Computer Science Assessment Report

2019-20

Learning Outcomes for Computer Science:

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.
4. Students will be able to apply their technical knowledge and critical thinking to solve problems.
5. Students will be able to speak about their work with precision, clarity and organization.
6. Students will be able to write about their work with precision, clarity and organization.
7. Students will be able to identify, locate, evaluate, and effectively and responsibly use and cite information for the task at hand.
8. Students will collaborate effectively in teams.
9. Students will be able to understand and create arguments supported by quantitative evidence.
10. Graduates will be prepared for careers that use computer science in business, industry, government and the non-profit sector; and graduate study in fields related to computer science.

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								
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019***
Compilation	100%	100%	92%	75%	100%	94%	90%	75%	
Runtime Correctness	86%	58%	85%	100%	62%	72%	95%	60%	45%
Problem Solving	100%	100%	100%	75%	92%	83%	80%	85%	70%

*Note that the instrument was changed in 2019.

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. The instrument was changed in 2019, the "compilation" test was removed because the rest of the work can not be evaluated if the program does not compile.

Changes to be Made Based on Data:
Continue to emphasize the need to carefully de-bug computer code during development. The rubric was modified to clarify the definition of run-time correctness which has made scoring simpler (Fall 2017). We continuing to work with students the detailed work needed for accurate computer programs.

CSC 254 Signature assignment

	Unsatisfactory (1)	Satisfactory (2)	Good (3)	Excellent (4)
Runtime correctness	• Less than 60% correct	• Between 60% – 79% correctness	• 80% - 89%	• 90% – 100%
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 or understands the solution but could not efficiently translate the solution to C++ code	• Analysis of program source code indicates that program is close to working, and could be modified to work given additional time.	• All tasks execute correctly indicating that the code is both correct and robust (can catch user input errors)

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
2009-10	70
2010-11	90
2011-12	63
2012-13	*
2013-14	53
2014-15	90
2015-16	92
2016-17	95
2017-18	42
2018-19	36
2019-20	No score

* 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. 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. We will also be discussing whether or not the ETS Major Field Test is the most effective tool for measuring student learning in this area.

The department has decided to discontinue using the ETS MFT. We are in the process of aligning this learning outcome with a signature assignment in a class.

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								
	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Hardware/software interaction understanding	85%	89%	82%	92%	88%	75%	69%	100%	92%

ETS Subscore:
Here are the most recent 10 years of data:

Year	Percentile
2009-10	90
2010-11	65
2011-12	89
2012-13	*
2013-14	82
2014-15	94
2015-16	86
2016-17	61
2017-18	53
2018-19	74
2019-20	No Score

* 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. The variations appear to be related to sample size.

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. The last few years we have not had as much success. This could be changes in the exam, the particular problems selected or variations in the students.

Changes to be Made Based on Data:
Continue to require operating systems (CSC314) of all CS and IS students.

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. We will be also be evaluating whether or not the ETS MFT is the best way to measure this learning objective.

The department has decided to discontinue using the ETS MFT. We are in the process of aligning this learning outcome with a signature assignment in a class.

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 and critical thinking to solve problems.

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

ETS Proficiency Profile: Critical Thinking

Criteria for Success:
CSC493: 85% of the students will score at least 70%

ETS PP: 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 Class at 70% or Higher			
	2013	**2015**	**2017**	**2019**
Problem Solving	67%	86%	77%	86%

	Percentage of Students Marginal or Proficient							
ETS Proficiency Profile	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
ETS Proficiency Profile Level 2 Critical Thinking	80%	92%	100%	84%	92%	76%	79%	80%

*****Critical thinking data is for the full department.

Conclusions Drawn from Data:
CSC493: In 2013, the students did not seem aware that a detailed response was expected for questions 2, 3 and 4. This confusion caused lower scores, in 2015 the questions were improved and this seems to have improved scores. Because new software development methodology is being used in this course, the questions were once again updated. While the students met the target, we may need to refine the questions further.

ETS: Students are meeting the standard for this basic skill.

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 and the change from waterfall to agile development methodology was made in 2016-17.

Rubric Used

We will score the questions according to the following table:

Questions	Maximum Points
1. Briefly describe the problem you were trying to solve	0
2. Give one functional requirement by cutting and pasting from your user stories	1
3. Give one non-functional requirement by cutting and pasting from your user stories	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.	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.	0
6 Did your final project iteration pass these two test cases? If not, why not?	0
7 Out of _____ tests in the Software Test Plan, _____ tests passed for the final project.	3
8 How many core requirements did you have in the User Stories? _____. How many were implemented in the final version of the software _____?	3
9 Explain the functionality of your final delivered code (1 point), highlighting similarities and differences with the initial problem requirements (1 point).	2
10 What programming language(s) did you use and why?	1
11 What operating system did you use and why?	1
12 What software tools (e.g. programming IDE, automated test tools, CASE tools, etc.) did you use and why?	1
13 Did you reuse software? Describe what libraries, frameworks, etc. you used and why.	1
14 Customer Satisfaction Rating	4
	20

ETS: The score comes from ETS

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 an 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	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Background	95%	100%	100%	92%	100%	95%	100%	100%	95%	100%
Organization	85%	100%	100%	100%	100%	100%	92%	94%	100%	100%
Oral Presentation Skills	90%	100%	100%	92%	100%	95%	100%	100%	95%	100%
Presentation Tools	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Ability to Field Questions	100%	83%	100%	100%	89%	100%	100%	100%	94%	94%

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	2016-17	2017-18	2018-19	2019-20
Organization	100%	100%	100%	100%	92%	94%	100%	100%
Language	100%	92%	100%	100%	100%	100%	95%	100%
Delivery	100%	92%	100%	95%	100%	100%	95%	100%
Supporting Material	100%	100%	100%	100%	100%	100%	100%	100%
Central Message	100%	100%	89%	100%	100%	100%	94%	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. We have been incorporating more oral presentations into classes and saw an improvement once we began dong that (before 2010).

Oral Presentation Rubric Update (4/12/17)

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 is between 10-15 minutes	☐ Presentation 1 minute outside of the range (10-15 minutes)	☐ Presentation 2 minutes outside of the range (10-15 minutes)	☐ Presentation 3 minutes outside of the range (10-15 minutes)
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 multiple time and engagement is well connected to talk (questions, examples, etc)	☐ Engages audience at least twice in content (questions, examples, etc.)	☐ Audience engagement at least once with content (questions, examples, etc.)	☐ 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 makes an 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	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Bibliography and Support	55%	93%	100%	100%	100%	89%	100%	76%	89%	81%
Organization	65%	93%	100%	100%	100%	100%	92%	94%	100%	100%
Grammar and Spelling	60%	79%	100%	92%	89%	84%	100%	88%	94%	94%
Depth of Information	50%	93%	91%	77%	78%	89%	85%	76%	83%	94%
Clarity of Writing	70%	79%	91%	77%	78%	89%	85%	88%	94%	88%

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	2016-17	2017-18	2018-19	2019-20
Context and Purpose for Writing	100%	100%	100%	89%	92%	94%	100%	100%
Content Development	100%	92%	100%	89%	85%	76%	83%	94%
Genre and Disciplinary Conventions	100%	92%	100%	100%	85%	94%	100%	81%
Sources and Evidence	100%	100%	100%	89%	100%	76%	89%	88%
Control of Syntax and Mechanics	100%	100%	89%	84%	85%	88%	94%	100%

	Percentage at Marginal or Proficient							
Written ETS	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
ETS Proficiency Profile Writing Level 2	60%	85%	100%	89%	85%	76%	84%	93%

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. The balance of the ETS scores are at or near benchmark (due to small sample sizes, the difference can often be a single person).

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 write at a professional level. The current rubric has been in use for the last 10 years. We have instituted more formal faculty reviews of their draft papers and are trying to give more specific feedback, particularly about the use of references.

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 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	2016-17	2017-18	2018-19	2019-20
References				95%	100%	71%	89%	81%
Citation				84%	92%	76%	89%	81%
Synthesis				84%	85%	82%	78%	81%
Determine the Extent of Information Needed	100%	62%	78%					
Access the Needed Information	91%	69%	100%					
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:
The students are meeting our expectations. For the first two years we applied the AAC&U 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 much more clearly understand the expectations regarding information literacy that are embedded in our writing rubric. This is still one of the areas with which the students have the most challenges.

Changes to be Made Based on Data:
We have tried a variety of approaches, using the AAC&U IL rubric and expanding on that rubric. After looking at the AAC&U results in parallel with the departmental writing rubric, it was clear that the difference in results were insignificant. It is a great deal less work for the department and clearer for the students to simply use the departmental writing rubrics IL components to assess students' IL. We continue to work with students in giving them clear feedback about the need to do a better job with references in technical papers.

Rubric
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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 collaborate effectively in teams.

Outcome Measure:
Annual: CSC324 Signature Assignment – evaluation of group while working on a project (before 2015-16) and ISS3042 Project Management – evaluation of group while working on a project (2016-17 and beyond)
Annual: MTH3052 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:

	Percent of students with average at least 2.5			
	Fall 2012 CSC324	**Fall 2014 CSC324**	**Fall 2016 ISS342***	**Fall 2018 ISS342**
Contributes to team meetings	86%	80%	90%	100%
Encourages team members	93%	84%	N/A	100%
Contributes individually outside of team meetings	93%	88%	86%	100%
Attitude	100%	96%	N/A	100%
Fosters constructive team climate	100%	92%	N/A	100%
Responds to conflict	100%	100%	90%	100%

*Note that the full group work rubric will be used in future years.

	MTH3052 Percent of students with average at least 2.5			
	Spring 2013	**Spring 2015**	**Spring 2017**	**Spring 2019**
Contributes to team meetings	91%	86%	100%	100%
Encourages team members	91%	93%	100%	100%
Contributes individually outside of team meetings	82%	93%	100%	100%
Attitude	100%	100%	100%	100%
Fosters constructive team climate	91%	100%	100%	100%
Responds to conflict	91%	100%	100%	100%

Conclusions Drawn from Data:
The students are performing well as member of teams.

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 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: 90% of the students will be Marginal or Proficient at Level 2. Note that we dropped the criteria of success so that it is possible for the department to pass even if a single student misses the criteria.

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 Marginal or Proficient							
ETS Proficiency Profile	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
ETS Proficiency Profile Level 2 Mathematics	100%	100%	100%	100%	92%	82%	95%	93%

Conclusions Drawn from Data:
Students are in general meeting our criteria. The variation often comes down to a single student because of small sample sizes.

Changes to be Made Based on Data:
None at this time. We will continue to monitor the results.

Rubrics
ETS Proficiency Profile (no rubric involved)

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:

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

Criteria for Success:
MFT: 50% of our students achieve above the 50th percentile on the exam.

Alumni Survey: 75% of the respondents say they were well prepared 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:

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
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
2016-17	Y	54	61	95
2017-18	Y	55	53	42
2018-19	N	31	74	36
2019-20	N/A	N/A	N/A	N/A

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

Alumni Data:
In the spring of 2017, the department surveyed alumni who had graduated in the last 15 years. The survey is data used to inform the department's program review. Below are the components of the survey relevant to our assessment plan for computer science.

How well did the undergraduate curriculum prepare you for:

	Well or higher	OK	Poorly
Work in the field (if went into the field)	61.0%	34.1%	4.8%
Graduate school	93.8%	0.0%	6.3%

Conclusions Drawn from Data:
ETS Results:
Our scores show that our benchmark is being met for overall performance on the test most of the time and when it is missed, it is generally a matter of one or two students with low scores. 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. Review of the free responses indicates that the root of the ratings for work in the field have to do with the desire for students to learn specific technologies that may not have been available at the time that they were students. It is not possible to teach students about all possible tools, so the goal of the program is to help them learn how to learn a new tool or technology.

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.

The department has decided to discontinue using the ETS MFT. We are in the process of aligning this learning outcome with a signature assignment in a class.

Survey:
In the last year we have changed our approach to helping students prepare for technical interviews and that may help them to feel a bit more prepared for entering the world of work. We also plan to emphasize the importance of learning new technologies independently in courses and projects.

Rubric:

ETS:
The ETS provides the data.

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