



Database

SQL

Creating and Populating Tables with Constraints

Case Study

» Game Store
Requirement
Design

Game Store Requirement



Game Store Requirement

Our company, **Apasaja Pte Ltd**, has been commissioned to develop an application to manage the data of an online app store. We want to store several items of information about our customers such as their **first name**, **last name**, **date of birth**, **e-mail**, **date** and **country of registration** to our online sales service and the **customer identifier** that they have chosen.

We also want to manage the list of our products, **games**, their **name**, their **version**, and their **price**. The price is fixed for each version of each game. Finally, our customers buy and **download** games. We record which version of which game each customer has downloaded. It is not essential to keep the download date for this application.

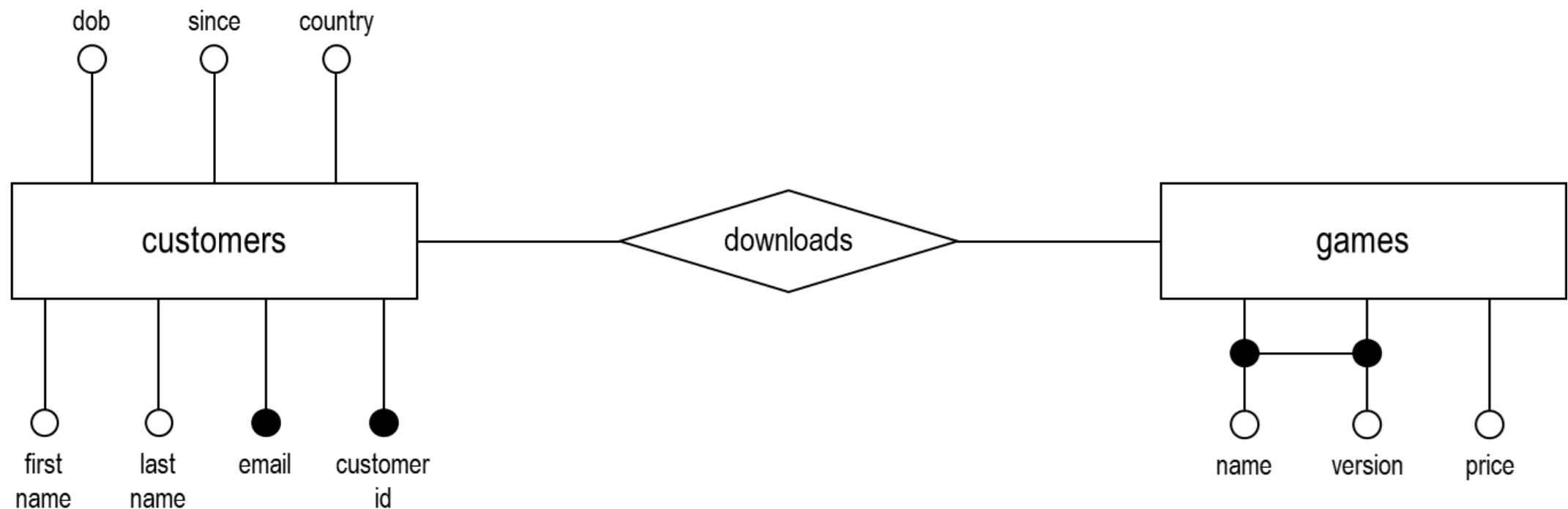
*Download from Canvas "[Files > Cases > AppStore](#)"

Case Study

Game Store
» Design

Design

Entity-Relationship Diagram



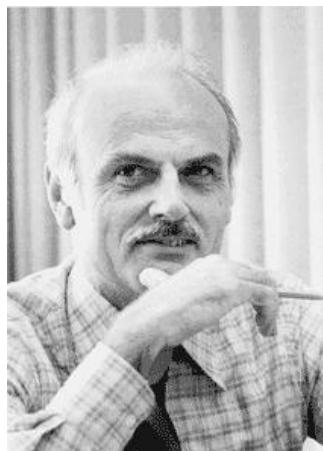
RDBMS

Database Management Systems

Definition

Most popular database management systems since the 1970's are relational. They implement the **relational model** of **Edgar F. Codd**, a simple and rigorous **data model** based on **relations** implemented as **tables**.

They support a language for the **definition**, **manipulation**, **query**, and **control**, which intersects the international standard for the **SQL** language.



"Future users of large data banks must be protected from having to know how the data is organized in the machine."

Edgar F. Codd

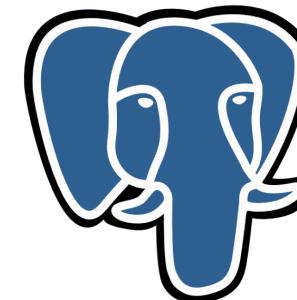
["A Relational Model for Large Shared Data Banks"](#)

DBMS

RDBMS
» Systems
Architecture

Systems

Popular Systems



PostgreSQL

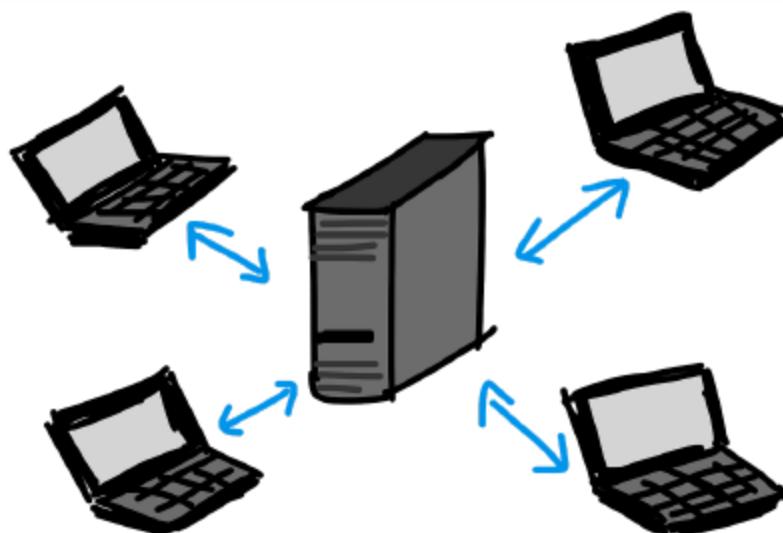


Architecture

Client-Server

Client-Server Architecture

Most popular relational database management systems since the 1970's have a **client-server** architecture and manage and control **distributed and concurrent** access to, usually **large amounts** of, **persistent data** on secondary storage, **persistent data**.

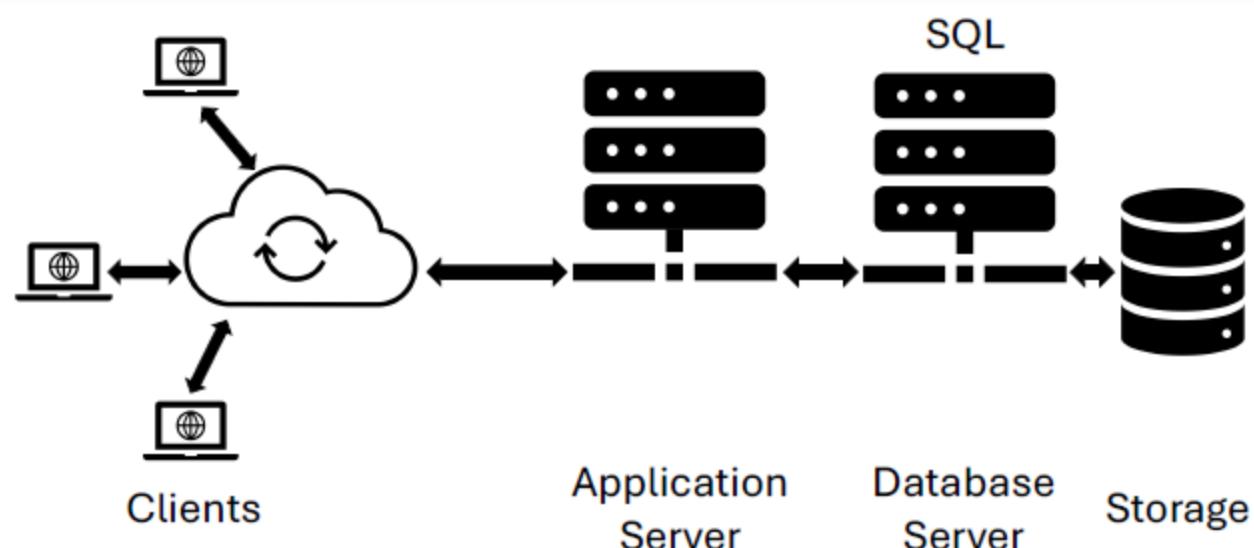


Architecture

Three-Tier

Three-Tier Architecture

Most modern database applications have a **three-tier** architecture. A three-tier architecture is a client-server software architecture that divides applications logically and physically into three distinct tiers: the **presentation tier** or clients, the **business logic tier** or application server, and the **data tier** or database server.





Logical Design

» Model
Relational
Design
Creation

Model

Relational

Relation in Theory

In theory, the **relational model** proposes to organise data in **relations**. Relations have a **name** and **attributes**. Attributes have a **name**.

Mathematically, relations are subsets of the Cartesian product of the **domains** of their attributes. Domains are **extensions of types**.

first_name	last_name	email	dob	since	customerid	country
Johnny	Gilbert	jgilberte8@nymag.com	1995-06-19	2023-07-15	JohnnyG89	Malaysia
Deborah	Ruiz	druiz0@drupal.org	1990-08-01	2024-04-17	Deborah84	Singapore
Tammy	Lee	tlee1@barnesandnoble.com	2004-09-14	2024-02-21	Tammy1998	Singapore
...						

Logical Design

» Model
Relational
Design
Creation

Model

Relational

Relation in Practice

In practice, the **relational database management systems** organise data in **tables**. Tables have a **name**. Tables are **multi-sets** (*not lists/sets*) of **rows** or **records**. Rows or records have **fields** corresponding to the **columns** of the table.

Columns or fields have a **name**. Columns or fields also have an **implicit position** indicated by the order in the corresponding creation statement. Columns or fields have a **domain** which is a type to the extension of which is added the possibility of a **NULL** value.

We shall discuss in a subsequent lecture the syntax, semantics, and behavior of **NULL** values and of the constructs that are used to manipulate them.

Logical Design

Model
» Design
Logical
Creation

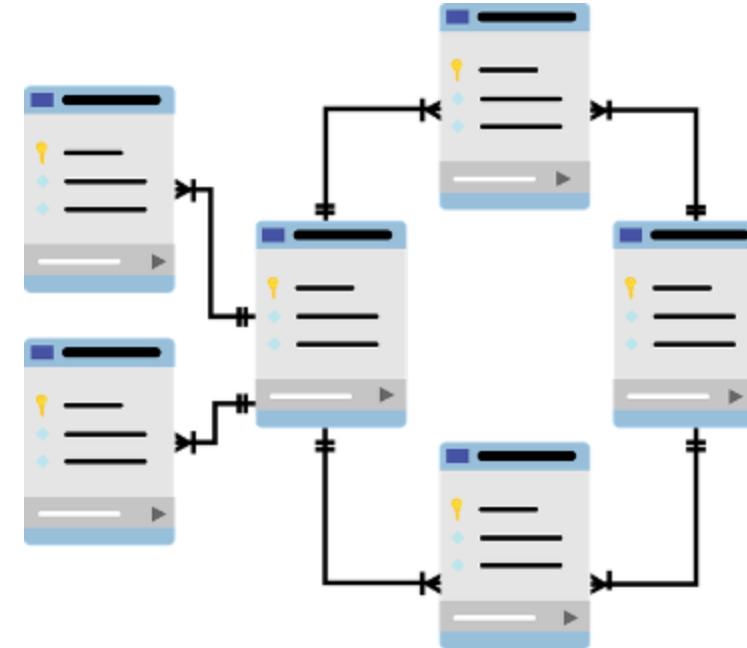
Design

Logical

Database Logical Design

Logical design is the activity consisting in choosing the **appropriate schema** for the database application.

It consists mainly the **number of tables**, the **names of the tables**, the **number of columns** each table should have and the **names and domains of the columns**.



Logical Design

Model
Design
» **Creation**
Basic
Decomposed

Creation

Basic

CREATE TABLE

```
CREATE TABLE downloads (
    first_name  VARCHAR(64),
    last_name   VARCHAR(64),
    email       VARCHAR(64),
    dob         DATE,
    since       DATE,
    customerid VARCHAR(16),
    country     VARCHAR(16),
    name        VARCHAR(32),
    version     CHAR(3),
    price       NUMERIC
);
```

Note

The choice of the number of columns and of their domains implicitly imposes **structural constraints**.

For instance, if we use only **one table**, there can be **no customer without a game** and **no game without a customer**, unless we use **NULL** values.

We can use the structural constraints as integrity constraints to control and maintain the **integrity of data** because data that does not fit in the table cannot be stored and only data that fit can be stored.

Logical Design

Model
Design
» Creation
Basic
Decomposed

Creation

Decomposed Table Creation

```
CREATE TABLE customers (
    first_name  VARCHAR(64),
    last_name   VARCHAR(64),
    email       VARCHAR(64),
    dob         DATE,
    since       DATE,
    customerid VARCHAR(16),
    country     VARCHAR(16)
);
```

```
CREATE TABLE games (
    name        VARCHAR(32),
    version     CHAR(3),
    price       NUMERIC
);
CREATE TABLE downloads (
    customerid VARCHAR(16),
    name        VARCHAR(32),
    version     CHAR(3)
);
```

We opt for a **schema** with three tables above with the indicated **columns** and their respective **domains** (e.g., *VARCHAR(64)*, *DATE*, *CHAR(3)*, *NUMERIC*, etc)*.

*See: <https://www.postgresql.org/docs/current/datatype.html>

Logical Design

Model
Design
» **Creation**
Basic
Decomposed

Creation

Decomposed Table Creation

```
CREATE TABLE customers (
    first_name  VARCHAR(64),
    last_name   VARCHAR(64),
    email       VARCHAR(64),
    dob         DATE,
    since       DATE,
    customerid VARCHAR(16),
    country     VARCHAR(16)
);
```

Note

Looking only at the `customers` table, we can add a new customer even if the customer has **not downloaded** any games.

We do not have to introduce `NULL` values.

Logical Design

Model
Design
» **Creation**
Basic
Decomposed

Creation

Decomposed Table Creation

Note

Similarly for the `games` table, we can add a new game even if there are **no customer** that has downloaded the game.

We do not have to introduce NULL values.

```
CREATE TABLE games (
    name      VARCHAR(32),
    version   CHAR(3),
    price     NUMERIC
);

CREATE TABLE downloads (
    customerid VARCHAR(16),
    name        VARCHAR(32),
    version    CHAR(3)
);
```

Logical Design

Model
Design
» Creation
Basic
Decomposed

Creation

Decomposed Table Creation

Note

Unlike using a single table, by splitting the table, we only need to remember the **identifier** of **customers** (i.e., *customerid*) and **games** (i.e., *(name, version)*).

As **customers** (*resp. games*) can be identified by **customerid** (*resp. (name, version)*), we can obtain the rest of the information if we want.

This uses **query** which is the topic for next week.

```
CREATE TABLE games (
    name      VARCHAR(32),
    version   CHAR(3),
    price     NUMERIC
);

CREATE TABLE downloads (
    customerid  VARCHAR(16),
    name        VARCHAR(32),
    version     CHAR(3)
);
```

Break



Constraints Check

» Constraints
Integrity
in Practice
Support

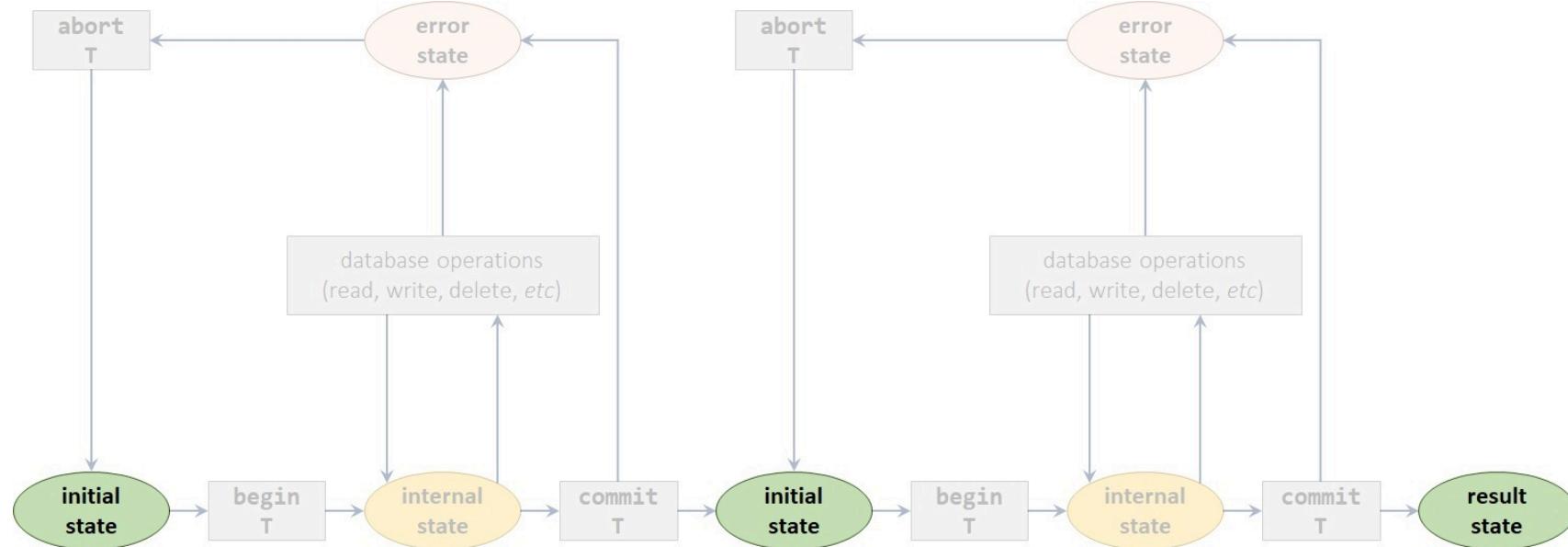
Recreation
Updates
Advice

Constraints

Integrity

Integrity Constraints

A **consistent state** of the database is a state which complies with the business rules as defined by the **structural constraints** and the **integrity constraints** in the schema.



Properties

Atomicity
Consistency
Isolation
Durability

Constraints Check

» Constraints

*Integrity
in Practice
Support*

Recreation
Updates

Advice

Constraints

Integrity

Integrity Constraints

A **consistent state** of the database is a state which complies with the business rules as defined by the **structural constraints** and the **integrity constraints** in the schema.

SQL allows to express business rules, such as "students who have not passed cs1010 cannot take cs2020" as integrity constraints.

If an integrity constraint is **violated** by an **operation** (*i.e., an insertion, update or deletion*), or a **transaction** (*i.e., a sequence of operations*), the **operation** or the **transaction** is **aborted** and **rolled back** and its changes are undone, otherwise, it is **committed** and its changes are effective for all users.

The database management system concurrency control and recovery mechanisms should ensure **atomicity, consistency, isolation**, and **durability** of transactions (*i.e., ACID properties*).

Constraints Check

» Constraints

Integrity

in Practice

Support

Recreation

Updates

Advice

Constraints

in Practice

Transaction

In practice, there are different ways to specify the scope of transactions in SQL or application code. One of them is to use blocks with keywords such as **BEGIN**, **END** or **COMMIT**, **ABORT** and **ROLLBACK**.

Deferred

In most systems, unfortunately, integrity constraints are **immediate** (*i.e. they are checked after each operation*). It is preferable to set all integrity constraints to be **deferred** (*i.e. they are checked after the end of transactions*). Unfortunately again, most systems, like PostgreSQL, do only allow certain constraints to be deferred.

Constraints Check

» Constraints

Integrity

in Practice

Support

Recreation

Updates

Advice

Constraints

Support

Integrity Constraints

SQL Support five kinds of integrity constraints:

NOT NULL

PRIMARY KEY

UNIQUE

FOREIGN KEY

CHECK

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Delete

DELETE FROM

```
DELETE FROM customers;
```

DELETE deletes the **content** of the table but **NOT** its definition.

DROP TABLE

```
DROP TABLE customers;
```

DROP deletes the **content** and the **definition** of the table.

*We recommend [W3Schools](#) for details of syntax and behavior of standard SQL construct.
For PostgreSQL specific behavior, see [PostgreSQL Documentation](#) instead.

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Primary Key

Definition

A **primary key** is a set of columns that **uniquely identifies** a record in the table. Each table has **at most one** primary key.

Note

The primary key can be **one column** or a **combination of columns**. An instance of the table cannot have two records with the same value or combination of values in the primary key columns and no primary key column cannot contain a **NULL** value*.

*This is not implemented in all database management systems.

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Primary Key

Column Constraint

```
CREATE TABLE customers (
    first_name  VARCHAR(64),
    last_name   VARCHAR(64),
    email       VARCHAR(64),
    dob         DATE,
    since       DATE,
    customerid  VARCHAR(16)
        PRIMARY KEY, -- applies to the row
    country     VARCHAR(16)
);
```

Table Constraint

```
CREATE TABLE customers (
    first_name  VARCHAR(64),
    last_name   VARCHAR(64),
    email       VARCHAR(64),
    dob         DATE,
    since       DATE,
    customerid  VARCHAR(16),
    country     VARCHAR(16),
        PRIMARY KEY (customerid) -- after row
);
```

customers(first_name, last_name, email, dob, since, customerid, country)

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Primary Key

Definition

```
CREATE TABLE customers (
    first_name  VARCHAR(64),
    last_name   VARCHAR(64),
    email       VARCHAR(64),
    dob         DATE,
    since       DATE,
    customerid  VARCHAR(16),
    country     VARCHAR(16),
    PRIMARY KEY customerid -- after row
);
```

Error

Try inserting another one with the same `customerid`, we will get an error.

INSERT INTO

```
INSERT INTO customers VALUES (
    'Carole',
    'Yoga',
    'cyoga@glarge.org',
    '2002-08-01',
    '2024-08-09',
    'Carole89',
    'France'
);
-- INSERT INTO tries to insert a row
```

Constraints Check

Constraints
» Recreation

Delete

Primary Key

Not NULL

Unique

Foreign Key

Check

Updates

Advice

Recreation

Primary Key

Composite

```
CREATE TABLE games (
    name      VARCHAR(32),
    version   CHAR(3),
    price     NUMERIC,
    PRIMARY KEY (name, version)
);
```

Note

Composite primary key is declared as **table constraint**. Each column composing the primary key is said to be a **prime attribute**.

games(name, version, price)

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Primary Key

Definition

```
CREATE TABLE games (
    name      VARCHAR(32),
    version   CHAR(3),
    price     NUMERIC,
    PRIMARY KEY (name, version)
);
```

Failure

```
INSERT INTO games VALUES
('Aerified', '1.0', 5),
('Aerified', '1.0', 6);
```

Success

```
INSERT INTO games VALUES
('Aerified', '1.0', 5),
('Aerified', '2.0', 6),
('Verified', '1.0', 7);
```

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Not NULL

Code

```
CREATE TABLE games (
    name      VARCHAR(32),
    version   CHAR(3),
    price     NUMERIC NOT NULL,
    PRIMARY KEY (name, version)
);
```

Note

A **NOT NULL** constraint guarantees that no value of the corresponding field in any record of the table can be set to **NULL**. A **NOT NULL** constraint is always declared as a **column constraint**.

When it is explicit, it is declared with the keyword **NOT NULL**. In the example on the right, the price of a game can never be **NULL**.

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Not NULL

Definition

```
CREATE TABLE games (
    name      VARCHAR(32),
    version   CHAR(3),
    price     NUMERIC NOT NULL,
    PRIMARY KEY (name, version)
);
```

Implicit NULL

```
INSERT INTO games (name, version)
VALUES ('Aerified2', '1.0');
```

Explicit NULL

```
INSERT INTO games VALUES
('Aerified2', '1.0', NULL);
```

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Not NULL

Default Value

```
CREATE TABLE games (
    name      VARCHAR(32),
    version   CHAR(3),
    price     NUMERIC NOT NULL
        DEFAULT 1.00,
    PRIMARY KEY (name, version)
);
```

Success

```
INSERT INTO games (name, version)
VALUES ('Aerified2', '1.0');
```

Failure

```
INSERT INTO games VALUES
('Aerified2', '1.0', NULL);
```

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Unique

Code

```
CREATE TABLE customers (
    first_name  VARCHAR(64),
    last_name   VARCHAR(64),
    email       VARCHAR(64) UNIQUE,
    dob         DATE,
    since       DATE,
    customerid VARCHAR(16),
    country     VARCHAR(16),
    UNIQUE (first_name, last_name)
);
```

Note

A UNIQUE constraint on a column or a combination of columns guarantees the table cannot contain two records with the **same value** in the corresponding column or combination of columns.

SQL Standard

According to SQL standard (*and in most system*), PRIMARY KEY is equivalent to UNIQUE and NOT NULL*.

*There are differences in **side-effect**: foreign-key, index, deferrability, etc.

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Foreign Key

Codes

```
CREATE TABLE downloads (
    customerid VARCHAR(16)
        REFERENCES customers (customerid),
    name        VARCHAR(32),
    version     CHAR(3),
    FOREIGN KEY (name, version)
        REFERENCES games (name, version)
);
```

Note

Referenced column required to be **primary key** for portability.

```
CREATE TABLE customers (
    first_name  VARCHAR(64),
    last_name   VARCHAR(64),
    email       VARCHAR(64),
    dob         DATE,
    since       DATE,
    customerid VARCHAR(16) PRIMARY KEY,
    country     VARCHAR(16)
);

CREATE TABLE games (
    name        VARCHAR(32),
    version     CHAR(3),
    price       NUMERIC,
    PRIMARY KEY (name, version)
);
```

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Foreign Key

Definition

```
CREATE TABLE downloads (
    customerid  VARCHAR(16)
        REFERENCES customers (customerid),
    name        VARCHAR(32),
    version     CHAR(3),
    FOREIGN KEY (name, version)
        REFERENCES games (name, version)
);
```

Not in Customers

```
INSERT INTO downloads VALUES
    ('Adam1983', 'Aerified', '1.0');
-- ('Adam1983') is not in customers
```

Not in Games

```
INSERT INTO downloads VALUES
    ('Carole89', 'Aerified', '1.1');
-- ('Aerified', '1.1') is not in games
```

Note

We check for the **existence** of the **set of values** in the referenced table.

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Foreign Key

Definition

```
CREATE TABLE downloads (
    customerid  VARCHAR(16)
        REFERENCES customers (customerid),
    name        VARCHAR(32),
    version     CHAR(3),
    FOREIGN KEY (name, version)
        REFERENCES games (name, version)
);
```

NULL Customers

```
INSERT INTO downloads VALUES
    (NULL, 'Aerified', '1.0');
-- Allow (NULL) for (customerid)
```

NULL Games

```
INSERT INTO downloads VALUES
    ('Carole89', NULL, '1.1');
-- Allow (NULL, '1.1') for (name, version)
```

Note

We **omit** the check if any value in the set to be checked is **NULL**.

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Foreign Key

Definition

```
CREATE TABLE downloads (
    customerid  VARCHAR(16)
        REFERENCES customers (customerid),
    name        VARCHAR(32),
    version     CHAR(3),
    FOREIGN KEY (name, version)
        REFERENCES games (name, version)
);
```

NULL Customers but Not in Games

```
INSERT INTO downloads VALUES
    (NULL, 'Aerified', '1.1');
-- Check BOTH
```

NULL Games but Not in Customers

```
INSERT INTO downloads VALUES
    ('Adam1983', NULL, '1.1');
-- Check BOTH
```

Note

We check all constraints **independently** and must **satisfy all constraints**.

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Foreign Key

Definition

```
CREATE TABLE downloads (
    customerid  VARCHAR(16)
        REFERENCES customers (customerid),
    name        VARCHAR(32),
    version     CHAR(3),
    FOREIGN KEY (name, version)
        REFERENCES games (name, version)
);

```

Prevent Deletion

```
DELETE FROM customers
WHERE country = 'France';
```

Error

Cannot delete the French customers because some of them have downloaded some games.

Note

The `WHERE <cond>` clause specifies the **condition** for the deletion. In other words, we do not delete all rows, but only rows satisfying the condition `<cond>`.

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Check

Positive Price

```
CREATE TABLE games (
    name      VARCHAR(32),
    version   CHAR(3),
    price     NUMERIC NOT NULL
        CHECK (price > 0),
    PRIMARY KEY (name, version)
);
```

Note

A **check** constraint enforces any other condition that can be expressed in SQL.

A check constraint is declared as a **column** or a **table constraint** with the **CHECK** keyword followed by the **SQL condition** in parenthesis. If the condition involves more than one column, it should be a table constraint.

In the example on the right, the price of game can not be zero or negative.

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation

Check

Definition

```
CREATE TABLE games (
    name      VARCHAR(32),
    version   CHAR(3),
    price     NUMERIC NOT NULL
        CHECK (price > 0),
    PRIMARY KEY (name, version)
);
```

Prevent Update

```
UPDATE games
    SET price = price - 5.5;
```

Error

Discounting all the prices by \$5.5 creates negative prices. This operation will be **aborted** and **rolled back**.

Constraints Check

Constraints
» Recreation
Delete
Primary Key
Not NULL
Unique
Foreign Key
Check
Updates
Advice

Recreation Check

SQL Standard

The **SQL standard** caters for very expression CHECK constraints. It even allows that CHECK constraints can be implemented as assertions outside tables (*using the construct CREATE ASSERTION*) so that they can involve several tables and use aggregate functions, nested queries etc..

In practice, vendors only offer check constraints that are limited to very simple row and table checks. PostgreSQL CHECK is limited to boolean expression involving one row and one table.

Vendors usually advocate the use of triggers and stored procedures. But these are notoriously difficult and error-prone. It largely defeats the objective of integrity management.

Constraints Check

Constraints
Recreation
» Updates
Motivation
Action
Advice

Updates

Motivation

Definition

```
CREATE TABLE downloads (
    customerid  VARCHAR(16)
        REFERENCES customers (customerid),
    name        VARCHAR(32),
    version     CHAR(3),
    FOREIGN KEY (name, version)
        REFERENCES games (name, version)
);
```

Question

What happened when things change?

Instances

downloads

name	version	customerid
Skype	1.0	tom1999
Comfort	1.1	john88
Skype	2.0	tom1999

customers

customerid	email	...
tom1999	tlee@gmail.com	...
john88	al@hotmail.com	...
walnuts	dcs@nus.edu.sg	...

Constraints Check

Constraints
Recreation
» **Updates**
Motivation
Action
Advice

Updates

Action

Cascade

```
CREATE TABLE downloads (
    customerid  VARCHAR(16)
        REFERENCES customers (customerid)
        ON UPDATE CASCADE
        ON DELETE CASCADE,
    name        VARCHAR(32),
    version     CHAR(3),
    FOREIGN KEY (name, version)
        REFERENCES games (name, version)
        ON UPDATE CASCADE
        ON DELETE CASCADE
);
```

Note

ON UPDATE/DELETE with the option CASCADE propagate the update or deletion.

Other options include:

- NO ACTION
- SET DEFAULT
- SET NULL

May cause **chain reaction**.

*For more powerful generalization, we have **triggers**.

Constraints Check

Constraints
Recreation
Updates
» Advice
Good Practices

Advice

Good Practices

Avoid NULL

It is generally a good idea to constrain all attributes to be not **NULL** unless there is a good design or tuning reason for not doing so.

Generally Defer

It is generally a good idea to defer all the constraints that can be deferred. A deferred constraint is checked at the end of a transaction and not immediately after each operation.

Justify Cascade

Think carefully about which foreign keys should be subject to cascade.

Play the Devil's Advocate

Given the complete schema for the three tables, try and find out the scenario in which an operation (*insertion, deletion, update*) on a table or a transaction containing a set of operation on one or more tables violate which constraint on which table

Query



» Mock Data
Mockaroo
App Store

Mock Data

Mockaroo

The screenshot shows the Mockaroo web application interface. At the top, there's a header with a file icon, a home icon, a title bar 'Mockaroo - Random Data X', and a close button. Below the header is a browser-style toolbar with back, forward, refresh, and search buttons, and a URL 'https://www.mockaroo.com'. The main area has a dark background with white text. It displays three fields: 'name' (App Name, Type: App Name), 'version' (Digit Sequence, Type: Digit Sequence), and 'price' (Number, Type: Number). Below these are buttons for '+ ADD ANOTHER FIELD' and 'GENERATE FIELDS USING AI...'. Underneath the fields are controls for '# Rows:' (set to 10), 'Format:' (SQL dropdown), and 'Table Name:' (set to 'games'). A checked checkbox says 'include CREATE TABLE'. At the bottom are five buttons: 'GENERATE DATA' (green), 'PREVIEW', 'SAVE AS...', 'DERIVE FROM EXAMPLE...', and a blue circular button with a white icon.

```
create table games (
    name VARCHAR(50),
    version VARCHAR(50),
    price DECIMAL(3,2)
);
insert into games (name, version, price)
    values ('Sonair', '6.5', 3.68);
insert into games (name, version, price)
    values ('Greenlam', '5.4', 3.91);
insert into games (name, version, price)
    values ('Domainer', '2.9', 8.11);
insert into games (name, version, price)
    values ('Prodder', '6.3', 7.25);
```

Query

Mock Data
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App Store

Creating

Steps

1. Download the following files from Canvas "Files > Cases > AppStore":
 - [AppStoreSchema.sql](#)
 - [AppStoreCustomers.sql](#)
 - [AppStoreGames.sql](#)
 - [AppStoreDownloads.sql](#)
2. Open the file and copy the content to [DB Fiddle](#).
 - The file [AppStoreClean.sql](#) is useful to clean up if you run this locally.

Note

We use variants of the same data and that the results on your computer may differ slightly from the results given in the slides for illustration purposes.

Query

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Querying

Prints Customers Table

```
SELECT *
FROM customers;
```

first_name	last_name	email	dob	since	customerid	country
Johnny	Gilbert	jgilberte8@nymag.com	1995-06-19	2023-07-15	JohnnyG89	Malaysia
Deborah	Ruiz	druiz0@drupal.org	1990-08-01	2024-04-17	Deborah84	Singapore
Tammy	Lee	tlee1@barnesandnoble.com	2004-09-14	2024-02-21	Tammy1998	Singapore
...						

1000 rows

Query

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Querying

Prints Games Table

```
SELECT *  
FROM games;
```

name	version	price
Aerified	1.0	12
Aerified	1.1	3.99
Aerified	1.2	1.99
...		

430 rows

Query

Mock Data
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Querying

Prints Downloads Table

```
SELECT *
FROM downloads;
```

customerid	name	version
Adam1983	Biodex	1.0
Adam1983	Domainer	2.1
Adam1983	Subin	1.1
...		

4214 rows

```
postgres=# exit
```

```
Press any key to continue . . .
```

