LEARNING OUTCOMES ASSESSMENT PLAN
DEPARTMENT OF MATHEMATICAL, INFORMATION AND COMPUTER SCIENCES

COMPUTER SCIENCE MAJOR

Department Learning Outcome (Teach): *Graduates will have a coherent and broad-based knowledge of the discipline of computing.*

Program Learning Outcomes (Teach):

1. Students will be able to write correct and robust software.
2. Students will use the theory of algorithms and computation to solve problems.
3. Students will analyze the interaction between hardware and software.

Department Learning Outcome (Shape): *Students will develop characteristics necessary to be effective members of the communities where they work and live.*

Program Learning Outcomes (Shape):

4. Students will be able to apply their technical knowledge to solve problems.
5. Students will be able to speak about their work with precision, clarity and organization (Oral Communication).
6. Students will be able to write about their work with precision, clarity and organization (Written Communication).
7. Students will collaborate effectively in teams.
8. Students will be able to identify, locate, evaluate, and effectively and responsibly use and cite information for the task at hand (Information Literacy).
9. Students will be able to gather relevant information, examine information and form a conclusion based on that information (Critical Thinking).
10. Students will be able to understand and create arguments supported by quantitative evidence, and they can clearly communicate those arguments in a variety of formats (Quantitative Reasoning).

Department Learning Outcome (Send): *We believe that work is an act of service. Graduates will be prepared to serve a complex world through their technical and professional abilities.*

Program Learning Outcomes (Send):

11. Computer Science graduates will be adequately prepared for entry into graduate school or jobs in the computing profession.

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will be able to write correct and robust software.

Outcome Measure: Annual: CSC254 Signature Assignment

Criteria for Success: 80% of the students should have an average score of at least 2 in each of the major areas.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage of Class at 2 or Higher	Percentage of Class at 2 or Higher	Percentage of Class at 2 or Higher	Percentage of Class at 2 or Higher	Percentage of Class at 2 or Higher
	2011	**2012**	**2013**	**2014**	**2015**
Compilation	100%	100%	92%	75%	100%
Runtime Correctness	86%	58%	85%	100%	62%
Problem Solving	100%	100%	100%	75%	92%

Conclusions Drawn from Data:
The students find the run-time correctness the most challenging. This is because this is the area of programming that is the most detailed oriented.

Changes to be Made Based on Data:
Continue to emphasize the need to carefully de-bug computer code during development.

CSC 254 Signature assignment

	Unsatisfactory (1)	Satisfactory (2)	Good (3)	Excellent (4)
Compilation	• Compiles with errors	• Compiles with no errors, but has linking errors	• Compiles with no syntax errors or linking errors, but has warnings.	• Compiles and links with no errors
Runtime correctness	• No correct response to any test case from the sample data provided.	• Executes correctly on at least one test case from the sample data provided.	• Executes correctly on the given sample data, but not accepted by the online judge (no need to look at source code in this case)	• Accepted by the online judge, indicating that it has passed numerous independent test cases unknown to the student.
Problem solving	• Analysis of program source code indicates that program is NOT close to working, and could NOT easily be modified to work given additional time.	• Analysis of program source code indicates that the student partially understands the problem solution.	• Analysis of program source code indicates that program is close to working, and could be modified to work given additional time.	• Accepted by judge

Criterion: 80% of students will average 2 in Runtime correctness and Problem solving.

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will use the theory of algorithms and computation to solve problems.

Outcome Measure: Annual: ETS Major Field Test in Computer Science: Structures and Algorithms subscore

Criteria for Success: The department subscore will be at the 65th percentile or higher.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data
This is the most recent 10 years of data.

Year	Percentile
2005-06	*
2006-07	90
2007-08	95
2008-09	70
2009-10	70
2010-11	90
2011-12	63
2012-13	*
2013-14	53
2014-15	90
2015-16	92

* Sample size too small to be given indicator scores.
ETS changed the CS exam in 2011-12.

Conclusions Drawn from Data:
This data is a challenge to interpret for several reasons: some years our sample size is too small for ETS to provide the subscore and our sample size is sufficiently small that the standard deviation is relatively large. We have been hitting our target most years, however we dropped after the CS exam was changed in 2011-12, yet showed improvement in 2014-15 and 2015-16.

Changes to be Made Based on Data:
We need to evaluate the test questions to determine if this remains a valid measurement tool that is aligned with our curriculum. We are also making curricular changes that will have students exposed to algorithms earlier in the curriculum. We have noticed that there may be a correlation between this data and our curricular cycle. We teach several key classes in alternating years and it appears that students are more successful in the years when the algorithms class is taught – this will be a topic for analysis in our upcoming program review.

Rubric Used
Scoring done by ETS on the Major Field Test.

Longitudinal Data:

	2013-14		2012-13		2011-12		2010-11		2009-10	
Computer Science	Score	Percentile	Score	Percentile	Score	Percentile	Score	Percentile	Score	Percentile
Department Average	154	65	139	14	155.3	64	156.3	70	153.5	65
Percent of Students Above 50th Percentile		67%		0%		57%		71%		60%
Number of Students Taking the Test		6		2		7		7		5
Programming Fundamentals	52	55	*	*	51	46	64	65	65	70
Computer Org/Arch/Oper Sys	49	82	*	*	53	89	39	65	49	90
Structures and Algorithms	40	53	*	*	43	63	56	90	49	70

	2008-09		2007-08		2006-07		2005-06		2004-05	
Computer Science	Score	Percentile	Score	Percentile	Score	Percentile	Score	Percentile	Score	Percentile
Department Average	162.8	90	167.3	95	166.3	95	158.6	80	152.3	55
Percent of Students Above 50th Percentile		100%		100%		100%		75%		100%
Number of Students Taking the Test		4		3		3		8		3
Programming Fundamentals	73	95	68	85	73	85	*	*	*	*
Computer Org/Arch/Oper Sys	54	95	52	44	52	90	*	*	*	*
Structures and Algorithms	50	70	77	95	59	90	*	*	*	*

* Sample size too small to be given indicator scores.
ETS changed the CS exam in 2011-12.

Conclusions Drawn from Data:
This data is a challenge to interpret for several reasons: some years our sample size is too small for ETS to provide the subscore and our sample size is sufficiently small that the standard deviation is relatively large. We have been hitting our target most years, however we dropped after the CS exam was changed in 2011-12.

Changes to be Made Based on Data:
We need to evaluate the test questions to determine if this remains a valid measurement tool that is aligned with our curriculum. We are also making curricular changes that will have students exposed to algorithms earlier in the curriculum.

Rubric Used
Scoring done by ETS on the Major Field Test.

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will analyze the interaction between hardware and software.

Outcome Measure:
Annual (CS and IS): CSC314 Signature Assignment
Annual (CS): ETS CS Exam Computer Organization, Architecture and Operating Systems Subscore.

Criteria for Success:
CSC314 Assignment: 80% of the students should have an average score of at least 7.
ETS: The department subscore will be at the 65th percentile or higher.

Aligned with DQP Learning Areas (circle one or more):
1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage of Class at 7 or Higher				
	2012	**2013**	**2014**	**2015**	**2016**
Hardware/software interaction understanding	85%	89%	82%	92%	88%

ETS Subscore:

Year	Percentile
2005-06	*
2006-07	90
2007-08	44
2008-09	95
2009-10	90
2010-11	65
2011-12	89
2012-13	*
2013-14	82
2014-15	94
2015-16	86

* Sample size too small to be given indicator scores.
ETS changed the CS exam in 2011-12.

Conclusions Drawn from Data:
Students have been able to successfully master the material in the CSC314 assessment.

This data from the ETS subscore is a challenge to interpret for several reasons: some years our sample size is too small for ETS to provide the subscore and in all years our sample size is sufficiently small that the standard deviation is relatively large. We have been hitting our target most years

Changes to be Made Based on Data:
Continue to require operating systems (CSC314) of all CS and IS students, even though we are in the process of changing the IS major.

We need to evaluate the ETS test questions to determine if this remains a valid measurement tool that is aligned with our curriculum. We have noticed that there may be a correlation between this data and our curricular cycle. We teach several key classes in alternating years and it appears that students are more successful in an alternating year cycle. We need to investigate this further as part of our upcoming program review.

Rubric Used (CSC314)
The scoring for this assignment is purely points based.

	Unsatisfactory (1)	**Satisfactory (2)**	**Good (3)**	**Excellent (4)**
Points gained by showing understanding of software/hardware interaction in answering question	6 and below	7	8	9-10

Rubric Used (ETS)
Scoring done by ETS on the Major Field Test.

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will be able to apply their technical knowledge to solve problems.

Outcome Measure: Alternating Year**:** CSC493 Signature Assignment related to constructing a software application.

Criteria for Success: 75% of the students should have an average score of at least 70%.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage of Class at 70% or Higher	**Percentage of Class at 70% or Higher**
	2013	**2015**
Hardware/software interaction understanding	67%	86%

Scale Used:

System based on a maximum of 20 points.

Conclusions Drawn from Data:

Students did not seem aware that a detailed response was expected for questions 2, 3 and 4. This confusion caused lower scores. The change in information seems to have improved scores. Note that this class will not be taught until 2016-17 so this is the most recent data that we have.

Changes to be Made Based on Data:

The prompt for the assignment has been modified to address the confusion about questions 2-4. We continue the need to engage in careful software development processes.

Rubric Used

We will score the questions according to the following table:

	Information to be Provided	Possible Points
1	Briefly describe the problem you were trying to solve	None
2	Give one functional requirement by **cutting and pasting** from your Requirements Analysis Document.	0-1
3	Give one non-functional requirement by **cutting and pasting** from your Requirements Analysis Document.	0-1
4	From your software test plan, give one test case that you developed for each the requirements given in 2 and 3 above. **Cut and paste the two test cases from your software test document.**	0-2
5	Attach the source code listing for the relevant portions of the code which satisfy the functional requirement given in #2 above. Please use a highlighter to highlight the relevant functions/code.	None
6	Did your final project iteration pass these two test cases? If not, why not?	None
7	Out of _____ tests in the Software Test Plan, _____ tests passed for the final project.	0-3
8	How many core requirements did you have in the Requirements Analysis Document? _____. How many were implemented in the final version of the software _____?	0-3
9	Explain the functionality of your final delivered code (1 point), highlighting similarities and differences with the initial problem requirements (1 point).	0-2
10	What programming language(s) did you use and why?	0-1
11	What operating system did you use and why?	0-1
12	What software tools (e.g. programming IDE, automated test tools, CASE tools, etc.) did you use and why?	0-1
13	Did you reuse software? Describe what libraries, frameworks, etc. you used and why.	0-1
14	Custom Satisfaction Rating	0-4

Notes:
Q7 and Q8 should be scored based upon the percentage of tests passed/requirements implemented, where less than 1/3 is 0, 1/3 to less than 2/3 is 1, 2/3 to less than all tests/requirements is 2, and all tests/requirement is 3.
Customer grade is customer's grade percentage times 4 'rounded' down to the next lowest integer.

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will be able to speak about their work with precision, clarity and organization (Oral Communication).

Outcome Measure: Annual: Each student will be required to give a 20-minute oral presentation on a topic in their field as a part of their participation in the Senior Seminar. The audience for this talk will include department faculty, fellow students and possibly some alumni. The students will be given the evaluation criteria in advance of their presentation and will be rated by the faculty using a rubric with a scale of 4 (outstanding) to 1 (unsatisfactory) in the following areas:

- Command of background material
- Organization
- Oral presentation skills (added as part of the new rubric in the spring of 2010)
- Use of presentation tools
- Ability to field questions from the audience

Note that the department has a mapping between its rubric and the AAC&U Oral Communication Value Rubric.

Criteria for Success: 80% of the students should have an average score of at least 2.5 in each of the major areas in the department rubric. This translates to 80% of the students being above a 3.5 in the AAC&U rubric.

Our translation from our data to the AAC&U is included. Our department continues to provide the students with our departmental rubric because it has been developed over many years and works effectively with our majors.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

Oral Presentation	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Background	92%	80%	94%	94%	88%	100%	95%	100%	100%	92%	100%	95%
Organization	92%	80%	94%	94%	94%	100%	85%	100%	100%	100%	100%	100%
Oral presetnation skills (2010)						100%	90%	100%	100%	92%	100%	95%
Presentation Tools	83%	80%	94%	88%	94%	100%	100%	100%	100%	100%	100%	100%
Ability to field questions	92%	80%	94%	81%	100%	100%	100%	83%	100%	100%	89%	100%

AAC&U "translation" (we have only done this for the years that PLNU has been making use of the DQP)

Oral AAC&U	2012-13	2013-14	2014-15	2015-16
Organization	100%	100%	100%	100%
Language	100%	92%	100%	100%
Delivery	100%	92%	100%	95%
Supporting Material	100%	100%	100%	100%
Central Message	100%	100%	89%	100%

Conclusions Drawn from Data:
In general, the students have been performing reasonably well in the area of giving oral presentations. We attribute this to the fact that we intentionally have students presenting technical material in front of others starting in their freshman year.

Changes to be Made Based on Data:
Over time we have increased our standards and expanded the rubric to increase clarity for students and to push them to speak at a professional level. Looking at the scores, it is possible to see the times when alterations have been made:

- 2008-09 Standards tightened
- 2009-10 Rubric expanded to include more detailed instructions

MICS Oral Presentation Rubric

Criteria	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
Command of background material	□ Clearly knows material and key facts by memory	□ Clearly knows key facts with a few memory slips	□ Reads some information; knows some facts from memory	□ Reads sentences from slides
	□ Expands on PPT slides	□ Some expansion on PPT slides	□ No expansion of PPT slide content	□ Dependent on notes
	□ Content appropriate for audience	□ Partial audience adaptation of content	□ Little audience adaptation of content	□ Lacks audience adaptation of content
Organization	□ Clear and concise outline	□ Clear outline	□ Some sense of outline	□ No clear outline
	□ Relevant graphics and key text items on slides	□ Too much information on slides (not concise)	□ Too much detailed information on slides	□ Slides are in paragraphed; too much detailed information on one slide
	□ Presentation length is +/- 30 seconds of time limit	□ +/- 1 minute of time limit	□ +/- 1:30 of time limit	□ +/- 2 minutes of time limit
Oral Presentation skills	□ Clearly has practiced several times; smooth transitions	□ Has practiced but transitions are not smooth	□ Has practiced presentation but cannot verbally make transitions between slides	□ Clearly did not practice presentation; Does not anticipate content of next slide
	□ Engages audience in content at least twice and engagement is well connected to talk (questions, examples, etc)	□ Engages audience at least once in content (questions, examples, etc.) and engagement is well connected to the talk.	□ Audience engagement at least once with content (questions, examples, etc.) but it is not well connected to the talk.	□ No audience involvement
	□ Free of disfluencies (ah, uhm)	□ A few disfluencies (ah, umh, er)	□ Many disfluencies (ah, umh, er)	□ Disfluencies (ah, umh, er) detract from presentation
	□ Is clearly heard in the room and uses inflection for emphasis	□ Can be understood most of the time and uses some inflection	□ Can sometimes be understood and uses little inflection	□ Can not be heard and/or speaks in a monotone
	□ Engaged audience through eye contact	□ Some engagement of audience through eye contact	□ Infrequent eye contact	□ Little audience awareness or eye contact
	□ Engaged audience through gestures	□ Some engagement of audience through gestures	□ Distracting gestures or mannerisms	□ Frequent distracting gestures or mannerisms
Use of Presentation Tools	□ PPT background is matched to content, legible font, seamless transitions	□ Appropriate PPT slide backgrounds, transitions & font	□ Distracting PPT slide backgrounds and transitions, font hard to read	□ No attention given to PPT slide backgrounds and transitions, font illegible
	□ Graphics imbedded and matched to topic, necessary hyperlinks work	□ Most graphics imbedded and matched to topic, most necessary hyperlinks work	□ Some inappropriate graphics or use of PPT embellishments, necessary hyperlinks don't work	□ Distracting use of embellishments, graphics not connected to topic
Ability to field questions	□ Able to answer questions clearly and without hesitation and prepared material to answer anticipated questions	□ Can answer all questions with some hesitation	□ Able to answer half of the questions with hesitation	□ Unable to answer any questions

Translation between MICS and AAC&U Rubric

MICS Category	MICS Item Position in Rubric	AAC&U Category
Clear and concise outline	4	Organization
Relevant graphics and key text items on slides	5	Organization
Presentation length is +/- 30 seconds of time limit	6	Organization
Expands on PPT slides	2	Language
Content appropriate for audience	3	Language
Engages audience	8	Language
Transitions	7	Delivery
Free of disfluencies (ah, uhm)	9	Delivery
Is clearly heard in the room and uses inflection for emphasis	10	Delivery
Engaged audience through eye contact	11	Delivery
Engaged audience through gestures	12	Delivery
PPT background is matched to content, legible font, seamless transitions	13	Delivery
Relevant graphics and key text items on slides	5	Supporting
Graphics imbedded and matched to topic, necessary hyperlinks work	14	Supporting
Clearly knows material and key facts by memory	1	Central Message
Able to answer questions clearly and without hesitation	15	Central Message

AAC&U Value Rubric

	Capstone 4	Milestones 3	Milestones 2	Benchmark 1
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced, but is not explicitly stated in the presentation.

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will be able to write about their work with precision, clarity and organization (Written Communication).

Outcome Measure:
Annual: Each student will be required to write a paper on a topic in their field as a part of their participation in the Senior Seminar. The audience for this talk will include department faculty, fellow students and possibly some alumni. The students will be given the evaluation criteria in advance of their presentation and will be rated by the faculty using a rubric with a scale of 4 (outstanding) to 1 (unsatisfactory) in the following areas:

- Bibliography and other supporting documentation
- Organization
- Grammar and spelling
- Depth of information
- Clarity of writing

Note that the department has a mapping between its rubric and the AAC&U Written Communication Value Rubric.

Annual: ETS Proficiency Profile.

Criteria for Success: 80% of the students should have an average score of at least 2.5 in each of the major areas in the department rubric. This translates to 80% of the students being above a 3.5 in the AAC&U rubric.

ETS: 85% of our students will be marginal or proficient on the Level 2 Writing test.

Our translation from our data to the AAC&U is included. Our department continues to provide the students with our departmental rubric because it has been developed over many years and works effectively with our majors

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

Written Report	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Bibliography and support	82%	60%	88%	69%	75%	88%	55%	93%	100%	100%	100%	89%
Organization	91%	87%	94%	100%	88%	63%	65%	93%	100%	100%	100%	100%
Grammar and Spelling	91%	73%	88%	94%	75%	81%	60%	79%	100%	92%	89%	84%
Depth of Information	82%	60%	88%	81%	88%	88%	50%	93%	91%	77%	78%	89%
Clarity of Writing	82%	80%	94%	94%	69%	81%	70%	79%	91%	77%	78%	89%

AAC&U “translation” (we have only done this for the years that PLNU has been making use of the DQP)

Written AAC&U	2012-13	2013-14	2014-15	2015-16
Organization	100%	100%	100%	89%
Language	100%	92%	100%	89%
Delivery	100%	92%	100%	100%
Supporting Material	100%	100%	100%	89%
Central Message	100%	100%	89%	84%

	Percentage at Marginal or Proficient			
Written ETS	2012-13	2013-14	2014-15	2015-16
ETS Proficiency Profile	60%	85%	100%	89%

Conclusions Drawn from Data:
In general, the students have been performing reasonably well in writing technical reports. We still some weaknesses in the quality of their writing and the use of their source material. The sample size for ETS in the first year was extremely small so we are not particularly concerned about the fact that the score was below the benchmark.

Changes to be Made Based on Data:
Over time we have increased our standards and expanded the rubric to increase clarity for students and to push them to speak at a professional level. Looking at the scores, it is possible to see the times when alterations have been made:

- 2008-09 Standards tightened
- 2009-10 Rubric expanded to include more detailed instructions
- In 2014-15 we instituted a literature review assignment to strengthen the students' capacity for using resources and identifying why the resources are relevant. This assignment needs to be adjusted, but seems to have helped students to understand their work.

In addition, the university has just changed general education requirements so that students will take an upper division literature class. We hope that this further exposure to formal writing later in their academic career will help to strengthen our students' writing.

MICS Written Presentation Rubric

Criteria	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
Bibliography and supporting documents	☐ Multiple references from distinct reputable sources	☐ Most references from distinct reputable sources	☐ Some references from reputable sources	☐ No bibliography or all references from untrusted sites on the internet
	☐ References cited in the body of the document	☐ Some citation of references in the body of the document	☐ Limited citation of references in the body of the document	☐ No citation of references in the body of the document
Organization	☐ Conveys a central theme with all ideas connected, arrangement of ideas clearly related to topic	☐ Conveys a central idea or topic with some ideas connected to the topic	☐ Attempts to focus on an idea or topic with many ideas not connected to the topic	☐ Has little or no focus on central idea or topic
	☐ Clear introduction, body (with sections), and conclusion includes summary and closure	☐ Includes introduction, body and conclusion	☐ Introduction, body, conclusion detectable but not clear	☐ Introduction, body or conclusion absent
	☐ Includes both an abstract and table of contents	☐ Includes abstract and table of contents (one partial and one complete)	☐ Includes partial abstract and partial table of contents	☐ No abstract or table of contents
Grammar and spelling	☐ No use of first- person tense	☐ Few uses of the first-person tense	☐ Several uses of the first- person tense	☐ Written in first-person tense
	☐ No grammatical or spelling errors	☐ Few grammatical and spelling errors	☐ Some grammatical and spelling errors	☐ Many grammatical and spelling errors
Depth of information	☐ Appropriately synthesizes information from multiple distinct sources	☐ Synthesis of information from at least three distinct sources	☐ Synthesis of information from at least two distinct sources	☐ Summary reporting of information without synthesis
	☐ Draws conclusions and personal insights from synthesis	☐ At least two personal insights or conclusions stated	☐ At least one personal insight or conclusion stated	☐ No personal insights
	☐ Has the minimum number of pages including penalty pages; subject coverage is excellent	☐ Has the minimum number of pages including penalty pages; subject coverage is good	☐ Has the minimum number of pages including penalty pages; subject coverage is adequate	☐ Does not have the minimum number of pages including penalty pages
Clarity of writing	☐ Sentences flow	☐ Good sentence structure	☐ Occasional poor sentence structure	☐ Frequent poor sentence structure
	☐ Smooth transitions between paragraphs	☐ Adequate transitions between paragraphs	☐ Transitions between paragraphs unclear	☐ Lacked transitions between paragraphs
	☐ Any and all terms and acronyms are defined	☐ Most terms and acronyms are defined	☐ Some terms and acronyms are defined	☐ Many terms and acronyms are undefined
	☐ Provides evidence to support points	☐ Lacks support for some points	☐ Provides minimal support for points	☐ Ideas not supported

Translation between MICS and AAC&U Rubric

MICS Category	MICS Item Position in Rubric	AAC&U Category
Conveys a central theme with all ideas connected, arrangement of ideas clearly related to topic	3	Purpose
Appropriately synthesizes information from multiple distinct sources	8	Development
Draws conclusions and personal insights from synthesis	9	Development
Has the minimum number of pages including penalty pages; subject coverage is excellent	10	Development
Provides evidence to support points	14	Development
Clear introduction, body (with sections), and conclusion includes summary and closure	4	Genre
Includes both an abstract and table of contents	5	Genre
Multiple references from distinct reputable sources	1	Source
References cited in the body of the document	2	Source
No use of first- person tense	6	Syntax
No grammatical or spelling errors	7	Syntax
Sentences flow	11	Syntax
Smooth transitions between paragraphs	12	Syntax
Any and all terms and acronyms are defined	13	Syntax

AAC&U Written Communication Value Rubric

	Capstone 4	Milestones 3	Milestones 2	Benchmark 1
Context of and Purpose for Writing *Includes considerations of audience, purpose, and the circumstances surrounding the writing task(s).*	Demonstrates a thorough understanding of context, audience, and purpose that is responsive to the assigned task(s) and focuses all elements of the work.	Demonstrates adequate consideration of context, audience, and purpose and a clear focus on the assigned task(s) (e.g., the task aligns with audience, purpose, and context).	Demonstrates awareness of context, audience, purpose, and to the assigned tasks(s) (e.g., begins to show awareness of audience's perceptions and assumptions).	Demonstrates minimal attention to context, audience, purpose, and to the assigned tasks(s) (e.g., expectation of instructor or self as audience).
Content Development	Uses appropriate, relevant, and compelling content to illustrate mastery of the subject, conveying the writer's understanding, and shaping the whole work.	Uses appropriate, relevant, and compelling content to explore ideas within the context of the discipline and shape the whole work.	Uses appropriate and relevant content to develop and explore ideas through most of the work.	Uses appropriate and relevant content to develop simple ideas in some parts of the work.
Genre and Disciplinary Conventions *Formal and informal rules inherent in the expectations for writing in particular forms and/or academic fields (please see glossary).*	Demonstrates detailed attention to and successful execution of a wide range of conventions particular to a specific discipline and/or writing task (s) including organization, content, presentation, formatting, and stylistic choices	Demonstrates consistent use of important conventions particular to a specific discipline and/or writing task(s), including organization, content, presentation, and stylistic choices	Follows expectations appropriate to a specific discipline and/or writing task(s) for basic organization, content, and presentation	Attempts to use a consistent system for basic organization and presentation.
Sources and Evidence	Demonstrates skillful use of high-quality, credible, relevant sources to develop ideas that are appropriate for the discipline and genre of the writing	Demonstrates consistent use of credible, relevant sources to support ideas that are situated within the discipline and genre of the writing.	Demonstrates an attempt to use credible and/or relevant sources to support ideas that are appropriate for the discipline and genre of the writing.	Demonstrates an attempt to use sources to support ideas in the writing.
Control of Syntax and Mechanics	Uses graceful language that skillfully communicates meaning to readers with clarity and fluency, and is virtually error-free.	Uses straightforward language that generally conveys meaning to readers. The language in the portfolio has few errors.	Uses language that generally conveys meaning to readers with clarity, although writing may include some errors.	Uses language that sometimes impedes meaning because of errors in usage.

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will collaborate effectively in teams.

Outcome Measure:
Annual: CSC324 Signature Assignment – evaluation of group while working on a project
Annual: MTH352 Signature Assignment – evaluation of group while working on a project

Criteria for Success: 80% of the students should have an average score of at least 2.5 in each of the major areas.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	CSC324 Percent of students with average at least 3.0	
	Fall 2012	Fall 2014
Contributes to team meetings	86%	80%
Encourages team members	93%	84%
Contributes individually outside of team meetings	93%	88%
Attitude	100%	96%
Fosters constructive team climate	100%	92%
Responds to conflict	100%	100%

	MTH352 Percent of students with average at least 3.0	
	Spring 2013	Spring 2015
Contributes to team meetings	91%	86%
Encourages team members	91%	93%
Contributes individually outside of team meetings	82%	93%
Attitude	100%	100%
Fosters constructive team climate	91%	100%
Responds to conflict	91%	100%

Conclusions Drawn from Data:
The students are performing well as member of teams. Note that these classes will not be taught again until 2016-17 so this is the most recent data that we have.

Changes to be Made Based on Data:
Continue to make use of group activities throughout the curriculum.

MICS Teamwork Rubric

Definition

Teamwork is behaviors under the control of individual team members (effort they put into team tasks, their manner of interacting with others on team, and the quantity and quality of contributions they make to team discussions.)

Evaluators are encouraged to assign a zero to any work sample or collection of work that does not meet unsatisfactory (cell one) level performance.

The purpose of this is to evaluate individual team members. Although no team member will ever see your evaluation of them, please take it seriously.

Directions:

- **Do not put your own name anywhere on this form, the evaluations are to be anonymous.**
- **Please write the name of the person you are evaluating here ……._____**
- **Please fill out one copy of this form for every person who was on your team, including one for yourself.**
- **For each row, place a checkmark in the box that best describes your teammate's performance.**

	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
Contributes to team meetings	□ Helps the team move forward by articulating the merits of alternative ideas or proposals.	□ Offers new suggestions to advance the work of the group.	□ Shares ideas but does not advance the work of the group.	□ Sits quietly in team meetings and does not contribute
Encourages members of the team	□ Actively seeks to find opportunities to encourage all members of the team.	□ Offers encouragement to all members of the team	□ Offers words of encouragement to friends	□ Does not offer word of encouragement to anyone
Individual contributions outside of team meetings	□ Completes all assigned tasks by deadline; work accomplished is thorough. Proactively helps other team members complete their assigned tasks.	□ Completes all assigned tasks by deadline; work accomplished is thorough.	□ Completes all assigned tasks by deadline.	□ Does not complete all assigned tasks by deadline.
Attitude	□ Demonstrates (comments, facial expressions, etc.) a negative attitude **rarely** and helps others to become more positive.	□ Demonstrates (comments, facial expressions, etc.) a negative attitude **rarely**.	□ Demonstrates (comments, facial expressions, etc.) a negative attitude **less** often than a positive attitude.	□ Demonstrates (comments, facial expressions, etc.) a negative attitude **more** often than a positive attitude.

Fosters constructive team climate	☐ Supports a constructive team climate by doing **all** of the following: • Treats team members respectfully by being polite and constructive in communication. • Uses positive vocal or written tone, facial expressions, and/or body language to convey a positive attitude about the team and its work. • Motivates teammates by expressing confidence about the importance of the task and the team's ability to accomplish it.	☐ Supports a constructive team climate by doing any **two** of the following: • Treats team members respectfully by being polite and constructive in communication. • Uses positive vocal or written tone, facial expressions, and/or body language to convey a positive attitude about the team and its work. • Motivates teammates by expressing confidence about the importance of the task and the team's ability to accomplish it.	☐ Supports a constructive team climate by doing any **one** of the following: • Treats team members respectfully by being polite and constructive in communication. • Uses positive vocal or written tone, facial expressions, and/or body language to convey a positive attitude about the team and its work. • Motivates teammates by expressing confidence about the importance of the task and the team's ability to accomplish it.	☐ Supports a constructive team climate by doing **none** of the following: • Treats team members respectfully by being polite and constructive in communication. • Uses positive vocal or written tone, facial expressions, and/or body language to convey a positive attitude about the team and its work. • Motivates teammates by expressing confidence about the importance of the task and the team's ability to accomplish it.
Responds to conflict	☐ Identifies and acknowledges conflict and acknowledges that relationships can be damaged. Seeks to restore relationships.	☐ Identifies and acknowledges conflict and acknowledges that relationships can be damaged.	☐ Identifies and acknowledges conflict but will not acknowledge that relationships can be damaged.	☐ Will not acknowledge that conflict has occurred or that relationships can be damaged.

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will be able to identify, locate, evaluate, and effectively and responsibly use and cite information for the task at hand (Information Literacy).

Outcome Measure: Annual: Each student will be required to write a paper on a topic in their field as a part of their participation in the Senior Seminar. The audience for this talk will include department faculty, fellow students and possibly some alumni. The students will be given the evaluation criteria in advance and their paper will be rated by the faculty using a rubric with a scale of 4 (capstone) to 1 (benchmark) in the following areas:

- References: Multiple references from distinct reputable sources
- Citation: References cited in the body of the document
- Synthesis: Appropriately synthesizes information from multiple distinct sources.

Criteria for Success: 80% of the students should have an average score of at least 3 in each of the major areas.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage of Students at 2.5 or Higher			
Information Literacy	2012-13	2013-14	2014-15	2015-16*
References				95%
Citation				84%
Synthesis				84%
Determine the Extent of Information Needed	100%	62%	78%	
Access the Needed Information	91%	69%	100%	
Evaluate Information and its Sources Critically (carefully explains the reasons for the choice of source) (added 2014-15)			33%	
Use Information Effectively to Accomplish a Specific Purpose	91%	85%	89%	
Access and Use Information Ethically and Legally	91%	77%	100%	

* Note that in 2015-16 we returned to gathering information literacy data from our writing rubric. The AAC&U rubric was not working well for our purposes.

Conclusions Drawn from Data:
For the first two years we applied the rubric to the student's final senior paper to measure their use of information. The quality of the use of information was uneven and we had not made our expectations clear.

The students are still having trouble articulating the reasons that they have selected a specific reference for use in their final paper. They are also not cite sources with the consistency that we would desire.

Changes to be Made Based on Data:
In 2014-15 we changed the assignment so that seniors submit a literature review in advance of submitting their final senior paper. This has helped students to consider their choice of references. The paper rubric (attached) has IL components and the students are asked to do a self-assessment with the rubric before turning in their final paper.

The first year of the literature review process was disappointing. We redesigned the process and changed the rubric. We returned to using the IL components of our writing rubric for assessment of IL in the senior seminar. This rubric has been in use for 10 years and the students better understand the expectations communicated by the rubric.

In addition, the change in general education requirements means that all students will be required to take an upper division literature course and that should help reinforce some of these skills closer to the time that our students are writing their final paper in senior seminar.

Rubric
Next Page

Bibliography and supporting documents	☐ Multiple references from distinct reputable sources ☐ References cited in the body of the document	☐ Most references from distinct reputable sources ☐ Some citation of references in the body of the document	☐ Some references from reputable sources ☐ Limited citation of references in the body of the document	☐ No bibliography or all references from untrusted sites on the internet ☐ No citation of references in the body of the document
Organization	☐ Conveys a central theme with all ideas connected, arrangement of ideas clearly related to topic ☐ Clear introduction, body (with sections), and conclusion includes summary and closure ☐ Includes both an abstract and table of contents	☐ Conveys a central idea or topic with some ideas connected to the topic ☐ Includes introduction, body and conclusion ☐ Includes abstract and table of contents (one partial and one complete)	☐ Attempts to focus on an idea or topic with many ideas not connected to the topic ☐ Introduction, body, conclusion detectable but not clear ☐ Includes partial abstract and partial table of contents	☐ Has little or no focus on central idea or topic ☐ Introduction, body or conclusion absent ☐ No abstract or table of contents
Grammar and spelling	☐ No use of first- person tense ☐ No grammatical or spelling errors	☐ Few uses of the first-person tense ☐ Few grammatical and spelling errors	☐ Several uses of the first- person tense ☐ Some grammatical and spelling errors	☐ Written in first-person tense ☐ Many grammatical and spelling errors
Depth of information	☐ Appropriately synthesizes information from multiple distinct sources ☐ Draws conclusions and personal insights from synthesis ☐ Has the minimum number of pages including penalty pages; subject coverage is excellent	☐ Synthesis of information from at least three distinct sources ☐ At least two personal insights or conclusions stated ☐ Has the minimum number of pages including penalty pages; subject coverage is good	☐ Synthesis of information from at least two distinct sources ☐ At least one personal insight or conclusion stated ☐ Has the minimum number of pages including penalty pages; subject coverage is adequate	☐ Summary reporting of information without synthesis ☐ No personal insights ☐ Does not have the minimum number of pages including penalty pages
Clarity of writing	☐ Sentences flow ☐ Smooth transitions between paragraphs ☐ Any and all terms and acronyms are defined ☐ Provides evidence to support points	☐ Good sentence structure ☐ Adequate transitions between paragraphs ☐ Most terms and acronyms are defined ☐ Lacks support for some points	☐ Occasional poor sentence structure ☐ Transitions between paragraphs unclear ☐ Some terms and acronyms are defined ☐ Provides minimal support for points	☐ Frequent poor sentence structure ☐ Lacked transitions between paragraphs ☐ Many terms and acronyms are undefined ☐ Ideas not supported

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will be able to gather relevant information, examine information and form a conclusion based on that information (Critical Thinking).

Outcome Measure:

Annual: Each student will be required to write a paper on a topic in their field as a part of their participation in the Senior Seminar. The audience for this talk will include department faculty, fellow students and possibly some alumni. The students will be given the evaluation criteria which will be applied to their paper and will be rated by the faculty using a rubric with a scale of 4 (capstone) to 1 (benchmark) in the following areas:

- Explanation of issues
- Evidence: Selecting and using information to investigate a point of view or conclusion
- Conclusion and related outcomes (implications and consequences)

Annual: ETS Proficiency Profile

Criteria for Success: 80% of the students should have an average score of at least 2.5 in each of the major areas. This is based on the AAC&U 1-4 point scoring system.

ETS: 85% of the students will be marginal or proficient at Level 2 Reading/Critical Thinking.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage of Students at 2.5 or Higher			
Critical Thinking Rubric	2012-13	2013-14	2014-15	2015-16
Explanation of issues	100%	77%	100%	89%
Evidence	100%	77%	89%	84%
Conclusions and related outcomes (implications and consequences)	100%	85%	89%	89%
	Percentage of Students Marginal or Proficient			
ETS Proficiency Profile	2012-13	2013-14	2014-15	2015-16
ETS Exam	80%	92%	100%	89%

Conclusions Drawn from Data:
The AAC&U rubrics are written in a language that is rooted in the humanities. We have had to work with students to translate/clarify the meaning of some aspects of the rubric, assignment and our expectations. They are generally meeting our expectations. We however still have work to do.

Our students have been meeting the benchmark on the ETS exam. The variability has to do with the small sample size.

Changes to be Made Based on Data:
We are providing the students with the critical thinking rubric as part of the instructions for the assignment and starting in 2014-15 we began having them self-assess their work with the rubric before submission. We expect to need to further modify the rubric to use language that is better understood by our students.

Rubric:

MICS Critical Thinking Rubric (2/6/13)
Adapted from the AAC&U Value Rubric

	Capstone – 4	Milestone -3	Milestone - 2	Benchmark -1
Explanation of issues	Issue/problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/or backgrounds unknown.	Issue/problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/evaluation. Viewpoints of experts are taken as fact, without question.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Students will be able to understand and create arguments supported by quantitative evidence, and they can clearly communicate those arguments in a variety of formats (Quantitative Reasoning).

Outcome Measure: Annual: Each student will participate in the ETS Proficiency Profile exam.

Criteria for Success: 95% of the students will be Marginal or Proficient at Level 2.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percent 2.5 or Higher	
MICS Rubric	2014-15	2015-16
Students will be able to formulate a mathematical model from a verbal description of a problem.	44%	94%
Students will be able it solve non-routine problems using logic and quantitative techniques.	100%	94%
Students will be able to construct solutions to problems using computational techniques.	89%	82%

	Percentage at Marginal or Proficient			
ETS Proficiency Profile	2012-13	2013-14	2014-15	2015-16
ETS Percentage - Level 2	100%	100%	100%	100%

Conclusions Drawn from Data:
When scoring the activity problems in 2014-15, we realized that some of the students had mis-interpreted the question related to “formulate a mathematical model from a verbal description.” This made the problem difficult to score. The assignment was revised in 2015-16. The university is using the ETS test to measure core competencies and that data is presented here as well. The students have done well in meeting benchmarks with both measures.

Changes to be Made Based on Data:
Revise the QL class activity. This was done and the students were more successful in 2015-16. Because of the nature of the disciplines in our department, our curriculum focuses a great deal on quantitative skills. We have found that a single rubric can not be created in a way that allows for the breadth of quantitative thinking and skills that we see in our senior projects and creating a class activity has seemed artificial. So we will be using the ETS exam as a measure of the core competency going forward.

Rubrics
Activity Rubric (attached)
ETS Proficiency Profile (no rubric involved)

Quantitative Reasoning Rubric (this is the same rubric we use for general education)

	Unsatisfactory	Low Satisfactory	Satisfactory	High Satisfactory	Outstanding
Students will be able to formulate a mathematical model from a verbal description of a problem (#1 up to filling in formula).	Completely incorrect	Missed more than one key step or concept	Missed one key step or concept	Made a minor error	Completely correct
Students will be able it solve non-routine problems using logic and quantitative techniques (#2).	Completely incorrect	Missed more than one key step or concept	Missed one key step or concept	Made a minor error	Completely correct
Students will be able to construct solutions to problems using computational techniques (#1 computation of payment).	Completely incorrect	Missed more than one key step or concept	Missed one key step or concept	Made a minor error	Completely correct

Translation between AAC&U Value Rubric and MICS Quantitative Literacy Rubric

Note that the main reason that our department has chosen to not use the AAC&U rubric is that the underlying assumption of the rubric is that students are working with statistical information and are writing text about that statistical information. There is a great deal more to quantitative literacy than statistics and writing about data.

MICS Category	AAC&U Category
	Interpretation *Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words)*
Students will be able to formulate a mathematical model from a verbal description of a problem	**Representation** *Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words)*
Students will be able to construct solutions to problems using computational techniques	**Calculation**
	Application / Analysis *Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis*
	Assumptions *Ability to make and evaluate important assumptions in estimation, modeling, and data analysis*
	Communication *Expressing quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized)*
Students will be able it solve non-routine problems using logic and quantitative techniques	

AAC&U Value Rubric

	Capstone 4	Milestones 3	Milestones 2	Benchmark 1
Interpretation *Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words)*	Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information. *For example, accurately explains the trend data shown in a graph and makes reasonable predictions regarding what the data suggest about future events.*	Provides accurate explanations of information presented in mathematical forms. *For instance, accurately explains the trend data shown in a graph.*	Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units. *For instance, accurately explains trend data shown in a graph, but may miscalculate the slope of the trend line.*	Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means. *For example, attempts to explain the trend data shown in a graph, but will frequently misinterpret the nature of that trend, perhaps by confusing positive and negative trends.*
Representation *Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words)*	Skillfully converts relevant information into an insightful mathematical portrayal in a way that contributes to a further or deeper understanding.	Competently converts relevant information into an appropriate and desired mathematical portrayal.	Completes conversion of information but resulting mathematical portrayal is only partially appropriate or accurate.	Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate.
Calculation	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. Calculations are also presented elegantly (clearly, concisely, etc.)	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem.	Calculations attempted are either unsuccessful or represent only a portion of the calculations required to comprehensively solve the problem.	Calculations are attempted but are both unsuccessful and are not comprehensive.
Application / Analysis *Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis*	Uses the quantitative analysis of data as the basis for deep and thoughtful judgments, drawing insightful, carefully qualified conclusions from this work.	Uses the quantitative analysis of data as the basis for competent judgments, drawing reasonable and appropriately qualified conclusions from this work.	Uses the quantitative analysis of data as the basis for workmanlike (without inspiration or nuance, ordinary) judgments, drawing plausible conclusions from this work.	Uses the quantitative analysis of data as the basis for tentative, basic judgments, although is hesitant or uncertain about drawing conclusions from this work.
Assumptions *Ability to make and evaluate important assumptions in estimation, modeling, and data analysis*	Explicitly describes assumptions and provides compelling rationale for why each assumption is appropriate. Shows awareness that confidence in final conclusions is limited by the accuracy of the assumptions.	Explicitly describes assumptions and provides compelling rationale for why assumptions are appropriate.	Explicitly describes assumptions.	Attempts to describe assumptions.
Communication *Expressing quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized)*	Uses quantitative information in connection with the argument or purpose of the work, presents it in an effective format, and explicates it with consistently high quality.	Uses quantitative information in connection with the argument or purpose of the work, though data may be presented in a less than completely effective format or some parts of the explication may be uneven.	Uses quantitative information, but does not effectively connect it to the argument or purpose of the work.	Presents an argument for which quantitative evidence is pertinent, but does not provide adequate explicit numerical support. (May use quasi-quantitative words such as "many," "few," "increasing," "small," and the like in place of actual quantities.)

Assessment Data Mathematical, Information and Computer Sciences

Learning Outcome: Computer Science graduates will be adequately prepared for entry into graduate school or jobs in the computing profession.

Outcome Measure: Annual**:** Require students to take the ETS Major Field Test in Computer Science as the mid-term exam for the capstone course, Computer Science 481, Senior Seminar in Computer Science.

Every 5 Years: Alumni will be surveyed every five years. They will be asked at least the following questions:

- If you have a job in Computer Science or Computer Information Systems: On a scale of 1 to 5, 1 being outstanding and 5 being poor, how well do you think that the undergraduate Computer Information Systems curriculum at PLNU prepared you for your work in the field?
- If you are going to graduate school or went to graduate school: On a scale of 1 to 5, 1 being outstanding and 5 being poor, how well do you think that the undergraduate Computer Information Systems curriculum at PLNU prepared you for graduate school?

Criteria for Success: 1) 50% of our students achieve above the 50th percentile on the exam.
2) An average response of 2 for each question.

Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

ETS Major Field Test:
Most recent 10 years of data.

	Overall Benchmark	Programming Fundamentals	Computer Organization, Architecture, Operating Systems	Structures and Algorithms
Year		Percentile	Percentile	Percentile
2005-06	Y	*	*	*
2006-07	Y	85	90	90
2007-08	Y	85	44	95
2008-09	Y	95	95	70
2009-10	Y	70	90	70
2010-11	Y	65	65	90
2011-12	Y	46	89	63
2012-13	N	*	*	*
2013-14	Y	55	82	53
2014-15	Y	84	94	90
2015-16	Y	89	86	92

* Sample size too small to be given indicator scores.
ETS changed the CS exam in 2011-12.

Alumni Data:
In the spring of 2010, the department surveyed alumni who had graduated in the last 15 years. The response rate on the survey was 31.7% with the majority (80.9%) of the respondents having graduated in the last decade. A detailed summary analysis of the data can be found in Appendix: 2010 Alumni Survey Results Summary of our department's Program Review. Below are the components of the survey relevant to our assessment plan.

How well did the undergraduate curriculum prepare you for:

	Well or higher	OK	Poorly
Work in the field (if went into the field)	85.2%	14.8%	0.0%
Graduate school	76.5%	5.9%	17.6%
Teaching	80.0%	20.0%	0.0%

Conclusions Drawn from Data:
ETS Results:
Our scores show that our benchmark is being met for overall performance on the test. We are continuing to evaluate the changes made by ETS in 2011-12 to determine if we are concerned about any the changes in student results. It may be that they are now including questions on some material that we do not teach. We have noticed a cyclical patter in some subscore results and are investigating to if this correlates with our two year rotation of upper division courses.

Alumni Survey:
Overall, our alumni believe that they were well prepared. Further investigation indicates that the students (3) who said that they were "poorly" prepared for graduate school are all mathematics majors who are employed as teachers and appear to be getting education-related masters degrees while working full-time. The hypothesis is that the "lack of preparation" may be in education coursework and not mathematics. We will be conducting another survey in 2016-17 as part of program review preparation.

Changes to be Made Based on Data:
ETS Results:
We have made curricular changes in the last few years to update our department coursework to align with new standards from the Association of Computing Machinery as well as to respond to assessment data. This has included increasing students' exposure to data bases and information security. See our APC proposals for the specific descriptions of curricular changes made.

Survey:
In 2005 our department instituted three changes that seem to have had an impact on developing critical skills in our graduates:

- Increasing the expectations for written and oral presentations in senior seminar (this is in addition to the writing and oral presentations that are threaded throughout our curriculum)
- Requiring all seniors in our department to take the senior seminar class
- Requiring an "integrative experience" (internship, year-long service learning project or year-long honor research project) of all of our majors.

This has a direct impact on five skills listed in the table below. The question on the survey is listed above the table.

Please tell us if your departmental course work enhanced your abilities in the listed areas:

		Very much enhanced	Much enhanced	Enhanced	Not enhanced and N/A
Think analytically and logically	2000-2004	53.8%	26.9%	15.4%	3.8%
	2005-2009	64.0%	36.0%	0.0%	0.0%
Write effectively in the discipline	2000-2004	11.5%	23.1%	42.3%	23.1%
	2005-2009	16.0%	36.0%	36.0%	12.0%
Effective oral communication	2000-2004	3.8%	23.1%	46.2%	26.9%
	2005-2009	12.0%	12.0%	60.0%	16.0%
Solve problems using technology	2000-2004	19.2%	46.2%	26.9%	7.7%
	2005-2009	32.0%	56.0%	8.0%	4.0%
Integrate knowledge from different sources	2000-2004	15.4%	34.6%	38.5%	11.5%
	2005-2009	8.0%	52.0%	32.0%	8.0%

Data from the Alumni Survey says that our graduates believe that their coursework in our department has also enhanced:

- Their ability to write effectively (88% for those who graduated in 2005-09, 77% for those who graduated in 2000-04)

- Their ability to communicate orally in the discipline (84% for those who graduated in 2005-09, 73% for those who graduated in 2000-04)
- Their ability to solve problems using technology (96% for those who graduated in 2005-09, 92% for those who graduated in 2000-04)

Rubric:

ETS:
The ETS provides the data.

Alumni Survey:
This is not rubric scored, but the data is tabulated.