Fall 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 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 2104 Discrete Mathematics.
2. Course-embedded Assessment of BS in CS Student Outcome (b) (Computer Science core) in COP 4555 Principles of Programming Languages.
3. Course-embedded Assessment of BS in CS Student Outcome (b) (Computer Science core) in COP 4710 Database Management.
4. Assessment of all BS in CS Student Outcomes, (a) through (h), via observation of six Senior Projects presented in Fall 2011.

The data obtained via these direct measures are summarized here. The following documents are referenced in this summary, and may be viewed at:
http://users.cs.fiu.edu/~pestaina/cis4911.html#fall2011

1. MAD 2104 Results of application of the Discrete Structures assessment rubric to the final exam of 1 section of MAD 2104, applied by Dr. Sue Gorman.
2. COP 4555 Results of Assessment Quiz prepared by Dr. Xudong He.
3. COP 4710 Embedded Assessment Report prepared by Dr. Shu-Ching Chen
4. Fall 2011 Rubric for assessing BS-CS Student Outcomes in Senior Projects

For reasons of confidentiality, the MAD 2104 final exams, and COP 4555 quiz are not included here.

Embedded Assessment of Outcome (a) in MAD 2104 Discrete Mathematics

The final examination responses in one section of MAD 2104 were analyzed by applying the *Discrete Structures Assessment* rubric. Ratings of the exams of the 7 Computer Science majors in this section who passed the course (C or higher grade) are summarized:

Rubric Score	# of Students	Cumulative %
16 = 100%	1	14 (1 / 7)
15 = 93.75%	2	43 (3 / 7)
14 = 87.5%	1	57 (4 / 7)
13 = 81.25%	1	71 (5 / 7)
12 = 75%	1	86 (6 / 7)
8 = 50%	1	100

TABLE MAD 2104-1: Rubric Score by Number of Students

	Scored Rating of 1	
Discrete Structures Rubric Item	**#**	**%**
Understand Terminology of SETS	6	85.71
Write SET Theory Proof	5	71.43
Understand Terminology of RELATIONS	7	100.0
Perform Operations on RELATIONS	7	100.0
Understand Terminology of FUNCTIONS	5	71.43
Perform Operations on FUNCTIONS	5	71.43
Understand Notation of LOGIC	7	100.0
Apply Methods of LOGIC	6	85.71
Know Structure of PROOFS	6	85.71
Apply MATHEMATICAL INDUCTION	4	57.14
Compute PERMUTATIONS	7	100.0
Compute COMBINATIONS	7	100.0
Know Terminology of GRAPHS	6	85.71
Apply Methods of GRAPHS	4	57.41
Use Disjunctive Normal Form in BOOLEAN ALGEBRA	6	58.71
Apply Minimization Techniques in BOOLEAN ALGEBRA	5	71.43

TABLE MAD 2104-2: Rubric Scores by Rubric Item

Expectation:

a. 75% of students completing the exam should achieve a rating of at least 75% (12/16) on the rubric.
b. Each of the 16 rubric items should be scored 1 on at least 70% (5/7) of sampled exams.

Observation:

86% of sampled exams achieved a rating of 75% or higher. 14 of the 16 rubric items were scored at 1 for at least 70% of the sample. The remaining 2 items were scored at 1 on 57% of the sample.

Discussion:

The rubric items with the fewest 1-ratings, proof by induction and graph manipulation, correspond to areas that students have traditionally found more difficult. The results are encouraging.

Embedded Assessment of BS-CS Student Outcome (b) in COP 4555 Principles of Programming Languages

Course Outcomes

1. Master programming a functional language, such as Standard ML
2. Master programming with recursion
3. Be familiar with the use of context-free grammars to specify programming language syntax and with recursive descent parsing
4. Be familiar with natural semantics for imperative and functional programming languages and their use in building interpreters
5. Be familiar with polymorphic type systems and type inference
6. Be familiar with issues in the design and implementation of programming languages, such as lexical versus dynamic scoping and static versus dynamic type checking

15 students enrolled in COP 4555 completed a 10-question multiple choice assessment quiz:

Correct Answers	# of Students	Cumulative %
7= 70%	1	7 (1 / 15)
6 = 60%	9	67 (10 /15)
5 = 50%	2	80 (12/15)
4 or 2	3	100

TABLE COP 4555-1: Number of Correct Answers by Number of Students

Question#	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Outcomes	**5**	**5**	**5**	**6**	**(1, 2) 6**	**(1), 6**	**(1), 4**	**3**	**5**	**(2), 6**
# Correct	6/15	4/15	8/15	10/15	6/15	3/15	11/15	9/15	10/15	14/15
%Correct	40.0	26.7	53.3	66.7	40.0	20.0	73.3	60.0	66.7	93.3

TABLE COP 4555-2: Number of Correct Answers by Quiz-Question & Course Outcomes

Expectation:

a. 75% of students completing the assessment quiz should score 70% (7/10) or higher.
b. Each quiz question should be answered correctly by 75% of students completing the quiz.

Observation:

Only 1 of 15 students scored at an acceptable level of 70%. Further, only 2 of 10 questions (#7 and #10) were answered correctly by the expected number of students.

Discussion:

1) These results are in marked contrast to the results of a similar assessment in Fall 2010 when 63% of students attained a score of at least 7/10 (70%). **The subject area coordinator should determine to what extent the quizzes are comparable, and whether corrective action is indicated.**
2) There is a strong indication here for *standardization* of the COP 4555 assessment instrument to permit consistent interpretation of results across multiple applications.
3) A more focused assessment will be possible when the assessment quiz is designed around the fine-grained learning outcomes of COP 4555.

Embedded Assessment of BS-CS Student Outcome (b) in COP 4710 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

15 students enrolled in COP 4710 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%	2	13 (2 / 15)
4 = 80%	8	67 (10 / 15)
3 = 60%	5	100

TABLE COP 4710 -1: Number of Correct Answers by Number of Students

Question#	**1**	**2**	**3**	**4**	**5**
Outcomes	**1, 2**	**3, 6**	**5**	**7**	**4**
# Correct	11/15	14/15	14/15	7/15	11/15
%Correct	73.3	93.3	93.3	46.7	73.3

TABLE COP 4710-2: Number of Correct Answers by Quiz-Question & Course Outcomes

Expectation:

a. 75% of students completing the assessment quiz should score 70% (7/10) or higher.
b. Each quiz question should be answered correctly by 75% of students completing the quiz.

Observation:

67% of students answered either 4 or 5 quiz questions correctly. All questions except question #4 were answered correctly by more than 73% of students taking the quiz. Question #4 was answered correctly at a contrastingly low rate.

Discussion:

1) The subject area coordinator should be made aware of the low attainment of outcome 7 indicated by question 4, and may consider whether corrective action is indicated.
2) A more focused assessment will be possible when the assessment quiz is designed around the fine-grained learning outcomes of COP 4710.

Assessment via CIS 4911 Senior Project

Each of the 6 projects was 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.

	Outcome (a)	Outcome (b)	Outcome (c)	Outcome (d)	Outcome (e)	Outcome (f)	Outcome (g)	Outcome (h)
Project 1	1	5	5	5	1	4	5	5
Chamber Link	1	5	5	5	3	4	5	5
(M)					**3**			
Project 2	1	5	5	5	2	5	5	5
Mobile PP	1	5	5	4	2	5	5	5
Project 3	4	5	5	5	4	5	5	5
vMoodle	1	4	5	4	2	5	5	5
(M)	**1**	**4**	**5**	**5**	**2**	**5**	**5**	**5**
Project 4	1	4	5	5	2	5	5	5
NLP Visual.	0	5	5	4	2	5	5	5
Project 5	0	5	5	4	4	5	5	5
PseudoNexus	1	5	5	5	4	5	5	5
Project 6	2	4	5	5	2	5	5	5
Vis. Design	3	3	5	4	2	5	5	5
	Outcome (a)	Outcome (b)	Outcome (c)	Outcome (d)	Outcome (e)	Outcome (f)	Outcome (g)	Outcome (h)
Mean	***1.08***	***4.50***	***5.00***	***4.67***	***2.50***	***4.83***	***5.00***	***5.00***

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

TABLE CIS 4911-1: Summary of Student Outcome ratings in Senior Project

Reliability: Prior to mediation, all 6 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+
34/48	11/48	3/48
70.08%	25%	6.25%

TABLE CIS 4911-2: Consistency of Student Outcome ratings in Senior Project

93.75% of the paired ratings are either identical or differ by 1. This compares with 85% in both Fall 2010 and Spring 2011. The scoring rubric was refined prior to the Spring 2011 application, with improvement to 72.5% identical ratings, compared to 45% in Fall 2010. Again refined prior to this application, the number of identical ratings, 68.75%, is comparable, while the number of ratings that differ by no more than 1, 93.75%, represents a significant improvement over the 85% of previous applications. This represents good consistency, and should be sustainable when the rubric is applied conscientiously.

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…* ***1.08***

Observation: This exceedingly low rating excludes 0 (n/a) scores. The preponderance of 0 and 1 ratings suggests that this aspect of the CS curriculum is not being adequately reflected in senior projects. The 1 scores are almost uniformly for modeling using state transition diagrams.

- Outcome (b): *Demonstrate proficiency in various areas of Computer Science…* ***4.50***

Observation: 15 of 16 raters scored attainment of outcome (b) as *excellent (5)* or *very good (4)*; only 1 rater scored it as *good (3)*, and none as fair or poor.

- Outcome (e): *Demonstrate understanding of the social and ethical concerns …* ***2.50***

Observation: Only 3 of 16 raters scored attainment of outcome (e) as *very good (4)*, and 1 as good (3). 7 raters scored attainment of this outcome as fair (2), and 1 rater scored it as *poor (1)*;

- Outcome (c): *Demonstrate proficiency in problem solving and application of software engineering techniques…****5.00***
- Outcome (d): *Demonstrate mastery of at least one modern programming language…* ***4.67***
- Outcome (f): *Demonstrate the ability to work cooperatively in teams…* ***4.83***
- Outcome (g): *Demonstrate effective communication skills…* ***5.00***
- Outcome (h): *Have experience with contemporary environments and tools…* ***5.00***

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