Spring 2011 **Summary of Direct Measure Assessment Data for the BS in Computer Science**

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BS in CS Student Outcomes (Revised Fall 2010)

To complete the program of study for the BS in Computer Science, every student will

a) Demonstrate proficiency in the foundation areas of Computer Science including mathematics, discrete structures, logic and the theory of algorithms.
b) Demonstrate proficiency in various areas of Computer Science including data structures and algorithms, concepts of programming languages and computer systems.
c) Demonstrate proficiency in problem solving and application of software engineering techniques.
d) Demonstrate mastery of at least one modern programming language and proficiency in at least one other.
e) Demonstrate understanding of the social and ethical concerns of the practicing computer scientist.
f) Demonstrate the ability to work cooperatively in teams.
g) Demonstrate effective communication skills.
h) Have experience with contemporary environments and tools necessary for the practice of computing.

In accordance with the SCIS Assessment Plan for the BS in Computer Science, direct measures of attainment of Student Outcomes were performed as follows:

1. Course-embedded Assessment of BS in CS Student Outcome (a) (Foundations area) in MAD 3512 Theory of Algorithms.
2. Course-embedded Assessment of BS in CS Student Outcome (b) (Computer Science core) in COP 4540 Database Management.
3. Course-embedded Assessment of BS in CS Student Outcome (b) (Computer Science core) in COP 3530 Data Structures.
4. Assessment of all BS in CS Student Outcomes, (a) through (h), via observation of the five Senior Projects presented in Spring 2011.

The data obtained via these direct measures are summarized here. The following documents are referenced in this summary. The raw data are available from the assessments data page: http://users.cs.fiu.edu/~pestaina/cis4911.html#spring2011

- Email communication of the MAD 3512 data from Dr. Dev Roy
- COP 4540 Embedded Assessment Report prepared by Dr. Shu-Ching Chen
- COP 3530 Results of Assessment Quiz prepared by Dr. Jai Navlakha
- Mapping of COP 3530 quiz questions to course outcomes (Appendix A)
- Spring 2011 Rubric for assessing BS-CS Student Outcomes in Senior Projects (Appendix B)

For reasons of confidentiality, the MAD 3512 and COP 3530 quizzes are not included. These may be made available for inspection as needed.

Embedded Assessment of BS-CS Student Outcome (a) in MAD 3512 Theory of Algorithms

Course Outcomes:

1. Be familiar with formal languages
2. Master finite state machines
3. Master Turing machines
4. Be familiar with primitive recursive and recursive functions
5. Be exposed to recursive unsolvability

12 students enrolled in MAD3512 completed a 5-question multiple choice assessment quiz. Because of a typographical error in one of the questions, the results from only 4 of the questions are considered. The results are summarized as follows:

Correct Answers	# of Students	Cumulative %	
4 = 100%	6	50	(6 / 12)
3 = 75%	3	75	(9 /12)
2 = 50%	2	92	(11/12)
1 or 0	1	100	

MAD 3512 TABLE 1: Number of Correct Answers by Number of Students

Expectation:

75% of students completing the assessment quiz should score 3/4 or higher.

Observation:

Exactly 75% of students completing the assessment quiz scored 3/4 or higher.

Discussion:

The MAD 3512 Instructor indicated that the same quiz was given in both Spring 2011 and Fall 2010. Because of the small number of students (4) completing the quiz in Fall 2010, no conclusions were drawn from student performance in Fall 2010. Nonetheless, a cursory comparison of the scores in these two semesters suggests a significantly improved indication in the current data for Spring 2011.

The MAD 3512 instructor's summary does not permit a question-specific analysis. This would have been helpful to allow course outcome analysis with a view to identifying where improvement is needed.

Embedded Assessment of BS-CS Student Outcome (b) in COP 4540 Database Management

Course Outcomes

1. Be exposed to information systems
2. Be familiar with database system and database architecture
3. Master the design conceptual schemas
4. Master normalization theory and the mapping of a conceptual schema to a relational schema
5. Master the expression of queries in SQL, relational algebra, and relational calculus
6. Be familiar with physical database design
7. Be familiar with writing application programs that use SQL

13 students enrolled in COP 4540 completed a 5-question multiple choice assessment quiz. The quiz and scores are attached. The results may be summarized as follows:

Correct Answers	# of Students	Cumulative %
5 = 100%	5	38 (5 / 13)
4 = 80%	7	92 (12 / 13)
3 = 60%	1	100

COP 4540 TABLE 1: Number of Correct Answers by Number of Students

Expectation:
75% of students completing the quiz should answer 4 or 5 questions correctly..

Observation:
92% of students answered either 4 or 5 quiz questions correctly.

Discussion:
The following table summarizes the COP 4540 quiz results by individual question and shows a mapping of quiz questions to course outcomes:

Question #	**1**	**2**	**3**	**4**	**5**
# of Correct Answers (of 13)	*13*	*13*	*12*	*7*	*11*
% of Answers Correct	*100*	*100*	*92*	*54*	*85*
Course Outcomes mapped	1,2	3,4,6	5	5	7

COP 4540 TABLE 2: Number of Correct Answers to each Question

With the exception of one facet of Course Outcome 5, there is evidence of high student attainment of all COP 4540 course outcomes. The course instructor's report includes an observation relevant to this that may be considered by the Systems Subject Area Coordinator.

Embedded Assessment of Outcome (b) in COP3530 Data Structures

25 students enrolled in COP 3530 completed a 10-question multiple choice assessment quiz. The quiz and scores are attached. The results may be summarized as follows:

# of Correct Answers	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**
# of Students	*0*	*2*	*1*	*6*	*7*	*4*	*3*	*2*
Cumulative # of Students	*0*	*2*	*3*	*9*	*16*	*20*	*23*	*25*

COP 3530 TABLE 1: Number of Correct Answers by Number of Students

Expectation:

75% of students completing the assessment quiz should answer 7 or more questions correctly.

Observation:

9 of 25 students (36%) answered 7 or more of 10 questions correctly;
16 of 25 students (64%) answered 6 or more of 10 questions correctly.
20 of 25 students (80%) answered 5 or more of 10 questions correctly

Discussion:

The following table summarizes the COP 3530 quiz results by individual question and shows a mapping of quiz questions to course outcomes:

Question #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
# of Correct Answers	*15*	*13*	*15*	*11*	*22*	*21*	*22*	*6*	*13*	*10*
% of Answers Correct	*60*	*52*	*60*	*44*	*88*	*84*	*88*	*24*	*52*	*40*
Course Outcomes mapped	*1, 4*	*1*	*1*	*2, 3*	*4*	*3*	*3, 4*	*6*	*1, 5*	*1, 5*

COP 3530 TABLE 2: Number of Correct Answers to each Question

Of the 10 questions, 3 questions (#'s 5, 6 and 7) were answered correctly by at least 80% of the students and only a further 2 questions (#'s 1 and 3) were answered correctly by at least 50% of the students. Put together, only about half of the quiz questions were answered correctly by at least half of the students taking the quiz. Fully half of the quiz questions (#'s 2, 4, 8, 9 and 10) were answered incorrectly by more than about half of the students.

There are clearly some indicators here that should be addressed by the Subject Area Coordinator and/or faculty who teach COP 3530.

Assessment via Senior Project

5 projects were observed for the purpose of obtaining ratings of attainment of BS-CS outcomes by at least 2 faculty members. The ratings are on a scale of 1 .. 5, or 0 if the project provided insufficient evidence about a particular outcome. A mediation rating was obtained when the initial ratings differed by more than 1 point. The scoring rubric followed by the raters is attached. The project ratings are summarized in the following table. The mediation ratings (if any) are in **bold**.

	Outcome (a)	Outcome (b)	Outcome (c)	Outcome (d)	Outcome (e)	Outcome (f)	Outcome (g)	Outcome (h)
Project 1	3	5	5	5	3	5	5	5
WResTT	4	5	5	5	3	5	5	5
Project 2	3	5	5	5	5	5	5	5
P-Care-2	3	1	5	5	5	5	5	5
(M)	**3**	**3**	**5**	**5**	**5**	**5**	**5**	**5**
Project 3	3	5	5	5	5	5	5	5
P-NEXUS	5	5	5	5	5	5	5	4
(M)	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**4**
Project 4	0	2	5	4	4	5	5	5
Geon-DB	3	5	5	5	5	5	5	5
(M)	**1**	**2**	**5**	**4**	**4**	**5**	**5**	**5**
Project 5	5	5	5	4	4	5	5	5
Data Vis	3	4	5	4	2	5	5	5
(M)	**4**	**4**	**5**	**4**	**4**	**5**	**5**	**5**
	Outcome (a)	**Outcome (b)**	**Outcome (c)**	**Outcome (d)**	**Outcome (e)**	**Outcome (f)**	**Outcome (g)**	**Outcome (h)**
Mean	***3.30***	***3.80***	***5.00***	***4.60***	***4.20***	***5.00***	***5.00***	***4.80***

The means expressed in the final row of the table are averaged over the five project outcome ratings, using either the mediated rating or the average of the 2 un-mediated ratings.

Reliability: Prior to mediation, all 5 projects were each rated across all 8 student outcomes by 2 raters. The consistency of the un-mediated outcome attainment ratings is summarized in the following table.

Identical Ratings	Ratings differing by 1	Ratings differing by 2+
29/40	5/40	6/40
72.5%	12.5%	15%

85% of the paired ratings are either identical or differ by 1. Of these 34 paired ratings, 5 differ by 1 and 29 are identical. Of the remaining 6 divergent paired ratings, 3 pairs differ by exactly 2 rating points and another 3 pairs differ by more than 2 (including one pair where a rater judged the project to provide insufficient evidence about an outcome (a)). It is noted that the previous Fall 2010 summary reported a similar 82.5%-17.5% split between paired ratings differing by fewer than 2 points or differing by 2+ points. **Then however, only 45% of paired ratings were identical, compared with 72.5% in Spring 2011**. The scoring rubric was refined prior to the Spring 2011 application. There is still room for improvement.

The following standard is applied to all BS-BC Student Outcome ratings via the Senior Project.
Expectation: Attainment of all outcomes should be **75% or 3.75** on a 1—5 scale, or better.

- Outcome (a): *Demonstrate proficiency in the foundation areas of Computer Science…* ***3.30***

Observation: 3 of 14 raters scored attainment of outcome (a) as *excellent (5)*, and 2 scored it as *very good (4)*; 7 raters scored it as *good (3)*; 1 raters scored attainment as *poor (1)*. 1 rater of project 4 thought that attainment of outcome (a) was not demonstrated in that project.

- Outcome (b): *Demonstrate proficiency in various areas of Computer Science…* ***3.80***

Observation: 8 of 14 raters scored attainment of outcome (b) as *excellent (5)* and 2 scored it as *very good (4)*; 1 rater scored it as *good (3)*; 2 raters scored it as *fair (2)*; 1 rater scored it as *poor (1)*.

- Outcome (e): *Demonstrate understanding of the social and ethical concerns …* ***4.20***

Observation: 7 of 14 raters scored attainment of outcome (e) as *excellent (5)* , 4 raters scored it as *very good (4)*, and 2 rater scored it as *good (3)*; Only project 5 received a *fair (2)* score by 1 rater.

- Outcome (c): *Demonstrate proficiency in problem solving and application of software engineering…****5.00***
- Outcome (d): *Demonstrate mastery of at least one modern programming language…* ***4.60***
- Outcome (f): *Demonstrate the ability to work cooperatively in teams…* ***5.00***
- Outcome (g): *Demonstrate effective communication skills…* ***5.00***
- Outcome (h): *Have experience with contemporary environments and tools…* ***4.80***

Observation: Attainment of outcomes (c), (d), (f), (g) and (h) as demonstrated in the Senior Projects is uniformly rated as *excellent (5)* or *very good (4)* across all five projects.

Appendix A

COP 3530 Outcomes Mapping

COP 3530	O1 Analysis	O2 Recursion	O3 Linked Struc	O4 Adv. DS	O5 Sorting	O6 Graph Alg.	O7 API
Q1	1			1			
Q2	2						
Q3	3						
Q4		4	4				
Q5				5			
Q6			6				
Q7			7	7			
Q8						8	
Q9	9				9		
Q10	10				10		

Appendix B

Rubric (Spring 2011)

Senior Project

Assessment of Student Outcomes of the BS in Computer Science of the School of Computing and Information Sciences Florida International University

The School of Computing and Information Sciences evaluates the Senior Projects of its graduating seniors for the purpose of assessing the level of attainment of the Student Outcomes of the BS in Computer Science program.

Your responses to this survey will be used solely for the purpose of assessing the Student Outcomes of the BS in Computer Science program of the School of Computing and Information Sciences at FIU. This survey is expressly NOT for assessment of student performance in the SCIS Senior Project course for assignment of letter grade, nor for assessment of the instructor(s).

Rating Instructions

For each program outcome, you are provided with a check-list of 7 or more criteria that evidence attainment of that outcome. Please check all criteria that are presented in this project. You may include additional criteria that are not explicitly listed; if so, please record the additional criteria in the spaces provided. Unless noted otherwise, the number of criteria checked, up to a maximum of 5, should be recorded as your rating of attainment of that outcome evidenced in the project.

Project Title _____

Semester & Year _____

Faculty / Industry Sponsor: _____

Evaluators: _____

_____

_____

Student Outcome *(a)*: *Demonstrate proficiency in the foundation areas of Computer Science including mathematics, discrete structures, logic and the theory of algorithms*

____ Project incorporates elements of mathematical reasoning or proof
(**e.g.** Lemma, Theorem, Propositional Logic, First Order Logic, Mathematical Induction)

____ Project utilizes elements of discrete mathematics
(**e.g.** Set Theory, Boolean Algebras, Combinatorics, Graph Theory)

____ Project utilizes some statistical procedure(s) to represent or summarize test data
(**e.g.** Mean, Standard Deviation, Stem Plot/Histogram, Box Plot/Percentile-Graph)

____ Project utilizes some statistical measure(s) of system behavior or performance
(**e.g.** Probability Distributions, Confidence Intervals, Hypothesis Testing)

____ Project design utilizes finite state diagrams to model system behavior

____ Project utilizes some aspect(s) of formal computer science
(**e.g.** Automata, Turing Machines, Recursive Function Theory, Recursive Unsolvability)

____ Project utilizes some technique(s) of numerical analysis
(**e.g.**Error Estimation, Interpolation, Numerical Calculus, Linear Systems, Matrix Algebra)

____ OTHER: _____

____ OTHER: _____

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

Data Structures & Algorithms

____ Project utilizes an advanced data structure, (**e.g.** search tree, hash table, priority queue)

____ Project utilizes some graph algorithm, (**e.g.** shortest path, minimum spanning tree)

____ Project documents runtime analysis of selected algorithms

Concepts of Programming Languages

____ Project utilizes knowledge of programming language syntax
(**e.g.** Context-Free Grammars, Parse Trees, Ambiguity, Recursive Descent)

____ Project utilizes knowledge of programming language semantics
(**e.g.** Natural Semantics, Interpreters, Expressions, L- and R- Value, Environments)

____ Project demonstrates familiarity with programming language design issues
(**e.g.** Scoping Rules, Dynamic Type Checking, Static Type Checking)

Computer Systems (Database)

____ Project utilizes or designs an appropriate database management system

____ Project utilizes conceptual and/or relational schema

____ Project utilizes a database query language such as SQL

Computer Systems (Operating Systems)

____ Project implementation utilizes knowledge of memory management

____ Project implementation utilizes knowledge of process synchronization

____ Project documents analysis of tradeoffs in selection of system characteristics

____ OTHER: _____

____ OTHER: _____

Student Outcome *(c)*: *Demonstrate proficiency in problem solving and application of software engineering techniques.*

____ Project demonstrates knowledge of the Software Development Life Cycle

____ Project deliverables include Project Specification

____ Project deliverables include Feasibility Study and/or Project Plan

____ Project deliverables include Requirements Documentation

____ Project deliverables include Design Documentation

____ Project documents testing and/or evaluation of the implementation

____ Project incorporates system walkthroughs

____ OTHER: _____

____ OTHER: _____

Student Outcome (d): *Demonstrate mastery of at least one modern programming language and proficiency in at least one other.*

____ Project is implemented using an appropriate high level language

____ Project implementation is reasonably efficient rather than “brute force”

____ Project implementation is modular and/or re-usable

____ Project implementation uses a modern API or Tool-Kit

____ Project implementation utilizes recursion

____ Project implementation utilizes some advanced features, e.g. polymorphism

____ A project sub-system or module utilizes an appropriate programming language other than the primary implementation language, e.g. SQL, ML, assembly language

____ OTHER: _____

____ OTHER: _____

Student Outcome *(e)*: *Demonstrate understanding of the social and ethical concerns of the practicing computer scientist*

____ Project documents sources and references

____ Project identifies and addresses any relevant social issues

____ Project identifies and addresses any relevant ethical issues

____ Project identifies and addresses relevant legal issues

____ Project identifies and addresses any relevant privacy issues

____ Project documents anticipated impact on users/clients

____ Project documents and addresses any anticipated technology impact issues

____ OTHER: _____

____ OTHER: _____

Student Outcome (f): *Demonstrate the ability to work cooperatively in teams*

____ Project completion evidences equitable participation by team members

____ Project presentation(s) included all team members

____ Project team activity is documented

____ Project team set out and followed a schedule for timely completion

____ Project team negotiated consensus when needed

____ Team members roles were clearly defined and executed

____ Team members shared responsibility for success and failure

____ OTHER: _____

____ OTHER: _____

Program Outcome *(g)*: *Demonstrate effective communication skills*

____ Presentations described the essential features of the project

____ Presentations utilized good quality slides and presentation aids

____ Presenters utilized their time effectively

____ Presenters spoke directly to the audience

____ Technical features were communicated clearly

____ Project artifacts clearly document all project features

____ Project reports are well organized and written

____ OTHER: _____

____ OTHER: _____

Program Outcome (j): *Have experience with contemporary environments and tools necessary for the practice of computing*

____ Project utilized contemporary design tools

____ Project implementation utilized a modern IDE(s)

____ Project utilized appropriate validation/testing tools

____ Project was demonstrated using appropriate presentation tools

____ Project utilized appropriate project management tools (e.g., MS Project)

____ Project utilizes appropriate version control/document sharing tools

____ Project documents consideration of trade-offs in selection of tools

____ OTHER: _____

____ OTHER: _____

ABET Student Outcome

The program must enable students to attain, by the time of graduation:
(j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices. [CS]

Please comment on how this project "*demonstrates comprehension of the tradeoffs involved in design choices"*: