MCA : MANAGEMENT : SEMESTER-I

NEW SYLLABUS

Database Management System

Gautam Bapat

NIRALI PRAKASHAN
ADVANCEMENT OF KNOWLEDGE

A Text Book of

DATABASE MANAGEMENT SYSTEM

FOR
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GAUTAM BAPAT
M.C.A. PGDBM (Marketing)
Asst. Professor, Computer Science & Applications
MITSOM College,
Pune

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Abhyudaya Pragati, 1312, Shivaji Nagar,
Off J.M. Road, PUNE – 411005
Tel - (020) 25512336/37/39, Fax - (020) 25511379
Email : niralipune@pragationline.com

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Tel : (020) 2445 2044, 66022708, Fax : (020) 2445 1538
Email : bookorder@pragationline.com, niralilocal@pragationline.com

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PREFACE

There has been significant development in recent years in the field of Computer Science. The book is a perfect blend of technology which has been a field of dramatic revolution; this subject focuses on different technologies of it.

It gives me great pleasure in presenting this book **"Database Management System"** designed to serve as a textbook for students of the First Semester of Master of Computer Application (M.C.A.), the book is organized in such a way that it mirrors the revised syllabus of University of Pune. The book will be found useful by a wide section of readers, teachers and students of Business, Technology and Computer Management courses in Indian Universities. The entire book is freshly written as per the revised syllabus.

The book has its own unique features. It brings out the subject in a very simple and lucid manner for easy and comprehensive understanding of the basic concepts, its intricacies, procedures and practices. This book will help the readers to have a broader view on Database Management System. The language used in this book is easy and will help students to improve their vocabulary of Technical terms and understand the matter in a better and happier way.

Particular attention has been paid to making this book stimulating and highly readable. The result is a text which is clear, focused and designed to capture student interest. This text is equally suitable for courses directed at undergraduates and postgraduates.

I have given my best inputs for this book. Any suggestions towards the improvement of this book and sincere comments are most welcome on niralipune@pragationline.com.

Author

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Author

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BASIC CONCEPTS

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1.1 Introduction to Database and DBMS

- Database is a collection of data.
- Database contains information about one particular enterprise. Examples of enterprise and its database are, a manufacturing company which stores product data.
  1. **Bank** which stores customers banking data,
  2. **Hospital** which stores patient data, and
  3. **University** which stores student data so on.
- A database is a collection of data elements or components such as tables (entities), columns (fields or attributes), rows (records).
- A database turns disparate pieces or parts of data into information based on needs collect essential information etc.

- We can define database as "the collection of data is known as database".

OR

- A database is a collection of interrelated data of an organization/enterprise.
- Database contains information or data relevant to an enterprise.
- Database Management System (DBMS) is collection of interrelated data and a set of programs to access the data.
- The objective of DBMS is to provide convenient and effective method of defining, storing and retrieving the information contained in the database.
- In addition the DBMS must provide for the safety of the information stored. It should protect the data from system crash or attempt at unauthorized access. If the data are to be shared among several users, the system must avoid possible anomalous results.
- **Examples of DBMS**
  1. Oracle,
  2. Microsoft Access, and
  3. Foxpro etc.
- DBMS manages a permanent self descriptive repository (database) of data.

1.1.1 Definition of DBMS

- A database management system is a computer based system or program to record and maintain information or data.
- In any organization, data is the basic resource needed to run the organization. This data is required by decision makers for processing and retrieving information.
- A data is collection of information or real fact which can be recorded and have implicit meaning. Customer_name, item price, balance etc. can be consider as data.
- The database is used to store information useful to an organization.
- A database is a shared collection of inter-related data, which is designed to fulfill the information needs.

  For example: Consider the names, telephone numbers and addresses of the people you know. This data is recorded in an indexed address book or stored on a diskette or using a personal computer. This is a collection of related data with an implicit meaning and hence is a database.
- A database use the following implicit properties.
  1. A database represents some aspect of the real world, sometimes called the miniworld. Changes to the miniworld are reflected in the database.
  2. A database is a logically collection of data with some meaning. A random assortment of data cannot correctly be referred to as a database.
  3. A database is designed, built and populated with data for a specific purpose. It has an intended group of users.

- So, finally we can say that a database has some source from which data are derived, some degree of interaction with events in the real world and an audience that is actively interested in the contents of the database.
- A Database Management System (DBMS) is a **software system that allows user to define, manipulate and process the data in a database, in order to produce meaningful information.**
- The basic functions of DBMS are:
  1. To store data in a database.
  2. To organize the data.
  3. To control access of data.
  4. To protect data i.e. provide security.
- The DBMS is hence a general purpose software system that facilitates the processes of defining, constructing and manipulating databases for various applications.
- **Defining a database** involves specifying the data types, structures and constraints for the data to be stored in the database.
- **Constructing the database** is the process of storing the data itself on some storage medium that is controlled by the DBMS.
- **Manipulating a database** includes such functions as querying the database to retrieve specific data, updating the database to reflect changes in the miniworld and generating reports from the data. So in general, user can write programs or queries; DBMS use the database stored on storage devices and gives meaningful information.

1.1.2 Components of DBMS and Overall Structure of DBMS

- Components of DBMS are broadly classified as follows:
  1. **Query Processor:**
     (i) DML Pre-compiler,
     (ii) Embedded DML Pre-compiler,
     (iii) DDL Interpreter, and
     (iv) Query Evaluation Engine.
  2. **Storage Manager:**
     (i) Authorization and Integrity Manager,
     (ii) Transaction Manager,
     (iii) File Manager, and
     (iv) Buffer Manager.
  3. **Data Structure:**
     (i) Data Files,
     (ii) Data Dictionary,

(iii) Indices, and

(iv) Statistical Data.

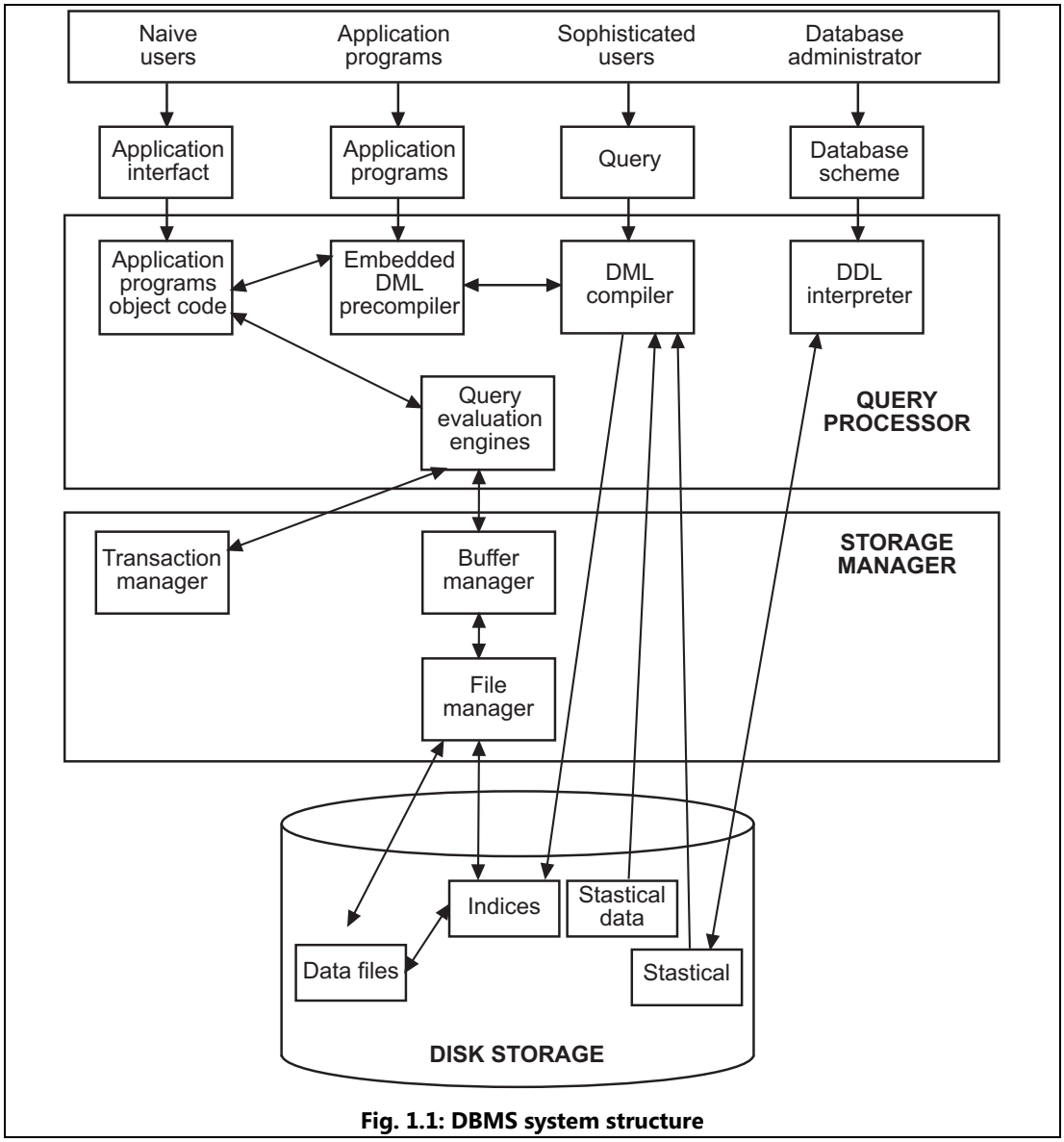


Fig. 1.1: DBMS system structure

1. Query Processor Components:

(i) DML Pre-compiler: It translates DML statements in a query language into low level instructions that query evaluation engine understands. It also attempts to transform user's request into an equivalent but more efficient form.

(ii) Embedded DML Pre-compiler: It converts DML statements embedded in an application program to normal procedure calls in the host language. The Pre-compiler must interact with the DML compiler to generate the appropriate code.

(iii) DDL Interpreter: It interprets the DDL statements and records them in a set of tables containing meta data or data dictionary.

(iv) Query Evaluation Engine: It executes low-level instructions generated by the DML compiler.

2. **Storage Manager Components:** They provide the interface between the low-level data stored in the database and application programs and queries submitted to the system.

   (i) Authorization and Integrity Manager: It tests for the satisfaction of integrity constraints checks the authority of users to access data.

   (ii) Transaction Manager: It ensures that the database remains in a consistent state despite the system failures and that concurrent transaction execution proceeds without conflicting.

   (iii) File Manager: It manages the allocation of space on disk storage and the data structures used to represent information stored on disk.

   (iv) Buffer Manager: It is responsible for fetching data from disk storage into main memory and deciding what data to cache in memory.

3. **Data Structures:** Following data structures are required as a part of the physical system implementation.

   (i) Data Files: It stores the database.

   (ii) Data Dictionary: It stores meta data (data about data) about the structure of the database.

   (iii) Indices: Provide fast access to data items that hold particular values.

   (iv) Statistical Data: It stores statistical information about the data in the database. This information is used by query processor to select efficient ways to execute query.

1.1.3 Functions of DBMS

- DBMS performs following functions:

  1. **Data Security and Data Integrity:** This is the most important function of database which handles the security and integrity scheme of database application.
  2. **Data Definition:** Data definition defines the structure of database. It is also defines field size, record structure.
  3. **Data Manipulation:** It contains manipulation of data, i.e inserting, modifying, deleting function.
  4. **Data Recovery:** After system failure to recover data in the database.
  5. **Concurrency:** To handle concurrent access of multiple users.

1.1.4 Data Models

- Data model is the collection of conceptual tools for describing:
  1. Data,
  2. Data Schema, and
  3. Consistency Constraints.
- Data models are classified into following three categories:
  1. Object Based Logical Data Model,
  2. Record Based Logical Data Model, and
  3. Physical Data Model.

1. Object-Based Logical Model: Object-based logical models are used in describing data at:

(i) Logical Level, and

(ii) View Level.

Following are the object based logical models:

1. Entity Relationship Model,
2. Object Oriented Model,
3. Semantic Data Model, and
4. Functional Data Model.

Entity Relationship (E-R) Model consist of a collection of basic objects, called entities and relationships among these objects.

An **Entity** is an object that is distinguishable from other objects by a specific set of attributes. A **Relationship** is an association among several entities.

An object may contain in addition to relations and entities ER model also represents certain constraints to which the contents of a database must conform. One important constraint is **Mapping Cardinality**, which express the number of entities to which another entity can be associated via a relationship set.

Object Oriented Model is based on a collection of objects. An **Object** contains values stored in instance variables within the object and bodies of code that operate on the object. These bodies of code are called **'Methods'**.

Objects that contain the same type of values and the same methods are grouped together into classes. A **Class** may be viewed as a type definition for objects. The only way in which one object can access the data of the another object is by invoking a method of that other object. This is called **Sending Messages** to the object.

2. **Record-Based Logical Model:** Record based logical model are used in describing data at:
   (i) Logical Level, and
   (ii) View Level.

   In record-based models, database is structured in fixed format records of several types. Each type defines a fixed number of fields or attributes and each field is usually of fixed length.

- Following are the record based data models:
  (i) Relational Model: It uses a collection of tables to represent both data and relationship among those data. Each table has multiple columns and each column has a unique name.
  (ii) Network Model: In Network Model, data is represented as collection of records and relationship among data are represented by links, which can be viewed as pointers. The records in databases are organized as collection of arbitrary graphs.
  (iii) Hierarchical Model: It is similar to Network Model, in the sense that data and relationship among data are represented by records and links respectively. But in this model the records in databases are organized as collections of trees rather than arbitrary graphs.

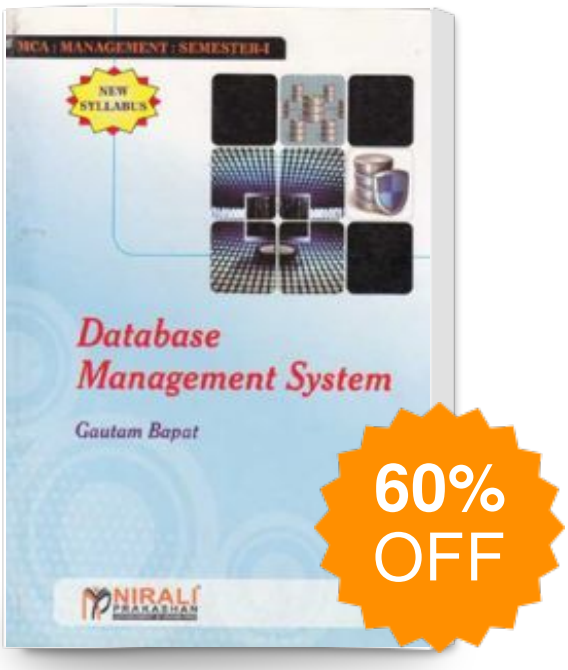
3. **Physical Data Model:** It is used to describe data at the lowest level. Following are the physical models.
   (i) Unifying model, and
   (ii) Frame memory model.

1.1.5 Data Abstraction

- A major purpose of DBMS is to provide users with an abstract view of the data. Many database system users are not computer-trained, hence the complexity is hidden from them through several levels of abstraction.
- Data abstraction means to hide certain details of how the data is **stored** and **maintained**.
- Fig. 1.2 shows the three levels of abstractions.

1. **Physical Level:** It is the lowest level of abstraction. It describes *how* the data is actually stored and describes the data structures and access methods to be used by the database. At the physical level, complex low-level data structures are described in detail. The internal view is expressed by the internal schema which contains the definition of stored record, the method of representing the data fields and the access aids used.

Database Management System



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