Sorting Permutations with Finite-Depth Stacks

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Sorting organizes information for optimal usage, and our work examines the mathematics behind sorting with stacks. In 1968, Donald Knuth showed that a permutation is sortable in an infinite-depth stack if and only if it avoids the pattern 231; Knuth also enumerated these permutations. Twenty-five years later, Julian West extended these ideas to permutations sortable with 2 consecutive stacks. We continue this work by limiting the stack(s) to a finite depth. In particular, we completely characterize permutations sortable through a single finite-depth stack and derive a handy enumeration formula. We also apply our pattern characterization and enumeration techniques to permutations that are sortable after k-passes through a finite-depth stack.

Information about the Authors:
Timothy Goodrich is a junior computer science and mathematics double major who hopes to pursue interdisciplinary work between these fields in graduate school. He is also a tutor for the Academic Success Center. Will Olson is a sophomore mathematics and political science double major; he also works as an Ambassador in Admissions and is involved in the Phi Kappa Psi fraternity. Ruyue (Julia) Yuan is a sophomore mathematics major with interests in research and theoretical mathematics and hopes to pursue a doctoral degree in mathematics. She also plays violin in the Valparaiso University Symphony Orchestra and tutors for the Academic Success Center. All three are members of Christ College. This project is a continuation of previous research by Timothy and two other researchers, Drew Groth and Lauren Knop. The current members were drawn to the project because of their interest in combinatorics, number sequences, and experimental mathematics.

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