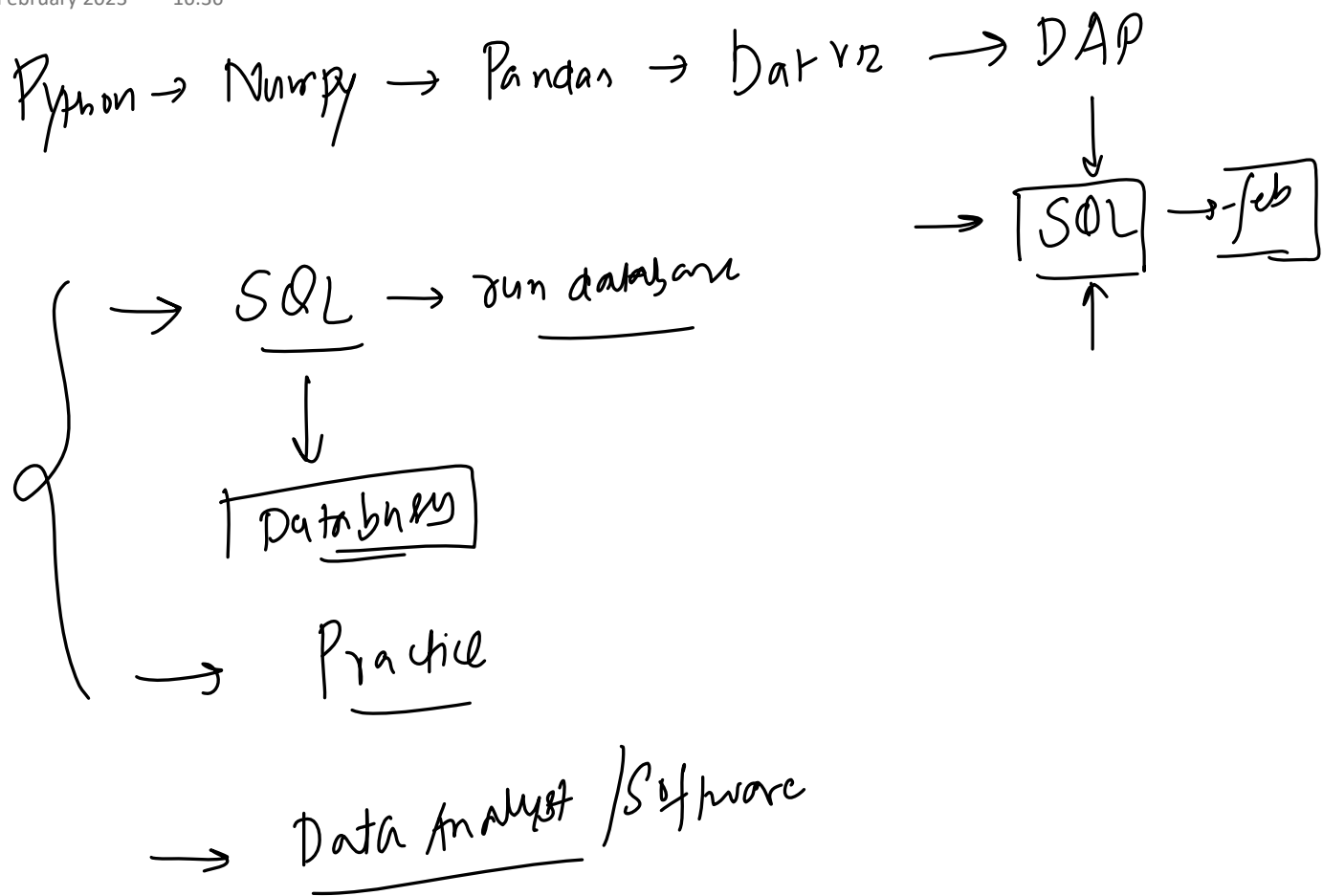


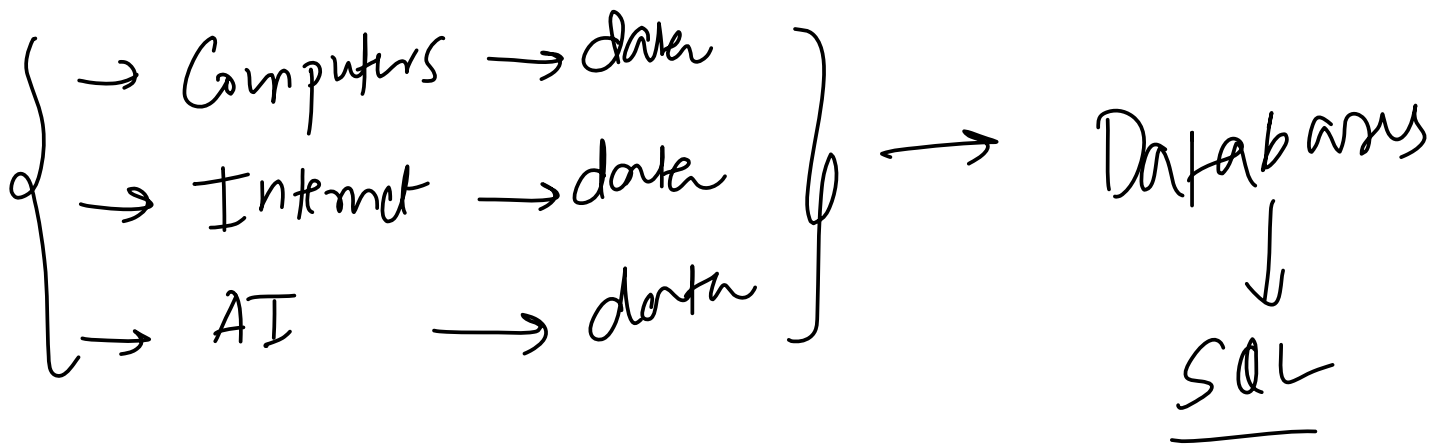
1. Before starting

06 February 2023 16:36



2. Importance of Data

06 February 2023 16:36



3. What are Databases?

06 February 2023 16:37

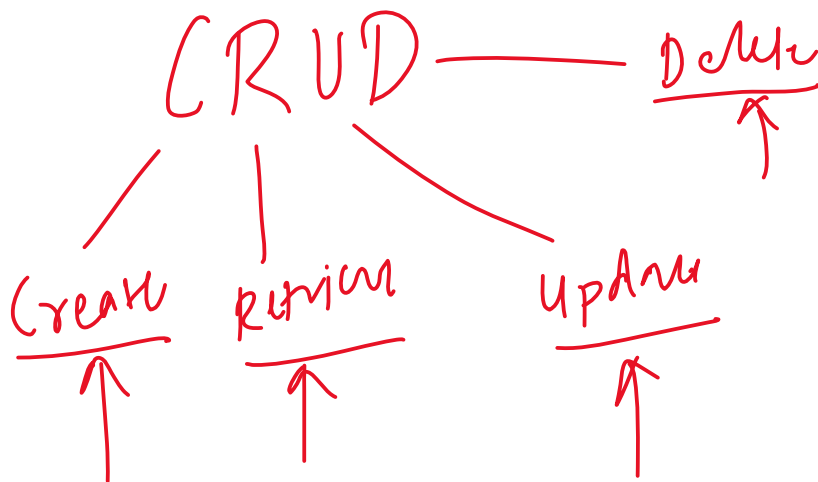
A Database is a shared collection of **logically related data** and **description** of these data, designed to meet the information needs of an organization

Data Storage: A database is used to **store** large amounts of **structured** data, making it easily accessible, searchable, and retrievable.

Data Analysis: A database can be used to perform complex data analysis, generate **reports**, and provide **insights** into the data.

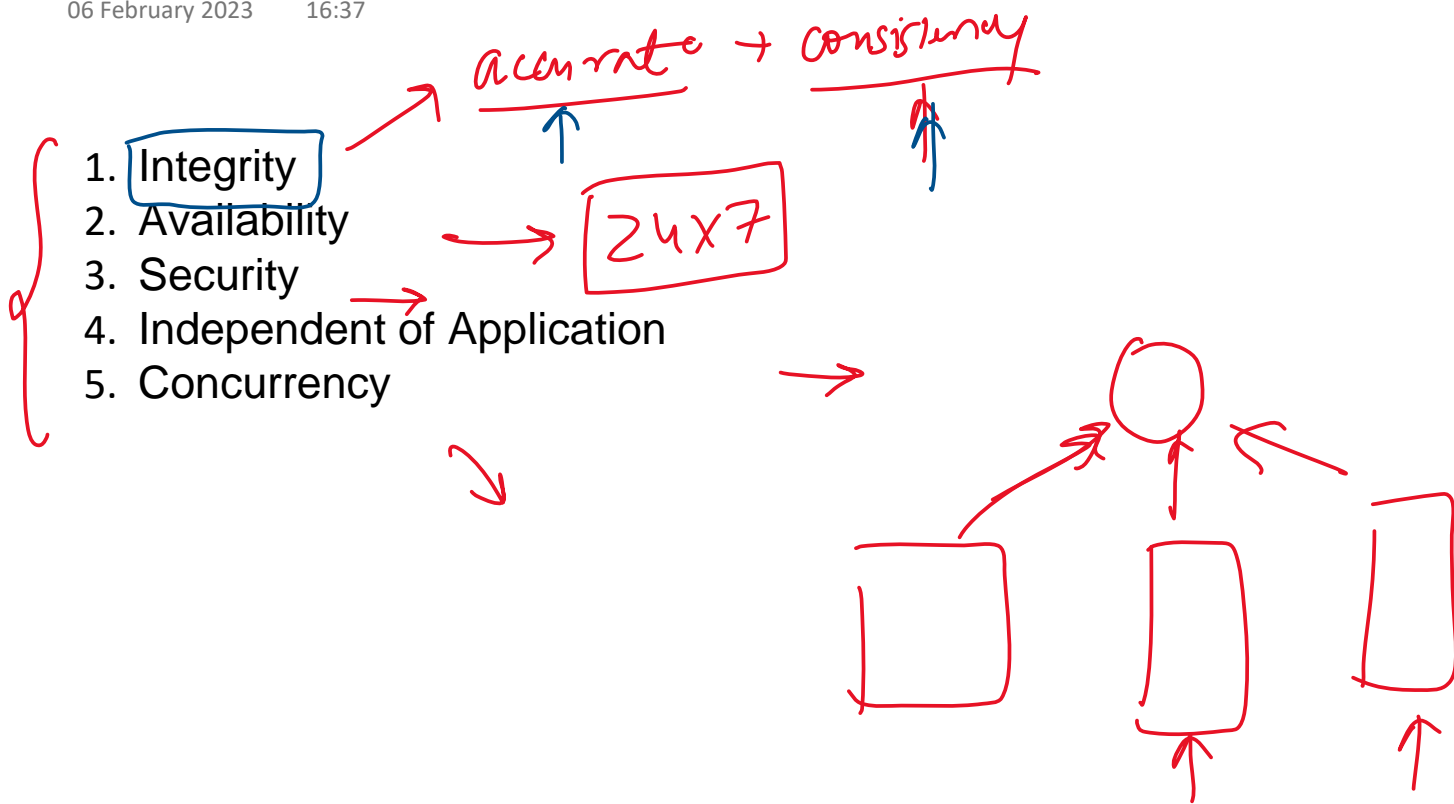
Record Keeping: A database is often used to keep track of important **records**, such as **financial transactions**, **customer information**, and **inventory** levels.

Web Applications: Databases are an essential component of many web applications, providing dynamic content and user management.



4. Properties of an Ideal Database

06 February 2023 16:37



5. Types of Databases

06 February 2023 16:42

1. Relational Databases - (row)

Also known as SQL databases, these databases use a relational model to organize data into tables with rows and columns.

2. NoSQL Databases -

These databases are designed to handle large amounts of unstructured or semi-structured data, such as documents, images, or videos. (MongoDB)

3. Column Databases -

These databases store data in columns rather than rows, making them well-suited for data warehousing and analytical applications. (Amazon Redshift, Google BigQuery)

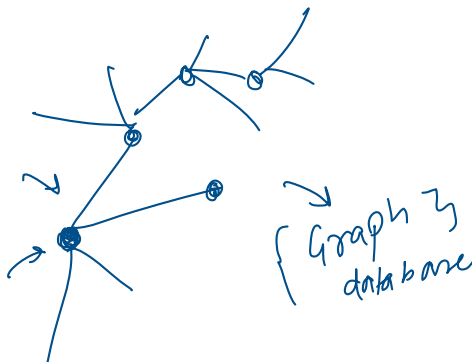
4. Graph Databases -

These databases are used to store and query graph-structured data, such as social network connections or recommendation systems. (Neo4j, Amazon Neptune)

5. Key-value databases -

These databases store data as a collection of keys and values, making them well-suited for caching and simple data storage needs (Redis and Amazon DynamoDB)

Which one should you use?



1000 students

→	nishu	EE	6.6
→			
→			

cgpa → mean

row → relation

→	nishu	EE	6.6	Ankit	CE	9.2
---	-------	----	-----	-------	----	-----

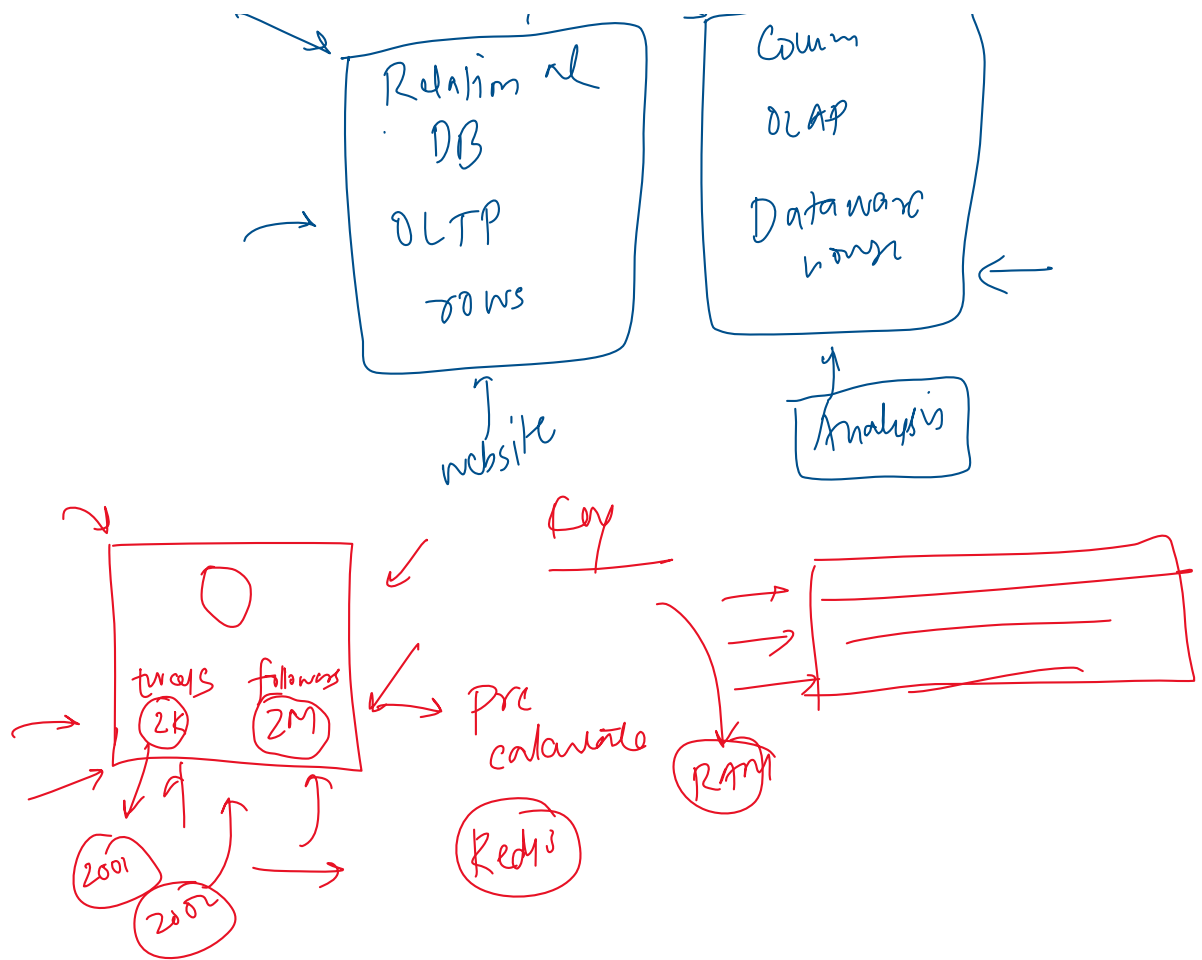
Sid name
 nishu
 Ankit
 ...
 :

Sid branch
 EE
 CE
 ...
 :

Sid cgpa
 6.6
 9.2
 ...
 :

nishu ankit ... EE CE ... 6.6 9.2 ...

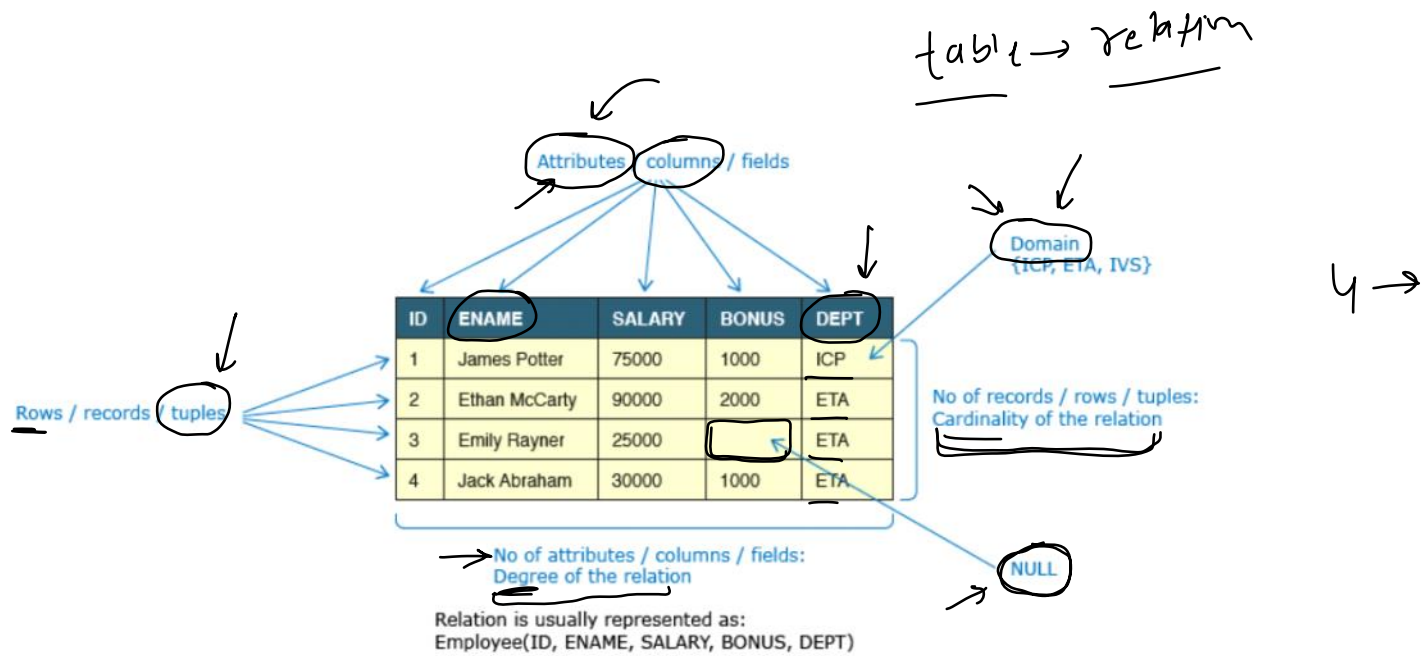




6. Relational Databases

06 February 2023 16:42

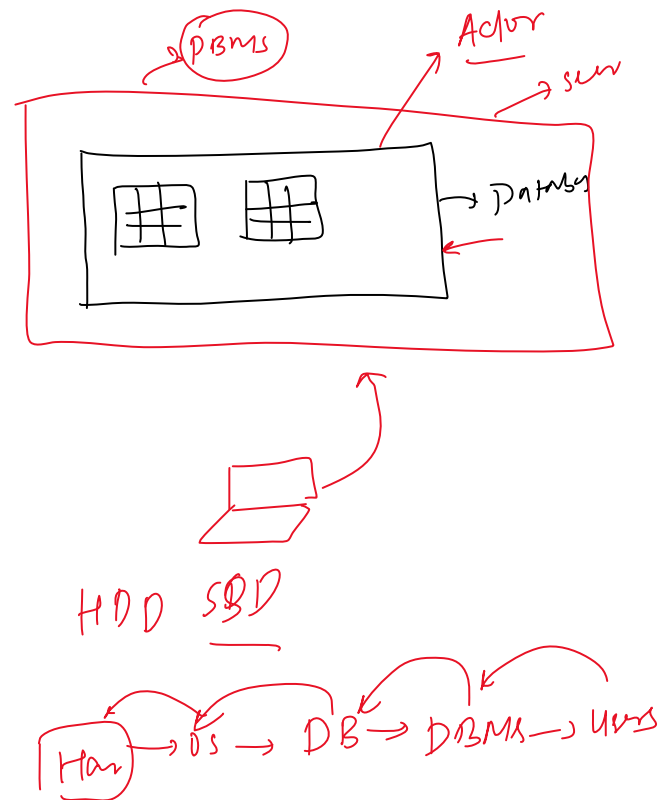
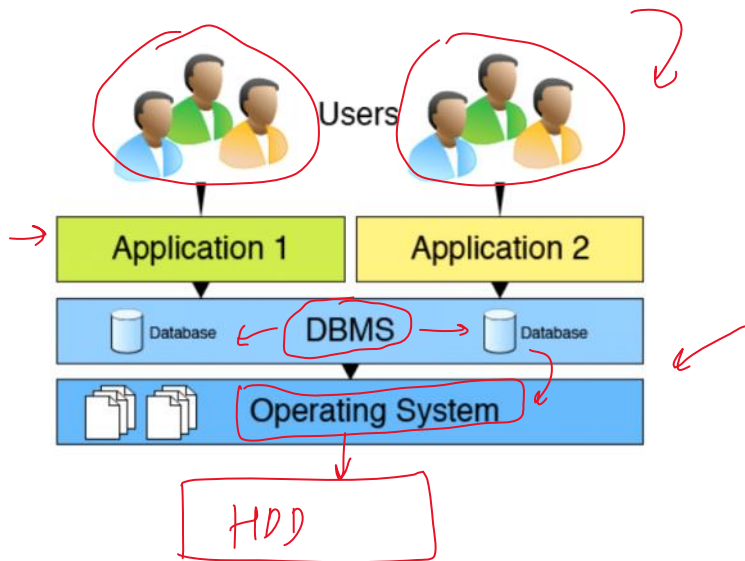
Also known as SQL databases, these databases use a relational model to organize data into tables with rows and columns.



7. What is a DBMS

06 February 2023 16:41

A database management system (DBMS) is a software system that provides the interfaces and tools needed to store, organize, and manage data in a database. A DBMS acts as an intermediary between the database and the applications or users that access the data stored in the database.



Functions of DBMS

Data Management - Store, retrieve and modify data

Integrity - Maintain accuracy of data

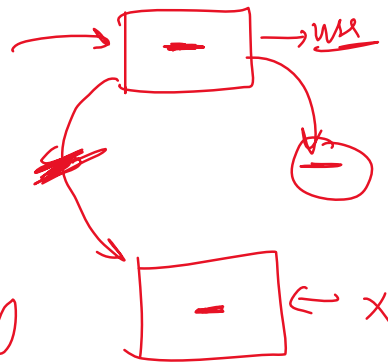
Concurrency - Simultaneous data access for multiple users

Transaction - Modification to database must either be successful or must not happen at all

Security - Access to authorized users only

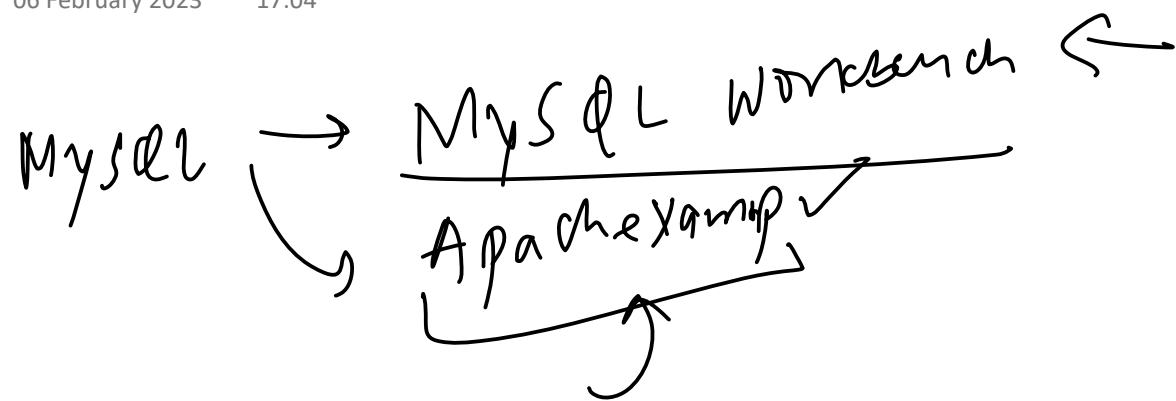
Utilities - Data import/export, user management, backup, logging

→ CRUD



9. Practical

06 February 2023 17:04



10. Database Keys

06 February 2023 17:07

A key in a database is an attribute or a set of attributes that uniquely identifies a tuple (row) in a table. Keys play a crucial role in ensuring the integrity and reliability of a database by enforcing unique constraints on the data and establishing relationships between tables.

1. Super Key

A Super key is a combination of columns that uniquely identifies any row within a relational database management system (RDBMS) table

2. Candidate key

A candidate key is a minimal Super key, meaning it has no redundant attributes. In other words, it's the smallest set of attributes that can be used to uniquely identify a tuple (row) in the table

3. Primary Key

A primary key is a unique identifier for each tuple in a table. There can only be one primary key in a table, and it cannot contain null values.

4. Alternate Key

An alternate key is a candidate key that is not used as the primary key.

5. Composite Key

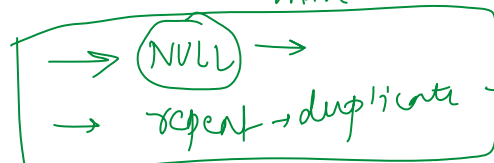
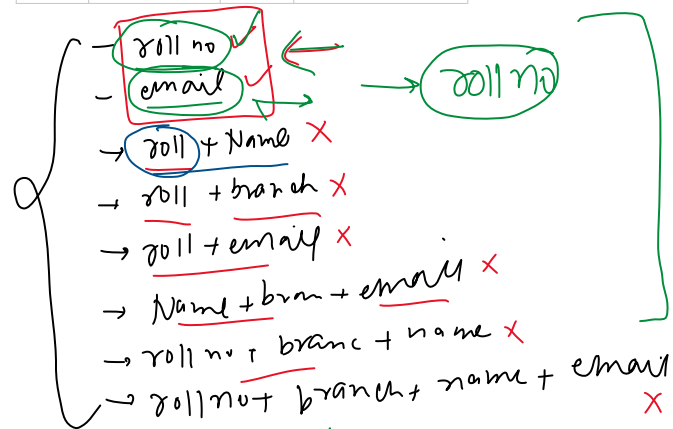
A composite key is a primary key that is made up of two or more attributes. Composite keys are used when a single attribute is not sufficient to uniquely identify a tuple in a table.

6. Surrogate Key

7. Foreign Key

A foreign key is a primary key from one table that is used to establish a relationship with another table.

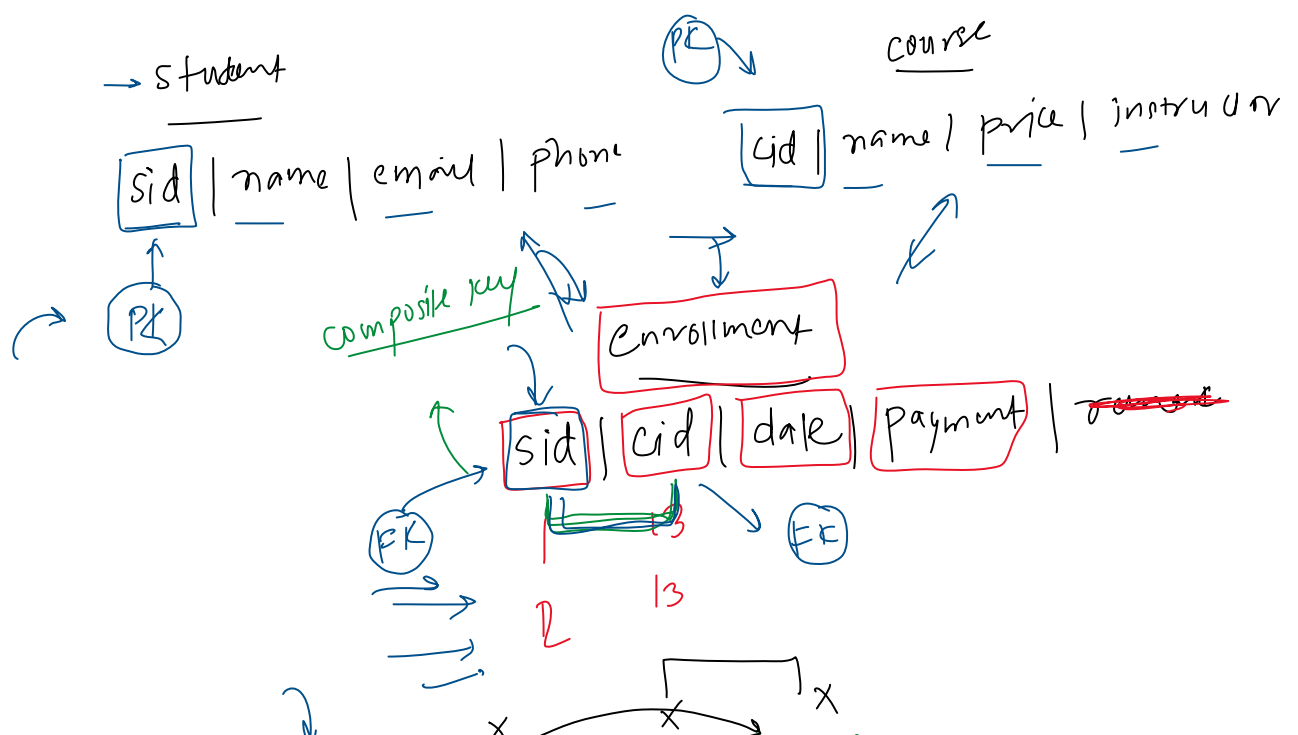
Roll no	Name	Branch	Email
1	Nitish Singh	CSE	nitish@gmail.com
2	Ankit Sharma	EEE	ankit@gmail.com
3	Neha Verma	ME	neha@gmail.com

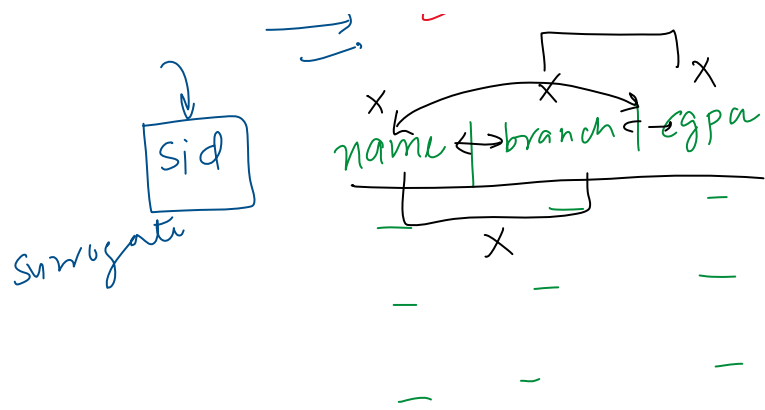


good to have

- numerical
- small
- constant

$$C K - P K = A K$$



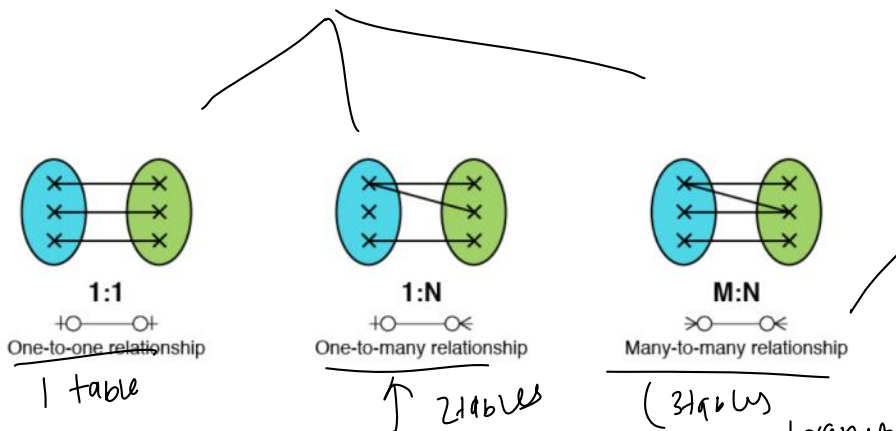


11. Cardinality of Relationships

06 February 2023 16:43

Cardinality in database relationships refers to the number of occurrences of an entity in a relationship with another entity. Cardinality defines the number of instances of one entity that can be associated with a single instance of the related entity.

Entity
↓
table



Examples

1. Person → Driving License Number
2. Student → college branch
3. Restaurants → orders
4. Restaurants → menu
5. Students → courses

name	DL no

(3 tables)

branch	name	hud
1	csu	—
2	ee	—

Student

sid	name	(bid) ^{FK}
1	xib	1
2	mtit	2

sid | name

cid | course | pna

sid | cid | date

12. Drawbacks of Databases

06 February 2023 16:39

Complexity: Setting up and maintaining a database can be **complex** and **time-consuming**, especially for large and complex systems.

Cost: The cost of setting up and **maintaining** a database, including hardware, software, and personnel, can be high.

Scalability: As the amount of data stored in a database grows, it can become more **difficult** to **manage**, leading to performance and scalability issues.

Data Integrity: Ensuring the **accuracy** and **consistency** of data stored in a database can be a challenge, especially when multiple users are updating the data **simultaneously**.

Security: Securing a database from **unauthorized access** and protecting sensitive information can be difficult, especially with the increasing threat of cyber attacks.

Data Migration: **Moving data** from one database to another or upgrading to a new database can be a complex and time-consuming process.

Flexibility: The structure of a database is often **rigid** and **inflexible**, making it difficult to adapt to changing requirements or to accommodate new types of data.