PROJECT SUMMARY
RIGOROUS EXPERIMENTAL COMBINATORICS

Doron Zeilberger proposes to continue to develop methodologies for harnessing the great potential of Computer Algebra to do research in Combinatorics and related areas, and design experiments for (rigorous) computer-assisted and computer-generated research.

In particular he hopes to develop a new, computer-assisted and computer-generated phase, in the theory of permutation statistics; explore seemingly intractable problems in combinatorial statistical physics from the point of view of *symbolic*, rather than *numeric*, computations; study lattice paths enumeration, and extend the Wilf-Zeilberger algorithmic proof theory to handle indefinitely many variables. He also hopes to tackle the intriguing Razumov-Stroganov conjecture about so-called Fully Packed Loops, that are in simple bijection with Alternating Sign matrices.

This research should be symbiotic, as it is expected that both the concrete results and the underlying methodologies, would help computer algebra developers to improve and enhance their systems. It is also hoped that this research will contribute to the budding field of Experimental Mathematics, in that it will help develop a research methodology for conducting computer experiments that output *rigorous* (and interesting!) mathematical theorems (and proofs), rather than just verifying and formulating conjectures.

This research is in the field of Combinatorics, whose usefulness to science and technology is well-known. In particular, computer science is largely based on combinatorics, as is electronic communication and the World Wide Web.