



Introduction to Database

Database Fundamentals



💡 Chapter 1: The Tale of Two Systems — Flat Files vs Relational Databases

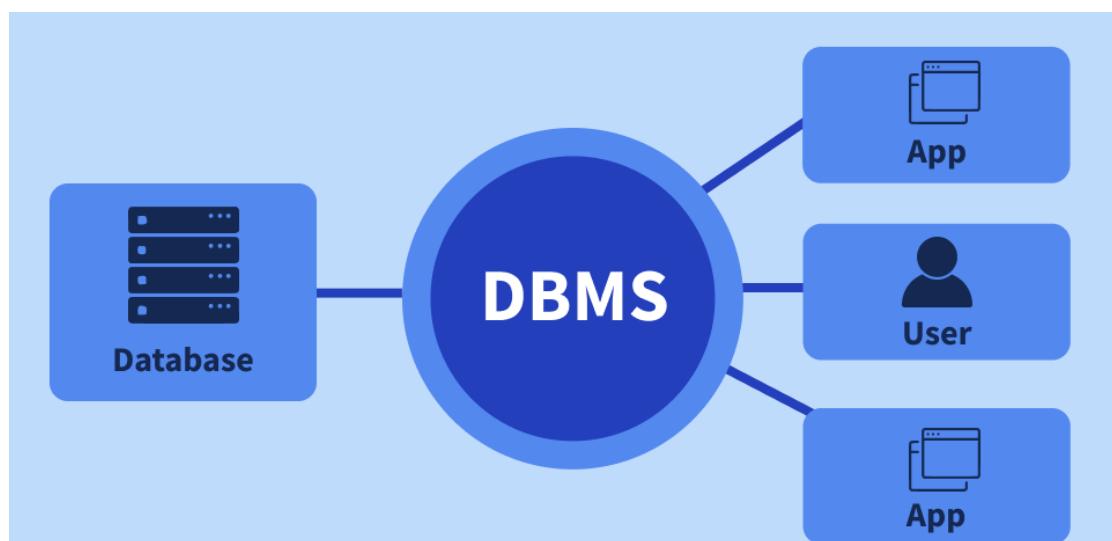
Once upon a time, data lived in simple text files. These were called **flat file systems** — like digital notebooks with no structure. Every entry was written line by line, and if you wanted to find something, you had to search manually.

But as data grew, so did the chaos. Repeated entries, no relationships, and no way to connect ideas. That's when the **Relational Database** was born — a system of tables that could talk to each other, like a well-organized city of information.

Feature	Flat File System	Relational Database
Structure	One big file	Multiple linked tables
Redundancy	High — same data repeated	Low — data split and reused smartly
Relationships	None — manual linking	Built-in via keys
Usage	Logs, CSVs, simple storage	Banking, schools, apps
Drawbacks	Hard to scale, error-prone	Needs setup and DBMS

🧠 Chapter 2: The Mind behind the machine -DBMS Awantages.

The development of databases requires custodians and systems that could be able to control them. Move inside the Database Management System (DBMS) which is a great brain that makes everything in order.



The mind map of its superpowers is as follows:

-  Security -Secures data against unauthorized access.
-  Integrity - makes data correct and consistent.
-  Backup - Stores information in case of breakdown.
-  Redundancy - prevents duplication.
-  Parallelism of accessibility - Permits the use of several users.
-  Data Sharing - Teams can work together.



Chapter 3: The Heroes of the Database World.

All database developments are collaborative. Meet the key players:

- System Analyst -The one who collects the needs of the users and identifies the purpose of the system.
- Database Designer - This is the architect that must plan the structure and relationships.
- Database Developer -The developer who writes SQL and query creator.
- Database Administrator (DBA) is the protector of good performance, security and backups.
- Application Developer- The interface between the database and the user interfaces.

BI Developer – The data wizard who turns raw data into insights and dashboards

🔗 Chapter 4: The Many Faces of Databases

There are numerous types of databases - each database fits a different world.

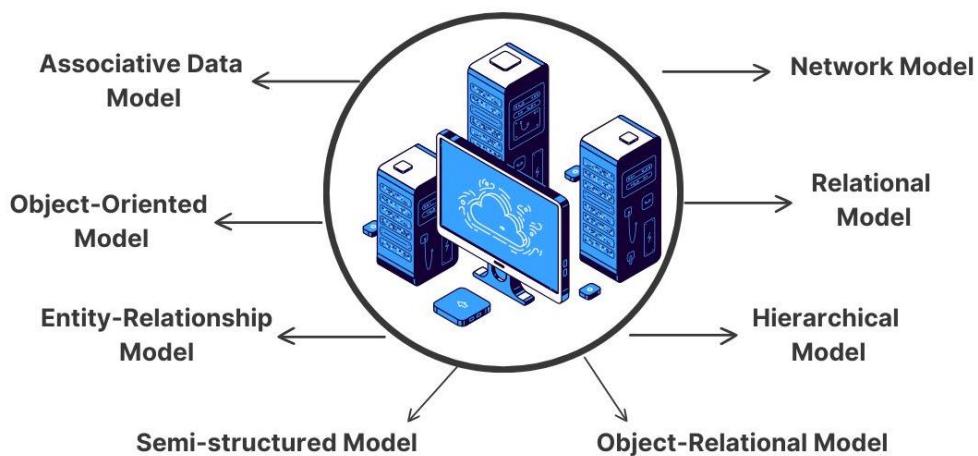
The difference between relational and non-relational.

Relational Structured tables, SQL (e.g. MySQL, Oracle)

Note: Can be non-relational: MongoDB and Cassandra are flexible data formats (e.g., documents, graphs).

- ◆ Cloud vs Distributed vs Centralized.
- Centralized: The location is centralized, easy control.
- Distributed: Multiple nodes, increased access speed.
- Cloud: Virtual, expandable and international.

Types of Data Models in DBMS



Use Cases:

- **Relational Banking, HR systems.**
- **Non-Relational → social media, IoT.**
- **Cloud → E-commerce, global apps**

🕒 Chapter 5: The Skyward Shift — Cloud Storage and Databases

With the rise of technology, data was rising. Cloud storage has been the new residence - it is flexible, scalable and can be accessed remotely.

🔗 What Is Cloud Storage?

It is as though it was renting a space in a digital warehouse. You save your information in remote servers and can access it at any time, any place.

✓ Advantages

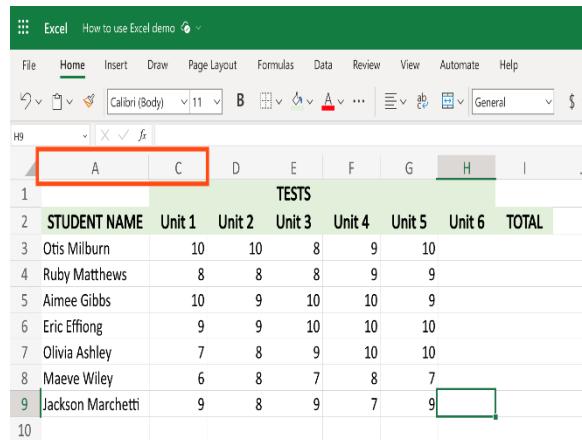
- No hardware needed
- Automatic backups
- Easy scaling
- Global access

⚠ Challenges

- Internet dependency
- Security risks
- Vendor lock-in

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- What is a database simply?

It is like a digital excel sheet where you store all data in a smart and organized way.



	A	C	D	E	F	G	H	I
1	TESTS							
2	STUDENT NAME	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	TOTAL
3	Otis Milburn	10	10	8	9	10		
4	Ruby Matthews	8	8	8	9	9	9	
5	Aimee Gibbs	10	9	10	10	10	9	
6	Eric Effong	9	9	10	10	10	10	
7	Olivia Ashley	7	8	9	10	10	10	
8	Maeve Wiley	6	8	7	8	7		
9	Jackson Marchetti	9	8	9	7	9		
10								

❖ Databases consist of.

- 1- Tables
- 2- Columns (Fields)
- 3- Rows (Record)
- 4- Primary Key (Main key)
- 5- Relationships: ex: - School linked with students table, teachers.

- 6- Quires
- 7- Forms (View of data)
- 8- Reports (Used to summarize data to share between candidates)
- 9- DBMS (control of database)

- o There are different types of databases:
- 1- Relational (Based on relationships between tables)
 - 2- Non – relation (Based on no relationship between tables)
 - 3- Centralized (Database is in one location)
 - 4- Distributed (from the name it is divided into many places or locations or servers)
 - 5- Cloud (it is virtualized and based on internet)
 - 6- Object oriented (This one is special because it holds object like other programming languages, for example Java)

To Understand Database more from technical view:

- 1- Requirement analysis (like having a scenario you read and collect useful information from by logical way)
- 2- Design (how the DB will look like)
- 3- Implementation (The DB will be created in this phase)
- 4- Testing (Check the DB if it works correctly or not)
- 5- Deployment (Live use of stockholders of the DB)
- 6- Maintenance (Fixing, Updating, DB)

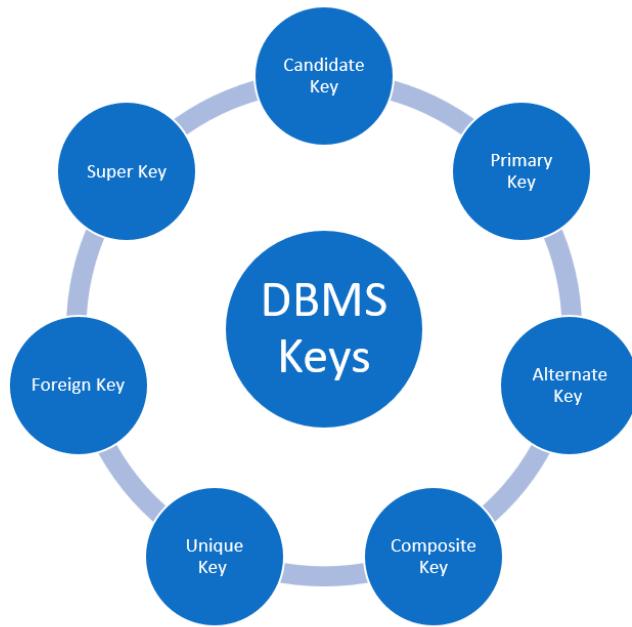
- DBMS definition?

Database management systems are software that helps to control databases by implementing different methods.

- ✓ List the methods used in DBMS.
- 10- Create
 - 11- Store
 - 12- Organize
 - 13- Search (Update)
 - 14- Protect

- ❖ What are DBMS benefits?

- 1- Security
- 2- Backups
- 3- Integrity



- ❖ What tool do we use to start using a database?

There are different tools names based on the level of developer for example, for beginners Microsoft Access. To make more easier check the table below:

Tool Name	Type	Best For
Microsoft Access	Desktop-based	Beginners, small projects
MySQL	Open-source	Websites, apps
SQLite	Lightweight	Mobile apps, small systems
Oracle	Enterprise-level	Large business
PostgreSQL	Advanced open source	Complex queries, analytics
MongoDB	NoSQL	Flexible data, social media
Google Firebase	Cloud-based	Mobile/web apps

▪ **Experience:**

My graduation experience while creating SMSW system I used MySQL which is the best choice for developing websites and apps. And recommend this app as beginner in SQL.



❖ Key concepts in DB:

- 1- Data → Raw facts
- 2- Information → data after finishing processing
- 3- Database Schema → design for the database
- 4- Normalization → organizing data to reduce repetition and improve efficacy.
- 5- SQL (Structure Query Language) → the language used to interact with relational database.
- 6- Primary key (PK) → special column in database identifies row in a table.
- 7- Foreign Key → a column in the table that links primary key.

SQl Commands category:

Category	Commands	purpose
DDL	CREATE, ALTER, DROP, TRUNCATE	Define structure
DML	INSERT, UPDATE, DELETE	Manipulate data
DQL	SELECT	Query data
DCL	GRANT, REVOKE	Control access
TCL	COMMIT, ROLLBACK, SAVEPOINT	Mange transactions

Example of SQL code:

```
SELECT Name FROM Students WHERE Grade = 10;
```

```
INSERT INTO Students VALUES (4, 'Salim', 15, 10);
```

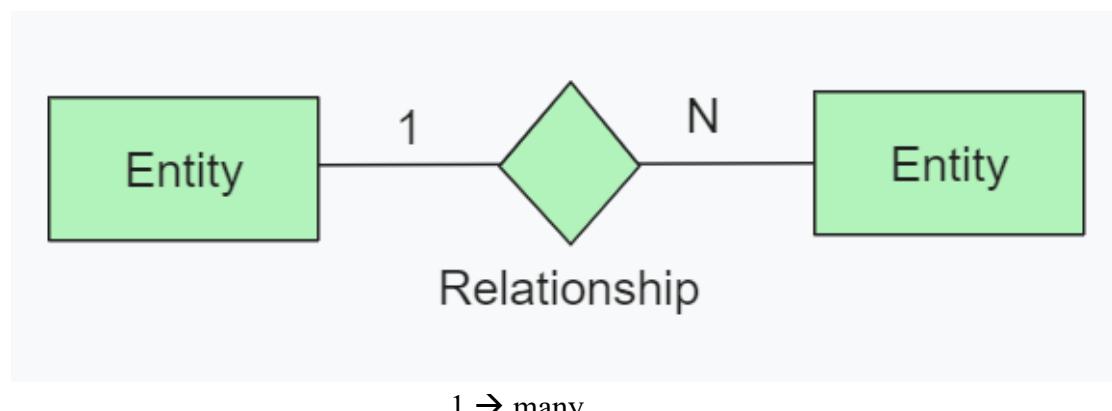
- ER Diagram and Relationships

It means how Entities interact with each other by relationships like:

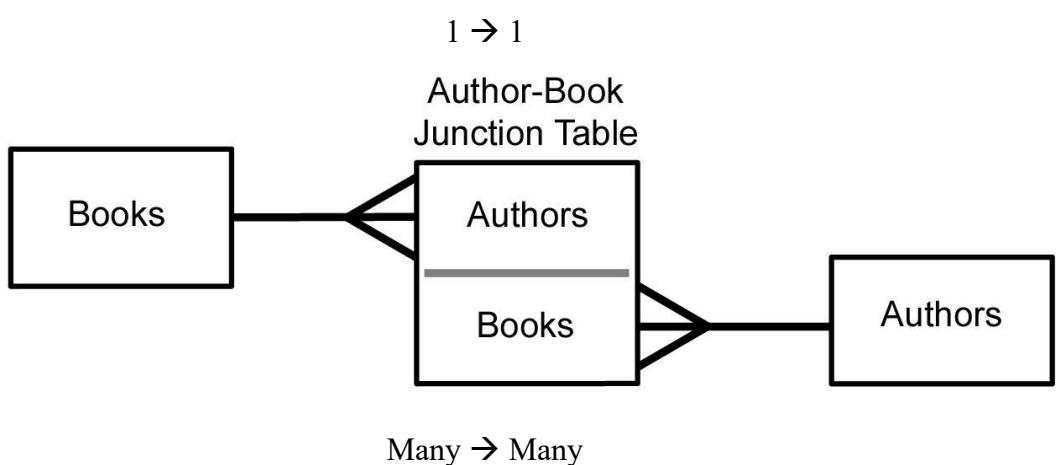
1 → 1

1 → Many

Many → Many



 BYJU'S
The Learning App



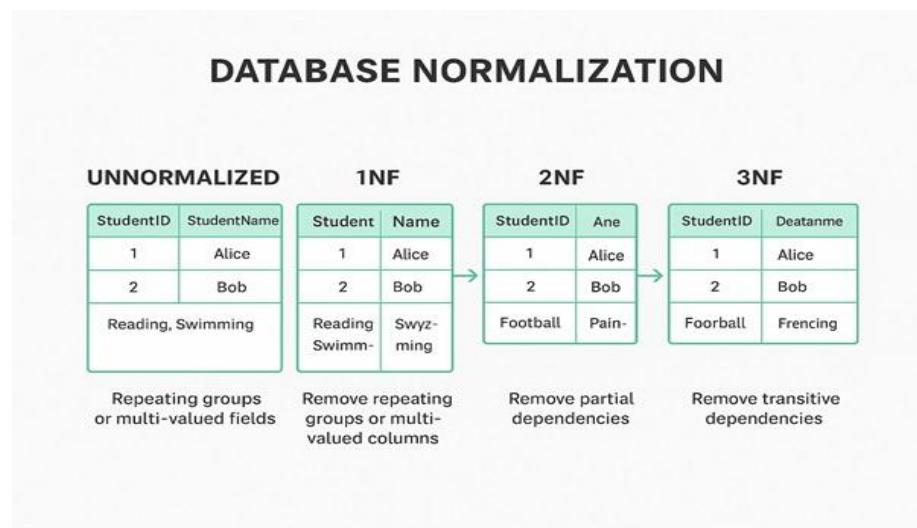
- Normalization:

- ✓ is process of reducing redundancy (Duplication)

- ✓ Normalization is easy to not store many copies of entities in many places.
- ✓ Easy updates
- ✓ Better performance

Level of Normalization:

Level	Description	Example
1NF	Single value each column	No Lists or multiple values in one cell
2NF	Removes partial dependencies	Every non – key column depends on PK
3NF	Remove transitive dependencies	Non – key column depends only on PK



Example:

Imagine a table storing student and course info together. Normalization would split this into:

- Students(StudentID, Name)
- Courses(CourseID, Title)
- Enrollments(StudentID, CourseID)