

THE DESIGN AND ANALYSIS OF SPATIAL DATA STRUCTURES

Hanan Samet
University of Maryland

This book presents the first complete introduction to spatial data structures. Spatial data include points, lines, rectangles, regions, surfaces, and volumes. The representation of such data has become increasingly important in a wide range of programming applications. The list of application areas includes:

- computer graphics
- image processing
- computer-aided design
- solid modeling
- robotics
- computer vision
- pattern recognition
- computational geometry
- database management systems
- geographic information systems (GIS)

The author shows how hierarchical data structures, and in particular, the quadtree and octree, can be used to represent spatial data. The advantage of hierarchical data structures is their ability to focus on interesting subsets of the data, resulting in more efficient representation and faster execution. Thus, they are particularly convenient for performing set operations. Even where other data structures might perform as efficiently, hierarchical data structures are often preferred for their conceptual clarity and ease of implementation.

The book contains a separate chapter for each spatial data type. Each chapter includes at least one detailed algorithm. These algorithms, with numerous other examples and exercises, will help readers evaluate the data structures presented and determine their applicability. Two problems are treated in greater detail: the rectangle intersection problem and the point location problem.

Another book by the same author, *Applications of Spatial Data Structures*, provides a comprehensive treatment of how quadtrees and octrees can be applied to solve problems in computer graphics, image processing, and geographic information systems (GIS). These two books provide a detailed picture of the current state of the art in the design, analysis, and application of spatial data structures. Each book contains an extensive bibliography, and the books are cross-referenced.



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