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The study of positive polynomials brings together algebra, geometry and analysis. The subject is of fundamental importance in real algebraic geometry when studying the properties of objects defined by polynomial inequalities. Hilbert's 17th problem and its solution in the first half of the 20th century were landmarks in the early days of the subject. More recently, new connections to the moment problem and to polynomial optimization have been discovered. The moment problem relates linear maps on the multidimensional polynomial ring to positive Borel measures. This book provides an elementary introduction to positive polynomials and sums of squares, the relationship to the moment problem, and the application to polynomial optimization. The focus is on the exciting new developments that have taken place in the last 15 years, arising out of Schmüdgen's solution to the moment problem in the compact case in 1991. The book is accessible to a well-motivated student at the beginning graduate level. The objects being dealt with are concrete and down-to-earth, namely polynomials in n variables with real coefficients, and many examples are included. Proofs are presented as clearly and as simply as possible. Various new, simpler proofs appear in the book for the first time. Abstraction is employed only when it serves a useful purpose, but, at the same time, enough abstraction is included to allow the reader easy access to the literature. The book should be essential reading for any beginning student in the area.