A database is an organised collection of data.

It is a collection of, Schemas, Tables, Queries, Reports, Views, and other objects. The data are typically organized to model aspects of reality, in a way that supports processes requiring information.

A white paper with black text

Description automatically generatedA **Database Management System (DBMS)** is an application that handles the database and interfaces; users and applications. Protects data integrity, adds new data, runs queries, user authorisation, …  
- Examples of DBMSs: Oracle, PostgreSQL, MS SQL server

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Description automatically generated

The database itself can be abstracted into parts:

* Structure descriptions (schema)
* The data it contains (instance)
* Some implementation for choices and rules



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# A text on a white background Description automatically generatedA white background with black text Description automatically generatedER Modelling

A diagram of a bank account

Description automatically generated

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Description automatically generatedA diagram of a relationship

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A close-up of a sign

Description automatically generated

A diagram of a relationship

Description automatically generated

Disjoint: Every entity must be specialized but cannot be both



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Binary, Ternary, etc.

d

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Mapping Cardinality Constraints: Express the number of entities

to which another entity can be associated via a relationship set

A close up of black text

Description automatically generatedA diagram of a loan

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A close up of text

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A close up of words

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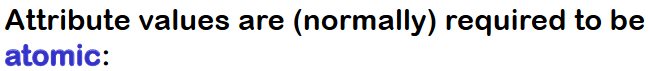
Eliminate redundancy →

A diagram of a work flow

Description automatically generatedA diagram of a company

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# A close up of text Description automatically generatedA close up of words Description automatically generatedThe Relational Model



A close up of words

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A close up of red text

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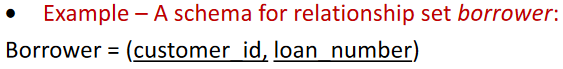


A diagram of a bank account

Description automatically generated





A diagram of a payment method

Description automatically generated

payment(loan\_number, payment\_number, payment\_date, payment\_amount)

A close up of black text

Description automatically generatedA close-up of black text

Description automatically generatedForeign Key loan\_number referencing loan\_number in loan table

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A close up of a sign

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A diagram of a person

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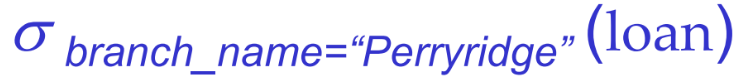
A close up of black text

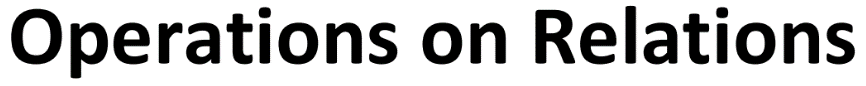
Description automatically generated

A close-up of a name tag

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# A close-up of a white background Description automatically generatedRelational Algebra

A black letter on a white background

Description automatically generated

A close-up of a number

Description automatically generated

A screenshot of a computer program

Description automatically generated



Blue text on a white background

Description automatically generated

A close-up of a text

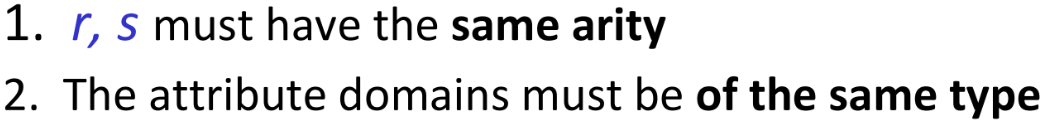
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A close-up of red text

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A black text on a white background

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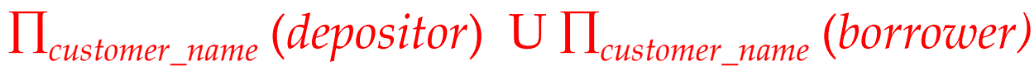
(Number of attributes)

A close-up of a table

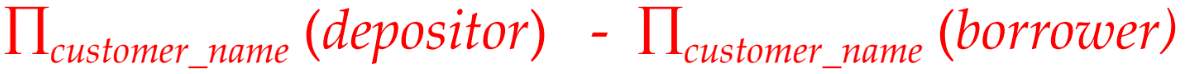
Description automatically generatedA white sign with black text

Description automatically generatedA couple of numbers and a deposit table

Description automatically generated with medium confidence



A table with numbers and letters

Description automatically generatedA name tag with black text

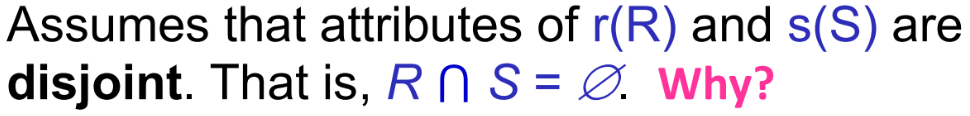
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A close-up of a number

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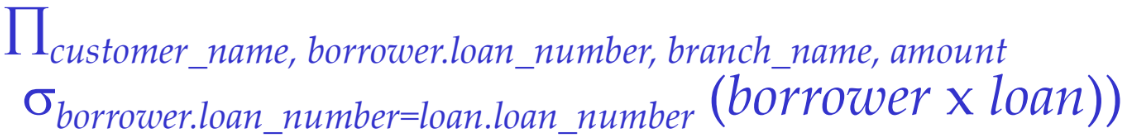
A close-up of a white background

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A screenshot of a computer

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A red text on a white background

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A screenshot of a math game

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A close-up of a white box with black letters

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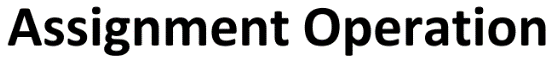
A screenshot of a computer

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# A white background with black text Description automatically generatedA close-up of words Description automatically generatedSQL

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Allows the specification of not only a set of relations but also information about each relation

* The schema for each relation
* The domain of values associated with each attribute
* Integrity constraints
* Security and authorization information for each relation
* The physical storage structure of each relation on disk

A close-up of a text

Description automatically generated

**create table** branch (branch\_name varchar(15)**,** branch\_city varchar(30), assets int, **primary key**(branch\_name) )

**DROP TABLE branch**

**DROP TABLE branch CASCADE**

**alter table** r **add** A D

where *A* is the name of the attribute to be added to relation *r*  and *D* is the domain (type) of *A.*

**alter table** r **drop** A

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Description automatically generated

**and, or, not union, intersect, except**

**where** amount **between** 90000 **and** 100000

between is inclusive

order by attribute = (asc) ascending order

order by attribute desc = descending order

**select distinct** branch\_name **from** loan

**select all** branch\_name **from** loan

all is the default behavior

**select** loan\_number, branch\_name, amount \*100 **from** loan

**This does not change what is stored in the DB!**

Select \* from loan = get all attributes from loan

**select \*** **from** borrower, loan = cartesian product

renaming using **as** clause

**AS** can appear *both* in the **select** and **from** clauses



**where***customer\_street* **like '**%Main%' ;

**like '**Main\%' uses **escape ‘**\' to match ‘Main%’

Concatenation (using “**||**”)





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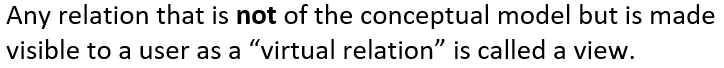




A close-up of a number

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A close-up of a logo

Description automatically generatedA black text on a white background

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A close-up of a sign

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Description automatically generated with medium confidence

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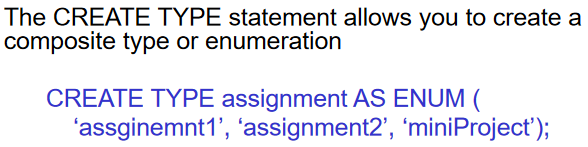
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A screenshot of a computer code

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A close up of words

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A screenshot of a computer code

Description automatically generatedReferential integrity => foreign Keys

A screenshot of a computer code

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# Normalization theory

R could have been a single relation containing all attributes that are of interest (called universal relation)

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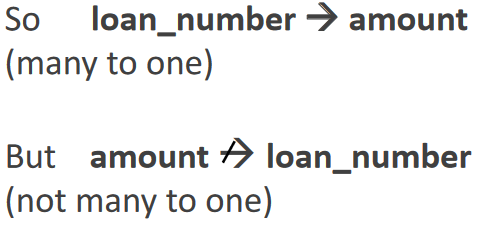
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A screenshot of a credit card

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Description automatically generated



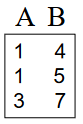
A close-up of a computer code

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α implies the values of β deterministically

A → B does NOT hold

B → A does hold

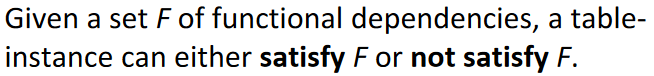


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A screenshot of a computer code

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A close up of a sign

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A screenshot of a computer

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Each iteration of the repeat loop of the procedure, except the last iteration, adds at least one functional dependency to F+. Thus, the procedure is guaranteed to terminate.

(Note: the amount of FDs on a finite set of attributes is finite. )

To compute the closure of a set of FDs, F:

Let F+ := F;

repeat

for each functional dependency f in F+

- apply augmentation and reflexivity rules on f

for each pair of functional dependencies f1 and f2 in F+

- combine f1 and f2 using transitivity

until F+ does not change any further

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A screenshot of a computer

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A close up of black text

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A screenshot of a whiteboard

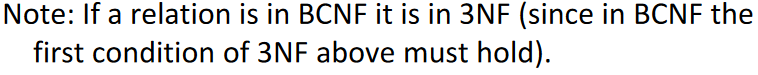
Description automatically generatedA black and white text

Description automatically generated

A white background with pink text

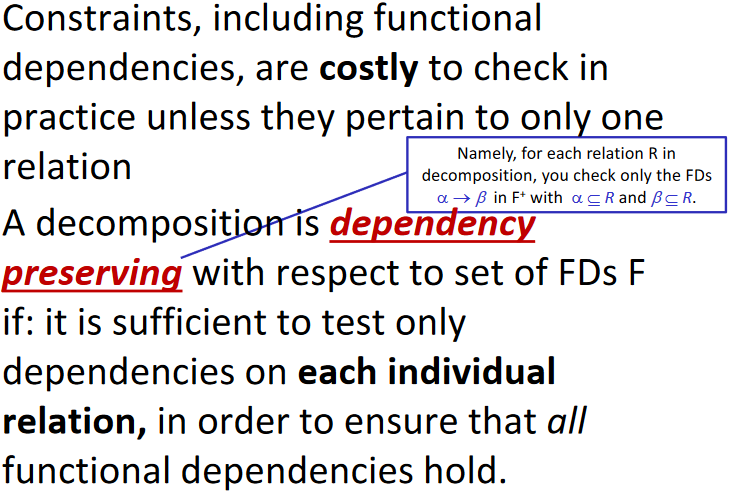
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Description automatically generatedA yellow sign with black text

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Description automatically generatedA close-up of a math problem

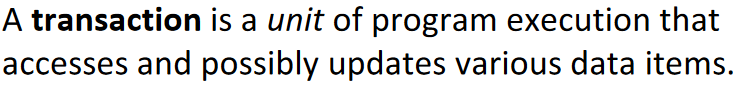
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# A white background with black text Description automatically generatedTransactions



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A close up of black text

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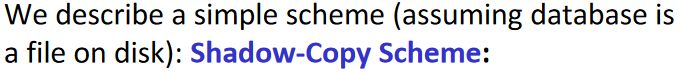
A screenshot of a document

Description automatically generated

A diagram of a diagram

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A diagram of a computer network

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A screenshot of a computer

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A screenshot of a computer error

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A white paper with black text

Description automatically generated



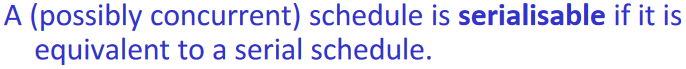
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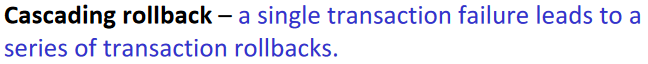
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A white rectangular sign with blue text

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A white text with blue and purple text

Description automatically generated

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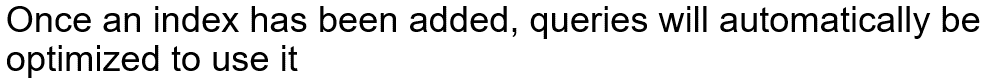
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# Indexing

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A screenshot of a computer

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A table with numbers and text

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A screenshot of a computer

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A table with numbers and arrows

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A screenshot of a computer

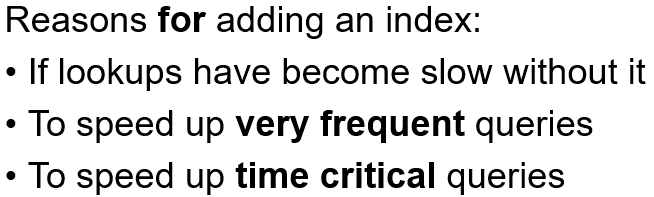
Description automatically generatedA screenshot of a computer code

Description automatically generated

A close up of black text

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Description automatically generatedA diagram of a tree

Description automatically generatedA diagram of a graph

Description automatically generated with medium confidenceA close-up of a text

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