Department of Mathematics and Computer Science

Student Assessment Plan

Department Learning Goals:

Computer Science Learning Goals:

Students completing a major in Computer Science at Hendrix College are expected to be able to do the following:

1. Create and demonstrate software that correctly solves realistic problems with open-ended scope.
2. Use empirical methods to analyze computational systems and models.
3. Employ multiple levels of algorithmic and data abstraction to manage system complexity.
4. Employ mathematical ideas in a computing context.
5. Create, implement, and evaluate software abstractions that model complex phenomena.
6. Create, apply, and understand the software abstractions that manage interactions with hardware.
7. As part of a team, develop robust software artifacts that successfully enable their users to achieve their goals.
8. Employ written and oral communication in both technical and nontechnical settings.
9. Understand the social and ethical context of computing.

Mathematics Learning Goals:

Students completing a major in Mathematics at Hendrix College are expected to be able to do the following:

1. Employ the methodologies used in mathematics, including calculation, proof, discovery of new mathematics, and application.
2. Understand basic content and principles in each of the broad divisions within mathematics: discrete (algebra and combinatorics), continuous (calculus and analysis), and geometric (linear algebra and topology).
3. Master at least one field of mathematics to a depth beyond that typical of a single advanced undergraduate course in the topic.
4. Understand the motivation and aesthetics underlying mathematics, including the historical and cultural context in which it was developed.
5. Communicate mathematical ideas in written papers, oral presentations, and group discussions. Possess the ability to argue mathematical proof validity in both written and oral work.

Curriculum Mapping:

See the attached curriculum mapping spreadsheet (1a), which links each course to the learning goals that are addressed in the course. It also indicates at what level students will achieve that learning goal through the course: Introduced, Developed, Mastered.

Plans for Gathering Information:
For our cycle, we will gather data for every learning goal each year, but we will assess one goal per program each academic year. See attached Cycle Spreadsheet (1b).

CSLG 1: Create and demonstrate software that correctly solves realistic problems with open-ended scope.

Direct Assessment: Final grades in CSCI 150, 151, 235, 270, 285, 320, 322, 335, 340, 352, 360, 365, and 370

Indirect Assessment: Common end of semester feedback question for 150, 151, 235, 270, 285, 320, 322, 335, 340, 352, 360, 365, and 370. (Appendix B)

CSLG 2: Use empirical methods to analyze computational systems and models.

Direct Assessment: Final grades in CSCI 150, 151, 235, 270, 285, 320, 335, 340, 352, and 370

Indirect Assessment: Common end of semester feedback question for 150, 151, 235, 270, 285, 320, 335, 340, 352, 370. (Appendix B)

CSLG 3: Employ multiple levels of algorithmic and data abstraction to manage system complexity.

Direct Assessment: Final grades in CSCI 150, 151, 320, 322, 335, 340, 352, 360, and 370

Indirect Assessment: Common end of semester feedback question for 150, 151, 320, 322, 335, 340, 352, 360, and 370. (Appendix B)

CSLG 4: Employ mathematical ideas in a computing context.

Direct Assessment: Final grades in CSCI 151, 285, 365, 380, 382, and MATH 240 and 340.

Indirect Assessment: Common end of semester feedback question for CSCI 151, 285, 365, 380, 382, and MATH 240 and 340. (Appendix B)

CSLG 5: Create, implement, and evaluate software abstractions that model complex phenomena.

Direct Assessment: Final grades in CSCI 335 and 360

Indirect Assessment: Common end of semester feedback question for CSCI 335 and 360. (Appendix B)

CSLG 6: Create, apply, and understand the software abstractions that manage interactions with hardware.

Direct Assessment: Final grades in CSCI 320 and 322

Indirect Assessment: Common end of semester feedback question for CSCI 320 and 322. (Appendix B)

CSLG 7: As part of a team, develop robust software artifacts that successfully enable their users to achieve their goals.

Direct Assessment: Final grades in CSCI 340, 352, and 370

Indirect Assessment: Common end of semester feedback question for 340, 352, 370. (Appendix B)

CSLG 8: Employ written and oral communication in both technical and nontechnical settings.

Direct Assessment: Capstone rubric. (Appendix A)

Indirect Assessment: End of semester feedback question for CSCI 410. (Appendix B)

CSLG 9: Understand the social and ethical context of computing.

Direct Assessment: Final grades in CSCI 340, 352, 370, and 410

Indirect Assessment: Common end of semester feedback question for 340, 352, 370, and 410. (Appendix B)

MLG 1: Employ the methodologies used in mathematics, including calculation, proof, discovery of new mathematics, and application.

Direct Assessment: Capstone rubric. (Appendix A)

Indirect Assessment: Common end of semester feedback question. (Appendix B)

MLG 2: Understand basic content and principles in each of the broad divisions within mathematics: discrete (algebra and combinatorics), continuous (calculus and analysis), and geometric (linear algebra and topology).

Direct Assessment: Final grades in relevant courses.

Indirect Assessment: Senior exit survey question. (Appendix C)

MLG 3: Master at least one field of mathematics to a depth beyond that typical of a single advanced undergraduate course in the topic.

Direct Assessment: Final grades in sequences MATH 320/420 and MATH 350/450

Indirect Assessment: Common end of semester feedback question for 420/450. (Appendix B)

MLG 4: Understand the motivation and aesthetics underlying mathematics, including the historical and cultural context in which it was developed.

Direct Assessment: Capstone rubric. (Appendix A)

Indirect Assessment: Senior exit survey question. (Appendix C)

MLG 5: Communicate mathematical ideas in written papers, oral presentations, and group discussions. Possess the ability to argue mathematical proof validity in both written and oral work.

Direct Assessment: Capstone rubric. (Appendix A)

Indirect Assessment: Common end of the semester feedback question. (Appendix B)

Appendix A: Capstone Rubric

The following Capstone Rubric can be used to directly assess the following departmental learning goals:

CSLG8: Employ written and oral communication in both technical and nontechnical settings.

Categories: Written exposition, Oral exposition, and Answering questions

MLG1: Employ the methodologies used in mathematics, including calculation, proof, discovery of new mathematics, and application.

Category: Integration of ideas, and Membership of MATH Community

MLG4: Understand the motivation and aesthetics underlying mathematics, including the historical and cultural context in which it was developed.

Category: Motivation and aesthetics. (Need to add category.)

MLG5: Communicate mathematical ideas in written papers, oral presentations, and group discussions. Possess the ability to argue mathematical proof validity in both written and oral work.

Categories: Written exposition, Oral exposition, and Answering questions

Capstone Rubric

Department of Mathematics and Computer Science

Hendrix College

Category	Excellent	Satisfactory	Questionable	Problematic
Integration of ideas	Devises innovative application of MATH/CSCI concepts from multiple classes or experiences for addressing a substantive problem.	Appropriately applies MATH/CSCI concepts and techniques from multiple classes or experiences to investigate a substantive problem.	Inconsistently applies MATH/CSCI concepts from multiple classes or experiences to investigate a substantive problem.	Incorrectly applies MATH/CSCI concepts to investigate a problem, or relies upon concepts and techniques from only one prior experience.
Written exposition	A clear and well-organized written document demonstrates deep technical insight and persuasively articulates topic significance.	A clear and well-organized written document demonstrates technical understanding and topic significance.	A written document that is somewhat unclear and mildly disorganized demonstrates modest technical understanding and conveys a notion of topic significance.	An unclear and/or poorly organized written document fails to convey technical understanding and/or topic significance.

Oral exposition	Provides a compelling education about project scope and achievements in a concise oral presentation.	Effectively communicates project scope and achievements in a concise oral presentation.	Conveys some idea of project scope and achievements in an oral presentation that is comprehensible with significant effort.	Fails to communicate project scope and/or achievements in an oral presentation.
Answering questions	Demonstrates profound understanding of project topic and work in answers to questions.	Demonstrates competency and mastery in answers to questions about project topic and work.	Answers questions in a manner that demonstrates modest understanding of project topic.	Unable to coherently answer questions about project topic and work.
Independence and Self-Awareness	Selects a compelling project topic, and responds in an innovative way to feedback.	Selects a pertinent and interesting project topic; as the project develops, responds appropriately to feedback.	Selects a project topic with some potential; makes modest use of feedback.	Selects an irrelevant or uninteresting project topic, or fails to respond appropriately to feedback.
Engagement	Demonstrates persistent and regular incremental progress throughout the project period.	Demonstrates consistent engagement for the duration of the project period.	Demonstrates somewhat consistent engagement during at least part of the project period.	Works inconsistently and irregularly during the project period.
Membership of MATH/CSCI Community	Shows mastery of pertinent technical terminology and concepts throughout the project.	Properly uses technical terminology and concepts throughout the project.	Mostly uses proper technical terminology and concepts, but makes several errors in doing so over the course of the project.	Consistently misuses technical terminology and concepts during the project.

Appendix B: Common End of the Semester Questions

The following questions from the end of the semester feedback forms provide indirect assessments for the corresponding learning goals. The courses that include the question on their forms are listed.

MATHEMATICS:

MLG1: Employ the methodologies used in mathematics, including calculation, proof, discovery of new mathematics, and application.

Student Feedback Form Question(s):

- 5 point Likert Scale: Strongly Disagree (1) to Strongly Agree (5)

This course has increased my abilities to employ the methodologies used in mathematics (e.g., calculation, proof, discovery of new mathematics, and application).

Courses: All MATH courses

MLG 3: Master at least one field of mathematics to a depth beyond that typical of a single advanced undergraduate course in the topic.

Student Feedback Form Question(s):

- 5 point Likert Scale: Strongly Disagree (1) to Strongly Agree (5)

  This course has built on the fundamentals learned in the first semester (320/350) in such a way that facilitated my mastery of the methodologies used in Algebra/Analysis.

Courses: MATH 420, MATH 450

MLG 5: Communicate mathematical ideas in written papers, oral presentations, and group discussions. Possess the ability to argue mathematical proof validity in both written and oral work.

Student Feedback Form Question(s):

- 5 point Likert Scale: Strongly Disagree (1) to Strongly Agree (5)

  This course has increased my ability to produce clear, coherent written solutions to problems, including using proper mathematical notation and terminology.

Courses: All MATH courses

<u>COMPUTER SCIENCE:</u>
NOTE: For a particular course, the instructor can alter the wording to better relate the course material for the goal.

CSLG 1: Create and demonstrate software that correctly solves realistic problems with open-ended scope.

- 5 point Likert Scale: Strongly Disagree (1) to Strongly Agree (5)
  - This course has increased my ability to create and demonstrate software that correctly solves open-ended realistic problems.

Courses: CSCI 150, 151, 235, 270, 285, 320, 322, 335, 340, 352, 360, 365, and 370.

CSLG 2: Use empirical methods to analyze computational systems and models.

- 5 point Likert Scale: Strongly Disagree (1) to Strongly Agree (5)

    - This course has increased my ability to observe whether a computing system is performing correctly, and to observe the space and time resources it consumes.

Courses: CSCI 150, 151, 235, 270, 285, 320, 335, 340, 352, and 370.

CSLG 3: Employ multiple levels of algorithmic and data abstraction to manage system complexity.

- 5 point Likert Scale: Strongly Disagree (1) to Strongly Agree (5)
    - This course has increased my ability to manage system complexity by employing a hierarchy of functions, classes, and methods.

Courses: CSCI 150, 151, 320, 322, 335, 340, 352, 360, and 370.

CSLG 4: Employ mathematical ideas in a computing context.

- 5 point Likert Scale: Strongly Disagree (1) to Strongly Agree (5)
    - This course has increased my ability to apply mathematical ideas that are relevant in a computing context.

Courses: CSCI 151, 285, 365, 380, and 382. MATH 240 and 340.

CSLG 5: Create, implement, and evaluate software abstractions that model complex phenomena.

- 5 point Likert Scale: Strongly Disagree (1) to Strongly Agree (5)
    - This course has increased my ability to create, implement, and evaluate software abstractions that model complex phenomena.

Courses: CSCI 335 and 360.

CSLG 6: Create, apply, and understand the software abstractions that manage interactions with hardware.

- 5 point Likert Scale: Strongly Disagree (1) to Strongly Agree (5)
    - This course has increased my ability to create, apply, and understand software abstractions that manage interactions with hardware.

Courses: CSCI 320 and 322.

CSLG 7: As part of a team, develop robust software artifacts that successfully enable their users to achieve their goals.

- 5 point Likert Scale: Strongly Disagree (1) to Strongly Agree (5)
    - As part of a team, in this course I developed usable, working software that enables its users to achieve their goals.

Courses: CSCI 340, 352, and 370.

CSLG 9: Understand the social and ethical context of computing.

- 5 point Likert Scale: Strongly Disagree (1) to Strongly Agree (5)
    - This course has increased my understanding of the social and ethical context of computing.

Courses: CSCI 340, 352, 370, and 410.

COMPUTER SCIENCE COURSE REFERENCE GUIDE

If you are teaching:	Include feedback questions for these goals:
CSCI 150	1, 2, 3
CSCI 151	1, 2, 3, 4
CSCI 235	1, 2, 6
CSCI 270	1, 2, 9
CSCI 285	1, 2, 4
MATH 240	4
CSCI 320	1, 2, 3, 6
CSCI 322	1, 3, 6
CSCI 335	1, 2, 3, 5
CSCI 340	1, 2, 3, 7, 9
CSCI 352	1, 2, 3, 7, 9
CSCI 360	1, 3, 5
CSCI 365	1, 4
CSCI 370	1, 2, 3, 7, 9
CSCI 380	4
CSCI 382	3, 4
MATH 340	4
CSCI 410	9

Appendix C: Senior Exit Survey

The following questions from the senior exit survey provide indirect assessments for the corresponding learning goals.

MLG 2: Understand basic content and principles in each of the broad divisions within mathematics: discrete (algebra and combinatorics), continuous (calculus and analysis), and geometric (linear algebra and topology).

Survey Question(s):

- 5 point Likert Scale Strongly Disagree to Strongly Agree

  Through my mathematics major courses, I have gained understanding of the content and principles in the following broad divisions within mathematics: discrete (e.g. algebra and combinatorics).

Comments:

- 5 point Likert Scale Strongly Disagree to Strongly Agree

  Through my mathematics major courses, I have gained understanding of the content and principles in the following broad divisions within mathematics: continuous (e.g. calculus and analysis).

  Comments:

- 5 point Likert Scale Strongly Disagree to Strongly Agree

  Through my mathematics major courses, I have gained understanding of the content and principles in the following broad divisions within mathematics: geometric (e.g. linear algebra and topology).

  Comments:

- 5 point Likert Scale Strongly Disagree to Strongly Agree

  Through my mathematics major courses, I have gained understanding of the distinctions between the broad divisions within mathematics: discrete, continuous, and geometric.

  Comments:

- 5 point Likert Scale Strongly Disagree to Strongly Agree

  Through my mathematics major courses, I have gained understanding of how the broad divisions (discrete, continuous, and geometric) unify to give a complete picture of mathematics as a discipline.

  Comments:

MLG 4: Understand the motivation and aesthetics underlying mathematics, including the historical and cultural context in which it was developed.

Survey Question(s):

- 5 point Likert Scale Strongly Disagree to Strongly Agree

  Through my mathematics major courses, I have gained understanding of the motivation underlying mathematics.

  Comments:

- 5 point Likert Scale Strongly Disagree to Strongly Agree

  Through my mathematics major courses, I have gained understanding of the aesthetics underlying mathematics.

  Comments: