taught in SE II, the students should not be expected to manage their own projects too. The instructor of the course, or his/her TA(s), should assume that role and should make sure that all the students are on time with their tasks. Also, they should have alternative plans, in case some of the students fall behind or ahead of the schedule of the projects.
- To make sure that each individual student gains the required knowledge and knows how to use it in the assigned project, they all should be given an opportunity to present their assigned work as part of group presentations, after each milestone of the project has reached.
- To make sure that each individual student knows how to properly use UML diagrams, they should all be asked to use a UML tool that is approved by the industry and can verify their diagrams. The instructor should ask students to verify their diagrams before submitting their deliverables.
- To make sure that all students understand software engineering terms and can use them properly, the definition of such terms should be asked in the mid and/or final tests.

CEN 4021: The following recommendations are made by the SAC.

- As suggested by one of the instructors also, this course should be only focused on software project planning and management. Therefore, I suggest that we remove the software architecture topic from the syllabus of this course and cover it in details in SE I.

- This course needs to be more applied and become more practical. For this, I suggest that we offer this course during the same semester as SE I is offered so that the students from this class can become project managers of the SE I projects. To address the potential issues that may arise, I suggest that we do the following:

    - It would be best if the instructor for both SE I and SE II to be the same person. If this is not possible in a semester, then the two instructors from SE I and SE II should meet before the semester starts and plan on how to synchronize their assignments.
    - Students in SE II should only gather data from students in SE I and must NOT give direct feedback to the SE I students. Basically, SE II students do NOT actually manage the SE I projects. Instead, SE II student sprovide the data and outcome of their work to the instructors of SE II for their assignments to be evaluated and receive their grades. Also, they should provide their work to the instructor of SE I for his/her use to actually manage the projects. This should greatly help the SE I instructor with the project management task, giving incentive to allow SE II students to contact SE I students.
    - The number of students in SE II may be more than the number of projects in SE I; therefore, more than one student from SE II may be assigned to gather data from the same SE I project. To limit the number of times that SE I students may be interrupted by SE II students to gather project status data, the SE II students assigned to the same SE I project may work together to collect the data, but they must process the data independently to make sure that they learn all the project management activities through practice.

CEN 4072: The following recommendations are made.

- This course needs better software examples for students to practice different testing tools.
- Students in this course need the knowledge of software engineering activities.
- Based on the above two observations, I make the following suggestions:
    - SE I should become a pre-requisite for this course.
    - Students can use their own SE I projects as the example to practice different software testing tools.
    - When the software from SE I is not sufficient for practicing a software tool, the instructor should provide other software project examples from the past SE I projects done by other students.

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

- As this course has gone through major changes over the past two years, some students have rightfully been confused and at times frustrated with the lack of clear direction and clear expectation from this course.
- The pre-test taken in Fall 2013 has indicated that in general our senior project students are under prepared for what is expected of them in this course.
- A single semester is too short to finish a major project by groups of 2 to 5 students, especially, if the projects are not assigned at the very beginning of the semester.

- Students may hide behind their teammates and may pass the course without earning it.
- Many of the students taking this course do not have sufficient teamwork experience.
- Many of the students taking this course have not taken SE II and have no software project management experience.
- Projects do not seem to be diverse enough to cover all aspects of our curriculum and most projects are very software engineering centric.
- Based on the above observations, I make the following suggestions:
    - SE I should better prepare the students as suggested before.
    - The coordinator (another name for senior project's instructor) must reach out to the SCIS faculty members and SCIS industrial partners before the semester starts and ask for project suggestions. To make sure that the suggested projects are appropriate for the senior project course, the only metric should be whether the project is software intensive or not. In other words, whether the students assigned to this project would need to develop a significant software solution to solve a significant problem or not, as opposed to whether the project is a software engineering project or not.
    - We do have deliverable templates for Software Engineering and System Centric projects. For all the other possible project types, the coordinator should work with the mentor to come up with some appropriate project deliverable templates to be used by the assigned students.
    - Students should be assigned to the selected projects on the first week of the semester to get them started as early as possible.
    - The tentative schedule for the whole semester should be given on the first day of class and the expectation should be clearly explained.
    - The coordinator or his TA(s) should play the role of the project manager for the assigned projects, freeing the students to only worry about their project activities.
    - According to the timeline and milestones of the projects, every week (or every other week, depending on the size of the class), each individual student should get a chance to present a progress report as part of a group presentation.
    - The coordinator should give comments/feedback either verbally or in written form to each individual student with respect to his/her performance and the status of the project after students present their work or deliver their deliverables.
    - Teamwork should be emphasized as this may be the first time students work in a group setting.

B. Recommendations of the Assessments Coordinator

AC-01: As the Foundations Area Coordinator indicated, the number of responses to the MAD 2104 and MAD 3512 Course Outcomes Surveys are non-existent. 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.

AC-02: The format for teaching COP 2210 was changed in this assessment cycle. No data is available to gauge the efficacy of this change. The Course Outcomes and Instructor Appraisals must be available in the next cycle for this very important course.

AC-03: In the Course Embedded Assessment for MAD 2104 for this assessment cycle, only 18 out of 34 (52.9%) students demonstrated proficiency in Discrete Mathematics. This is way below the acceptable level. Also, the SAC recommendation for COT 3420 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.

AC-04: Course Embedded Assessment results for MAD 3512 are also very poor (only 23 out of 55 (41.8%) students demonstrated proficiency). 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-05: The Course Outcomes ratings (Table 1) for the Value and Adequacy of Coverage of COT 3420 is substantially better in this cycle as compared with the previous one (Value: 4.25 v/s 3.86, Coverage: 3.93 v/s 3.53). However, the Subject Area Coordinator's report clearly indicates that the Course Outcomes are not followed consistently by the various instructors of COT 3420. The content and delivery of this course must be clearly specified and followed by all instructors. Furthermore, as suggested by the AC in the previous report, it would not be untimely to consider alternative implementations of COT 3420 to include knowledge units from applied logic areas, for example artificial intelligence, knowledge-based reasoning, robotics, game playing, etc.

AC-06: 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-07: Very little new data is available from the Alumni Survey, 3 over the current assessment cycle. I believe that this Survey is useful, and hence, its administration needs to be streamlined better.

AC-08: It is important to have a consistent style of Course Embedded Assessments. When different instructors conduct this assessment, it is natural that their styles differ. 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.

AC-09: Now that we are on a 2-year assessments cycle, it is not necessary to perform the Course Embedded Assessment for each course more than once in any cycle. The Assessments Coordinator should consult the Associate Director to repeat it for a specific course based on salient conditions (number of students tested is very small, the results indicate that proficiency level of students is very low, and so on), and make an informed decision.

AC-10: The Subject Area Coordinator for Software Engineering has made substantial suggestions to improve the whole sequence of courses (CEN 4010, CEN 4021, and CIS 4911). The SCIS undergraduate Committee should discuss them seriously getting the SAC input directly in its deliberations, and then should decide if changes are warranted.

AC-11: I will reiterate here the request/recommendation made by the Faculty Advisor of UPE. "UPE continues to face several challenges including low levels of membership, and more recently, the UPE office space was reallocated for use by the SCIS undergraduate advisors. SCIS is expected to get additional office space during the 2104-2015 academic year and we expect that SCIS will return the office space to UPE for use by its members."

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 (4.39/5, 87.8%, Table 1). Evaluations of attainment of its Student Outcomes (90.0%, Table 3) and Program Educational Objectives (77.25%, 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 introduced a capstone experience in the Senior Project course in the last assessment cycle. That is working very well as indicated by the students (Value of Outcome 4.58/5, 91.6%) and showed in the measurements using the rubrics for that course. The Software Development track introduced instruction in software testing techniques (CEN 4072) in the last cycle, and continues to improve our offerings. The program assessment processes are continually being strengthened by introduction and fine-tuning of more direct assessment strategies, e.g., instructors of COP 3337 and COP 3530 are evaluating Student Learning of various topics by separate Course Embedded Assessments.

The ACM, WICS, STARS, and UPE chapters have become very active (Appendix H) and continue expanding their sphere of influence among participating members. It is noteworthy that our industry partner Ultimate Software offers 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 its support of Programming Teams. WICS has been working with the other groups.

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 report is the first biennial assessment report, and includes the introduction of many new features to our BS in CS program. Data for some of the new features are not available, and hence, they will be better evaluated in the subsequent report.