Rodica Simion

January 18, 1955 – January 7, 2000

by Richard P. Stanley[1]

The mathematical world lost one of its most enthusiastic and dedicated adherents with the tragic death of Rodica Simion on January 7, 2000. Rodica received her B.S. degree from the University of Bucharest in 1974. She came to the U.S. from Romania in 1976 and obtained her Ph.D. at the University of Pennsylvania in 1981 under the direction of Herbert Wilf. Her thesis was entitled "On Compositions of Multisets" and included a very influential result[2] which asserted that certain combinatorially defined polynomials have only real zeros. She taught at Southern Illinois University and Bryn Mawr College before coming to George Washington University (GWU) in 1987. She moved up the career ladder at GWU, culminating in an appointment to Professor in 1997. Just last year she was awarded a prestigious Columbian School Professorship at GWU in recognition for her many contributions to mathematics.

Rodica had a passionate love for mathematics and labored completely selflessly to develop and promote all aspects of the subject, from original research to making deep mathematical results accessible to the general public. Her research remained in the area of combinatorics, where she made many outstanding contributions. As an example of Rodica's research, we mention one pretty result[3] which requires little mathematical background to understand. Let A_n be the set of all permutations $a_1a_2\cdots a_n$ of $1, 2, \ldots, n$ with no decreasing subsequence of length 3, i.e., there do not exist $i < j < k$ such that $a_i > a_j > a_k$. For instance,

$$A_3 = \{123, 132, 213, 231, 312\},$$

the only excluded permutation being 321. Similarly let B_n be the set of all permutations $a_1a_2\cdots a_n$ of $1, 2, \ldots, n$ such that there do not exist $i < j < k$

[1]Partially supported by NSF grant DMS-9500714. I am grateful to Joseph Bonin for providing a wealth of useful information.

[2]See her paper "A multiindexed Sturm sequence of polynomials and unimodality of certain combinatorial sequences," *J. Combinatorial Theory (A)* **36** (1984), 15–22.

[3]See Proposition 19 of "Restricted partitions," *Europ. J. Combinatorics* **6** (1985), 383–406.

satisfying $a_i > a_k > a_j$. For instance,

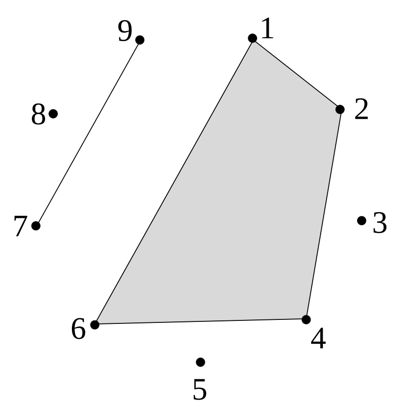
$$B_3 = \{123, 132, 213, 231, 321\},$$

this time the only excluded permutation being 312. It had been known that A_n and B_n had the same number of elements, namely,

$$|A_n| = |B_n| = \frac{1}{n+1}\binom{2n}{n}.$$

(This number is a *Catalan number*, but this fact is not relevant here.) Rodica (together with her long-time collaborator Frank Schmidt) "explained" this seeming coincidence by exhibiting an elegant one-to-one correspondence (bijection) between A_n and B_n. This bijection of Rodica's was just one of many results in the seminal paper in which it appeared. It was the first paper to systematically investigate the theory of "permutations with forbidden patterns," currently a highly active area of research.

A topic which fascinated Rodica (as well as many other mathematicians, including myself) throughout her career was the theory of noncrossing partitions. A *partition* of a set S is a collection of nonempty pairwise disjoint subsets of S whose union is S. For instance, one of the partitions of the set $\{1, 2, \ldots, 9\}$ consists of the subsets $\{1, 2, 4, 6\}$, $\{3\}$, $\{5\}$, $\{7, 9\}$, and $\{8\}$. We can represent this partition geometrically by arranging the elements $1, 2, \ldots, 9$ clockwise around a circle, and drawing polygons whose vertices are the subsets of S defining the partition:



If the polygons do not intersect, as is the case here, then we call the partition *noncrossing*. Noncrossing partitions have a multitude of beautiful properties and unexpected applications. The most basic result is that the number of noncrossing partitions of the set $\{1, 2, \ldots, n\}$ is the Catalan number $\frac{1}{n+1}\binom{2n}{n}$. As an example of the wide applicability of noncrossing partitions, they play a fundamental role in the theory of "free probability" developed by Dan-Virgil Voiculescu and his students. Rodica wrote several fundamental papers on noncrossing partitions and was perhaps the world's leading authority on this topic. She was in the process of writing another paper involving noncrossing partitions at the time of her death.

I wrote one joint paper with Rodica alone[4]. The basic idea for this paper was Rodica's. We were both visiting MSRI (the Mathematical Sciences Research Institute in Berkeley, California) in the fall of 1996 when she walked into my office one day with the question "Did you know that the poset of shuffles is locally rank-symmetric?" I had earlier developed a general theory of certain creatures known as "locally rank-symmetric posets," but few examples were known. Rodica and I spent many stimulating weeks applying the theory of locally rank-symmetric posets to the poset of shuffles.

Altogether Rodica published well over 30 papers. Most of these were original research papers, but a few were expository and exemplify Rodica's strong desire to reveal the beauty of mathematics to as wide an audience as possible. One paper that does not appear in her list of publications but deserves to be a joint paper with me is her write-up[5] of my lecture series given at the Capital City Conference on Combinatorics, held at GWU in 1989. With characteristic modesty Rodica refused to receive any credit for the arduous job of converting my lectures to a survey paper.

The Capital City Conference was actually organized entirely by Rodica and was but one of many events which she helped to arrange. For instance, she was a member of the organizing committee for the Combinatorial Year at MSRI during the 1996–97 academic year. She was a long-standing member of the Permanent Committee for the Formal Power Series and Algebraic Combi-

[4]Flag-symmetry of the poset of shuffles and a local action of the symmetric group, *Discrete Math.* **204** (1999), 369-396.

[5]Some applications of algebra to combinatorics, *Discrete Applied Math.* **34** (1991), 241–277.

natorics (FPSAC) conference held each summer in different cities throughout the world. Most recently, she and I were the co-organizers of a Special Session in Memory of Gian-Carlo Rota held January 20–22, 2000, at the annual meeting of the American Mathematical Society in Washington, DC. Gian-Carlo Rota, who died in April of 1999, was perhaps the most influential combinatorialist of his time and was greatly admired by Rodica. It is especially tragic that Rodica passed away less than two weeks before the start of this Special Session. The time scheduled for her own talk was devoted to a series of touching remembrances before an overflow audience.

The research, expository, and organizational activities I have mentioned, together with normal teaching and administrative duties at GWU, would have been full-time work for an ordinary person, but Rodica actually accomplished much more. For instance, around 1990 Rodica became concerned that there wasn't a solid mathematics exhibit anywhere on the east coast. With the help of three of her colleagues and a Master's student in museum studies at GWU she organized an exhibit at GWU, supplying about 25% of the ideas for the content herself, as well as contributing tremendous organizational and fund-raising skills. Meanwhile the Maryland Science Museum in Baltimore had contacted the National Science Foundation about building a mathematics exhibit. To make a long story short, the 6,000 sq ft exhibit *Beyond Numbers* opened at the Maryland Science Museum in 1995, with Rodica putting in the majority of the work. Topics include graph theory, topology (including knot theory), tilings, chaos, minimal surfaces, and much more. The exhibit is still open at the Maryland Science Museum, and a copy is traveling to science museums across the United States[6]. The museum estimates that by the end of 2000 over four million people will have seen the exhibit.

A second program in which Rodica played a major role is the Summer Program for Women in Mathematics, held each summer at GWU for sixteen talented undergraduate women. Rodica was the person most responsible for obtaining funding and for designing the program, which began in 1995. One innovation due to Rodica was basing the program on four short courses in different areas of mathematics that are not typically covered in the undergraduate curriculum. The success of the program is confirmed by the many of

[6]See www.mdsci.org for a schedule.

its participants who go on to graduate school and who return to the program as counselors.

Rodica had a consistently upbeat, cheerful, and caring personality. She was the kind of person who could light up a room as soon as she entered. She never had a harsh word for anyone and worked tirelessly to counsel any person in need of advice or guidance. She was exceptionally modest about her own accomplishments and would artfully deflect any praise directed toward her. She will be dearly missed by her countless friends throughout the world.