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Geographic Databases & Information Systems

In memory of

Professor Y.C. Lee

Preface

The management and analysis of geographic data is a major scientific domain nowadays. It is estimated that 80% of economic and political decisions worldwide engage explicitly or implicitly with some form of geographic information. The Geographic Information Systems (GIS) has been a response technology to meet the urgent demands of users and applications.

The aim of this textbook is to present GIS from a technological perspective. Emphasis is given to the core of these systems, which is the Geographic Database (GDB) along with the corresponding Database Management System (GDBMS). These two components are largely responsible for the performance and efficiency of a GIS. The fundamental methods and algorithms to analyze the geographic data are also at the heart of the debate.

The textbook is organized into fifteen (15) chapters, which are grouped into three (3) parts (Figure 1). Part I discusses the nature of geographic data (Chapter 1), the coordinate systems associated with the earth's surface (Chapter 2), the projection of the earth's surface on paper and digital maps (Chapter 3), and concludes with an introduction to geographic information systems (Chapter 4).

In Part II, the discussion focuses on the technology of database systems. After presenting the basic concepts of these systems (Chapter 5), the process of their design is elaborated (Chapter 6). Then, some advanced database system design topics are visited (Chapter 7) along with the mechanisms of structuring data to support efficient management (Chapter 8).
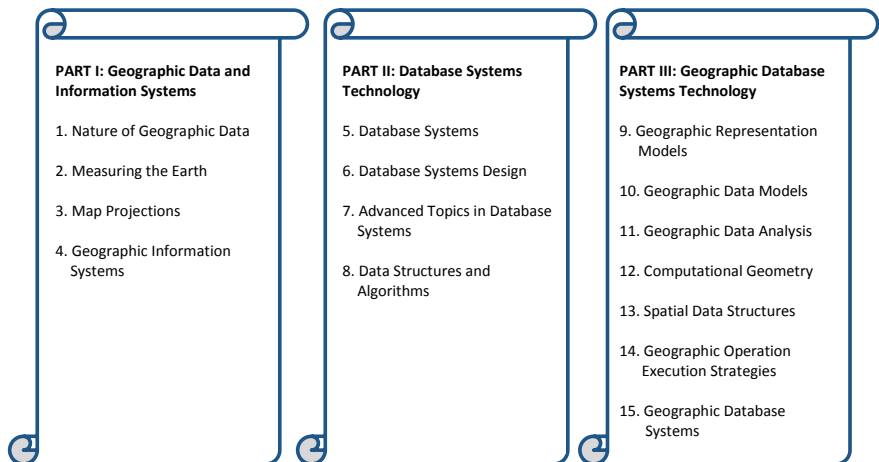

PART I: Geographic Data and Information Systems

1. Nature of Geographic Data

2. Measuring the Earth

3. Map Projections

4. Geographic Information Systems

PART II: Database Systems Technology

5. Database Systems

6. Database Systems Design

7. Advanced Topics in Database Systems

8. Data Structures and Algorithms

PART III: Geographic Database Systems Technology

9. Geographic Representation Models

10. Geographic Data Models

11. Geographic Data Analysis

12. Computational Geometry

13. Spatial Data Structures

14. Geographic Operation Execution Strategies

15. Geographic Database Systems

Fig. 1. Organization of content into three parts and fifteen chapters.

In Part III the discussion relates to geographic databases. The representation and data models for geographic data are presented (Chapters 9 and 10) followed by a classification of geographic data analysis operations (Chapter 11). The principles of computational geometry (Chapter 12), spatial data structures (Chapter 13), and optimization strategies for the execution of geographic procedures (Chapter 14) are discussed, before the state-of-the-art in geographic database systems technology (Chapter 15) is presented.

This resource aims to provide an aid and reference to both students (undergraduate and graduate level) and professionals. Prior knowledge of basic computer concepts is necessary to understand the content. Readers with discipline in software engineering and database systems can skip the Chapters in Part II.

Hoping that this textbook will fulfill its main objective, which is to contribute to knowledge transfer and promote research, readers are kindly requested to notify the author their comments and concerns, which will contribute constructively in improving the content of future editions.

Emmanuel Stefanakis