Computer Engineering Technology
2007-08 Assessment Report

I. Introduction

In 1965, OIT was invited to join a Technical Education consortium sponsored by a number of major computer manufacturers. In response, OIT developed an Electro-Mechanical Engineering Technology program. This program was based on a mix of existing EET, MET, Math and other support courses. The name of the program was changed to Computer Systems Engineering Technology in 1973 in order to better represent the course material and capabilities of graduates. Course offerings were expanded, refined and renumbered using CST prefixes to reflect their computer systems content. Since that time, the program has continued to evolve in order to track new developments in the field and keep graduates current. As of fall 2007, there were 109 students in the program, which is located on the Klamath Falls campus.

II. Summary of program mission, educational objectives and student learning outcomes

The program faculty met during the 2007 fall convocation and reviewed the program mission statement, objectives, and outcomes for the CET bachelor's and associate's programs. We made several minor, mainly editorial changes to the objectives and outcomes. The amended program mission and objectives and outcomes for both programs are listed below.

Mission

The mission of the Computer Engineering Technology (CET) Degree program in the Computer Systems Engineering Technology (CSET) Department at Oregon Institute of Technology is to provide an excellent education incorporating industry-relevant, applied laboratory based design and analysis to our students. The program is to serve a constituency consisting of its students, high-technology industry, and the citizens of Oregon. Major components of the CET program's mission in the CSET Department are to:

I. educate computer engineering technology students to meet current and future industrial challenges,

II. promote a sense of scholarship, leadership, and professional service among our graduates,

III. enable our students to create, develop, and disseminate knowledge for the applied engineering environment,

IV. expose our students to cross-disciplinary educational programs, and provide high tech industry employers with graduates in the computer engineering technology profession, a profession which is increasingly being driven by advances in technology.

CET Bachelor of Science Program Educational Objectives

A. Graduates of the Computer Engineering Technology (CET) bachelor's degree program will possess the ability to analyze, test, and solve hardware and software computer engineering problems, using the basic principles of physics, mathematics and applied engineering. They will be able to use modern engineering techniques, skills, and tools, particularly recognizing the role that computers play in applied engineering. They will be able to identify, formulate, and solve computer engineering problems that are subject to realistic constraints. (Mission I & III)

B. Graduates of the CET bachelor's degree program will be able to apply the knowledge and skills from their education in order to understand the impact of computer engineering and technological solutions in an environment consistent with the principles of applied engineering design and development. (Mission I & III)

C. Graduates of the concurrent degree program will be technically competent with aspects of software technologies and electronics as appropriate to the discipline within each student's technical interests, and professional goals. They will have the ability to apply undergraduate fundamentals in all discipline areas within the field and be able to apply the results to software/hardware/electronic co-design. (Mission I & II & V)

D. Graduates of the CET bachelor's will have developed a broad base of skills preparing them for professional practice as engineering technologists. They will practice with ethical and professional responsibility; recognize the need for, and have the ability to engage in, continual learning pertaining to advances in technology; and have the ability to function and communicate effectively, both individually and within teams. (Mission I & V)

CET Bachelor of Science Program Student Learning Outcomes

Graduates of the CET Bachelor's degree program are expected to be able to demonstrate:

(1) an ability to identify, formulate, and solve computer engineering technology problems, including the specification, design, implementation, and operation of systems and components, that meet performance, and quality requirements in a timely manner (Objective A, B, & C) ;

(2) an ability to design, conduct, and interpret experiments including applying the results to verify the system (Objective A & D);

(3) an ability to function effectively on teams (Objective D);

(4) an understanding of professional, ethical and social responsibility (Objective D);

(5) a recognition of the need for, and an ability to engage in, life-long learning (Objective D).

(6) the ability to apply mathematics including differential and integral calculus, probability, and discrete mathematics to hardware and software problems (Objective A);

(7) mastery of the techniques skills, and computer topics appropriate to the degree program, with depth in at least two sub disciplines (microprocessors, ASICs, software, computer architecture) of the computer engineering technology program (Objective A, B, & C);

(8) an ability to use applied engineering tools, techniques, and skills including computer-based tools for design, analysis and simulation (Objective A);

(9) an ability to design, fabricate and test systems containing hardware and software components; as well as to analyze and interpret test results in order to improve the system (Objective A, B&C);

(10) an ability to convey technical material through oral presentation and interaction with an audience (Objective D);

(11) an ability to convey technical material through written reports which satisfy accepted standards for writing style (Objective D);

(12) an ability to improve system design with regard to quality and project management (Objective D).

CET Associate Degree Program Educational Objectives

The CET Associate Degree is intended to serve a number of purposes. It provides primarily a way for students obtaining a Bachelor degree in Software (or other related degrees) to add breadth to their education. It also allows students who run into unforeseen events that prevent them from obtaining a CET Bachelor degree the option of obtaining an Associate. It also provides an educational option preparing students for employment as technicians. According to current statistics, one third of students who obtain the CET Associate degree also obtain a Bachelor degree in a related discipline.

A. Graduates of the Computer Engineering Technology (CET) associate degree program will possess the ability to test hardware, and solve software problems, using the basic principles of electronics, physics, mathematics and applied engineering. They will be able to use modern techniques, skills, and tools. (Mission I & III)

B. Graduates of the CET associate degree program will be able to apply the knowledge and skills from their education in order to understand the role of computer and technological solutions in an industrial environment. (Mission I & III)

C. Graduates of associate degree program will be technically competent with aspects of software technologies and electronics as appropriate to the discipline within each student’s technical interests. (Mission I & II & V)

D. Graduates of the CET associate degree program will have developed a broad base of skills preparing them to be able to pursue professional practice as computer technicians. They will practice ethically and responsibly; recognize the need for, and have the ability to engage in, continual learning as pertaining to advances in technology; and have the ability to function and communicate effectively, both individually and within teams. (Mission I & V)

E. Graduates of the CET associate degree program who have done so in conjunction with obtaining an SET bachelor degree will have developed a broadened appreciation of hardware functionality and its limitations enabling them to be able to use and directly interface with hardware. (Mission I & V)

CET Associate Degree Student Learning Outcomes

Graduates of the CET Associate degree program are expected to be able to demonstrate:

(1) an ability to identify, formulate, and solve computer engineering technology problems, including the test, implementation, and operation of systems and components, that meet performance and quality requirements in a timely manner (Objective A, B, & C) ;

(2) an ability to design, conduct, and interpret experiments including applying the results to verify a system (Objective A, D & E);

(3) an ability to function effectively on teams (Objective D);

(4) an understanding of professional, ethical and social responsibility (Objective D);

(5) a recognition of the need for, and an ability to engage in, life-long learning (Objective D).

(6) the ability to apply mathematics including differential and integral calculus and discrete mathematics to hardware and software problems (Objective A&E);

(7) an ability to use applied engineering tools, techniques, and skills including computer-based tools for analysis, simulation, and testing (Objective A&E);

(8) an ability to fabricate and test engineering systems containing hardware and software components (Objective A, C&E);

(9) an ability to convey technical material through oral presentation and interaction with an audience (Objective D);

(10) an ability to convey technical material through written reports which satisfy accepted standards for writing style (Objective D);

The following matrices give the set of objectives to be assessed in each year for each program.

CET BS Program Assessment Plan – Fall 2007

Learning Outcome	2007-08	2008-09	2009-10	2010-11	2011-12	20012-13
(1) an ability to identify, formulate, and solve computer engineering technology problems, including the specification, design, implementation, and operation of systems and components, that meet performance, and quality requirements in a timely manner;	•			•		
(2) an ability to design, conduct, and interpret experiments including applying the results to verify the system;		•			•	
(3) an ability to function effectively on teams;	•			•		
(4) an understanding of professional, ethical and social responsibility;			•			•
(5) a recognition of the need for, and an ability to engage in, life-long learning.		•			•	
(6) the ability to apply mathematics including differential and integral calculus, probability, and discrete mathematics to hardware and software problems;	•			•		
(7) mastery of the techniques skills, and computer topics appropriate to the degree program, with depth in at least two sub disciplines (microprocessors, ASICs, software, computer architecture) of the computer engineering technology program;			•			•
(8) an ability to use applied engineering tools, techniques, and skills including computer-based tools for design, analysis and simulation;		•			•	
(9) an ability to design, fabricate and test systems containing hardware and software components; as well as to analyze and interpret test results in order to improve the system;	•			•		
(10) an ability to convey technical material through oral presentation and interaction with an audience;			•			•
(11) an ability to convey technical material through written reports which satisfy accepted standards for writing style;		•			•	
(12) an ability to improve system design with regard to quality and project management			•			•

CET AS Program Assessment Plan – Fall 2007

Learning Outcome	2007-08	2008-09	2009-10	2010-11	2011-12	20012-13
(1) an ability to identify, formulate, and solve computer engineering technology problems, including the test, implementation, and operation of systems and components, that meet performance and quality requirements in a timely manner;	•			•		
(2) an ability to design, conduct, and interpret experiments including applying the results to verify a system;		•			•	
(3) an ability to function effectively on teams;	•			•		
(4) an understanding of professional, ethical and social responsibility;			•			•
(5) a recognition of the need for, and an ability to engage in, life-long learning;		•			•	
(6) the ability to apply mathematics including differential and integral calculus and discrete mathematics to hardware and software problems;	•			•		
(7) an ability to use applied engineering tools, techniques, and skills including computer-based tools for analysis, simulation, and testing;		•			•	
(8) an ability to fabricate and test engineering systems containing hardware and software components;	•			•		
(9) an ability to convey technical material through oral presentation and interaction with an audience;			•			•
(10) an ability to convey technical material through written reports which satisfy accepted standards for writing style		•			•	

Similar outcomes were chosen for assessment in each program in order to be able to use common assessments to serve both programs. We also began the process to identify what classes could best be used to provide points in the program to assess each outcome. In Appendix A, an H indicates that the class would likely be a very good point to assess the outcome, covering most of the elements of the outcome. An M indicates that portions, but perhaps not all of the elements of the outcome could be assessed at that point.

IV. Summary of 2007-08 Assessment Activities

During the 2007-08 academic year, the program faculty assessed the student learning outcomes summarized below. The actual assessment data, performance criteria and

results of the individual assessments described are attached in appendix B. The results of assessments completed since the time this report was submitted will be available in the department as well. Also, examples of student projects completed during the junior and senior projects are available for inspection.

B.S. Program Outcome #1: an ability to identify, formulate, and solve computer engineering technology problems, including the specification, design, implementation, and operation of systems and components, that meet performance, and quality requirements in a timely manner. This outcome is identical to A.E. program outcome #1.

Assessments for this outcome (as specified in the 3 year rotation) were performed across the curriculum (CST 102 (baseline), CST 231, CST 372, CST 344 and CST 441).

Strengths: Student performance met expectations for all performance criteria at the Junior level (CST 372). Students were able to specify and implement a system and successfully solve problems to overcome difficult challenges in the implementation of their junior projects. Seniors (CST 344 and CST 441) were able to solve design problems at an acceptable level of performance.

Areas needing improvement: No formal actions for improvement need to be taken at this time. However, we will continue to focus informally on problem solving skills to maintain and improve performance in this area.

B.S. Program Outcome #3: an ability to function effectively on teams.(This outcome is identical to A.E. program outcome #3.

Assessments for this outcome (as specified in the 3 year rotation) were performed in CST 102 (baseline) CST 371 and CST 371.

Strengths: While incoming freshmen students were judged to have only a developing level of teamwork skills, juniors in CST 371 (based on a peer assessment) met expectations on all performance criteria. Juniors in CST 372, based on an objective assessment, met and exceeded expectations on 3 of 6 performance criteria.

Areas needing improvement: Juniors in CST 372 did not meet expectations (though just barely) on 3 of 6 performance criteria. This also correlated with professors own overall impressions. It was decided that it would be desirable to work on improving performance. It appears that while the students were aware of the importance of teamwork skills, the need to complete the project would lead them to believe they didn’t have time to work on those skills. It was determined that earlier instruction in these skills might be helpful.

Plans for improvement: CST 102 (a single term freshman introductory class offered in fall term) is being replaced by a sequence of classes in the freshman year – CST 102, 104, 105 (this is being done mainly as a response to a desire to improve freshman retention). Direct instruction in teamwork skills will be added to CST 104 winter 2009. A

baseline assessment will be performed in CST 103 fall 2008 and a follow on assessment will be performed in CST 105 spring 2009. In the junior project sequence during the 2011/12 year (the next time this assessment comes up in regular rotation and the year the freshmen will reach junior project), team work assessments will be performed to see if there is an improvement. In the mean time assessments will be used in all quarters of JP in order to identify developing team problems in order to allow early intervention on the part of the professor.

B.S. Program Outcome #4: an understanding of professional, ethical and social responsibility. This outcome is identical to A.E. program outcome #4.

Assessments for this outcome were performed in CST 102 and based on program faculty's evaluation of a student paper prepared by seniors for BUS 304.

Strengths: 60% or more of freshman students assessed performed at excellent or good on 3 of 4 performance criteria.

Areas Needing Improvement: A majority of freshman did not perform at the excellent or good levels on one performance criteria, and seniors did not meet expectations on 3 of 4 performance criteria.

Plans for improvement: Direct instruction on professional ethics will be provided in CST 103/4/5 and this outcome will be reassessed when it comes up in the regular assessment rotation in 2009/10.

B.S. Program Outcome #5: a recognition of the need for, and an ability to engage in, life-long learning. This outcome is identical to A.E. program outcome #5.

An assessment of this outcome was performed with seniors in CST 451.

Strengths: Students met or exceeded performance expectations in their ability to gather information from various sources and to evaluate the quality of that information. The professor's overall impression was that student's skills in this area were strengthened by their underlying problem solving skills.

Areas Needing Improvement: None at this time.

B.S. Program Outcome #6: the ability to apply mathematics including differential and integral calculus, probability, and discrete mathematics to hardware and software problems. This outcome is similar to A.E. program outcome #6 with the exception that probability is not included.

This outcome was assessed (as specified in the 3 year rotation) in a number of classes. Skills in discrete mathematics were assessed in CST 162 and in CST 321. Skills in probability, algebra and calculus were assessed in CST 418.

Strengths: Seniors exceeded expectations in algebraic manipulations and in being able to take derivatives. Juniors exceeded expectations in discrete math skills. Freshmen met and exceeded expectations in 10 of 13 performance criteria on a discrete math evaluation.

Areas Needing Improvement: While freshmen failed to meet expectations on 3 of 13 performance criteria (related to correct looping of K-maps), the juniors were able to demonstrate these skills. In retrospect, it would have been interesting to run an assessment on these skills at the sophomore level (CST 231/2) to identify if this is where these skills were being refined. Also, the seniors did not meet expectations in basic probability skills and in problem formulation skills.

Plans for improvement: More emphasis in the areas the students were found to be weak in will be included in CST 162. More direct instruction on probability will be added to CST 418. This objective will be reassessed in 2011/12 in accordance with the regular assessment rotation.

B.S. Program Outcome #9: an ability to design, fabricate and test systems containing hardware and software components; as well as to analyze and interpret test results in order to improve the system. This outcome is similar to A.E. program outcome #8: an ability to fabricate and test engineering systems containing hardware and software components.

Assessments of this outcome are being performed this year (as specified in the 3 year rotation) in CST 373 (done) and CST 461, but are not yet complete enough to report as they depend on final project reports not completed until the end of spring term.

Plans for improvement: While the assessment for this outcome is not yet complete, attempting to assess the testing facet of this outcome in CST 373 revealed that not much testing actually takes place partly as a result of the large scope of many projects does not allow for adequate time for testing. It was decided that it was probably not appropriate to assess for this aspect of this outcome in CST 373.

B.S. Program Outcome #10: an ability to convey technical material through oral presentation and interaction with an audience. This outcome is identical to A.E. program outcome #9.

An assessment of this outcome was performed in the Senior Project design review in CST 451. All three program faculty evaluated each student's design review according to a rubric.

Strengths: Students exceeded expectations in all performance criteria for this outcome.

Areas Needing Improvement: None at this time.

B.S. Program Outcome #12: an ability to improve system design with regard to quality and project management. There is no corresponding A.E. outcome.

An assessment of this outcome was performed in CST 373.

Strengths: It appears that students have a working understanding of quality management as all JP teams were able to implement improvements in their projects.

Areas needing improvement: While all students remember that the topic was addressed in the class, they did not meet expectations in being able to provide a definition of quality management.

Plans for improvement: Instead of addressing the topic of quality management only CST 373, it will be addressed in dedicated lecture periods during each of the 3 quarters of junior project (CST 371/2/3). This outcome will be assessed again in 2009/10 when it comes up in the regular assessment rotation. It was felt that it would be appropriate also to attempt an assessment of this outcome with seniors in BUS 304 (Engineering Management) at that time.

Appendix A SLO-Curriculum Map Matrix

Outcome Assessment Points, BS Progam H = Highly assessable M = Weakly assessable blank = Low to not assessable		(1) problem solving	(2) experiment	(3) teamwork	(4) ethical / social resp	(5) lifel-long learning	(6) calc, prob, discrete	(7) master skills + depth	(8) design, analysis, sim	(9) design, fab, test, improve	(10) oral presentation	(11) written presentation	(12) quality, proj. manage
Freshman Year	Eval. Cycle ⇨	Y1	Y2	Y1	Y3	Y2	Y1	Y3	Y2	Y1	Y3	Y2	Y3
CST 102	Intro to Comp ET	M	M	M	M					M		M	
CST 162	Intro to Digital Logic	H	M				M						
MATH 111	College Algebra												
WRI 121	English Comp												
CST 116	C++ Prog I												
CST 130	Computer Org						M						
MATH 112	Trigonometry												
WRI 122	English Comp												
CST 126	C++ Prog II												
CST 131	Comp Arch						M						
MATH 251	Diff Calculus						M						
SPE 111	Fund of Speech										M		
SSC	SS Elective												
Sophomore Year													
CST 250	Assembly Lang												
MATH 252	Integral Calculus						M						
PSY 201	Psychology												
WRI 227	Tech Report											M	
CST 133	Dig Elec II – Seq w HDL						M			M			
CST 204	Intro to controllers						M		M	M			
EE 221	DC & 1st Ord Trans												
CST 231/2	Comp Des w/PLD	M	H			M	M		M	H			
MATH 254N	Vector Calc						H						
CST 313	Comp Soft Tech	M	M				M	M	M	M			
EE 223	AC & 2nd Ord Trans												
SPE 321	Team Comm			M							H		
HUM	Hum Elective												
MATH	Math Elective						H						

Outcome Assessment Points, BS Program continued		(1) problem solving	(2) experiment	(3) teamwork	(4) ethical / social resp	(5) lifel-long learning	(6) calc, prob, discrete	(7) master skills + depth	(8) design, analysis, sim	(9) design, fab, test, improve	(10) oral presentation	(11) written presentation	(12) quality, proj, manage
Junior Year	Eval. Cycle ⇨	Y1	Y2	Y1	Y3	Y2	Y1	Y3	Y2	Y1	Y3	Y2	Y3
EE 321	Intro Amp & Semi												
CST 335	I/O Interfacing	M	M	M		M				M			
CST 371	Embedded Sys Dev I	H	M	H		M			H	M	H	H	M
PHY 221	Physics w/Calculus												
CST 321	Intro to proc	M	M				M	M	M	M		H	
CST 372	Embedded Sys Dev II	H	M	H		M	M	M	H	H	M	M	M
PHY 222	Physics w/Calculus												
WRI 327	Adv Tech Writing											H	
CST 331	Microproc Interface	M	M				M	M	M	M		M	
CST 351	Advanced PLDs	H	H		M	M		M	H	M			M
CST 373	Embedded Sys Dev III	H	H	H	M	H	M	M	M	H	H	H	H
PHY 223	Physics w/Calculus												
HUM	Hum Elective				M								
Senior Year													
BUS 304	Engr Management				M								
CST 344	Intermediate Arch	M			M		M	M	M	M			
CST 441	Logic Synth w VHDL	H	H		M	M		H	H	M			
CST 418	Data Comm & Net	M				M	H						
CST xxx	Tech Elective					M							
CST 442	Advanced Arch.	M				M	H	H	M	M			
CST 451	ASIC Des using FPGAs	H	H		M	M		H	M	H	H	H	M
SSC	SS Elective				M								
IMGT 345	Engr Economy				M								M
CST 464	RISC-Based proc	M	M	M		M		M	M	M			
CST 461	Adv Topics in VLSI	M	H				M	H	H			M	
PSY 347	Org Behavior				M								
HUM	Hum Elective				M								

x

Outcome Assessment Points, AS Progam H = Highly assessable M = Weakly assessable blank = Low to not assessable		(1) problem solving	(2) experiment	(3) teamwork	(4) ethical / social resp	(5) lifel-long learning	(6) calc, discrete	(7), analysis, sim, test	(8) fabricate, test	(9) oral presentation	(10) written presentation
Freshman Year	Eval. Cycle ⇨	Y1	Y2	Y1	Y3	Y2	Y1	Y2	Y1	Y3	Y2
CST 102	Intro to Computer Eng. Tech.	M	M	M					M		M
CST 162	Intro to Digital Logic	H	M				M				
MATH 111	College Algebra										
WRI 121	English Composition										
CST 116	C++ Programming I										
CST 130	Computer Organization						M				
MATH 112	Trigonometry										
WRI 122	English Composition										
CST 126	C++ Programming II										
CST 131	Computer Architecture						M				
MATH 251	Differential Calculus						M				
SPE 111	Fundamentals of Speech									M	M
SSC	Social Science Elective										
Sophomore Year											
CST 250	Computer Assembly Language										
MATH 252	Integral Calculus						M				
PSY 201	Psychology										
WRI 227	Technical Report Writing										M
CST 133	Dig. Elec. II – Seq. Logic w HDL						M				
CST 204	Introduction to Microcontrollers						M				
EE 221	Circ. I – DC & 1st Order Trans.										
CST 231	Computer Design w/PLD	M	H			M	M	M	H		
CST 232	Comp. Design w/PLD Lab	H	H			M	M	M	H		
PHY 221	General Physics w/Calculus										
CST 313	Comp Software Techniques	H	M	H			M	M	M		M
EE 223	Circ. II – AC & 2nd Order Trans.										
PHY 222	General Physics w/Calculus										
HUM	Humanities Elective				M						
CST xxx	Technical Elective**					M					

Appendix B: CET Program Outcome Assessment Summary

Learning Outcome: (1) an ability to identify, formulate, and solve computer engineering technology problems, including the specification, design, implementation, and operation of systems and components, that meet performance, and quality requirements in a timely manner.

This assessment focuses on the design of a solution to a problem.

Data Collection Date: 12/3/07 Coordinator: Douglas W. Lynn

Assessment Method: A question focusing on the register level design of some logic for a micro programmed control unit was given in the CST 344 (Intermediate Arch.) final exam.
A good design made use of a 4 to 1 mux with enable. An acceptable design used a 5 to 1 mux. An unacceptable design used a larger mux, or was not even close.

Performance Criteria	Measurement Scale	Minimum Acceptable Performance	Results
Acceptable design	yes/no	70% acceptable	77% acceptable 10 acceptable 3 unacceptable
Overall Correctness	correct, 1-2 mistakes, incorrect	70% <= 1-2 mistakes	77% meet 4 correct 6 1-2 mistakes 2 incorrect

Evaluation 3/1/08 (date)

The performance was acceptable.

Actions 3/1/08 (date)

No formal action is required.

CET Program Outcome Assessment Summary

Learning Outcome: (1) an ability to identify, formulate, and solve computer engineering technology problems, including the specification, design, implementation, and operation of systems and components, that meet performance, and quality requirements in a timely manner.

This assessment focuses on the design of a solution to a problem.

Data Collection Date: 12/7/07 Coordinator: Ralph Carestia

Assessment Method: Students in CST 441 were given a sequence detector state machine design problem that tested their ability to identify and develop the state diagram, state table and the VHDL code for implementation of the problem. Student work was assessed in each of the following performance criteria as defined in the attached rubric.

Performance Criteria	Measurement Scale	Minimum Acceptable Performance	Results
Understanding	Number Scoring Excellent or Good	70%	100% (6 / 6)
Information Gathering	"	"	100% (6 / 6)
Plan to Solve	"	"	83.3% (5 / 6)
Carry out Plan	"	"	100% (6 / 6)
Evaluating	"	"	100% (6 / 6)
Communication	"	"	100% (6 / 6)
Solution	"	"	100% (6 / 6)

Evaluation 6/4/08 (date)

The performance exceeded expectations.

Actions 6/4/08 (date)

No formal action is required.

Problem Solving Rubric:

	Poor	Fair	Good	Excellent
Understanding	Student needs a complete explanation of the problem	Student needs some clarification from others to understand the problem.	Student understands (can explain) the problem and proceeds to the next step	Student understands the problem and relates it to other situations
Information gathering	Student does not collect any information that relates to the topic	Student collects very little information, some relates to the topic	Student collects some basic information, most relates to the topic	Student collects a great deal of information, all relates to the topic
Plan to Solve	Designs only one strategy, required assistance to evaluate strategy	Come up with a few strategies and requires assistance to select an appropriate strategy.	Come up with several strategies, decides on an appropriate solution	Come up with many strategies, decides on appropriate solution to each strategy.
Carrying out the Plan	Attempts to solve problem with an inadequate strategy	Solves problem without making modifications.	Solves problem using design, makes appropriate modifications.	Tries new methods to solve problem.
Evaluating	Student Requires assistance to evaluate solutions	Student has Limited evaluation of solution without assistance.	Student compare actual and expected results	Student suggests other modifications or applications of the results
Communicates	Student Explains what happened in simple terms	Student Explains results using terminology related to the problem.	Student Explains the reason one method is better using specialized language	Student Generalizes solution, describes how solution can be used.
Solution	Student has no solution or wrong solution	Student has partial answer for problem	Student has the correct solution.	Student has correct solution of problem and provided results extending the solution.

CET Program Outcome Assessment Summary

Learning Outcome: (1) an ability to identify, formulate, and solve computer engineering technology problems, including the specification, design, implementation, and operation of systems and components, that meet performance, and quality requirements in a timely manner.

This assessment focuses on the design of a solution to a problem.

Data Collection Date: 12/11/07 Coordinator: Ralph Carestia

Assessment Method: Students in CST 441 were given a problem that had multiple possible solutions. In addition to solving the problem (see attached) students were asked to reflect on their design choices. Student work was assessed in each of the following performance criteria as defined in the attached rubric. Note that this assessment was also used for the institutional assessment of critical thinking.

Performance Criteria	Measurement Scale	Minimum Acceptable Performance	Results
Problem	Number Scoring High Proficiency or Proficient	70%	100% (7 / 7)
Context	"	"	71.4% (5 / 7)
Perspectives	"	"	71.4% (5 / 7)
Assumptions	"	"	85.7% (6 / 7)
Evidence	"	"	71.4% (5 / 7)
Implications	"	"	85.7% (6 / 7)

Evaluation 6/4/08 (date)

The performance met and exceeded expectations.

Actions 6/4/08 (date)

No formal action is required.

ISLO #4 Critical Thinking Rubric (adapted from NE Ill University)**: Approved 11-02-07**

	No/Limited Proficiency	Some Proficiency	Proficiency	High Proficiency
1. Identifies and explains **problem/question/issue**	Fails to identify, summarize, or explain the main problem or question. Represents the issues inaccurately or inappropriately.	Identifies main issues but does not summarize or explain them clearly or sufficiently.	Successfully identifies and summarizes the main issues, but does not explain why/how they are problems or create questions.	Clearly identifies and summarizes main issues and successfully explains why/how they are problems or questions; and identifies embedded or implicit issues, addressing their relationships to each other.
2. Recognizes stakeholders and **contexts** (i.e., cultural, social, educational, technological, political, scientific, economic, ethical, personal experience)	Fails accurately to identify and explain any empirical or theoretical contexts for the issues. Presents problems as having no connections to other conditions or contexts.	Shows some general understanding of the influences of empirical and theoretical contexts on stakeholders, but does not identify any specific ones relevant to situation at hand.	Correctly identifies all the empirical and most of the theoretical contexts relevant to all the main stakeholders in the situation.	Not only correctly identifies all the empirical and theoretical contexts relevant to all the main stakeholders, but also finds minor stakeholders and contexts and shows the tension or conflicts of interest among them.
3. Frames personal responses and/or acknowledges other **perspectives**	Fails to formulate and clearly express own point of view, (or) fails to anticipate objections to his/her point of view, (or) fails to consider other perspectives and position.	Formulates a vague and indecisive point of view, or anticipates minor but not major objections to his/her point of view, or considers weak but not strong alternative positions.	Formulates clear and precise personal point of view concerning the issue, and seriously discusses its weaknesses as well as its strengths.	Not only formulates a clear and precise personal point of view, but also acknowledges objections and rival positions and provides convincing replies to these.
4. Evaluates **assumptions**	Fails to identify and evaluate any of the important assumptions behind the claims and recommendations made. does not evaluate them for plausibility or clarity.	Identifies some of the most important assumptions, but does not evaluate them for plausibility or clarity.	Identifies and evaluates all the important assumptions, but not the ones deeper in the background—the more abstract ones.	Not only identifies and evaluates all the important assumptions, but also some of the more hidden, more abstract ones.
5. Evaluates **evidence**	Fails to identify data and information that counts as evidence for truth-claims and fails to evaluate its credibility.	Successfully identifies data and information that counts as evidence but fails to thoroughly evaluate its credibility.	Identifies all important evidence and rigorously evaluates it.	Not only identifies and rigorously evaluates all important evidence offered, but also provides new data or information for consideration.
6. Evaluates **implications**, conclusions, and consequences.	Fails to identify implications, conclusions, and consequences of the issue, or the key relationships between the other elements of the problem, such as context, assumptions, or data and evidence.	Suggests some implications, conclusions, and consequences, but without clear reference to context, assumptions, data, and evidence.	Identifies and briefly discusses implications, conclusions, and consequences considering most but not all the relevant assumptions, contexts, data, and evidence.	Identifies and thoroughly discusses implications, conclusions, and consequences, considering all relevant assumptions, contexts, data, and evidence.

CET Program Outcome Assessment Summary

Learning Outcome: (1) an ability to identify, formulate, and solve computer engineering technology problems, including the specification, design, implementation, and operation of systems and components, that meet performance, and quality requirements in a timely manner

This assessment focused on how each team solved a specific problem encountered during the implementation phase of the Junior project

Data Collection Date: 3/5/08 Coordinator: Phong Nguyen

Assessment Method: A graded peer paper in CST 372 (Embedded System Development II- Junior Project) was used. The criteria and grading scale for the paper are shown below.

Performance Criteria	Measurement Scale:	Minimum Acceptable Performance:	Results
Problem identification	Number attaining >= 7/10	80%	100% (6/6)
Formulate solution and specs	"	80%	100% (6/6)
Paper design	"	80%	83.3% (5/6)
Implement solution	"	80%	100% (6/6)
Test implementation	"	80%	83.3% (5/6)

Evaluation 3/17/08 (date)
Although 5 of 6 teams passed the minimum acceptable grade of 7 on all five criteria, 4 of 6 got the minimum, 7, in the formulation of solution and specifications. Also, in paper design and test implementation, 3 of 6 teams got 7. In addition, one team struggled with 4 of 5 criteria. Most teams had problems with coming up with a solid paper design (hierarchy schematic, testing plan). Overall, testing plan implementation was problematic as little time was left to test which is part of a course scheduling problem.

Actions 6/4/08 (date)
Need to revise course schedule to include less optimistic completion time due to problems and revise testing plan accordingly. Furthermore, there is some weakness in half or over half of students achieving only the minimum on three of five criteria. In future, talk regularly to team leaders and inquire on the status of the team project. Next, get entire teams together to instruct them on the importance of specifications, paper design and testing.

CET Program Outcome Assessment Summary

Learning Outcome: (3) an ability to function effectively on teams

This assessment focused on how each team member values other members of the team as pertaining to the project.
Data Collection Date: 3/12/08 Coordinator: Phong Nguyen

Assessment Method: Professors assessment of each individual in a team based on teamwork criteria in CST 372 (Embedded System Development II-Junior Project).

Performance Criteria	Measurement Scale:	Minimum Acceptable Performance:	Results
Attitude (motivation toward project/team members/customers, work ethics, positive/negative outlook on tasking	Number of students ranked 7/10 or above	90%	95.2% (20/21)
Interaction (assist others, accept assistance, respect opinions, cooperate, resolves conflicts, motivate others)	"	90%	85.7% (18/21)
Workload (assign fair share, accomplishes assigned work, willingness for extra work)	"	90%	90.4% (19/21)
Work quality (complete work of high standards)	"	90%	90.4% (19/21)
Communication (listens to others, expect clear expectations of others, good written/verbal skills)	"	90%	85.7% (18/21)
Time management (attendance, avoid procrastination, multitask effectively)	"	90%	85.7% (18/21)

Evaluation: 4/1/08 (date)
Three failures (interaction, communication, time management) were cause by one team of three. Out of 6 teams, this one team had serious personal problems which were carried into the project. These personal conflicts prevented the members from working well together. In the end, the project did pass in that a "B"-grade beta version was produced.
Actions: 6/4/08 (date)
Need to catch personal problems earlier and exert corrective actions as soon as possible.

CET Program Outcome Assessment Summary

Learning Outcome: (3) an ability to function effectively on teams

This assessment focused on how each team member values other members of the team as pertaining to the project.
Data Collection Date: 12/3/07 Coordinator: Phong Nguyen

Assessment Method: A guided peer evaluation survey in CST 371 (Embedded System Development I- Junior Project) was used. An individual student's score was based on the average of the other team members evaluation of the student.

Performance Criteria	Measurement Scale:	Minimum Acceptable Performance:	Results
Attitude (motivation toward project/team members/customers, work ethics, positive/negative outlook on tasking	Number of students ranked 7/10 or above	90%	100% (22/22)
Interaction (assist others, accept assistance, respect opinions, cooperate, resolves conflicts, motivate others)	"	90%	95.5% (21/22)
Workload (assign fair share, accomplishes assigned work, willingness for extra work)	"	90%	100% (22/22)
Work quality (complete work of high standards)	"	90%	100% (22/22)
Communication (listens to others, expect clear expectations of others, good written/verbal skills)	"	90%	100% (22/22)
Time management (attendance, avoid procrastination,	"	90%	100% (22/22)

multitask effectively)			

Evaluation 1/7/08 (date)
No problems are noted from the collective scores of the peer evaluations covering aspects of teamwork.

Actions 6/4/08 (date)
No formal actions are required based on these results.

CET Program Outcome Assessment Summary

Learning Outcome: (3) an ability to function effectively on teams

Data Collection Date: 11/16/07 Coordinator: Ralph Carestia
Assessment Method: Students were observed in the CST 102 lab and assessed on the following items: a) how often they offered assistance to other team members, b) how well they listened to other student ideas, c) group participation, d) how well they exchanged and defended ideas, e) how well they discussed things with other team members, f) how well they shared ideas with the team. The assignment was to design and build a Lego mindstorm robot that can sense the edge of a table and not fall off. This was a baseline survey. The rubric used follows below.

Performance Criteria	Measurement Scale:	Minimum Acceptable Performance:	Results
Helping	Number of students ranked Exemplary or Accomplished	n/a	(3/7)
Listening	"	n/a	(2/7)
Participating	"	n/a	(2/7)
Persuading	"	n/a	(0/7)
Questioning	"	n/a	(1/7)
Respecting		n/a	(4/7)
Sharing	"	n/a	(1/7)

Evaluation 1/7/08 (date)
It was presumed that most students would be in the Developing or Beginning classes of these categories as no formal instruction in teamwork is provided in this class.
Actions 6/4/08 (1/10/08)
It was decided that we should begin to introduce teamwork skills in a more formal manner to freshman. Accordingly, direct instruction in teamwork skills will be added to CST 104 winter 2009. A baseline assessment will be performed in CST 103 fall 2008 and a follow on assessment will be performed in CST 105 spring 2009. In the junior project sequence during the 2011/12 year (the next time this assessment comes up in regular rotation and the year the freshmen will reach junior project), team work assessments will be performed to see if there is an improvement.
Teamwork Rubric

	Beginning	Developing	Accomplished	Exemplary
Helping	*Students Never offer* assistance to other team members.	*Students offer some* assistance to other team members.	*Students often offer* assistance to other team members.	*Students always offer* assistance to other team members.
Listening	*Students never* work from each other's ideas	*Students* work from each other's ideas once in a while	*Students* work from each other's ideas most of the time	*Students always* work from each other's ideas
Participating	None of Students in the group contributing to the project.	½ of Students in the group contributing to the project.	¾ of Students in the group contributing to the project	All Students in the group contributing to the project.
Persuading	*Students Never* exchanging, defending, and rethinking ideas.	*Some Students* exchanging, defending, and rethinking ideas.	*Most Students* exchanging, defending, and rethinking ideas.	*All Students on the team* exchanging, defending, and rethinking ideas.
Questioning	Students never interact discuss, or posing questions to other members of the team.	Some Students interact discuss, and posing questions to other members of the team.	*Most Students* interact discuss, and posing questions to other members of the team.	*All Students* interact discuss, and posing questions to other members of the team.
Respecting	Students never supporting the ideas and efforts of other team members.	Some Students support the ideas and efforts of other team members.	Most Students support the ideas and efforts of other team members.	All Students support the ideas and efforts of other team members.
Sharing	Students never reporting their findings to each other team members.	Some Students report their findings to other team members.	Most Students report their findings to other team members.	All Students report their findings to other team members.

CET Program Outcome Assessment Summary

Learning Outcome: (4) an understanding of professional, ethical and social responsibility.

Data Collection Date: 12/5/07 Coordinator: Ralph Carestia
Assessment Method: Students in CST 102 were asked to analyze an ethical question (see attached) and to discuss their choice. The rubric used to grade the assignment is also attached.

Performance Criteria	Measurement Scale:	Minimum Acceptable Performance:	Results
Issue	Number of students ranked Excellent or Good	60%	77.7% (14/18)
Scenario	"	60%	66.7% (12/18)
Position	"	60%	66.7% (12/18)
Defense	"	60%	38.9% (11/18)

Evaluation 1/7/08 (date)
Expectations were not met in the defense category
Actions 6/4/08 (date)
Lecture material on ethics will be expanded in CST 103/4/5 (the course sequence replacing CST 102). This outcome will be reassessed in regular rotation.

CST 102 - Introduction to Computer Systems
FINAL REPORT

Due: Monday, December 3 — Put in my assignment box in the CSET Office

Engineering Ethics

Discuss your choice.

Smith and Jones worked together for three years on a major research project and had nearly completed a paper for joint presentation to the national meeting of their engineering society. Smith was fired by their company for poor work habits and insubordination. Since Smith no longer works for the company, the management wants Jones to complete the paper and present it at the national meeting with no credit to Smith. What action should Jones take?

- Complete the paper and present it as the only author.
- Complete the paper and present it with acknowledgment to Smith (risking management displeasure).
- Stop preparation of the paper.
- Take some other action.

<u>Discuss your choice.</u>

Hint:

Read the Society ethics area of the ACM, http://www.acm.orq/about/code-ofethics, IEEE http/www.ieee.org/web/membership/ethics/code_ethics.html, online ethics center of the National Academy of Engineering http://onlineethics.org, or other professional organizations that you wish to view.

Use the Ethics information to discuss and justify your solution.

Ethics Rubric

	Poor	Fair	Good	Excellent
Ethical Issue	*Student does not understand the ethical codes from the professional society*	*Student understands some of the ethical codes from the professional society.*	*Student understands the ethical codes from the professional society but not sure he agrees.*	*Student understands the ethical codes from the professional society and agrees with them*
Application to Scenario	*Student does not know how to apply ethical principles to the scenario*	*Student know how the ethical principles could be part of the problem but does not know how to apply to the scenario*	*Student know how the ethical principles affects the scenario and has some ideas on how to apply to the scenario*	*Student demonstrates how the ethical principles is applied to the scenario*
Position	*Student does not have a position on the scenario*	*Student has a position on the scenario but is unclear on the position on mediation*	*Student has a position on the scenario but lacks support for mediation of his/her position.*	*Student has an organized and clear presentation along with good support for mediation of his/her position.*
Defense - Arguments	*Student can not defend his/her position on the scenario*	*Student has a defense for his position but is lacking logical thinking for defense*	*Student has a defense for his/her position along with some logical but lacks organization of his/her defense*	*Student has a defense for his/her position along with an organized and well supported discussion*

CET Program Outcome Assessment Summary

Learning Outcome: (4) an understanding of professional, ethical and social responsibility.

Data Collection Date: 12/5/07 Coordinator: Ralph Carestia
Assessment Method: Students in BUS 304 were asked to complete a written assignment on an ethical question (see attached). These papers were then graded by two department faculty independently using the same rubric as was used in the CST 102 assessment (see above).

Performance Criteria	Measurement Scale:	Minimum Acceptable Performance:	Results
Issue	Number of students ranked Excellent or Good	80%	46.6% (7/15)
Scenario	"	80%	66.7% (10/15)
Position	"	80%	66.7% (10/15)
Defense	"	80%	73.3% (11/15)

Evaluation 1/7/08 (date)
Expectations were not met.
Actions 6/4/08 (date)
Lecture material on ethics will be expanded in CST 103/4/5 (the course sequence replacing CST 102). This outcome will be reassessed in regular rotation.

Step 1 : Identify the Issues

1 . What are the major moral or ethical issues raised by this case?
2. What are the major factual issues raised by this case?
3. What are the major conceptual issues raised by this case?
4. Who are the major stakeholders in this case? (stakeholders refers to all individuals whose interest could be affected by the decision made in the case).
5. How the issues are in this case related to the application of technology?

Step 2: Outline the Options

1 . What are the main alternative actions or policies that might be followed in responding to the ethical issues in this case?
2. What are the major views on the conceptual issues raised by this case?
3 . What facts are unknown or controverter that might be relevant to deciding this case (may require research to determine some facts).

Step 3: Construct Ethical Arguments

1 . Determine which of the four moral standards discussed by Harris (egoism, natural law, utilitarianism, and respect for persons) apply to this case?
2. Identify the moral principles or high-level rules that can be invoked to support a conclusion as to what ought to be done ethically in this case or similar cases?
3 . Determine whether the different moral standards yield converging or diverging judgments about what ought to be done?

Step 4: Evaluate the Arguments for each Option

1 . Weigh the ethical reasons and arguments for each option in terms of their relative importance, assigning weights to each consideration where:
    3 = very important consideration
    2 = somewhat important consideration
    1 = a consideration of only minor importance
2. Determine whether there are any unwarranted factual assumptions that need to be examined in each argument.
3 . Determine whether there are any unresolved conceptual issues in each argument.
4. Determine whether any of the arguments involve fallacies or logical errors.

Step 5: Make a Decision

1 . Decide which of the identified options you would recommend or judge to be the ethically best way to deal with the issue presented in this case based upon which option has the strongest ethical reasons behind it.
2. Determine how a critic of your position might try to argue against it using other ethical reasons, and present a rebuttal or counter-argument in defense of your judgment.

CET Program Outcome Assessment Summary

Learning Outcome: (5) a recognition of the need for, and an ability to engage in, life-long learning.

Data Collection Date: 3/24/08 Coordinator: Ralph Carestia
Assessment Method: Senior project proposals were evaluated along four dimensions – quality of research, quality of analysis/evaluation, effectiveness of project organization and overall writing style. The first two criteria were directly related to lifelong-learning while the last two criteria are indirectly related and were used to determine how effective and convincing the research and analysis was. The rubric used for this assessment is attached.

Performance Criteria	Measurement Scale:	Minimum Acceptable Performance:	Results
Information Gathering	Number of students ranked Excellent or Good	70%	87.5% (7/8)
Evaluation/ Analysis	"	70%	75% (6/8)
Organization	"	70%	75% (6/8)
Style	"	70%	75% (6/8)

Evaluation 6/4/08 (date)
Expectations were exceeded. Results on problem solving evaluations also correlate well with this data.
Actions 6/4/08 (date)
No formal actions are required at this time.

	1	2	3	4
Information gathering	Student does not collect any information that relates to the project	Student collects adequate information, but fails to relate it to the project	Student collects adequate information, and relates to the project.	Student collects a great deal of information, all relates to the topic
Evaluating - Analysis	Student Requires assistance to evaluate solutions. Analysis is simple and there is now supporting evidence.	Student has Limited evaluation of solution without assistance. Has some analysis along with some supporting evidence	Student has adequate analysis and good supporting evidence. However lacks closure.	Student has detailed analysis and accounts for good closure in evaluation. Reaches conclusions well.
Organization	Student ideas are not well organized and do not lead to any clear conclusions.	Student ideas are presented, but lacking plausible conclusions	Student ideas are organized. Key points are presented but do not demonstrate depth. Has a somewhat convincing solution	Student paper is clear and focused - Relevant information. helps reader develop insight into the project
Style	Student has occasional problems with word choices. Reader is unsure of what the student means	Student words and sentences are adequate, but lack energy. Struggles to keep readers interest.	Student has good writing style, flow and adequately keeps reader somewhat engaged in the proposal	Student has compelling writing style. Keeps reader engaged in proposal throughout the entire document

CET Program Outcome Assessment Summary

Learning Outcome: (6) The ability to apply mathematics including differential and integral calculus, probability, and discrete mathematics to hardware and software problems.
This assessment focused on the application of discrete mathematics using Truth Tables and Karnaugh Maps.

Data Collection Date: 11/14/07 Coordinator: Phong Nguyen

Assessment Method: A question focusing on solving for a minimized SOP Boolean Equation was given in the CST 162 (Intro to Logic Design) quiz.

The following table provides the results

Performance Criteria:	Measurement Scale: for all criteria	Minimum Acceptable Performance Out of 28 graded	Results
Truth Table:			
Filled out inputs XYZ with correct sequence of 000, 001…	Number Correct	80%	96.4% (27/28)
Filled out output K correctly with required 0's in accordance to problem statement	"	80%	96.4% (27/28)
Filled out output K correctly with required 1's in accordance to problem statement	"	80%	96.4% (27/28)
Filled out output K correctly with required X's in accordance to problem statement	"	80%	92.9% (26/28)
K-Map:			
Fill out K-Map inputs XYZ with correct sequences, especially the 01 to 11 transition	"	80%	96.4% (27/28)
Filled out K-Map correctly with required output 0's in accordance with Truth table	"	80%	96.4% (27/28)
Filled out K-Map correctly with required output 1's in accordance with Truth table	"	80%	96.4% (27/28)
Filled out K-Map	"	80%	92.9%

correctly with required output X's in accordance with Truth table			(26/28)
Change X's to correct 0's or 1's so as to best minimize expression from K-Map	"	70%	89.3% (25/28)
Make correct boxes of 1' s in accordance to K-Map rules	"	70%	64.3% (18/28)
Translate boxes to correct product terms for minimized Boolean expression	"	70%	75% (21/28)
One special box of 2 at top right bottom right that wraps around needs to be recognized	"	70%	64.3% (18/28)
Obtain the correct final answer: K= X'YZ'+Y'Z+XY'	"	70%	64.3% (17/28)

Evaluation 1/16/08 (date)

The performance expectations were met in 10 out of 13 criteria.

Actions 6/4/08 (date)

Revise CST 162 lecture material to concentrate more on K-map looping (wrap around loops), translating loops to product terms, realization of a minimized answer, and checking results against the Truth table.

CET Program Outcome Assessment Summary

Learning Outcome: (6) The ability to apply mathematics including differential and integral calculus, probability, and discrete mathematics to hardware and software problems.
This assessment focused on Boolean algebra, specifically K-map minimization.

Data Collection Date: 10/22/07 Coordinator: Douglas W. Lynn

Assessment Method: A homework question was given in CST 321 (Micros) that required the students create and minimize 3 Boolean functions of 4 variables. This assessment focused solely on the entering, looping and reading of the K-maps.

Performance Criteria	Measurement Scale	Minimum Acceptable Performance	Results
Entered correctly	number of errors	80% <=1 minor error	94% <=1 minor error 13 correct 2 1 minor error 1 > 2 errors
Looped correctly	number of errors	80% <=1 minor error	88% 10 correct 4 1 minor error 2 > 2 errors
Read correctly	number of errors	80% <=1 minor error	100% 15 correct 1 1 minor error 0 > 2 errors

Evaluation 1/8/07 (date)

Students demonstrated very good performance on K-map minimization. Expectations were exceeded.

Actions 6/4/08 (date)

No formal action is required as a result of this assessment.

CET Program Outcome Assessment Summary

Learning Outcome: (6) The ability to apply mathematics including differential and integral calculus, probability, and discrete mathematics to hardware and software problems.
This assessment focused on the application of basic probability.

Data Collection Date: 12/5/07 Coordinator: Douglas W. Lynn

Assessment Method: The following question was given in the CST 418 (Networks) final exam:
If the probability of an error in one packet of a message traversing one hop of a network is *Pe*, what is the probability that *N* packets can be delivered across an *n* hop virtual circuit without any errors?

To correctly solve this problem students must realize that *Pne = 1 - Pe*, that N x n packets have to be transmitted without error and that probabilities multiply.

Performance Criteria	Measurement Scale	Minimum Acceptable Performance	Results
Pne = 1 - Pe	correct / incorrect (or not attempted)	90% correct	44.4% (4/9)
Probabilities multiply	correct / incorrect (or not attempted)	80% correct	66.7% (6/9)
Overall Correctness	correct, 1 mistake, incorrect (2 or more errors).	80% no more than 1 mistake	66.7% (6/9)

Evaluation 1/9/07 (date)

The performance did not meet expectations.

Actions 6/4/08 (date)

A more direct in-class instruction approach for basic probability will be taken in CST 418 next year and the assessment will be repeated at that time.

CET Program Outcome Assessment Summary

Learning Outcome: (6) The ability to apply mathematics including differential and integral calculus, probability, and discrete mathematics to hardware and software problems.
This assessment focused on problem formulation and application of calculus.

Data Collection Date: 11/24/07 Coordinator: Douglas W. Lynn

Assessment Method: A homework question was given in CST 418 (Networks) that required the students to solve for the optimal packet size in the transmission of a message over an N hop network.

Performance Criteria	Measurement Scale	Minimum Acceptable Performance	Results
Correct Formulation	number of errors	70% <=1 minor error	33% <=1 minor error 2 correct 0 1 minor error 4 major error
Errors in algebra	number of errors	70% <=1 algebraic errors	100% 6 had no major errors
Errors in finding the derivative	number of errors	70% <=1 error	100% 3 correct 2 1 error 1 didn't apply calculus (not counted)

Evaluation 1/8/07 (date)

Students demonstrated acceptable performance on algebra and calculus skills, but did not meet expectations at creating a correct formula in the first place.

Actions 6/4/08 (date)

More emphasis on problem solving techniques and students checking their results for correctness across the curriculum.

The problem given follows:

10.6 What value of P as a function of N, L, and H, results in minimum end-to-end delay on a datagram network? Assume that L is much larger than P and D is zero.

N = number of hops between two given end systems
L = message length in bits
B = data rate, in bits per second (bps), on all links
P = fixed packet size, in bits
H = overhead (header) bits per packet
D = propagation delay per hop in seconds

a) First work out an equation for the end-to-end delay using the variables B, N, L, H and P.
b) Then use calculus to find the minimum.
Let the packet size P be the amount of data in the packet. Thus, P+H gives the size of the transmitted packet including the header. Also assume that we always send full packets. That is, if there isn't enough data to completely fill the last packet to P+H, the packet is padded until it reaches this size. Your equation should include the expression ceil(L/P) (where ceil is the ceiling function and means "the integer greater than or equal to") for the number of packets in the message. Assuming L is large, ceil(L/P) can be approximated as L/P for the purposes of finding the minimum.

10.6 Answer) k = ceil(L/P) is the number of packets that will be sent. Each packet will take (P+H)/B to transmit. After all k packets are transmitted out of the first node, the last packet will have to pass over N-1 more hops to reach the destination node (not counting prop delay) and complete the transmission. Thus,
delay = (P+H)/B (ceil(L/P) + (N-1)) which z (P+H)/B ((L/P) + (N-1))
We want to minimize this function with respect to P, so we differentiate it with respect to P
d/dP (P+H)/B ((L/P) + (N-1)) = d/dP (L/B + HL/(PB) + P(N-1)/B + H/B(N-1))
= $-HL/(P^2B) + (N-1)/B$
setting this equation to 0 and solving for P will give the P that minimizes the delay
$(N-1)/B - HL/(P^2B) = 0$ gives **P = sqrt(HL/(N-1))**.

CET Program Outcome Assessment Summary

Learning Outcome: (9) an ability to design, fabricate and test systems containing hardware and software components; as well as to analyze and interpret test results in order to improve the system

Data Collection Date: 6/3/08 Coordinator: Phong Nguyen
Assessment Method: A survey in CST 373 (Embedded System Development III- Junior Project) was used. In addition, testing documents collected at end of third quarter are used.

Performance Criteria	Measurement Scale:	Minimum Acceptable Performance:	Results
Power supply functional for beta version demo.	yes/no answers to appropriate survey questions	70%	85.7% (12/14)
Functionality testing of final version of project satisfying original proposal	number of successful teams	5 of 6 teams	5/6
Fabrication of final version of packaging (complete enclosure for electronics, mounting, wire wraps not proto boards)	number of successful teams	5 of 6	6/6

Evaluation 6/3/08 (date)
Expectations were met and exceeded. Functional testing was completed and good testing resulted in successful products. However, documentation of testing could use some improvement
Actions 6/4/08 (date)
Raise awareness of proper testing documentation during class lecture.

CET Program Outcome Assessment Summary

Learning Outcome: (10) an ability to convey technical material through oral presentation and interaction with an audience.

Data Collection Date: 3/9/08 Coordinator: Ralph Carestia
Assessment Method: Senior project design review oral presentations were evaluated by several CET faculty members. The grading rubric for this exercise is attached

Performance Criteria	Measurement Scale:	Minimum Acceptable Performance:	Results:
Preparation	Number ranking Excellent or Good	80%	100% (8/8)
Knowledge	"	80%	87.5% (7/8)
Organization	"	80%	100% (8/8)
Delivery	"	80%	100% (8/8)
Graphics	"	80%	100% (8/8)
Elocution	"	80%	100% (8/8)

Evaluation 6/4/08 (date)
Students exceeded expectations. There was a consensus among faculty that the seniors gave adequate presentations.
Actions 6/4/08 (date)
No formal action is required at this time.

CET Program Outcome Assessment Summary

Learning Outcome: (12) an ability to improve system design with regard to quality and project management

Data Collection Date: 6/3/08 Coordinator: Phong Nguyen
Assessment Method: A survey in CST 373 (Embedded System Development III- Junior Project) was used. The survey covered three aspects of quality management: understanding of quality management, validation testing and planning for validation testing. The last criterion was based on the professor's direct assessment of student projects.

Performance Criteria	Measurement Scale:	Minimum Acceptable Performance:	Results
Understanding / definition of quality management	Number of students that can define quality management	70%	57.1% (8/14)
Quality management was taught and is a part of JP	Number of students that believed QM was an integral part of JP	n/a	78.6% (11/14)
Improvement of design in packaging	6 of 6 groups improved packaging by 6th week	5 of 6 groups improve	6 of 6

Evaluation 6/4/08 (date)
Although 11/14 students recalled that quality management was taught, only 6/14 remembered the details of it well enough to provide a definition of quality management. However, as part of continuous improvement, packaging of the project saw improvements from all 6 teams from the first packaging trial.

Actions 6/4/08 (date)
Instead of addressing the topic of quality management only CST 373, it will be addressed in dedicated lecture periods during each of the 3 quarters of junior project (CST 371/2/3). This outcome will be assessed again in 2009/10 when it comes up in the regular assessment rotation. It was felt that it would be appropriate also to attempt an assessment of this outcome with seniors in BUS 304 (Engineering Management) at that time.