

UNIT 1

Introduction to DBMS

(3 Hours) — Database Management System (CACS255) · BCA II Year / IV Semester

⚠ Important Note — Please Read

These notes were prepared quickly from the course syllabus and standard textbook knowledge. **They may contain errors, typing mistakes or incomplete points.** Please take care: cross-check definitions, formulas, SQL syntax and examples with your class notes, the prescribed textbook and your teacher before relying on them for exams or practicals.

1.1 Introduction of Database Management System

Data means raw, unprocessed facts such as names, numbers, dates or images (for example: *Ram, 21, Kathmandu*). **Information** is data that has been processed so that it becomes meaningful and useful for decisions (for example: *“The average age of BCA students is 21”*).

A **database** is an organized collection of related data that is stored so that it can be easily accessed, managed and updated. A **Database Management System (DBMS)** is a software package that lets users define, create, store, retrieve, update and control access to a database. Popular examples are MySQL, Oracle, Microsoft SQL Server, PostgreSQL and MS Access.

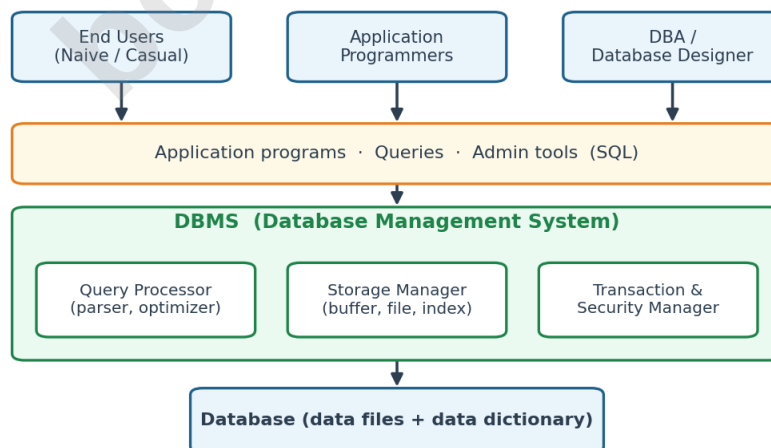


Figure 1.1 — Simple DBMS environment: users, applications, DBMS and the database

Example 1.1 — Database vs DBMS

Database: the actual college data — Student, Course, Teacher and Result records.

DBMS: the software (e.g. MySQL) that stores this data and lets you run *SELECT*, *INSERT*, *UPDATE* commands on it.

Components of a Database System

Component	Description
Hardware	Computers, disks and servers on which the database is stored and run.
Software	The DBMS itself, operating system and application programs.
Data	The operational data plus <i>metadata</i> (data about data) kept in the data dictionary.
Procedures	Rules and instructions for using, backing up and maintaining the system.
People	DBA, database designers, application programmers and end users.

Users of a Database

- **Database Administrator (DBA):** installs the DBMS, controls security, backup and performance.
- **Database Designer:** decides what data to store and designs its structure.
- **Application Programmer:** writes programs (Java, PHP, etc.) that use the database.
- **End Users:** naive users (bank clerk using a form) and sophisticated/casual users (analysts writing SQL).

1.2 Objectives of Database Management System

The DBMS was developed to overcome the weaknesses of the traditional **file-processing system**, in which every application kept its own separate files. Its main objectives are:

- **Reduce data redundancy** — avoid storing the same fact in many places.
- **Maintain data consistency** — one copy of data means all users see the same value.
- **Data sharing** — many users and applications can use the same data at the same time.
- **Data integrity** — enforce rules (constraints) so that only valid data is stored.
- **Data security** — allow only authorized users to view or change data.
- **Data independence** — change how data is stored without rewriting application programs.
- **Backup and recovery** — restore data after a crash or failure.

- **Concurrent access** — let many users work together without corrupting data.

File System vs. DBMS

Point	File-Processing System	DBMS
Redundancy	High — same data in many files	Controlled / minimal
Consistency	Inconsistency is common	Maintained by constraints
Data sharing	Difficult	Easy and controlled
Security	Weak, OS-level only	Strong, user-level privileges
Concurrency	Problems (lost updates)	Handled by concurrency control
Recovery	Manual or none	Automatic backup and recovery
Data independence	Low — programs depend on file format	High
Querying	Need a new program for each query	Ad-hoc queries using SQL

Example 1.2 — Problem of the file system

A college keeps student addresses in both the *Library file* and the *Accounts file*. When a student shifts house, the address is updated only in the Library file. Now the same student has **two different addresses** — this is **data inconsistency** caused by **data redundancy**. A DBMS stores the address once, so the problem does not occur.

1.3 Importance of DBMS

In today's world almost every organization — banks, hospitals, schools, airlines, e-commerce sites — depends on large volumes of data. A DBMS is important because it:

- provides fast and efficient storage and retrieval of huge amounts of data;
- gives accurate, up-to-date information that helps management take decisions;
- protects data from unauthorized access, loss and corruption;
- supports many users working together (multi-user environment);
- reduces development time of applications because data-handling is done by the DBMS;
- allows a simple, standard language (SQL) for all data operations.

1.4 Merits and Demerits of DBMS

Merits (Advantages)	Demerits (Disadvantages)
Controls data redundancy	High initial cost of hardware, software and training
Avoids data inconsistency	Complexity — needs skilled DBA and designers
Sharing of data among users	Large size requires much memory and disk space
Enforces integrity constraints	Failure of the central DBMS can affect the whole organization
Better security and access control	Performance overhead for small, simple applications
Backup and recovery facilities	Conversion from an old file system is costly and time-consuming
Data independence	Higher impact of a failure because data is centralized
Standards can be enforced	Security features may need extra configuration

1.5 Applications of DBMS

Area	How a DBMS is used
Banking	Customer accounts, transactions, loans, ATM operations
Education	Student records, admissions, results, library management
Airlines / Railways	Reservations, schedules, ticketing
Telecommunication	Call records, billing, customer details
Healthcare	Patient history, appointments, pharmacy stock
E-commerce	Products, orders, payments, customer reviews
Finance and Stock market	Share holdings, trades, market data
Human Resources	Employee details, payroll, attendance
Government	Citizen records, tax, voter lists, land records
Social media	User profiles, posts, friend connections

Note: Real-world Nepali examples include bank core-banking systems, the Election Commission voter list and university exam-result systems.

Key Takeaways — Unit 1

- ✓ Data is raw facts; information is processed data; a database is an organized collection of related data.
- ✓ A DBMS is software that creates, stores, retrieves and controls access to a database.

- ✓ DBMS overcomes file-system problems: redundancy, inconsistency, poor security and no concurrency control.
- ✓ Main merits: less redundancy, integrity, security, sharing, backup/recovery and data independence.
- ✓ Main demerits: high cost, complexity, large size and single point of failure.
- ✓ DBMS is used in banking, education, airlines, healthcare, e-commerce and government.

— *End of Unit 1* —

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