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Nota di contenuto	Cover -- Title page -- Introduction -- Acknowledgments -- Part 1. Definitions and results -- Chapter 1. Background and definitions -- 1.1. Symmetric and quasisymmetric functions -- 1.2. Combinatorial definitions -- Chapter 2. Conjectures -- 2.1. The Delta conjecture -- 2.2. The generalised Delta conjecture -- 2.3. Our conjecture with $\text{pmaj}$ -- 2.4. Our conjecture with polyominoes -- 2.5. Our square conjecture -- Chapter 3. Our results -- 3.1. A decorated $\text{Schröder}$ -- 3.2. A decorated $\text{Narayana}$ -- 3.3. Links with the Delta conjecture -- 3.4. A symmetry result -- 3.5. A new $\text{square}$ -- 3.6. Symmetric functions identities -- 3.7. A few open problems -- Part 2. Proofs -- Chapter 4. Symmetric functions -- 4.1. Basic identities -- 4.2. A summation formula -- 4.3. Three families of plethystic formulae -- 4.4. Another symmetric function identity -- 4.5. Two theorems and a corollary -- 4.6. $\text{at} = 1/$ -- Chapter 5. Combinatorics of decorated Dyck paths -- 5.1. Haglund's (sweep) map -- 5.2. The map exchanging peaks and falls -- 5.3. Combinatorial recursions -- Chapter 6. Combinatorics of polyominoes -- 6.1. Parallelogram

polyominoes -- 6.2. Reduced polyominoes -- 6.3. Two car parking functions -- 6.4. Partially labelled Dyck paths -- 6.5. A new  $\text{dinv}$  statistic on parallelogram polyominoes -- 6.6. A  $\text{bounce}$  statistic on partially labelled Dyck paths -- Chapter 7. Putting the pieces together -- 7.1. Combinatorial interpretations of plethystic formulae -- 7.2. Proof of the decorated  $\delta$ -Schröder -- 7.3. Proof of the decorated  $\delta$ -Narayana -- Chapter 8. Square paths -- 8.1. A new  $\delta$ -square -- 8.2. Observations when  $\delta=1$  -- Appendix A. Proof of the elementary lemmas -- Bibliography -- Back Cover.

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## Sommario/riassunto

"We discuss the combinatorics of decorated Dyck paths and decorated parallelogram polyominoes, extending to the decorated case the main results of both Haglund ("A proof of the Schröder conjecture", 2004) and Aval et al. ("Statistics on parallelogram polyominoes and an analogue of the Narayana numbers", 2014). This settles in particular the cases of the Delta conjecture of Haglund, Remmel and Wilson ("The delta conjecture", 2018). Along the way, we introduce some new statistics, formulate some new conjectures, prove some new identities of symmetric functions, and answer a few open problems in the literature (e.g., from Aval, Bergeron and Garsia [2015], Haglund, Remmel and Wilson [2018], and Zabrocki [2019]). The main technical tool is a new identity in the theory of Macdonald polynomials that extends a theorem of Haglund in "A proof of the Schröder conjecture" (2004)"--

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