

Database Course Documentation



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Flat File Systems vs. Relational Databases

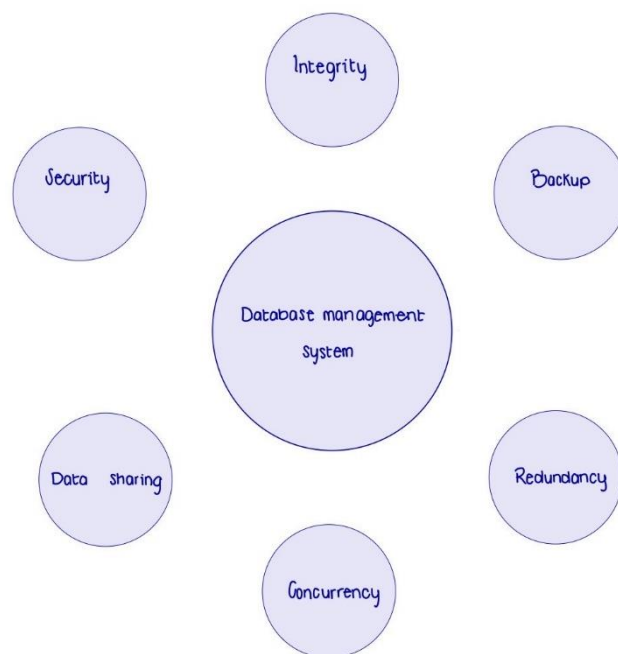
Feature	Flat File Systems	Relational Databases
Structure	Stores data in a single table or file	Organizes data into multiple tables with defined relationships
Data Redundancy	High redundancy due to lack of relationships	Minimizes redundancy through normalization
Relationships	No support for relationships	Supports primary and foreign keys to enforce relationships
Example Usage	Simple storage like CSV files or text logs	Business systems, ERP, CRM, etc.
Drawbacks	Poor scalability, hard to maintain, no query optimization	More complex to set up, requires DBMS knowledge

This comparison highlights the key differences between flat file systems and relational databases. Flat file systems are simple and store data in a single file, making them suitable for small-scale or temporary data storage. However, they often lead to high redundancy and lack the ability to manage relationships between data. In contrast, relational databases are structured to handle complex data with minimal redundancy through normalization. They support relationships using keys and are ideal for large-scale applications like enterprise systems. While more powerful, relational databases require a more sophisticated setup and understanding of database management systems.

DBMS Advantages – Mind Map

Advantages:

- Security
Role-based access control and encryption
- Integrity
Enforces rules like unique keys, data types, constraints
- Backup
Scheduled backups and recovery mechanisms
- Redundancy
Minimizes duplicate data via normalization
- Concurrency
Supports multi-user access with transaction controls
- Data Sharing
Controlled and concurrent data access for multiple users



Roles in a Database System

- System Analyst:

Gathers and defines business requirements. Bridges users and technical team.

- Database Designer

Designs the logical and physical structure of the database based on requirements.

- Database Developer

Implements the database design using SQL and programming.

- Database Administrator (DBA)

Manages database performance, backups, security, and user access.

- Application Developer

Builds the front-end or middle-tier applications that interact with the database.

- BI Developer

Designs dashboards, performs data analysis, and supports decision-making using reports.

Types of Databases

Relational vs. Non-Relational Databases

- **Relational:** Structured schema, uses SQL (e.g., MySQL)
- **Non-Relational:** Schema-less or semi-structured (e.g., MongoDB)

Centralized vs. Distributed vs. Cloud Databases

- **Centralized:** Single location; easier to manage, but a single point of failure
- **Distributed:** Spread across multiple locations/nodes; improves reliability and performance
- **Cloud:** Hosted on cloud platforms (e.g., AWS, Azure); supports scalability, maintenance, and remote access

Use Cases:

- **Relational:** Banking systems, inventory, and HR systems
- **Non-Relational:** Social media content, IoT sensor data, real-time analytics
- **Centralized:** Small business applications, single-location inventory or employee management systems
- **Distributed:** Content delivery networks, global applications
- **Cloud:** Startups scaling apps quickly, SaaS platforms

Cloud Storage and Databases

Cloud storage is an online service that allows data to be stored, managed, and accessed remotely via the internet. It complements databases by providing scalable and flexible infrastructure.

Advantages	Disadvantages
Scalability on demand	Vendor lock-in
High availability and redundancy	Potential latency and performance issues
Minimal hardware setup	Data security and compliance concerns
Maintenance by cloud providers	Internet dependency

References

1. Elmasri, R., & Navathe, S. B. (2016). *Fundamentals of Database Systems (7th ed.)*. Pearson Education.
2. Silberschatz, A., Korth, H. F., & Sudarshan, S. (2020). *Database System Concepts (7th ed.)*. McGraw-Hill.