

# Exploring Computer Science and Mathematics Students' Cognitive Processes in Discrete Mathematics

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## Introduction

Discrete mathematics lies at the intersection of mathematics and computer science and provides a landscape for mathematics education researchers to analyze the interaction between mathematical reasoning and computational thinking. In this poster, we provide preliminary findings from our analysis of undergraduate mathematics and computer science (CS) students' problem-solving strategies on a set of discrete mathematics questions.

## Methods

Twenty-two students were interviewed in the Fall 2024 semester through think-aloud protocols (TAPs) to elicit their mathematical activity (e.g., Reinhart et al., 2022). In these TAPs, students were asked to verbalize their thinking as they solved mathematics problems. Mathematics and CS undergraduate students from four cohorts were interviewed. The first and second cohorts consist of 4 first- and second-year students in CS and 2 first- and second-year students in mathematics, respectively. The third and fourth cohorts consisted of 8 third- and fourth-year students in CS and mathematics, respectively. Students were presented with an assessment protocol consisting of 13 discrete mathematics problems. The problems included the following concepts: functions, combinatorics, game theory, recursion, set theory, logic, recursion, decision trees, and graph theory. As a preliminary pass through the data, all questions students answered were graded as either correct (1) or incorrect (0). A more detailed analysis will be conducted as we move forward with the project.

## Results

For this poster, the analysis compares and contrasts how students from the four cohorts performed on the protocol questions. On average, mathematics and CS majors answered 7 out of the 13 questions on the protocol. Of the 7 answered, the math cohorts had a median score of 73%, while students in the CS cohorts scored 70%. A Wilcoxon rank sum test was conducted to evaluate differences in scores between math majors ( $n=10$ ) and CS majors ( $n=12$ ). The results indicated no significant difference in scores between the two groups ( $W=59.5$ ,  $p=1.0$ ). The CS cohorts exhibited larger variability in their assessment scores compared to the math cohorts. For a more in-depth analysis, a cluster analysis to inform the identification of natural groupings of students will be provided on the final poster.

## Discussion

Preliminary analysis indicates that students from both majors performed about the same on the assessment protocol. However, interviews with the different cohorts of students revealed many different solution strategies and varying levels of sophistication. Our goal with this analysis is to yield fruitful insights into student reasoning in discrete mathematics and contribute to more effective mathematics education at the undergraduate level.

### References

- Reinhart, A., Evans, C., Luby, A., Orellana, J., Meyer, M., Wieczorek, J., Elliott, P., Burckhardt, P., & Nugent, R. (2022). Think-aloud interviews: A tool for exploring student statistical reasoning. *Journal of Statistics and Data Science Education*, 30(2), 100–113.  
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