

Notes to the Textbook

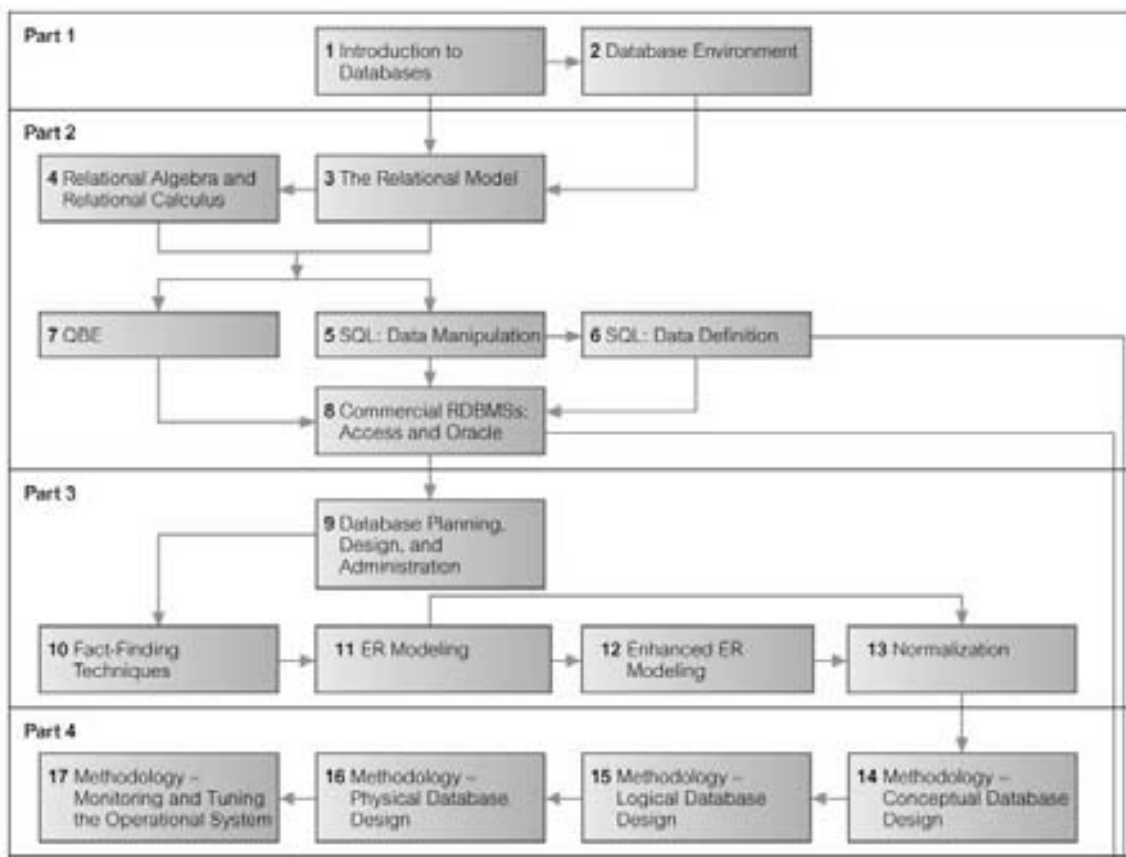
The textbook used for this course is: *Database Systems – A Practical Approach to Design, Implementation, and Management* by Thomas M. Connolly & Carolyn E. Begg, published by Addison-Wesley.

It is a good book for database design and management, providing an easy-to-use, step-by-step methodology for the three main phases of relational database design (conceptual, logical and physical). You should be able to master this methodology after studying the course.

The textbook provides ‘*Chapter Objectives*’ and a ‘*Chapter Summary*’ for each chapter. You should constantly refer to the objectives whilst reading each chapter, and check your understanding by attempting the ‘*Review Questions*’. The ‘*Chapter Summary*’ refreshes you with some important concepts covered in each chapter.

The Purpose of this Study Book

This book will provide learning objectives for each chapter in the textbook. You must read the textbook while using the notes in the study book as a guide. The following figure shows the logical organization of the textbook and the suggested paths through it.



This course will cover the first four parts of the textbook:

1. Part 1 Background
 - Chapter 1 Introduction to Databases
 - Chapter 2 Database Environment
2. Part 2 The Relational Model and Languages
 - Chapter 3 The Relational Model
 - Chapter 4 The Relational Algebra and Relational Calculus
 - Chapter 5 SQL: Data Manipulation
 - Chapter 6 SQL: Data Definition
 - Chapter 7 Query-by-Example
 - Chapter 8 Commercial RDBMSs: Access and Oracle
3. Part 3 Database Analysis and Design Techniques
 - Chapter 9 Database Planning, Design, and Administration
 - Chapter 10 Fact-Finding Techniques
 - Chapter 11 Entity-Relationship Modeling
 - Chapter 13 Enhanced Entity-Relationship Modeling
 - Chapter 13 Normalization
4. Part 4 Methodology
 - Chapter 14 Methodology – Conceptual Database Design
 - Chapter 15 Methodology – Logical Database Design
 - Chapter 16 Methodology – Physical Database Design for Relational DBMSs
 - Chapter 17 Methodology – Monitoring and Tuning the Operation System

As this guide is written principally to accompany the prescribed text, it follows exactly in the sequence and numbering of items. Many of the major headings, highlighted points and definitions have been replicated, with permission from Pearson Education.

Module 1

INTRODUCTION TO DATABASES

Learning Objectives

Upon successful completion of this module students should be able to:

- Define the terms: Database and Database Management System (DBMS);
- List:
 - common uses of database systems;
 - characteristics of file-based systems;
 - problems with the file-based approach;
 - major components and personnel of the DBMS environment; and
 - the advantages and disadvantages of DBMS.

The material in Chapter 1 of the textbook covers a wide area, and introduces many basic concepts.

1.1 Traditional File-Based Systems

From *section 1.2 File-based Systems*, you should understand the limitations of the file-based approach, what constitutes a computer file system, and what are some of its problems.

Note that a computer file system stores data in independent, unrelated files on disk. The sharing, security and integrity of the data can't be enforced efficiently because of the following problems:

- Separation and isolation of data:
Each program maintains its own set of data. Users of one program may be unaware of potentially useful data held by other programs.
- Data dependence:
File structure is defined in the program code.
- Duplication of data:
The same data is held by different programs. There is wasted space and potentially different values and/or different formats for the same item.
- Incompatible file formats:
Programs are written in different languages, and so cannot easily access each others files.
- Fixed Queries/Proliferation of application programs:
Programs are written to satisfy particular functions. Any new requirement needs a new program.

1.2 Database Approach

The textbook gives definitions for the database, the system catalog (data dictionary or metadata), and the Database Management System (DBMS).

The DBMS is a software system that:

- enables users to define, create, and maintain the database.
- provides controlled access to this database.

What are the DBMS Functions, and Why are They Important?

Read *section 1.3.2* of the text, on how the DBMS provides the facilities for database management.

The two languages of databases are:

- Data definition language (DDL).
Permits specification of data types, structures and any data constraints. All specifications are stored in the database.
- Data manipulation language (DML).
General enquiry facility (query language) of the data.

What are the Components of the DBMS Environment?

1. Hardware
 - can range from a PC to a network of computers.
2. Software
 - DBMS, operating system, network software (if necessary) and also the application programs.
3. Data
 - data constitutes the database's central component through which information is generated
4. Procedures
 - instructions and rules that should be applied to the design and use of the database and DBMS.
 - designed to accomplish desired activities
5. People
 - perform different functions within the environment

Roles in the Database Environment

There are four distinct types of people that participate in the DBMS environment.

1. Data Administrator (DA) & Database Administrator (DBA)
2. Database Designers (Logical and Physical)
3. Application Programmers
4. End Users (naive and sophisticated)

What is a Database Model?

A database model is a collection of logical constructs used to represent the database's data structure as well as the data relationship(s) found within that structure.

Advantages and Disadvantages of DBMS

Finally, from *section 1.6 Advantages and Disadvantages of DBMS*, a proper database system eliminates data dependence and provides:

- Control of data redundancy.
- Data consistency.
- More information from the same amount of data.
- Sharing of data.
- Improved data integrity.
- Improved security.
- Enforcement of standards.
- Economy of scale.
- Balanced conflicting requirements.
- Improved data accessibility and responsiveness.
- Increased productivity.
- Improved maintenance through data independence.
- Increased concurrency.
- Improved backup and recovery services.

Disadvantages of DBMS are the complexity, size and cost of DBMS etc.

Read the *Chapter Summary* at the end of the textbook to review the topics covered in the chapter.

Review Questions

Attempt the *Review Questions* on page 31 of the textbook. Below you will find listed some helpful notes for each:

1.1 List four examples of database systems other than those listed in Section 1.1.

Some examples could be:

- A system that maintains component part details for a car manufacturer;
- An advertising company keeping details of all clients and adverts placed with them;
- A training company keeping course information and participants' details;
- An organization maintaining all sales order information.

1.2 Discuss each of the following terms:

- data (See Section 1.3.3)
- database (See Section 1.3.1)
- database management system (See Section 1.3.2)
- Data Independence (See Sections 1.2.2 and 1.3.1)
- Security (See Section 1.6)
- Integrity (See Section 1.6)
- Views (See Section 1.3.2)

1.3 Describe the approach taken to the handling of data in the early file-based systems. Discuss the disadvantages of this approach.

(See Section 1.2).

(See Section 1.2.2).

1.4 Describe the main characteristics of the database approach and contrast it with the file-based approach.

(See Section 1.3)

1.5 Describe the five components of the DBMS environment and discuss how they relate to each other.

See Section 1.3.3.

1.6 Discuss the roles of the following personnel in the database environment:

Data Administrator See Section 1.4.1

Database Administrator See Section 1.4.1

Logical Database Designer See Section 1.4.2

Physical Database Designer See Section 1.4.2

Application Programmer See Section 1.4.3

End Users See Section 1.4.4

1.7 Discuss the advantages and disadvantages of database processing.

See Section 1.6

Activities

Attempt the following exercises from page 31 of the textbook:

Exercise 1.8

Interview some users of database systems. Which DBMS facilities do they find most useful and why? Which DBMS facilities do they find least useful and why? What do these users perceive to be the advantages and disadvantages of the DBMS?

N.B. Select a variety of users for a particular DBMS. If the users are using different DBMSs, group the answers for the different systems, which will give an overall picture of specific systems.

Additional Activities

Exercise 1.9

Write a small program that allows entry and display of renter details including a renter number, name, address, telephone number, preferred number of rooms and maximum rent. The details should be stored in a file. Enter a few records and display the details. Now repeat this process but rather than writing a special program, use any DBMS that you have access to. What can you conclude from these two approaches?

N.B. The program can be written in any appropriate programming language, such as Pascal, FORTRAN or C. It should adhere to basic software engineering principles including being well structured, modular, and suitably commented. It is important to appreciate the process involved even in developing a small program such as this. The DBMS facilities to structure, store, and retrieve data are used to the same effect. The differences in the approaches, such as the effort involved, potential for extension, and ability to share the data should be noted.

Exercise 1.10

Study the DreamHome case study presented in Section 10.4. In what ways would a DBMS help this organisation? What data can you identify that needs to be represented in the database? What relationships exist between the data? What queries do you think are required?

N.B. It may be useful to review the file-based approach and the database approach here before tackling the first part of the exercise. Careful reading and thinking about how people might use the applications should help in carrying out the rest of the exercise.