
“The Department of Mathematics and Computer Science has a mission grounded in the University Mission Statement and the University Curriculum Statement. The ability to think logically and analytically is at the core of both mathematics and computer science. Writing is critical to both areas: mathematical proofs, while making extensive use of symbols, rely heavily on a natural language to establish a chain of reasoning, and computer programs require extensive documentation. The department fosters students’ independent thinking by requiring projects as part of classes, encouraging independent studies, and requiring senior class projects in computer science. Additionally, the department is committed to the generation, study, analysis, and exchange of ideas through publications, seminars, discussions, and attendance at professional meetings.”

The Department of Mathematics and Computer Science faculty have agreed to focus assessment efforts on the curricular goals, common to both Department and University, that ask the students to think logically and analytically, and communicate clearly and effectively, both orally and in writing.

The following assessment tool is designed to evaluate the department faculty’s specific goal that students develop proficiency with the structure, development, implementation, and written presentation, including use of technical language, of mathematical statements and proofs. Students who are enrolled in Mathematics 290 (Linear Algebra) will be assessed since that is the gateway course within the department that requires students to actively engage in the process of developing and presenting mathematical proofs.

The following includes statements of the goals to be assessed, the measurement process used to gather data relevant to those goals, the method used to analyze that data, and how the department will use that analysis to better attain the goals.

Assessing Proficiency with Theorems and Proofs

Goals

Students will understand the structure of a mathematical theorem and of its proof by

- (Content) analyzing the theorem statement and using their analysis to find and present an argument supporting the theorem’s claim.
- (Contradiction) mastering the technique of proof by contradiction.
Measurement

Professors who teach Mathematics 290 (Linear Algebra) agree to collect, near the end of the semester, samples directed at the content and contradiction proficiency goals from each student.

These samples will be collected by including two designated problems on the final examinations of all sections of linear algebra. Members of the department agree all pertinent definitions must be either well-known or included in the statements of the two problems. One problem will be a mathematical statement in conditional ((if . . . then . . .) form with a proof structure amenable to a standard “forward-backward” analysis. The other will be a problem designed to highlight the student’s ability to use the mathematical technique of proof by contradiction.

Three members of the department will write the problems and individually rank the resulting solutions. For each solution, these individual rankings will be summarized in a composite ranking. One method for forming the composite might be by agreement of at least two of the three individual rankings. The readers will then summarize the ranking results for each goal.

Analysis

After the end of the academic year, the department will have a meeting to discuss student performance as related to each goal. Minutes are taken at the department meeting summarizing these discussions.

Use and Implementation

- This assessment by the department is ongoing and done annually.

- Based on the departmental discussion of student performance, professors teaching proof-based mathematics courses agree to modify presentation of proof techniques in a manner suited to their teaching style.

- Minutes from the meeting serve as documentation of the department’s efforts to assess and improve student proficiency with mathematical theorems and proofs.