A day without new knowledge is a lost day.

Database Technologies - MySQL

If A and a, B and b, C and c etc. are treated in the same way then it is case-insensitive. **MySQL is case-insensitive**

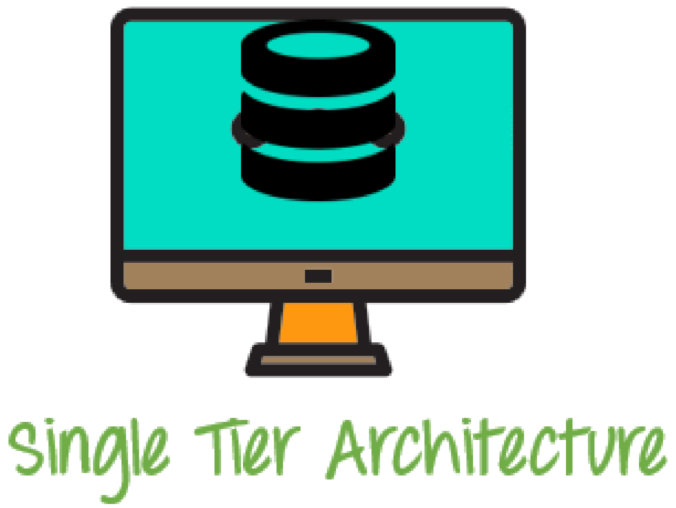
In this module we are going to learn SQL, PL/SQL and NoSQL(MongoDB)

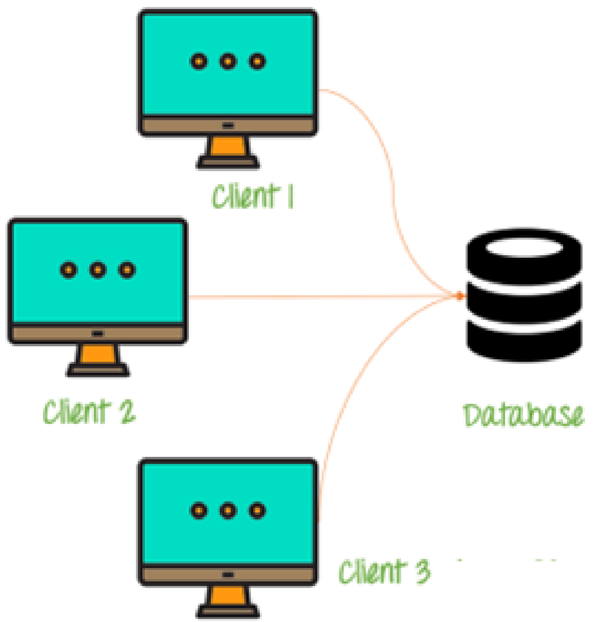
Introduction

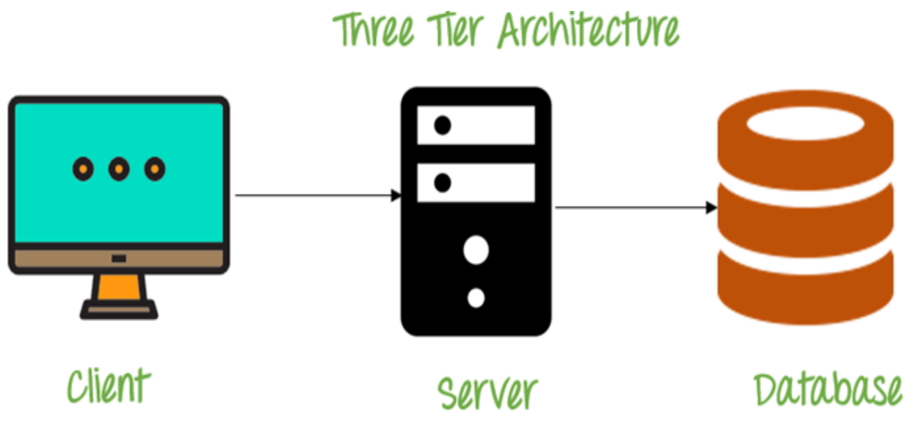
- If anyone who wants to develop a good application
  then he should have the knowledge three major components.

They are . . . . .

- Presentation Layer [UI]
- Application Layer [Server Application and Client Application]
- Data Layer [Data Access Object (DAO) / Data Access Layer (DAL)] { Flat Files | RDBMS | NoSQL }







Introduction

Why do we need databases (Use Case)?

We **need databases** because they organize data in a manner which allows us to store, query, sort, and manipulate data in various ways. Databases allow us to do all this things.

Many companies collects data from different resource (like Weather data, Geographical data, Finance data, Scientific data, Transport data, Cultural data, etc.)

What is Relation and Relationship?

Remember:

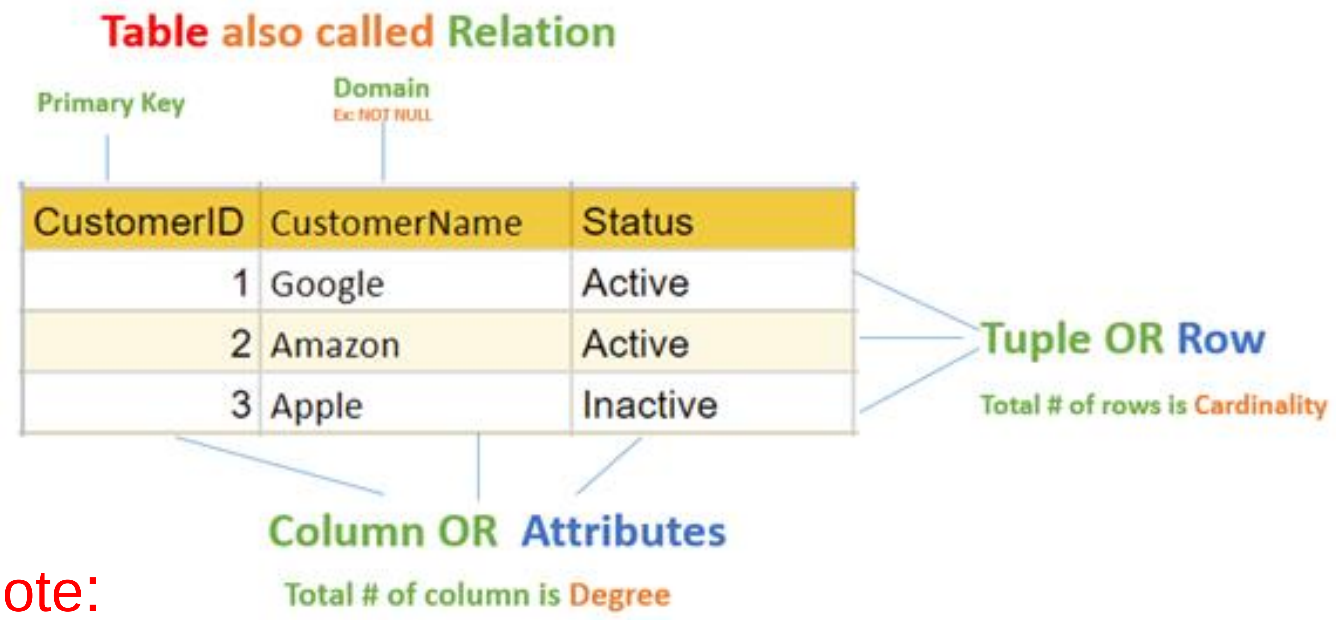
- A ***reference*** is a relationship between two tables where the values in one table refer to the values in another table.
- A ***referential key*** is a column or set of columns in a table that refers to the primary key of another table. It establishes a relationship between two tables, where one table is called the parent table, and the other is called the child table.

relation and relationship?

Relation ***(in Relational Algebra "R" stands for relation)*****:** In Database, a relation represents a **table** or an **entity** than contain attributes.

Relationship: In database, relationship is that how the two entities are **connected** to each other, i.e. what kind of relationship type they hold between them.

Primary/Foreign key is used to specify this relationship.



Remember:

Foreign Key is also know as
- referential constraint
- referential integrity constraint.

Note:

- **Table -** The physical instantiation of a relation in the database schema.
- **Relation -** A logical construct that organizes data into rows and columns.

File Systems is the traditional way to keep your data organized.

File System

vs

DBMS

file-oriented system

File Anomalies

```
struct Employee {
   int emp_no;
   char emp_name[50];
   int salary;
} emp[1000];
```

```
struct Employee {
   int emp_no;
   char emp_name[50];
   int salary;
};
struct Employee emp[1000];
```

c:\employee.txt

```
1   suraj 4000
2   ramesh 6000
3   rajan 4500
.
.
.
500 sam 3500
.
.
.
1000 amit 2300
```

c:\employee.txt

```
1   suraj 4000
2   ramesh 6000
3   rajan 4500
.
.
.
500 sam 3500
.
.
1000 amit 2300
.
.
.
2000 jerry 4500
.
.
```

c:\employee.txt

```
1   suraj 4000
2   ramesh 6000
3   rajan 4500
.
.
500  sam 3500
.
3   rajan 4500
.
500  sam 3500
.
.
1000 amit 2300
```

c:\employee.txt

```
1   suraj 4000
2   ramesh 6000
3   rajan 4500
.
.
sam 500 3500
.
ram  550 5000
.
1000 amit 2300
```

c:\employee.txt

```
1   suraj 4000
2   ramesh 6000
3   rajan 4500
.
500 sam 3500
.
600 neel 4500
```

file-oriented system

File Anomalies

- Create/Open an existing file
- Reading from file
- Writing to a file
- Closing a file

c:\employee.txt

1 suraj 4000
2 ramesh 6000
3 rajan 4500
.
.
.
500 sam 3500
.
.
.
1000 amit 2300

file attributes

- File Name
- Type
- Location

file permissions

- File permissions
- Share permissions

search empl ID=1

1 suraj 4000
2 ramesh 6000
3 rajan 4500
.
.
.
500 sam 3500
.
.
.
1000 amit 2300

search emp_name

1 suraj 4000
2 ramesh 6000
3 rajan 4500
.
.
.
500 sam 3500
.
.
.
1000 amit 2300

file-oriented system

A **flat file** database is a database that stores data in a plain text **file (**e.g. ***.txt, *.csv** format**)**. Each line of the text **file** holds one record, with fields separated by delimiters, such as **commas** or **tabs**.

1 rajan MG Road Pune MH 34500
2 rahul patil SSG Lane Pune MH 54000
3 suraj raj k Deccan Gymkhana Pune MH 22000

4, S M Kumar, Mg Road Pune MH, 32000
5, S M Kumar, Mg Road, Pune, MH, 32000

1,raj,k,1984-06-12,raj.kumar@gmail.com
2,om,,1969-10-25,om123@gmail.com
3,rajes,kumar,1970-10-25,
4,rahul,patil,1982-10-31,rahul.patil@gmail.com
5,ketan,,,ruhan.bagde@gmail.com

The Zen of Python,

Beautiful is better than ugly.
Explicit is better than implicit.
Simple is better than complex.
Complex is better than complicated.
Flat is better than nested.
Sparse is better than dense.
Readability counts.
Special cases aren't special enough to break the rules.
Although practicality beats purity.
Errors should never pass silently.
Unless explicitly silenced.
In the face of ambiguity, refuse the temptation to guess.
There should be one-- and preferably only one --obvious way to do it.
Although that way may not be obvious at first unless you're Dutch.
Now is better than never.
Although never is often better than *right* now.
If the implementation is hard to explain, it's a bad idea.
If the implementation is easy to explain, it may be a good idea.
Namespaces are one honking great idea -- let's do more of those!

advantages of file-oriented system

The biggest advantage of file-based storage is that anyone can understand the system.

Advantage of File-oriented system

- **Backup**: It is possible to take faster and automatic back-up of database stored in files of computer-based systems.
- **Data retrieval:** It is possible to retrieve data stored in files in easy and efficient way.
- **Editing**: It is easy to edit any information stored in computers in form of files.
- **Remote access**: It is possible to access data from remote location.
- **Sharing**: The files stored in systems can be shared among multiple users at a same time.

disadvantage of file-oriented system

The biggest disadvantage of file-based storage is as follows.

Disadvantage of File-oriented system

- **Data redundancy**: It is possible that the same information may be duplicated in different files. This leads to data redundancy results in memory wastage.

(Suppose a customer having both kind of accounts- saving and current account. In such a situation a customers detail are stored in both the file, saving.txt- file and current.txt- file , which leads to Data Redundancy.)

- **Data inconsistency**: Because of data redundancy, it is possible that data may not be in consistent state.

(Suppose customer changed his/her address. There might be a possibility that address is changed in only one file (saving.txt) and other (current.txt) remain unchanged.)

- **Limited data sharing**: Data are scattered in various files and also different files may have different formats (for example: .txt, .csv, .tsv and .xml) and these files may be stored in different folders so, due to this it is difficult to share data among different applications.
- **Data Isolation:** Because data are scattered in various files, and files may be in different formats (for example: .txt, .csv, .tsv and .xml), writing new application programs to retrieve the appropriate data is difficult.
- **Data security:** Data should be secured from unauthorized access, for example a account holder in a bank should not be able to see the account details of another account holder, such kind of security constraints are difficult to apply in file processing systems.

***Relation Schema*:** A relation schema represents name of the relation with its attributes.

- e.g. student (roll_no int, name varchar, address varchar, phone varchar and age int) is relation schema for STUDENT

DBMS

- **database:** Is the collection of **related data** which is **organized,** database can store and retrieve large amount of data easily, which is stored in one or more data files by one or more users, it is called as **structured data.**
- **management system**: it is a software, designed to **define**, **manipulate**, **retrieve** and **manage** data in a database.

Difference between File System and DBMS

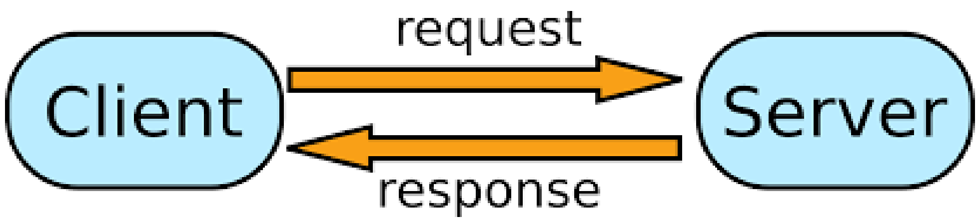
File Management System	Database Management System
• File System is easy-to-use system to store data which require less security and constraints.	• Database Management System is used when security constraints are high.
• Data Redundancy is more in File System.	• Data Redundancy is less in Database Management System.
• Data Inconsistency is more in File System.	• Data Inconsistency is less in Database Management System.
• Centralization is hard to get when it comes to File System.	• Centralization is achieved in Database Management System.
• User locates the physical address of the files to access data in File System.	• In Database Management System, user is unaware of physical address where data is stored.
• Security is low in File System.	• Security is high in Database Management System.
• File System stores unstructured data. "unstructured data" may include documents, audio, video, images, etc.	• Database Management System stores structured data.

relational database management system?

A RDBMS is a database management system (DBMS) that is based on the **relational model** introduced by Edgar Frank Codd at IBM in 1970.

RDBMS supports

- *client/server Technology*
- *Highly Secured*
- *Relationship (PK/FK)*



- A server is a computer program or device that provides a service to another computer program and its user, also known as the client.
- In the client/server programming model, a server program awaits and fulfills requests from client programs, which might be running in the same, or other computers.

relational model concepts

and

properties of relational table

relational model concepts

Relational model organizes data into one or more tables (or "relations") of columns and rows. Rows are also called records or tuples. Columns are also called attributes.

- **Tables** – In relational model, relations are saved in the form of Tables. A table has rows and columns.
- **Attribute** – Attributes are the properties that define a relation. e.g. (**roll_no, name, address, phone and age)**
- **Tuple** – A single row of a table, which contains a single record for that relation is called a tuple.
- **Relation schema** – A relation schema describes the relation name (table name) with its attribute (columns) names.

  e.g. **student(prn, name, address, phone, DoB, age, hobby, email, status)** is relation schema for student relation.
- **Attribute domain** – An attribute domain specifies the data type, format, and constraints of a column, and defines the range of values that are valid for that column.

Remember:

- In database management systems, null is used to represent missing or unknown data in a table column.

properties of relational table

ID	job	firstName	DoB	salary
1	manager	Saleel Bagde	yyyy-mm-dd	••••••
3	salesman	Sharmin	yyyy-mm-dd	••••••
4	accountant	Vrushali	yyyy-mm-dd	••••••
2	salesman	Ruhan	yyyy-mm-dd	••••••
5	9500	manager	yyyy-mm-dd	••••••
5	Salesman	Rahul Patil	yyyy-mm-dd	••••••

Relational tables have six properties:

- Values are atomic.
- Column values are of the same kind. (***Attribute Domain*: Every attribute has some pre-defined datatypes, format, and constraints of a column, and defines the range of values that are valid for that column known as attribute domain.)
- Each row is unique.
- The sequence of columns is insignificant – (unimportant).
- The sequence of rows is insignificant – (unimportant).
- Each attribute/column must have a unique name.

What is data?

what is data?

Data is any facts that can be stored and that can be processed by a computer.

Data can be in the form of Text or Multimedia

e.g.

- number, characters, or symbol
- images, audio, video, or signal

What is Entity Relationship Diagram?

Entity Relationship Diagram (ER Diagram)

Use E-R model to get a high-level graphical view to describe the **"ENTITIES"** and their **"RELATIONSHIP"**

The basic constructs/components of ER Model are **Entity**, **Attributes** and **Relationships**.

An entity can be a **real-world object.**

What is Entity?

entity

In relation to a database , an entity is a

- Person(student, teacher, employee, department, …)
- Place(classroom, building, …) --a particular position or area
- Thing(computer, lab equipment, …) --an object that is not named
- Concept(course, batch, student’s attendance, …) -- an idea,

about which data can be stored. All these entities have some **attributes** or **properties** that give them their **identity**.

Every entity has its own characteristics.

When you are designing attributes for your entities, **you will sometimes find that an attribute does not have a value**. For example, you might want an attribute for a person's middle name, but you can't require a value because some people have no middle name. **For these, you can define the attribute so that it can contain null values.**

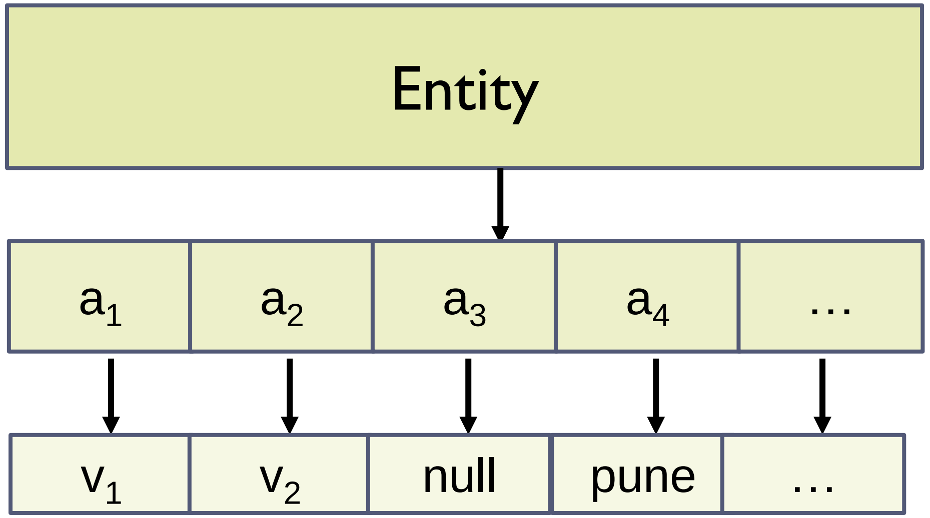
In database management systems, **null** is used to represent missing or unknown data in a table column.

What is an Attribute?

Attributes are the properties that define a relation.

e.g. student(ID, firstName, middleName, lastName, city)

In some cases, you might not want a specific attribute to contain a null value, but you don't want to require that the user or program always provide a value. In this case, a default value might be appropriate. **A default value is a value that applies to an attribute if no other valid value is available.**



A table has rows and columns

In RDBMS, a table organizes data in rows and columns. The **COLUMNS** are known as **ATTRIBUTES / FIELDS** whereas the **ROWS** are known as **RECORDS / TUPLE**.

In Relation: EMP

Attributes

ID	EmployeeName	Job	Hiredate	Salary
1	KING	PRESIDENT	2017-02-15	5000
…	…	…	…	…
…	…	…	…	…
…	…	…	…	…

Rows

In Entity Relationship(ER) Model attributes can be classified into the following types.

- Simple/Atomic and Composite Attribute
- Single Valued and Multi Valued attribute
- Stored and Derived Attributes
- Complex Attribute

Remember:

In SQL, the same name can be used for two (or more) attributes as long as the attributes are in different relations.

attributes

- **Simple / Atomic Attribute** --VS-- **Composite Attribute**
  (Can't be divided further) (Can be divided further)
- **Single Value Attribute** --VS-- **Multi Valued Attribute**
  (Only One value) (Multiple values)
- **Stored Attribute** --VS-- **Derived Attribute**
  (Only One value) (Virtual)
- **Complex Attribute**
  (Composite & Multivalued)

Employee ID: An employee ID can be a composite attribute, which is composed of sub-attributes such as department code, job code, and employee number.

- **Atomic Attribute:** An attribute that cannot be divided into smaller independent attribute is known as atomic attribute.
  e.g. ID's, PRN, age, gender, zip, marital status cannot further divide.

- **Single Value Attribute:** An attribute that has only single value is known as single valued attribute.
  e.g. manufactured part can have only one serial number, voter card, blood group, price, quantity, branch can have only one value.

- **Stored Attribute:** The stored attribute are such attributes which are already stored in the database and from which the value of another attribute is derived.
  e.g. (HRA, DA…) can be derive from salary, age can be derived from DoB, total marks or average marks of a student can be derived from marks.

Composite **VS** Multi Valued Attribute

composite / multi valued attributes

Composite Attribute

Person Entity

- *Name* attribute: (firstName, middleName, and lastName)
- *PhoneNumber* attribute: (countryCode, cityCode, and phoneNumber)

```
{Address}
{street, city, state, postal-code}
{street-number, street-name, apartment-number}
```

Multi Valued Attribute

Person Entity

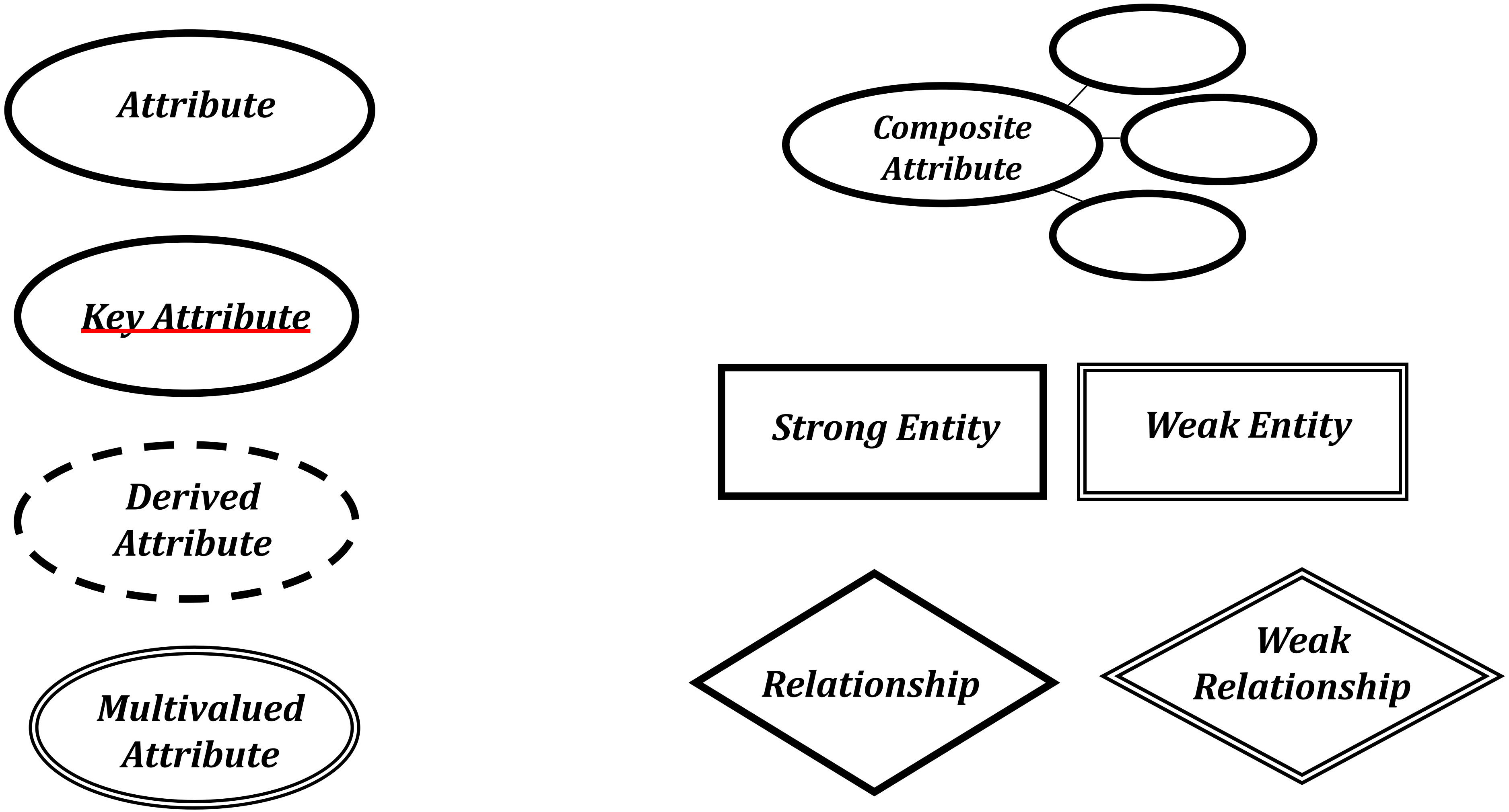
- *Hobbies* attribute: [reading, hiking, hockey, skiing, photography, . . .]
- *SpokenLanguages* attribute: [Hindi, Marathi, Gujarati, English, . . .]
- *Degrees* attribute: [10^{th} , 12^{th}, BE, ME, PhD, . . .]
- *emailID* attribute: [saleel@gmail.com, salil@yahoomail.com, . . .]

What is an Prime, Non-Prime Attribute?

Prime attribute (*Entity integrity*)
An attribute, which is a **part of the prime-key (**candidate key**)**, is known as a prime attribute.

Non-prime attribute
An attribute, which is **not a part of the prime-key (**candidate key**)**, is said to be a non-prime attribute.

entity relationship diagram symbols



strong and weak entity

An entity may participate in a relation either totally or partially.

Strong Entity: A strong entity is not dependent on any other entity in the schema. A strong entity will always have a primary key. Strong entities are represented by a single rectangle.

Weak Entity: A weak entity is dependent on a strong entity to ensure its existence. Unlike a strong entity, a weak entity does not have any primary key. A weak entity is represented by a double rectangle. The relation between one strong and one weak entity is represented by a double diamond. This relationship is also known as identifying relationship.

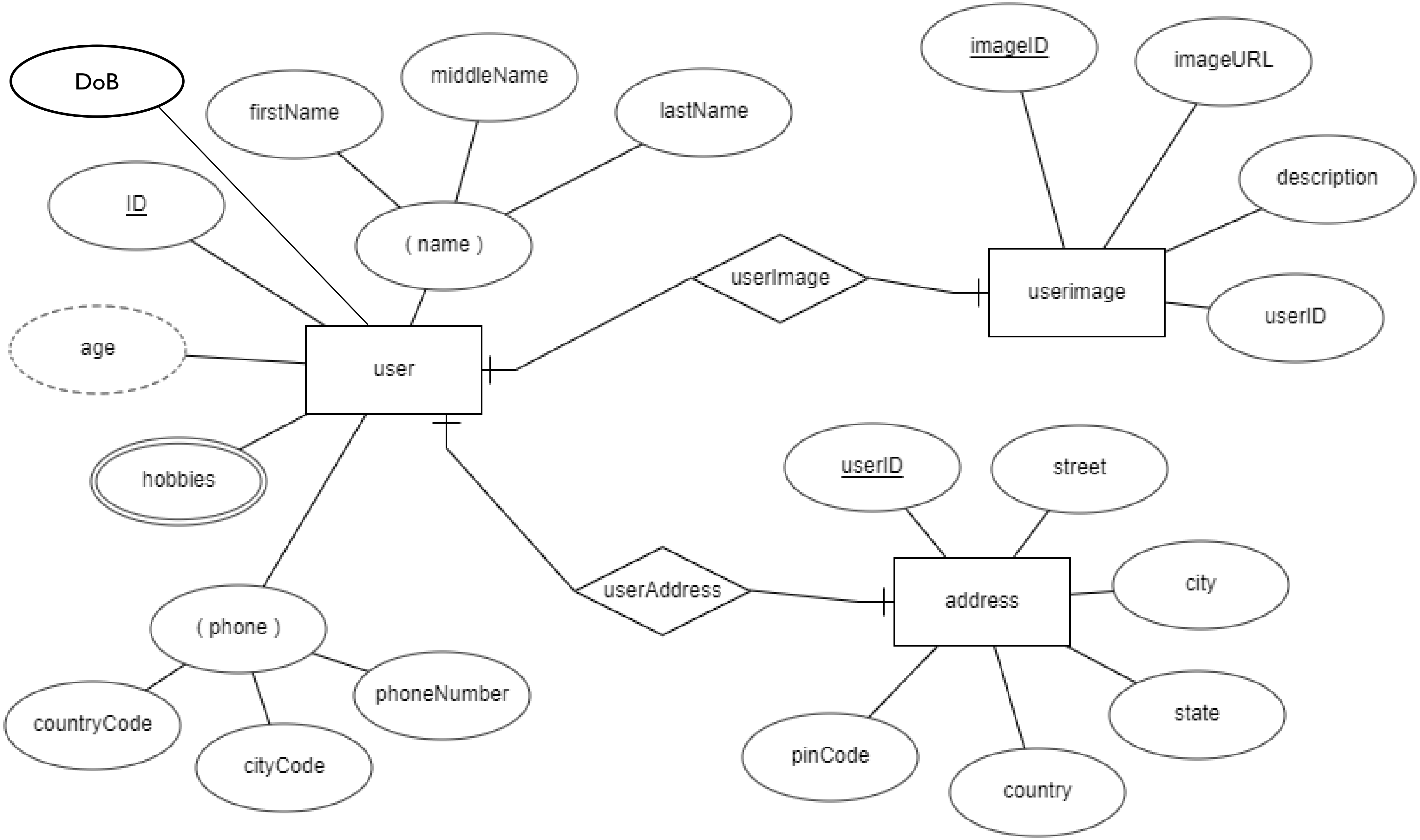
Example 1 – A loan entity can not be created for a customer if the customer doesn’t exist

Example 2 – A payment entity can not be created for a loan if the loan doesn’t exist

Example 3 – A dependents list entity can not be created if the employee doesn’t exist

Example 4 – A prescription entity can not be created for a patient if the patient doesn’t exist

entity relationship diagram



What is a degree, cardinality, domain and union in database?

What is a degree, cardinality, domain and union in database?

- **Degree d(R) / Arity**: Total number of **attributes/columns** present in a relation/table is called **degree of the relation** and is denoted by $\mathbf{d}(R)$.

- **Cardinality |R|**: Total number of **tuples/rows** present in a relation/table, **is called cardinality of a relation** and is denoted by $|R|$.

- **Domain**: Total range of accepted values for an attribute of the relation **is called the domain of the attribute**. (**Data Type(size)**)

- **Union Compatibility**: Two relations R and S are set to be Union Compatible to each other if and only if:
  1. They have the **same degree** $\mathbf{d(R)}$.
  2. Domains of the respective attributes should also be same.

What is domain constraint and types of data integrity constraints?

Data integrity refers to the correctness and completeness of data.

A domain constraint and types of data integrity constraints

❖ **Domain Constraint** = data type + Constraints (**not null/unique/primary key/foreign key/check/default**)

e.g. custID INT, constraint pk_custid PRIMARY KEY(custID)

Three types of integrity constraints: **entity integrity, referential integrity** and **domain integrity**:

- **Entity integrity:** Entity Integrity Constraint is used to ensure the uniqueness of each record the table. There are primarily two types of integrity constraints that help us in ensuring the uniqueness of each row, namely, UNIQUE constraint and PRIMARY KEY constraint.
-
- **Referential integrity:** Referential Integrity Constraint ensures that there always exists a valid relationship between two tables. This makes sure that if a foreign key exists in a table relationship then it should always reference a corresponding value in the second table $t_1[FK] = t_2[PK]$ or it should be null.

- **Domain integrity:** A domain is a set of values of the same type. For example, we can specify if a particular column can hold null values or not, if the values have to be unique or not, the data type or size of values that can be entered in the column, the default values for the column, etc..

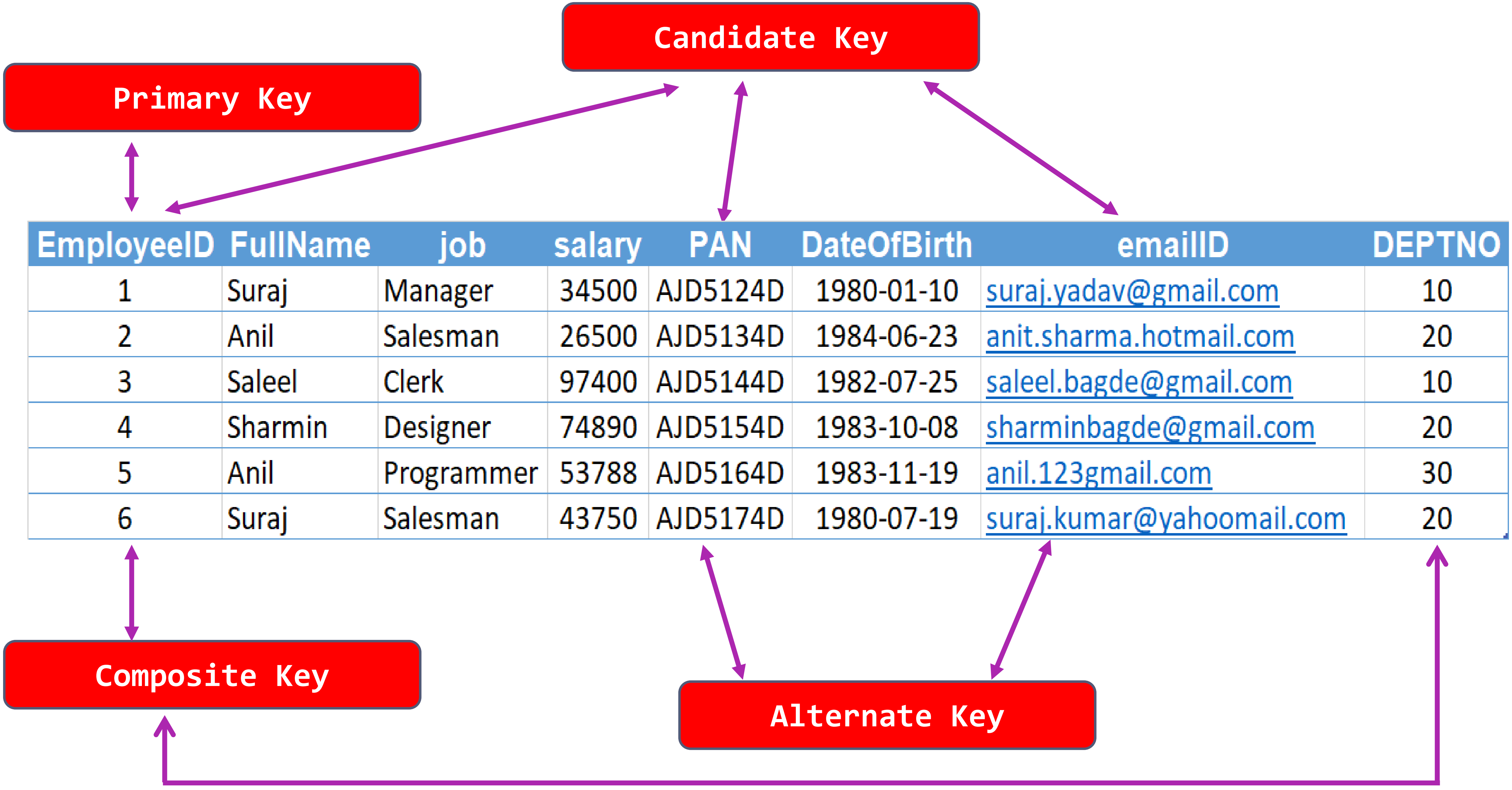
types of Keys?

Keys are used to establish relationships between tables and also to uniquely identify any record in the table.

types of Keys?

r = Employee(EmployeeID, FullName, job, salary, PAN, DateOfBirth, emailID, deptno)

- **Candidate Key:** are individual columns in a table that qualifies for uniqueness of all the rows. Here in Employee table EmployeeID, PAN or emailID are Candidate keys.
- **Primary Key**: is the columns you choose to maintain uniqueness in a table. Here in Employee table you can choose either EmployeeID, PAN or emailID columns, EmployeeID is preferable choice.
- **Alternate Key**: Candidate column other the primary key column, like if EmployeeID is primary key then , PAN or emailID columns would be the Alternate key.
- **Super Key**: If you add any other column to a primary key then it become a super key, like EmployeeID + FullName is a Super Key.
- **Composite Key**: If a table do not have any single column that qualifies for a Candidate key, then you have to select 2 or more columns to make a row unique. Like if there is no EmployeeID, PAN or emailID columns, then you can make FullName + DateOfBirth as Composite key. But still there can be a narrow chance of duplicate row.

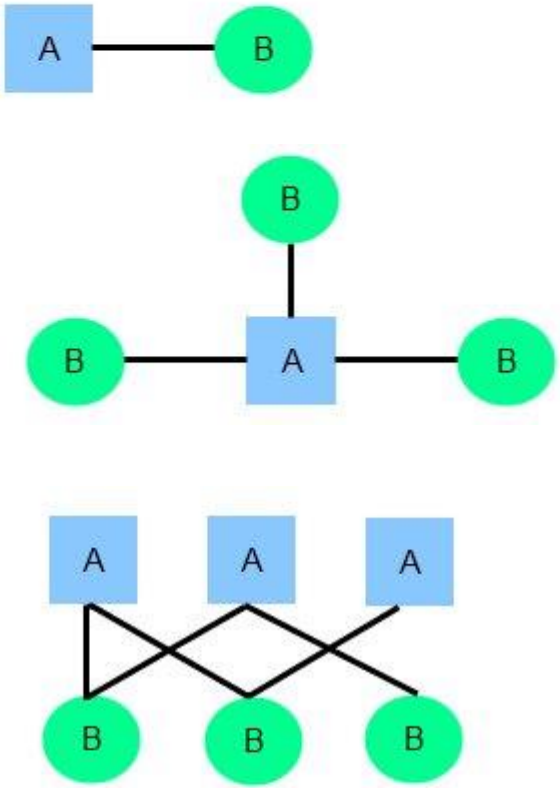


EmployeeID	FullName	job	salary	PAN	DateOfBirth	emailID	DEPTNO
1	Suraj	Manager	34500	AJD5124D	1980-01-10	suraj.yadav@gmail.com	10
2	Anil	Salesman	26500	AJD5134D	1984-06-23	anit.sharma.hotmail.com	20
3	Saleel	Clerk	97400	AJD5144D	1982-07-25	saleel.bagde@gmail.com	10
4	Sharmin	Designer	74890	AJD5154D	1983-10-08	sharminbagde@gmail.com	20
5	Anil	Programmer	53788	AJD5164D	1983-11-19	anil.123gmail.com	30
6	Suraj	Salesman	43750	AJD5174D	1980-07-19	suraj.kumar@yahoomail.com	20

Common relationships

Common relationship

1. one-to-one (1:1)
2. one-to-many (1:M)
3. many-to-many (M:N)

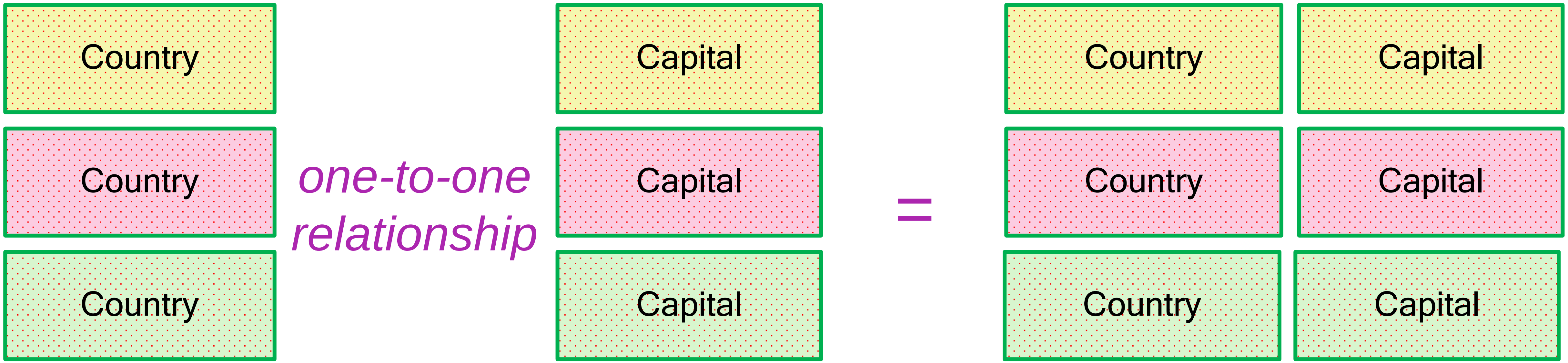


one-to-one relationship

one-to-one relationship

A *one-to-one* relationship between two tables means that a row in one table can only relate to zero/one row in the table on the other side of their relationship. This is the least common database relationship.

A *one-to-one* relationship is a type of cardinality that refers to the relationship between two entities ***R*** and ***S*** in which one element of entity ***R*** may only be linked to zero/one element of entity ***S***, and vice versa.



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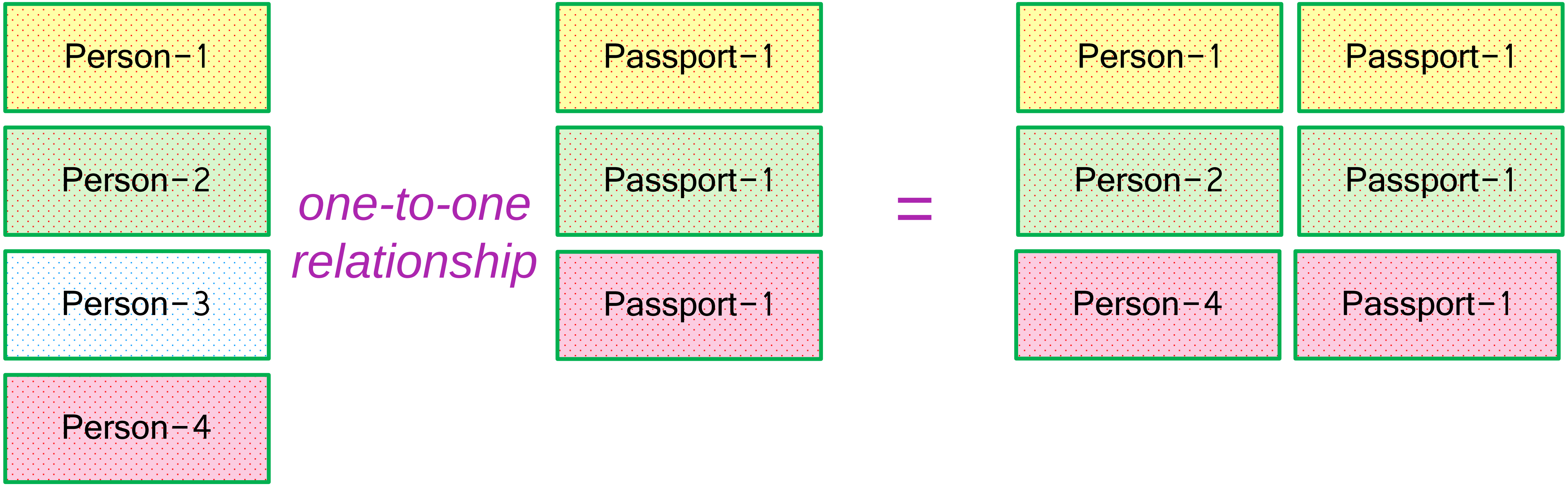

one-to-many relationship

one-to-many relationship

A *one-to-many* relationship between two tables means that a row in one table can have zero or more row in the table on the other side of their relationship.

a *one-to-many* relationship is a type of cardinality that refers to the relationship between two entities ***R*** and ***S*** in which an element of ***R*** may be linked to many elements of ***S***, but a member of ***S*** is linked to only one element of ***R***.

Customer−1
Customer−2
Customer−3
Customer−4
Customer−5

one-to-many relationship

Order−1
Order−1
Order−2
Order−1
Order−2
Order−3
Order−1

=

Customer−1	Order−1
Customer−2	Order−1
Customer−2	Order−2
Customer−3	Order−1
Customer−3	Order−2
Customer−3	Order−3
Customer−4	Order−1

one-to-many relationship

A *one-to-many* relationship between two tables means that a row in one table can have one or more row in the table on the other side of their relationship.

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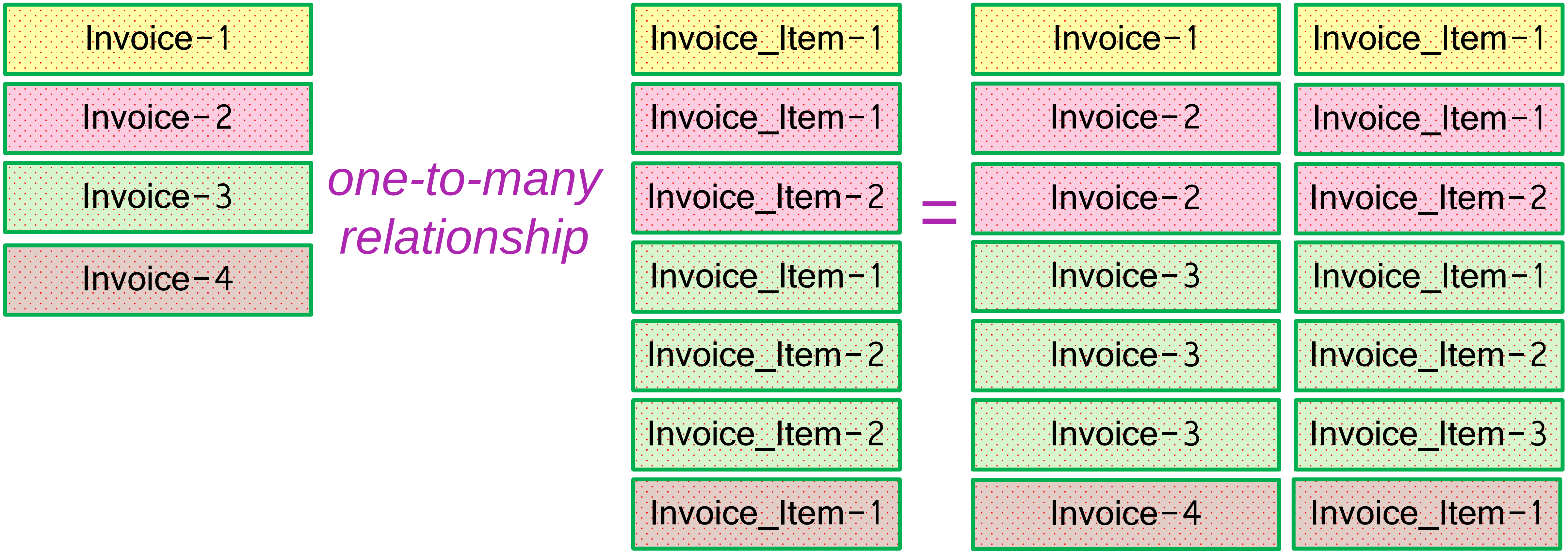
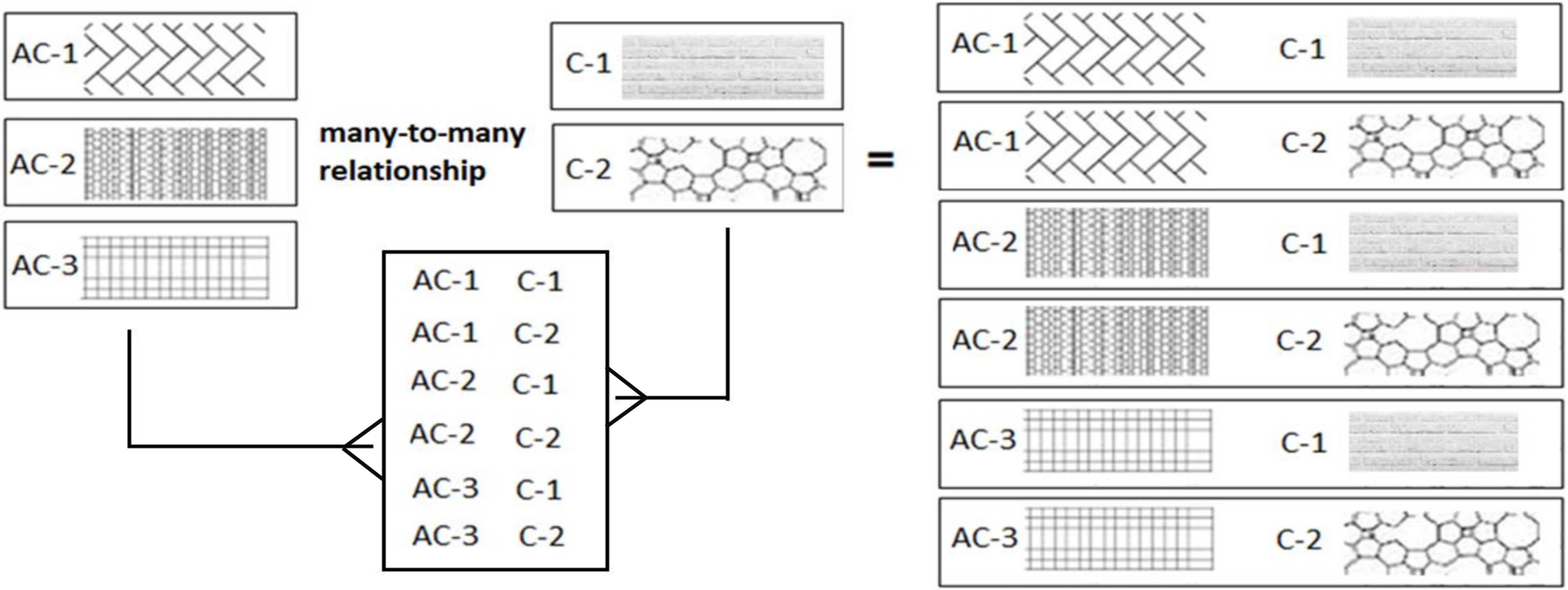


many-to-many relationship

many-to-many relationship

A *many-to-many* relationship is a type of cardinality that refers to the relationship between two entities ***R*** and ***S*** in which ***R*** may contain a parent instance for which there are many children in ***S*** and vice versa.

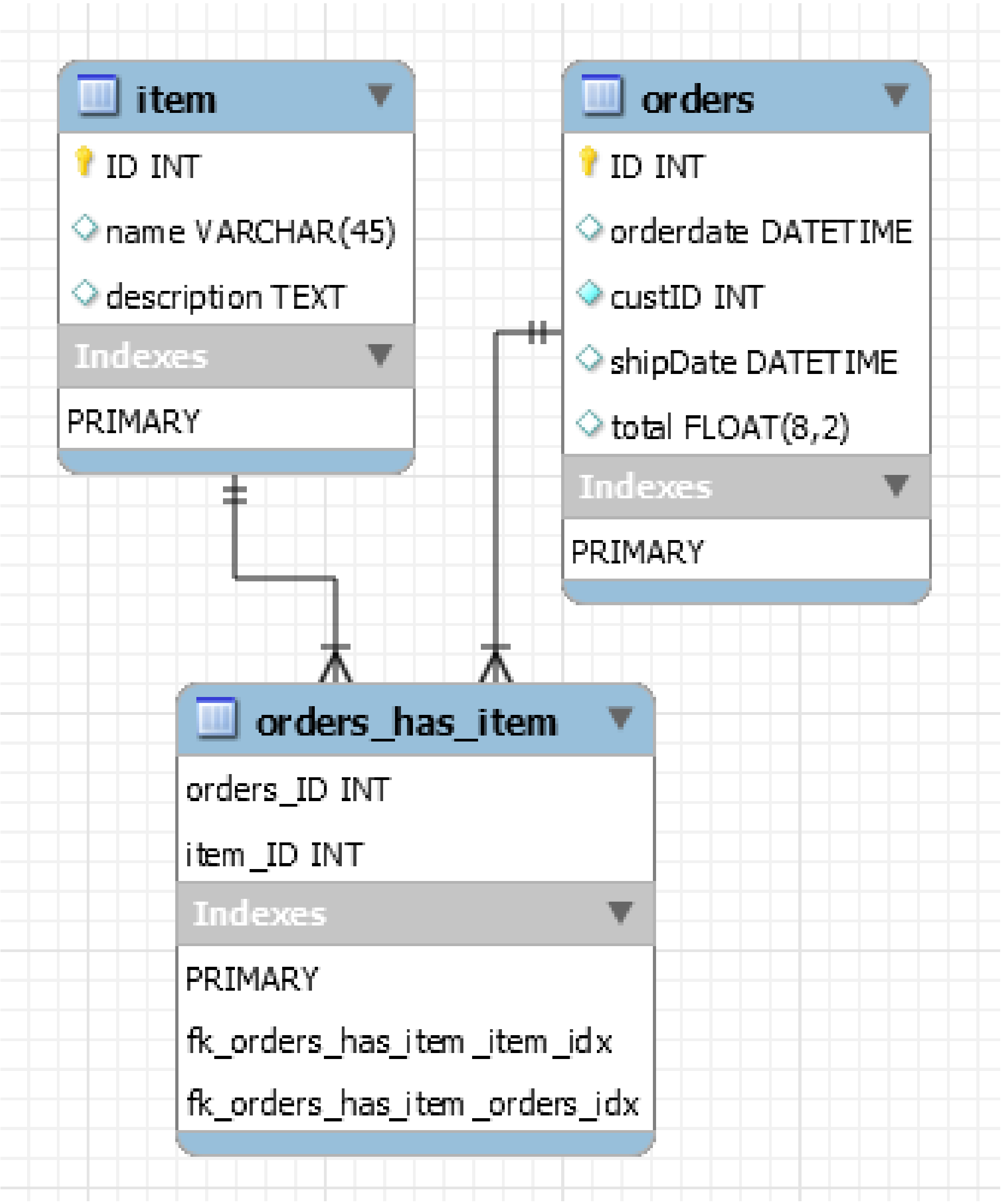


how to create many-to-many relationship

```
CREATE TABLE item (
    ID INT PRIMARY KEY,
    name VARCHAR(45),
    description TEXT
);

CREATE TABLE orders (
    ID INT PRIMARY KEY,
    orderdate DATETIME,
    custID INT NOT NULL,
    shipDate DATETIME,
    total FLOAT(8,2),
    constraint total_greater_zero CHECK(total >= 0)
);

CREATE TABLE orders_has_item (
   orders_ID INT NOT NULL,
   item_ID INT NOT NULL,
   PRIMARY KEY(orders_ID, item_ID),
   constraint fk_orders_has_item_orders FOREIGN KEY(orders_ID)
   REFERENCES orders(ID),
   constraint fk_orders_has_item_item1 FOREIGN KEY(item_ID)
   REFERENCES item(ID)
);
```

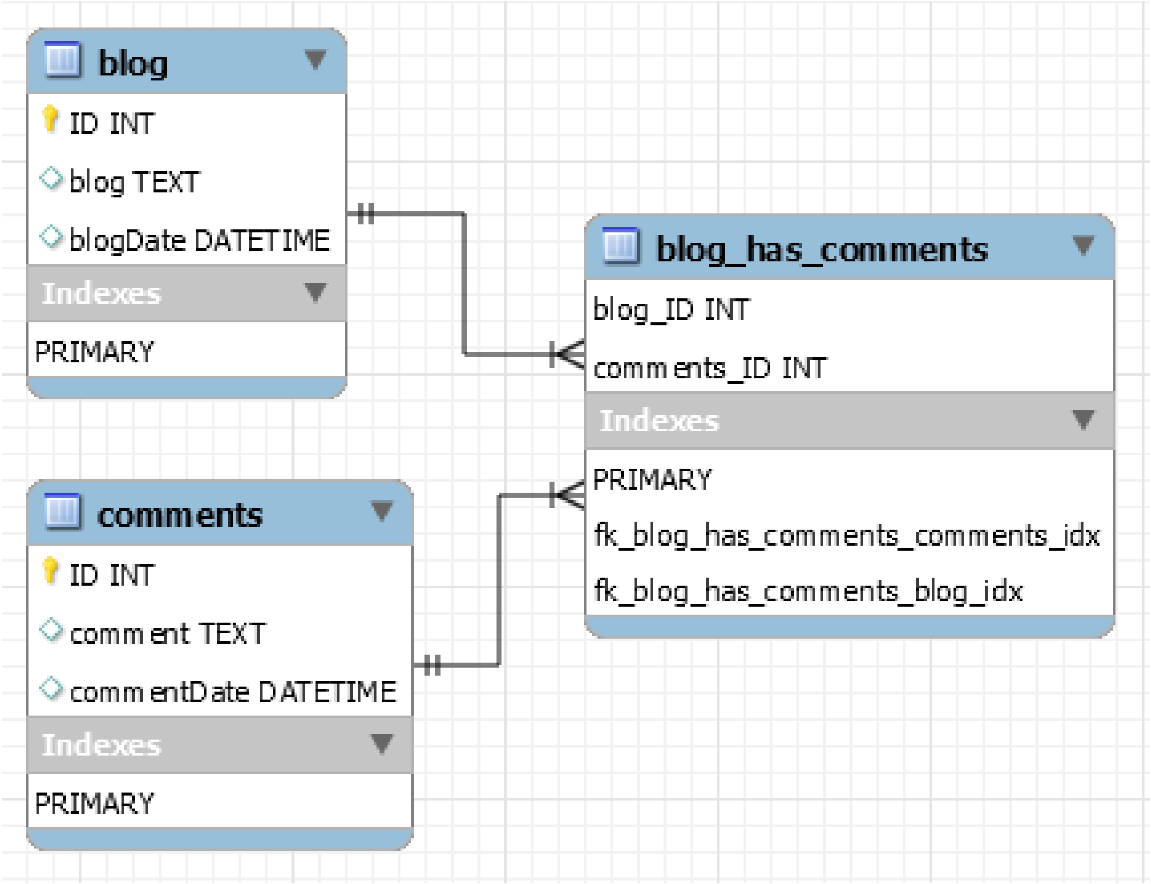


how to create many-to-many relationship

```
CREATE TABLE blog (
  ID INT PRIMARY KEY,
  blog TEXT,
  blogDate DATETIME
);

CREATE TABLE comments (
  ID INT PRIMARY KEY,
  comment TEXT,
  commentDate DATETIME
);

CREATE TABLE blog_has_comments (
   blog_ID INT,
   comments_ID INT,
   PRIMARY KEY(blog_ID, comments_ID),
   constraint fk_blog_has_comments_blog FOREIGN KEY(blog_ID)    REFERENCES blog(ID),
   constraint fk_blog_has_comments_comments FOREIGN KEY(comments_ID) REFERENCES comments(ID)
);
```



MySQL is the most popular **Open Source** Relational Database Management System.

MySQL was created by a Swedish company - MySQL AB that was founded in 1995. It was acquired by Sun Microsystems in 2008; Sun was in turn acquired by Oracle Corporation in 2010.

When you use MySQL, you're actually using at least two programmes. One program is the MySQL server (*mysqld.exe*) and other program is MySQL client program (*mysql.exe*) that connects to the database server.

What is SQL?

Remember:

- **EXPLICIT or IMPLICIT commit will commit the data.**

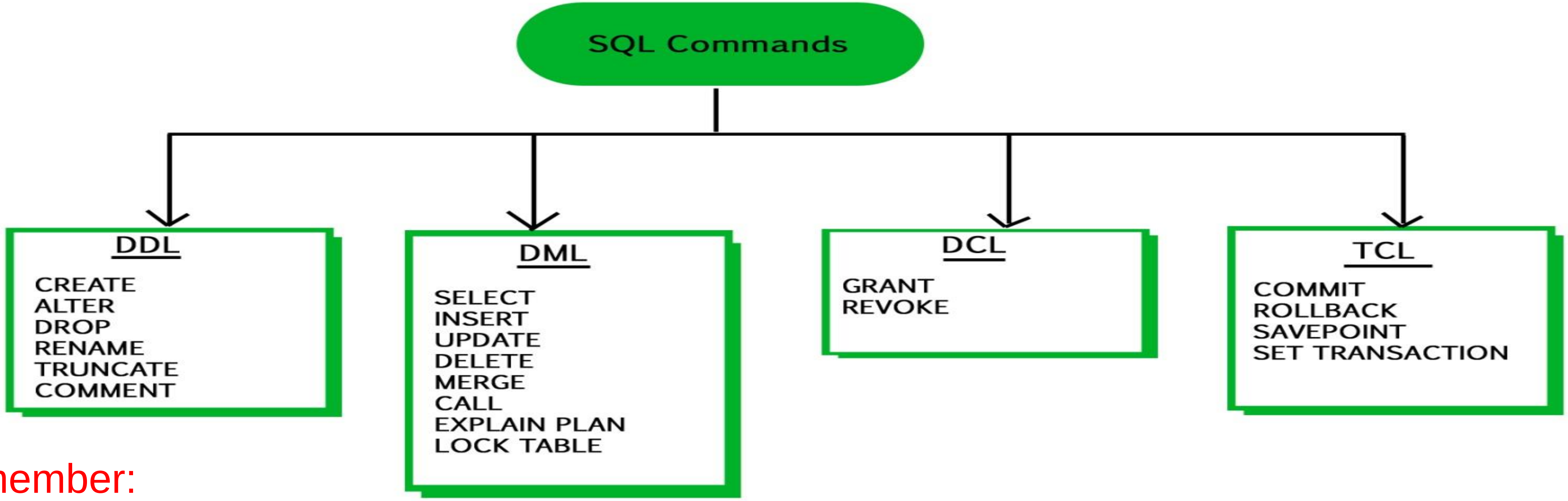
what is sql?

SQL (**Structured Query Language**) is a database language designed and developed for managing data in relational database management systems (**RDBMS**). SQL is common language for all Relational Databases.

Remember:

what is sql?

- **An EXPLICIT commit happens when we execute an SQL "COMMIT" command.**
- **An IMPLICIT commits occur without running a "COMMIT" command.**



Remember:

- A **NULL** value is not treated as a **blank** or **0**. Null or NULL is a special marker used in Structured Query Language to indicate that a data value does not exist or missing or unknown in the database.
- **Degree d(R)**: Total no. of attributes/columns present in a relation/table is called degree of the relation and is denoted by **d(R).**
- **Cardinality |R|**: Total no. of tuples present in a relation or Rows present in a table, is called cardinality of a relation and is denoted by **|R|.**

comments in mysql

- From a # character to the end of the line.
- From a -- sequence to the end of the line.
- From a /* sequence to the following */ sequence.

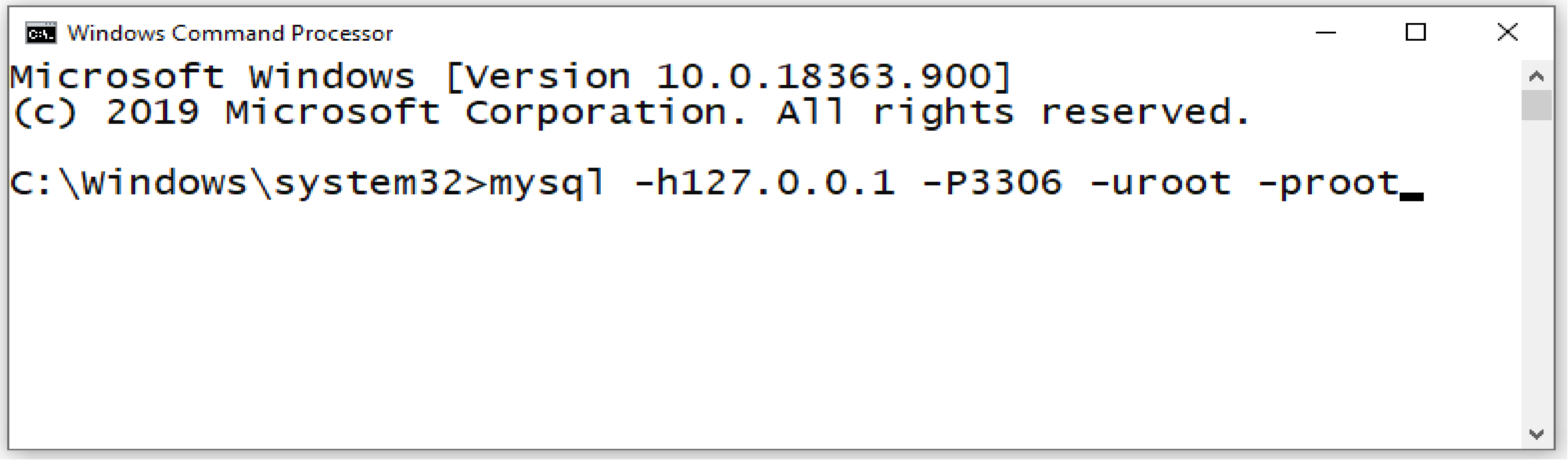
Reconnect to the server	**\r**
Execute a system shell command	**\!**
Exit mysql	**\q**
Change your mysql prompt.	**prompt str or \R str**

Login to MySQL

Default port for MySQL Server: **3306**

login

- C:\> mysql -hlocalhost -P3307 -uroot -p
- C:\> mysql -h127.0.0.1 -P3307 -uroot -p [*database_name*]
- C:\> mysql -h192.168.100.14 -P3307 -uroot -psaleel [*database_name*]
- C:\> mysql --host localhost --port 3306 --user root --password=ROOT [*database_name*]
- C:\> mysql --host=localhost --port=3306 --user=root --password=ROOT [*database_name*]



SHOW DATABASES

SHOW DATABASES Syntax

```
SHOW {DATABASES | SCHEMAS} [LIKE 'pattern' | WHERE expr]
```

SHOW SCHEMAS is a synonym for SHOW DATABASES.

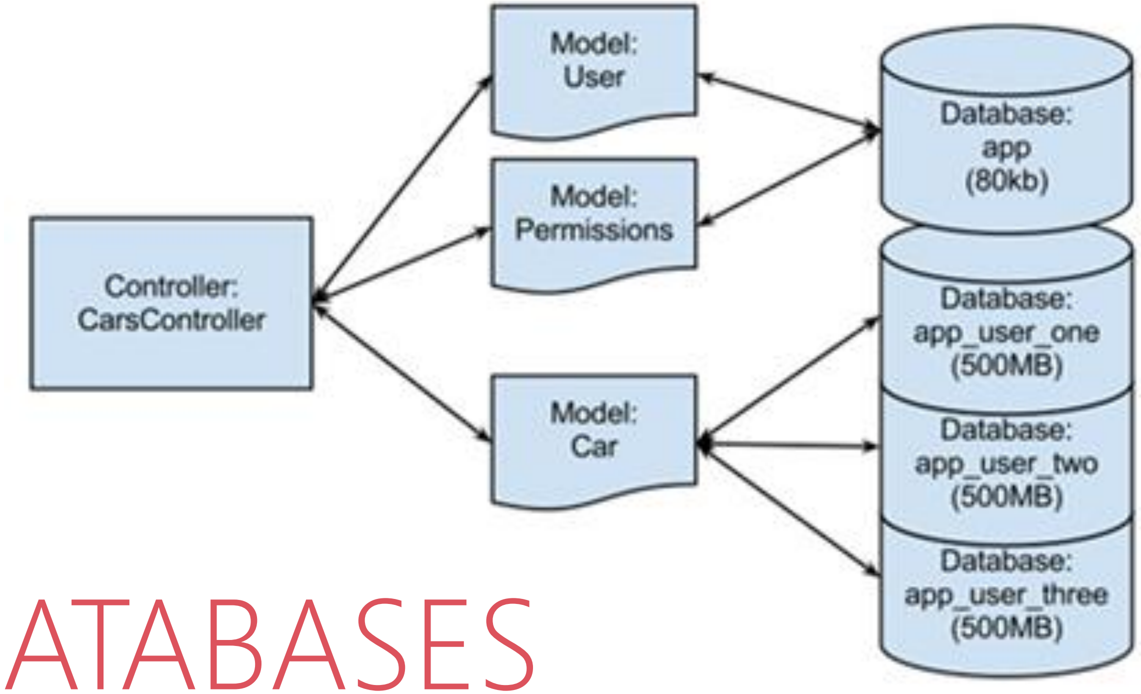
```
SHOW DATABASES;

SHOW SCHEMAS;

SHOW DATABASES LIKE 'U%';

SHOW SCHEMAS LIKE 'U%';
```

NULL means “no database is selected”. Issue the ***USE dbName*** command to select the database.



USE DATABASES

The **USE db_name** statement tells MySQL to use the db_name database as the default (current) database for subsequent statements. The database remains the default until the end of the session or another **USE** statement is issued.

USE DATABASES Syntax

USE *db_name*
\U *db_name*

Note:

- USE, does not require a semicolon.
- USE must be followed by a database name.

```
USE db1

\U db1
```

Source Command

source command

You can execute an SQL script file using the source command or \. command

\. file_name
source file_name

- \. 'D:\mysqldemobld7.sql'
- SOURCE 'D:\mysqldemobld7.sql'
- SOURCE //infoserver1/infodomain1/Everyone/DBT/mysqldemobld7.sql

The **char** is a fixed-length character data type,
The **varchar** is a variable-length character data type.

```
CREATE TABLE temp (c1 CHAR(10), c2 VARCHAR(10));

INSERT INTO temp VALUES('SALEEL', 'SALEEL');

SELECT * FROM temp WHERE c1 LIKE 'SALEEL';
```

datatypes

ENAME CHAR (10)	S	A	L	E	E	L				LENGTH -> 10
ENAME VARCHAR2(10)	S	A	L	E	E	L				LENGTH -> 6

In MySQL

When CHAR values are retrieved, the trailing spaces are removed (unless the ***PAD_CHAR_TO_FULL_LENGTH*** SQL mode is enabled)

ENAME CHAR (10)	S	A	L	E	E	L				LENGTH -> 6
ENAME VARCHAR(10)	S	A	L	E	E	L				LENGTH -> 6

Note:

The BINARY and VARBINARY types are similar to CHAR and VARCHAR, except that they store binary strings rather than nonbinary strings. That is, they store byte strings rather than character strings.

datatype - string

Datatypes	Size	Description
CHAR [(length)]	0-255	
VARCHAR (length)	0 to 65,535	The maximum row size (65,535 bytes, which is shared among all columns.
TINYTEXT [(length)]	$(2^8 - 1)$ bytes	
TEXT [(length)]	$(2^{16} -1)$ bytes	65,535 bytes ~ 64kb
MEDIUMTEXT [(length)]	$(2^{24} -1)$ bytes	16,777,215 bytes ~16MB
LONGTEXT [(length)]	$(2^{32} -1)$ bytes	4,294,967,295 bytes ~4GB
ENUM('value1', 'value2',...)	65,535 members	
SET('value1', 'value2',...)	64 members	
BINARY[(length)]	255	
VARBINARY(length)		

By default, trailing spaces are trimmed from CHAR column values on retrieval. If ***PAD_CHAR_TO_FULL_LENGTH*** is enabled, trimming does not occur and retrieved CHAR values are padded to their full length.

- *SET sql_mode = '';*
- *SET sql_mode = 'PAD_CHAR_TO_FULL_LENGTH';*

datatype - numeric

Datatypes	Size	Description
TINYINT	1 byte	-128 to +127 **(The unsigned range is 0 to 255).**
SMALLINT [(length)]	2 bytes	-32768 to 32767. **(The unsigned range is 0 to 65535).**
MEDIUMINT [(length)]	3 bytes	-8388608 to 8388607. **(The unsigned range is 0 to 16777215).**
INT, INTEGER [(length)]	4 bytes	-2147483648 to 2147483647. **(The unsigned range is 0 to 4294967295).**
BIGINT [(length)]	8 bytes	-9,223,372,036,854,775,808 to 9,223,372,036,854,775,807
FLOAT [(length[,decimals])]	4 bytes	**FLOAT(255,30)**
DOUBLE [PRECISION] [(length[,decimals])], REAL [(length[,decimals])]	8 bytes	**REAL(255,30) / DOUBLE(255,30)** REAL will get converted to DOUBLE
DECIMAL [(length[,decimals])], NUMERIC [(length[,decimals])]		**DECIMAL(65,30) / NUMERIC(65,30)** NUMERIC will get converted in DECIMAL

For: float(M,D), double(M,D) or decimal(M,D), M must be >= D

Here, **(M,D)** means than values can be stored with up to ***M*** digits in total, of which ***D*** digits may be after the decimal point.

UNSIGNED prohibits negative values.

datatype – date and time

Datatypes	Size	Description
YEAR	1 byte	YYYY
DATE	3 bytes	YYYY-MM-DD
TIME	3 bytes	HH:MM:SS
DATETIME	8 bytes	YYYY-MM-DD hh:mm:ss

datatype – boolean

CREATE TABLE temp (col1 INT ,col2 BOOL, col3 BOOLEAN);

CREATE TABLE tasks (id INT AUTO_INCREMENT PRIMARY KEY, title VARCHAR(255) NOT NULL, completed BOOLEAN);

- INSERT INTO tasks VALUE(default, 'Task1', 0);
- INSERT INTO tasks VALUE(default, 'Task2', 1);
- INSERT INTO tasks VALUE(default, 'Task3', False);
- INSERT INTO tasks VALUE(default, 'Task4', True);
- INSERT INTO tasks VALUE(default, 'Task5', null);
- INSERT INTO tasks VALUE(default, 'Task6', default);
- INSERT INTO tasks VALUE(default, 'Task7', 1 > 2);
- INSERT INTO tasks VALUE(default, 'Task8', 1 < 2);
- INSERT INTO tasks VALUE(default, 'Task9', 12);
- INSERT INTO tasks VALUE(default, 'Task10', 58);
- INSERT INTO tasks VALUE(default, 'Task11', .75);
- INSERT INTO tasks VALUE(default, 'Task12', .15);
- INSERT INTO tasks VALUE(default, 'Task13', 'a' = 'a');

id	title	completed
1	Task1	0
2	Task2	1
3	Task3	0
4	Task4	1
5	Task5	NULL
6	Task6	NULL
7	Task7	0
8	Task8	1
9	Task9	12
10	Task10	58
11	Task11	1
12	Task12	0
13	Task13	1
NULL	NULL	NULL

Note:

- BOOL and BOOLEAN are **synonym of TINYINT(1)**

Use a CREATE TABLE statement to specify the layout of your table.

```
CREATE TABLE `123` (c1 INT, c2 VARCHAR(10));
```

Remember:

- Max 4096 columns per table provided the row size <= 65,535 Bytes

create table

Use a **CREATE TABLE** statement to specify the layout of your table.

Note:

- **USER TABLES**: This is a collection of tables created and maintained by the user. Contain USER information.
- **DATA DICTIONARY**: This is a collection of tables created and maintained by the MySQL Server. It contains database information. All data dictionary tables are owned by the SYS user.

create table

Use a **CREATE TABLE** statement to specify the layout of your table.

Remember:

- by default, tables are created in the default database, using the InnoDB storage engine.
- table name should not begin with a number or special symbols.
- table name can start with _table_name (underscore) or $table_name (dollar sign)
- table name and column name can have max 64 char.
- multiple words as table_name is invalid, if you want to give multiple words as table_name then give it in \`table_name\` (backtick)
- error occurs if the table exists.
- error occurs if there is no default database.
- error occurs if the database does not exist.

Note:

- Table names are stored in lowercase on disk. MySQL converts all table names to lowercase on storage. This behavior also applies to database names and table aliases.
  e.g. show variables like 'lower_case_table_names';

create table

syntax

CREATE [TEMPORARY] TABLE [IF NOT EXISTS] tbl_name
    (*create_defineation*, . . .)
    [table_options]
    [partition_options]

create_definition:
    col_name ***column_definition***

column_definition:
    data_type [NOT NULL | NULL] [DEFAULT default_value]
     [AUTO_INCREMENT] [UNIQUE [KEY] | [PRIMARY] KEY]
     [reference_definition]
  | data_type [GENERATED ALWAYS] AS (expression) [VIRTUAL]
    [VISIBLE | INVISIBLE]

table_options:
ENGINE [=] engine_name

e.g.

- ```
  CREATE TABLE student (
    ID INT,
    firstName VARCHAR(45),
    lastName VARCHAR(45),
    DoB DATE,
    emailID VARCHAR(128)
  );
  ```

show engines;
set default_storage_engine = memory;
  ```

default value

The DEFAULT specifies a default value for the column.

default value

col_name data_type DEFAULT value

The **DEFAULT** specifies a **default** value for the column.

```
CREATE TABLE posts (
  postID INT,
  postTitle VARCHAR(255),
  postDate DATETIME DEFAULT NOW(),
  deleted INT
);
```

Field	Type	Null	Key	Default	Extra
postID	int	YES		NULL	
postTitle	varchar(255)	YES		NULL	
postDate	datetime	YES		CURRENT_TIMESTAMP	DEFAULT_GENERATED
deleted	int	YES		NULL	

version 8.0 and above.

```
CREATE TABLE empl (
  ID INT PRIMARY KEY,
  firstName VARCHAR(45),
  phone INT,
  city VARCHAR(10) DEFAULT 'PUNE',
  salary INT,
  comm INT,
  total INT DEFAULT(salary + comm)
);
```

Field	Type	Null	Key	Default	Extra
ID	int	NO	PRI	NULL	
firstName	varchar(45)	YES		NULL	
phone	int	YES		NULL	
city	varchar(10)	YES		PUNE	
salary	int	YES		NULL	
comm	int	YES		NULL	
total	int	YES		(`salary` + `comm`)	DEFAULT_GENERATED

insert rows

INSERT is used to add a single or multiple tuple to a relation. We must specify the relation name and a list of values for the tuple. **The values should be listed in the same order in which the corresponding attributes were specified in the CREATE TABLE command.**

You can insert data using following methods:

- INSERT … VALUES
- INSERT … SET
- INSERT … SELECT

dml- insert … values

INSERT inserts new row(s) into an existing table. The INSERT ... VALUES

INSERT [IGNORE] [INTO] tbl_name [PARTITION (*partition_name* [, *partition_name*] ...)] [(col_name, . . .)] { VALUES | VALU E } ({ expr | DEFAULT }, . . .), (. . .), . . . [ON DUPLICATE KEY UPDATE assignment_list]

The affected-rows value for an INSERT can be obtained using the ROW_COUNT() function.

```
INSERT INTO DEPT VALUES (1, 'HRD', 'Pune')
```

Column Values

```
INSERT INTO DEPT(ID, NAME, LOC) VALUES (1, 'HRD', 'Pune')
```

Column List

```
INSERT INTO DEPT(ID, NAME, LOC) VALUES (1, 'HRD', 'Baroda'),
 (2,'Sales','Surat'), (3,'Purchase','Pune'), (4,'Account','Mumbai')
```

Inserting multiple rows

Do not use the * operator in your SELECT statements. Instead, use column names. Reason is that in MySQL Server scans for all column names and replaces the * with all the column names of the table(s) in the SELECT statement. Providing column names avoids this search-and-replace, and enhances performance.

SELECT statement…

```
SELECT what_to_select
FROM which_table
WHERE conditions_to_satisfy;
```

SELECT CLAUSE

The **SELECT** statement retrieves or extracts data from tables in the database.

- You can use one or more tables separated by comma to extract data.
- You can fetch one or more fields/columns in a single SELECT command.
- You can specify star (*****) in place of fields. In this case, SELECT will return all the fields.
- SELECT can also be used to retrieve rows computed without reference to any table e.g. SELECT 1 + 2;

Capabilities of SELECT Statement

1. SELECTION
2. PROJECTION
3. JOINING

Capabilities of SELECT Statement

➢SELECTION

Selection capability in SQL is to choose the record's/row's/tuple's in a table that you want to return by a query.

R

EMPNO	ENAME	JOB	HIREDATE	DEPTNO
1	Saleel	Manager	1995-01-01	10
2	Janhavi	Sales	1994-12-20	20
3	Snehal	Manager	1997-05-21	10
4	Rahul	Account	1997-07-30	10
5	Ketan	Sales	1994-01-01	30

Capabilities of SELECT Statement

➢PROJECTION

Projection capability in SQL to choose the column's/attribute's/field's in a table that you want to return by your query.

R

EMPNO	ENAME	JOB	HIREDATE	DEPTNO
1	Saleel	Manager	1995-01-01	10
2	Janhavi	Sales	1994-12-20	20
3	Snehal	Manager	1997-05-21	10
4	Rahul	Account	1997-07-30	10
5	Ketan	Sales	1994-01-01	30

Capabilities of SELECT Statement

➢JOINING

Join capability in SQL to bring together data that is stored in different tables by creating a link between them.

R

EMPNO	ENAME	JOB	HIREDATE	DEPTNO
1	Saleel	Manager	1995-01-01	20
2	Janhavi	Sales	1994-12-20	10
3	Snehal	Manager	1997-05-21	10
4	Rahul	Account	1997-07-30	20
5	Ketan	Sales	1994-01-01	30

S

DEPTNO	DNAME	LOC
10	HRD	PUNE
20	SALES	BARODA
40	PURCHASE	SURAT

select statement

SELECTION Process

SELECT * FROM <table_references>

selection-list | field-list | column-list

Remember:

- Here, " * " is known as metacharacter (all columns)

PROJECTION Process

SELECT column-list FROM <table_references>

selection-list | field-list | column-list

Remember:

- Position of columns in SELECT statement will determine the position of columns in the output (as per user requirements)

ORDER BY in UPDATE: if the table contains two values 1 and 2 in the id column and 1 is updated to 2 before 2 is updated to 3, an error occurs. To avoid this problem, add an ORDER BY clause to cause the rows with larger id values to be updated before those with smaller values.

In a **SET** statement, = is treated identically to :=

Note:

Here c1 column is a Primary Key

- UPDATE temp SET c1 = c1 - 1 ORDER BY c1 ASC; # In case of decrement
- UPDATE temp SET c1 = c1 + 1 ORDER BY c1 DESC; # In case of increment

single-table update

UPDATE is used to change/modify the values of some attributes of one or more selected tuples.

- SET @x := 0;
- UPDATE emp SET id = @x := @x + 1;
- UPDATE t, (SELECT isactive, COUNT(isactive) r1 FROM emp GROUP BY isactive) a SET t.c2 = a.r1 WHERE t.c1 = a.isactive;

```
mysql> SELECT * FROM t;
+-------+--------+        +-------+------+
| c1    | c2     |        | c1    | c2   |
+-------+--------+        +-------+------+
|   0   | NULL |          |   0   |   6  |
|   1   | NULL |          |   1   |  14  |
+-------+--------+        +-------+------+
```

e.g.

1. Update top 2 rows.
2. Update UnitPrice for the top 5 most expensive products.

single-table update

The UPDATE statement updates columns of existing rows in the named table with new values. The SET clause indicates which columns to modify and the values they should be given. The **WHERE** clause, if given, specifies the conditions that identify which rows to update. With **no WHERE** clause, all rows are updated. If the **ORDER BY** clause is specified, the rows are updated in the order that is specified. The **LIMIT** clause places a limit on the number of rows that can be updated.

```
UPDATE tbl_name SET col_name1 = { expr1 | DEFAULT } [, col_name2 = { expr2 | DEFAULT } ] . . .
    [WHERE where_condition]
    [ORDER BY . . .]
    [LIMIT row_count]
```

- UPDATE temp SET dname = 'new_value' LIMIT 2;
- UPDATE temp SET c1 = 'new_value' ORDER BY loc LIMIT 2;
- UPDATE temp SET c1 := 'new_value' WHERE deptno < 50;
- UPDATE temp SET c1 := 'new_value' WHERE deptno < 50 LIMIT 2;
- ALTER TABLE dept ADD SUMSALARY INT;
- UPDATE dept SET sumsalary = (SELECT SUM(sal) FROM emp WHERE emp.deptno = dept.deptno GROUP BY emp.deptno);
- UPDATE candidate SET totalvotes = (SELECT COUNT(*) FROM votes WHERE candidate.id = votes.candidateID GROUP BY votes.candidateID);

- UPDATE duplicate SET id = (SELECT @cnt := @cnt + 1);

single-table delete

DELETE is used to delete tuples from a relation.

single-table delete

The DELETE statement deletes rows from tbl_name and returns the number of deleted rows. To check the number of deleted rows, call the *ROW_COUNT()* function. The optional WHERE clause identify which rows to delete. With no WHERE clause, all rows are deleted. If the ORDER BY clause is specified, the rows are deleted in the order that is specified. The LIMIT clause places a limit on the number of rows that can be deleted.

```
DELETE FROM tbl_name
   [PARTITION (partition_name [, partition_name] . . .)]
   [WHERE where_condition]
   [ORDER BY . . .]
   [LIMIT row_count]
```

Note:

- LIMIT clauses apply to single-table deletes, but not multi-table deletes.
- `DELETE FROM temp;`
- `DELETE FROM temp ORDER BY loc LIMIT 2;`
- `DELETE FROM temp WHERE deptno < 50;`
- `DELETE FROM temp WHERE deptno < 50 LIMIT 2;`

auto_increment column

The **AUTO_INCREMENT** attribute can be used to generate a unique number/identity for new rows.

auto_increment

IDENTITY is a synonym to the *LAST_INSERT_ID* variable.

col_name data_type AUTO_INCREMENT [UNIQUE [KEY] | [PRIMARY] KEY]

Remember:

- There can be only one AUTO_INCREMENT column per table.
- it must be indexed.
- it cannot have a DEFAULT value.
- it works properly only if it contains only positive values.
- It applies only to integer and floating-point types.
- when you insert a value of NULL or 0 into AUTO_INCREMENT column, it generates next value.
- *use LAST_INSERT_ID*() function to find the row that contains the most recent AUTO_INCREMENT value.

- SELECT @@IDENTITY
- SELECT LAST_INSERT_ID()
- SET INSERT_ID = 7

- ```
  CREATE TABLE posts (
    c1 INT UNIQUE KEY AUTO_INCREMENT,
    c2 VARCHAR(20)
  ) AUTO_INCREMENT = 2;      // auto_number will start with value 2.
  ```
  ```

auto_increment

The **auto_increment** specifies a **auto_increment** value for the column.

- ```
  CREATE TABLE posts (
    postID INT AUTO_INCREMENT UNIQUE KEY,
    postTitle VARCHAR(255),
    postDate DATETIME DEFAULT NOW(),
    deleted INT
  );
  ```

Field	Type	Null	Key	Default	Extra
postID	int	NO	PRI	NULL	auto_increment
postTitle	varchar(255)	YES		NULL	
postDate	datetime	YES		CURRENT_TIMESTAMP	DEFAULT_GENERATED
deleted	int	YES		NULL	

- ```
  CREATE TABLE comments (
    commentID INT AUTO_INCREMENT PRIMARY KEY,
    comment TEXT,
    commentDate DATETIME DEFAULT NOW(),
    deleted INT
  );
  ```

Field	Type	Null	Key	Default	Extra
commentID	int	NO	PRI	NULL	auto_increment
comment	text	YES		NULL	
commentDate	datetime	YES		CURRENT_TIMESTAMP	DEFAULT_GENERATED
deleted	int	YES		NULL	

- **CREATE TABLE . . . LIKE . . .**, the destination table *preserves generated column information* from the original table.
- **CREATE TABLE . . . SELECT . . .**, the destination table *does not preserves generated column information* from the original table.

generated column

Remember:

- Stored functions and user-defined functions are not permitted.
- Stored procedure and function parameters are not permitted.
- Variables (system variables, user-defined variables, and stored program local variables) are not permitted.
- Subqueries are not permitted.
- The AUTO_INCREMENT attribute cannot be used in a generated column definition.
- Triggers cannot use NEW.COL_NAME or use OLD.COL_NAME to refer to generated columns.
- Stored column cannot be converted to virtual column and virtual column cannot be converted to stored column.
- Generated column can be made as invisible column.

Note:

- The expression can contain literals, built-in functions with no parameters, operators, or references to any column within the same table. If you use a function, it must be scalar and deterministic.

virtual column - generated always

col_name data_type [GENERATED ALWAYS] AS (*expression*) [VIRTUAL | STORED]

- **VIRTUAL**: Column values are not stored, but are evaluated when rows are read, immediately after any BEFORE triggers. A virtual column takes no storage.
- **STORED**: Column values are evaluated and stored when rows are inserted or updated. A stored column does require storage space and can be indexed.

Note:

- The default is **VIRTUAL** if neither keyword is specified.

Field	Type	Null	Key	Default	Extra
productCode	int	NO	PRI	NULL	auto_increment
productName	varchar(45)	YES		NULL	
productVendor	varchar(45)	YES		NULL	
productDescription	text	YES		NULL	
quantityInStock	int	YES		NULL	
buyPrice	float	YES		NULL	
stockValue	float	YES		NULL	VIRTUAL GENERATED

- ```
  CREATE TABLE product(
    productCode INT AUTO_INCREMENT PRIMARY KEY,
    productName VARCHAR(45),
    productVendor VARCHAR(45),
    productDescription TEXT,
    quantityInStock INT,
    buyPrice FLOAT,
    stockValue FLOAT GENERATED ALWAYS AS(quantityInStock * buyPrice) VIRTUAL
  );
  ```
  ```

visible / invisible columns

Columns are visible by default. To explicitly specify visibility for a new column, use a VISIBLE or INVISIBLE keyword as part of the column definition for CREATE TABLE or ALTER TABLE.

Note:

- An invisible column is normally hidden to queries, but can be accessed if explicitly referenced. Prior to MySQL 8.0.23, all columns are visible.
- A table must have at least one visible column. Attempting to make all columns invisible produces an error.
- SELECT * does not include invisible columns.

invisible column

col_name data_type INVISIBLE

```
CREATE TABLE employee (
    ID INT AUTO_INCREMENT PRIMARY KEY,
    firstName VARCHAR(40),
    salary INT,
    commission INT,
    total INT DEFAULT(salary + commission) INVISIBLE
    tax INT GENERATED ALWAYS AS (total * .25) VIRTUAL INVISIBLE
) ;
```

```
CREATE TABLE employee (
    ID INT PRIMARY KEY AUTO_INCREMENT INVISIBLE ,
    firstName VARCHAR(40)
) ;
```

- `INSERT INTO employee(firstName, salary, commission) VALUES('ram', 4700, -700);`
- `INSERT INTO employee(firstName, salary, commission) VALUES('pankaj', 3400, NULL);`
- `INSERT INTO employee(firstName, salary, commission) VALUES('rajan', 3200, 250);`
- `INSERT INTO employee(firstName, salary, commission) VALUES('ninad', 2600, 0);`
- `INSERT INTO employee(firstName, salary, commission) VALUES('omkar', 4500, 300);`
- `SELECT * FROM employee;`

- `ALTER TABLE employee MODIFY total INT VISIBLE;`
- `ALTER TABLE employee MODIFY total INT INVISIBLE;`

varbinary column

TODO

Note:

- TODO
- TODO
- TODO

varbinary column

col_name VARBINARY

```
CREATE TABLE login (
    ID INT AUTO_INCREMENT PRIMARY KEY,
    userName VARCHAR(40),
    password VARBINARY(40) INVISIBLE
) ;
```

- INSERT INTO login(userName, password) VALUES('ram', 'ram@123');
- INSERT INTO login(userName, password) VALUES('pankaj', 'pankaj');
- INSERT INTO login(userName, password) VALUES('rajan', 'rajan');
- INSERT INTO login(userName, password) VALUES('ninad', 'ninad');
- INSERT INTO login(userName, password) VALUES('omkar', 'omkar');

- SELECT * FROM login;
- SELECT username, CAST(password as CHAR) FROM login;

constraints

CONSTRAINT is used to define rules to allow or restrict what values can be stored in columns. The purpose of inducing constraints is to enforce the integrity of a database.

CONSTRAINTS can be classified into two types –

- *Column Level*
- *Table Level*

The column level constraints can apply only to one column where as table level constraints are applied to the entire table.

Remember:

- PRI => primary key
- UNI => unique key
- MUL=> is basically an index that is neither a **primary key** nor a **unique key**. The name comes from "multiple" because multiple occurrences of the same value are allowed.

constraints

To limit or to restrict or to check or to control.

Note:

- a table with a foreign key that references another table's primary key is **MUL**.
- If more than one of the Key values applies to a given column of a table, Key displays the one with the highest priority, in the order **PRI**, **UNI**, and **MUL**.

Keys are used to establish relationships between tables and also to uniquely identify any record in the table.

types of Keys?

r = Employee(EmployeeID, FullName, job, salary, PAN, DateOfBirth, emailID, deptno)

- **Candidate Key:** are individual columns in a table that qualifies for uniqueness of all the rows. Here in Employee table EmployeeID, PAN or emailID are Candidate keys.
- **Primary Key**: is the columns you choose to maintain uniqueness in a table. Here in Employee table you can choose either EmployeeID, PAN or emailID columns, EmployeeID is preferable choice.
- **Alternate Key**: Candidate column other the primary key column, like if EmployeeID is primary key then , PAN or emailID columns would be the Alternate key.
- **Super Key**: If you add any other column to a primary key then it become a super key, like EmployeeID + FullName is a Super Key.
- **Composite Key**: If a table do not have any single column that qualifies for a Candidate key, then you have to select 2 or more columns to make a row unique. Like if there is no EmployeeID, PAN or emailID columns, then you can make FullName + DateOfBirth as Composite key. But still there can be a narrow chance of duplicate row.

Candidate Key

Primary Key

EmployeeID	FullName	job	salary	PAN	DateOfBirth	emailID	DEPTNO
1	Suraj	Manager	34500	AJD5124D	1980-01-10	suraj.yadav@gmail.com	10
2	Anil	Salesman	26500	AJD5134D	1984-06-23	anit.sharma.hotmail.com	20
3	Saleel	Clerk	97400	AJD5144D	1982-07-25	saleel.bagde@gmail.com	10
4	Sharmin	Designer	74890	AJD5154D	1983-10-08	sharminbagde@gmail.com	20
5	Anil	Programmer	53788	AJD5164D	1983-11-19	anil.123gmail.com	30
6	Suraj	Salesman	43750	AJD5174D	1980-07-19	suraj.kumar@yahoomail.com	20

Composite Key

Alternate Key

Remember:

- A primary key cannot be NULL.
- A primary key value must be unique.
- A table has only one primary key.
- The primary key values cannot be changed, if it is referred by some other column.
- The primary key must be given a value when a new record is inserted.
- **An index can consist of 16 columns, at maximum. Since a PRIMARY KEY constraint automatically adds an index, it can't have more than 16 columns.**

PRIMARY KEY constraint

Choosing a primary key is one of the most important steps in good database design. A primary key is a column that serves a special purpose. A primary key is a special column (or set of combined columns) in a relational database table, that is used to uniquely identify each record. Each database table needs a primary key.

Note:

- Primary key in a relation is always associated with an **INDEX** object.
- If, we give on a column a combination of **NOT NULL & UNIQUE** key then it behaves like a PRIMARY key.
- If, we give on a column a combination of **UNIQUE key & AUTO_INCREMENT** then also it behaves like a PRIMARY key.
- Stability: The value of the primary key should be stable over time and not change frequently.

clustered and non-clustered index

Indexing in MySQL is a process that helps us to return the requested data from the table very fast. If the table does not have an index, it scans the whole table for the requested data.

MySQL allows two different types of Indexing:

- Clustered Index
- Non-Clustered Index

Clustered Index:- The InnoDB table uses a clustered index for optimizing the speed of most common lookups (SELECT statement) and DML operations like INSERT, UPDATE, and DELETE command. Clustered indexes sort and store the data rows in the table based on their key values that can be sorted in only one way. If the table column contains a primary key or unique key, MySQL creates a clustered index named PRIMARY based on that specific column.

Non-Clustered Index:- The indexes other than PRIMARY indexes (i.e. clustered indexes) called a non-clustered index. The non-clustered indexes are also known as secondary indexes. The non-clustered index and table data are both stored in different places. It is not sorted (ordering) the table data.

- CREATE TABLE test(c1 INT, c2 INT, c3 INT, c4 INT,c5 INT, c6 INT, c7 INT, c8 INT, c9 INT, c10 INT, c11 INT, c12 INT, c13 INT, c14 INT, c15 INT, c16 INT, c17 INT, c18 INT, c19 INT, c20 INT, PRIMARY KEY (c1, c2, c3, c4, c5, c6, c7, c8, c9, c10, c11, c12, c13, c14, c15, c16, c17, c18)); // error

constraints – add primary key

col_name data_type PRIMARY KEY

The following example creates tables with **PRIMARY KEY** column.

```
CREATE TABLE users (
  ID INT PRIMARY KEY,
  userName VARCHAR(25),
  password VARCHAR(25),
  email VARCHAR(255)
) ;
```

```
CREATE TABLE purchase_orders (
  po_number INT,
  vendor_id INT NOT NULL,
  po_status INT NOT NULL,
  PRIMARY KEY(po_number)
);
```

```
CREATE TABLE supplier (
 supplier_id INT,
 supplier_name VARCHAR(50),
 contact_name VARCHAR(50),
 constraint pk_supplier_id PRIMARY KEY(supplier_id)
);
```

```
CREATE TABLE person (
  ID INT NOT NULL UNIQUE,
  lastName VARCHAR(45),
  firstName VARCHAR(45),
  age INT,
  email VARCHAR(255)
);
```

constraints – add composite primary key

The following example creates tables with **COMPOSITE PRIMARY KEY** column.

- ```
  CREATE TABLE salesDetails (
   customerID INT,
   productID INT,
   timeID INT,
   qty INT,
   salesDate DATE,
   salesAmount INT,
   PRIMARY KEY(customerID , productID, timeID)
  ) ;
  ```

customerID	productID	timeID	quantity	salesDate	salesAmount
Cust-001	PRD-1	D1-T1	100	●●●●●●	25,00,000
Cust-001	PRD-1	D2-T1	100	●●●●●●	25,00,000
Cust-001	PRD-2	D1-T1	200	●●●●●●	50,00,000
Cust-002	PRD-1	D1-T1	100	●●●●●●	25,00,000
Cust-004	PRD-1	D1-T1	100	●●●●●●	25,00,000
Cust-004	PRD-2	D3-T1	200	●●●●●●	50,00,000
  ```

constraints – add composite primary key

The following example creates tables with **COMPOSITE PRIMARY KEY** column.

- ```
  CREATE TABLE payments (
    paymentID INT,
    orderID INT,
    amount INT,
    bankDetails VARCHAR(255),
    PRIMARY KEY(paymentID , orderID)
  ) ;
  ```

- ```
  CREATE TABLE order_product (
    orderID INT,
    productID INT,
    qty INT,
    rate INT,
    constraint pk_orderID_productID PRIMARY KEY(orderID, productID)
  ) ;
  ```

Try It

```
CREATE TABLE try(c1 INT,c2 INT,c3 INT,c4 INT,c5 INT,c6 INT,c7
INT,c8 INT,c9 INT,c10 INT,c11 INT,c12 INT,c13 INT,c14 INT,c15
INT,c16 INT,c17 INT,c18 INT,c19 INT,c20 INT,c21 INT,c22 INT,c23
INT,c24 INT,c25 INT,c26 INT,c27 INT,c28 INT,c29 INT,c30 INT,c31
INT,c32 INT,c33 INT, PRIMARY KEY(c1, c2, c3, c4, c5, c6, c7, c8,
c9, c10, c11, c12, c13, c14, c15, c16, c17));
```

```
ALTER TABLE table_name
  ADD [ CONSTRAINT constraint_name ]
    PRIMARY KEY (column1, column2, . . . column_n)
```

Add Primary Key using Alter

constraints – add primary key using alter

You can use the **ALTER TABLE** statement to **ADD PRIMARY KEY** on existing column.

```
ALTER TABLE table_name
 ADD [ CONSTRAINT constraint_name ]
  PRIMARY KEY (column1, column2, . . . column_n)
```

- ```
  CREATE TABLE vendors (
    vendor_id INT,
    vendor_name VARCHAR(25),
    address VARCHAR(255)
  );
  ```
- `ALTER TABLE vendors ADD PRIMARY KEY(vendor_id);`
- `ALTER TABLE vendors ADD constraint pk_vendor_id PRIMARY KEY(vendor_id);`
  ```

```
ALTER TABLE table_name
  DROP PRIMARY KEY
```

Drop Primary Key

constraints – drop primary key

You can use the **ALTER TABLE** statement to **DROP PRIMARY KEY**.

```
ALTER TABLE table_name
 DROP PRIMARY KEY
```

- ```
  CREATE TABLE vendors (
    vendor_id INT,
    vendor_name VARCHAR(25),
    address VARCHAR(255)
  );
  ```

```
ALTER TABLE vendors DROP PRIMARY KEY;
```
```

Remember:

- A unique key can be NULL.
- A unique key value must be unique.
- A table can have multiple unique key.
- A column can have unique key as well as a primary key.

UNIQUE KEY constraint

A **UNIQUE key** constraint is a set of one or more than one fields/columns of a table that uniquely identify a record in a database table.

Note:

- Unique key in a relation is always associated with an ***INDEX*** object.

constraints – add unique key

col_name data_type UNIQUE KEY

The following example creates table with **UNIQUE KEY** column.

- ```
  CREATE TABLE clients (
     client_id INT,
     first_name VARCHAR(50),
     last_name VARCHAR(50),
     company_name VARCHAR(255),
     email VARCHAR(255) UNIQUE
  );
  ```

- ```
  CREATE TABLE brands (
    ID INT,
    brandName VARCHAR(30),
    constraint uni_brandName UNIQUE(brandName)
   );
  ```

- ```
  SHOW  INDEX FROM clients;
  ```

- ```
  CREATE TABLE contacts (
     ID INT,
     first_name VARCHAR(50),
     last_name VARCHAR(50),
     phone VARCHAR(15),
     UNIQUE(phone)
  );
  ```

```
ALTER TABLE table_name
  ADD [ CONSTRAINT constraint_name ]
    UNIQUE (column1, column2, . . . column_n)
```

Add Unique Key using Alter

constraints – add unique key using alter

You can use the **ALTER TABLE** statement to **ADD UNIQUE KEY** on existing column.

```
ALTER TABLE table_name
 ADD [ CONSTRAINT constraint_name ]
  UNIQUE (column1, column2, . . . column_n)
```

- ```
  CREATE TABLE shop (
    ID INT,
    shop_name VARCHAR(30)
  );
  ```

- `ALTER TABLE shop ADD UNIQUE(shop_name);`
- `ALTER TABLE shop ADD constraint uni_shop_name UNIQUE(shop_name);`
  ```

```
ALTER TABLE table_name
  DROP INDEX constraint_name;
```

Drop Unique Key

constraints – drop unique key

You can use the **ALTER TABLE** statement to **DROP UNIQUE KEY**.

```
ALTER TABLE table_name
 DROP INDEX constraint_name;
```

- ```
  SELECT table_name, constraint_name, constraint_type FROM information_schema.table_constraints WHERE constraint_schema = 'z' AND table_name IN ('A', 'B');
  ```

- `ALTER TABLE users DROP INDEX <COLUMN_NAME>;`
- `ALTER TABLE users DROP INDEX U_USER_ID;      #CONSTRAINT NAME`

- ```
  CREATE TABLE users (
    ID INT PRIMARY KEY,
    userName VARCHAR(40),
    password VARCHAR(255),
    email VARCHAR(255) UNIQUE KEY
  ) ;
  ```

- ```
  CREATE TABLE users (
    ID INT PRIMARY KEY,
    userName VARCHAR(40),
    password VARCHAR(255),
    email VARCHAR(255),
    constraint uni_email UNIQUE KEY(email)
  ) ;
  ```

- `ALTER TABLE users DROP INDEX email;`
- `ALTER TABLE users DROP INDEX uni_email;`
  ```

FOREIGN KEY constraint

A **FOREIGN KEY** is a **key** used to link two tables together. A **FOREIGN KEY** is a field (or collection of fields) in one table that refers to the PRIMARY **KEY** in another table. The table containing the **foreign key** is called the child table, and the table containing the candidate **key** is called the referenced or parent table.

constraints – foreign key

Remember:

- A foreign key can have a different column name from its primary key.
- DataType of primary key and foreign key column must be same.
- It ensures rows in one table have corresponding rows in another.
- Unlike the Primary key, they do not have to be unique.
- Foreign keys can be null even though primary keys can not.

Note:

- The table containing the FOREIGN KEY is referred to as the child table, and the table containing the PRIMARY KEY (referenced key) is the parent table.
- PARENT and CHILD tables must use the same storage engine,
- and they cannot be defined as temporary tables.

insert, update, & delete – (primary key/foreign key)

A referential constraint could be violated in following cases.

- An **INSERT** attempt to add a row to a child table that has a value in its foreign key columns that does not match a value in the corresponding parent table's column.
- An **UPDATE** attempt to change the value in a child table's foreign key columns to a value that has no matching value in the corresponding parent table's parent key.
- An **UPDATE** attempt to change the value in a parent table's parent key to a value that does not have a matching value in a child table's foreign key columns.
- A **DELETE** attempt to remove a record from a parent table that has a matching value in a child table's foreign key columns.

Note:

- PARENT and CHILD tables must use the same storage engine,
- and they cannot be defined as temporary tables.
- If we don't give constraint name. System will automatically generated the constraint name and will assign to foreign key constraint. **e.g. login_ibfk_1, login_ibfk_2, …..**

anomaly – (primary key/foreign key)

Remember:

Student (parent) Table

RollNo	Name	Mobile	City	State	isActive
1	Ramesh	●●●●	Pune	MH	1
2	Amit	●●●●	Baroda	GJ	1
3	Rajan	●●●●	Surat	GJ	1
4	Bhavin	●●●●	Baroda	GJ	1
5	Pankaj	●●●●	Surat	GJ	1

student_course (child) Table

RollNo	CourceDuration	CourceName
1	1.5 month	RDBMS
2	1.2 month	NoSQL
3	2 month	Networking
1	2 month	Java
2	2 month	.NET

Insertion anomaly:

- If we try to insert a record in Student_Course (child) table with RollNo = 7, it will not allow.

Updation and Deletion anomaly:

- If you try to chance the RollNo from Student (parent) table with RollNo = 6 whose RollNo = 1 , it will not allow.
- If you try to chance the RollNo from Student_Course (child) table with RollNo = 9 whose RollNo = 3 , it will not allow.
- If we try to delete a record from Student (parent) table with RollNo = 1, it will not allow.

alter, drop – (primary key/foreign key)

Remember:

Parent Table

```
student  = {
   rollno INT,  * (PK)
   name VARCHAR(10),
   mobile VARCHAR(10),
   city VARCHAR(10),
   state VARCHAR(10),
   isActive BOOL
}
```

Child Table

```
student_course = {
   rollno INT,   * (FK)
   courceduration VARCHAR(10),
   courcename VARCHAR(10)
}
```

DDL command could be violated in following cases.

Alter command:

- If we try to modify datatype of RollNo in Student or Student_Course table with VARCHAR, it will not allow.
- If we try to apply auto_increment to RollNo in Student table, it will not allow
- If we try to drop RollNo column from Student table , it will not allow.

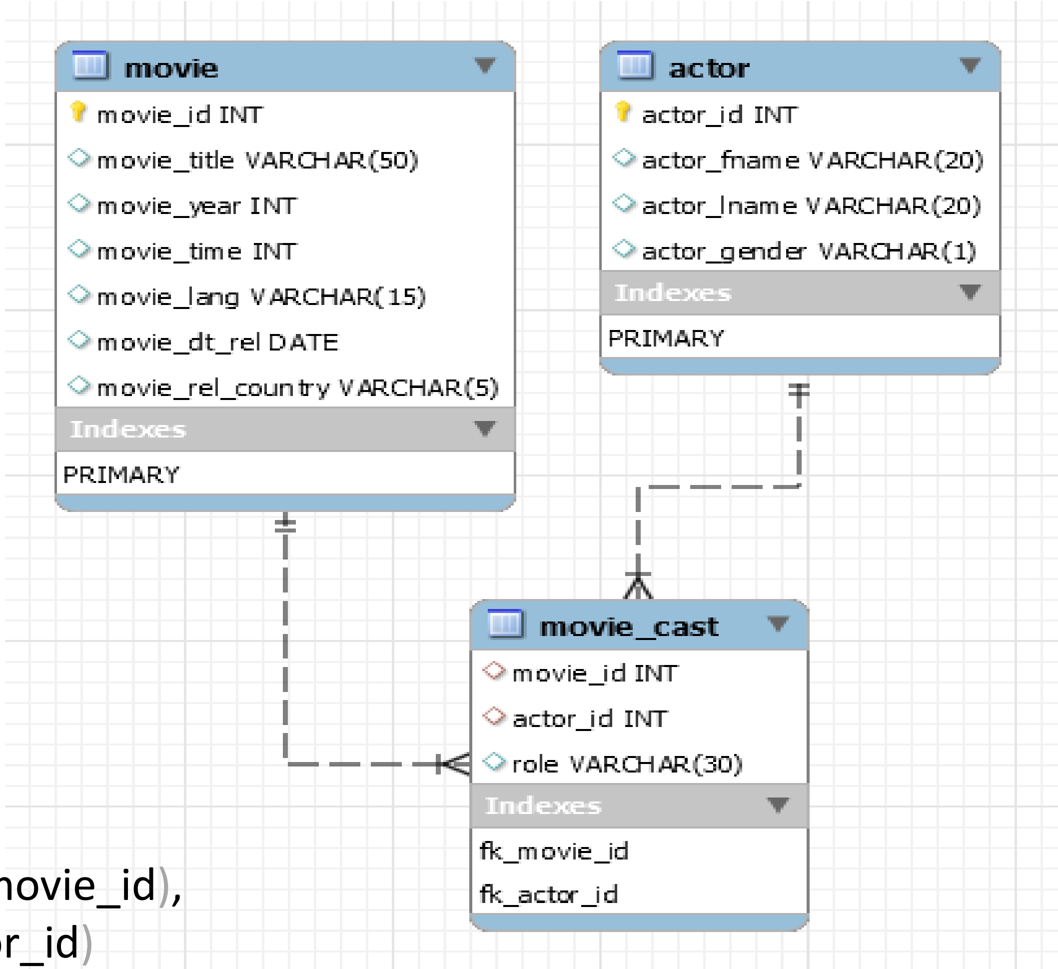
Drop command:

- If we try to drop Student (parent) table, it will not allow.

constraints – foreign key

A foreign key is a field in a table that matches another field of another table. A foreign key places constraints on data in the related tables, which enables MySQL to maintain referential integrity.

- ```
  CREATE TABLE movie (
    movie_id INT PRIMARY KEY,
    movie_title VARCHAR(50),
    movie_year INT,
    movie_time INT,
    movie_lang VARCHAR(15),
    movie_dt_rel DATE,
    movie_rel_country VARCHAR(5)
  );
  ```
- ```
  CREATE TABLE actor (
    actor_id INT PRIMARY KEY,
    actor_fname VARCHAR(20),
    actor_lname VARCHAR(20),
    actor_gender VARCHAR(1)
  );
  ```
- ```
  CREATE TABLE movie_cast (
    movie_id INT,
    actor_id INT,
    role VARCHAR(30),
    constraint fk_movie_id FOREIGN KEY(movie_id) REFERENCES movie(movie_id),
    constraint fk_actor_id FOREIGN KEY(actor_id) REFERENCES actor(actor_id)
  );
  ```


  ```

QUESTION – find foreign key columns

The following example find ***Foreign Key*** columns.

- ```
  CREATE TABLE owner (
    owner_id INT PRIMARY KEY,
    first_name VARCHAR(50),
    last_name VARCHAR(50),
    email VARCHAR(255)
  );
  ```
- ```
  CREATE TABLE contacts (
    contact_id INT PRIMARY KEY,
    owner_id INT,
    contact_number VARCHAR(15)
  );
  ```
- ```
  CREATE TABLE shop (
    shop_id INT,
    owner_id INT,
    shop_name VARCHAR(30)
  );
  ```
- ```
  CREATE TABLE shop_brand (
    ID INT PRIMARY KEY,
    shop_id INT,
    brand_id INT
  );
  ```
- ```
  CREATE TABLE brands (
    brand_id INT PRIMARY KEY,
    brand_name VARCHAR(30) UNIQUE
  );
  ```
  ```

```
ALTER TABLE table_name
  ADD [ CONSTRAINT constraint_name ]
    FOREIGN KEY (child_col1, child_col2, . . . child_col_n)
    REFERENCES parent_table (parent_col1, parent_col2, . . . parent_col_n);
```

Add Foreign Key Constraint using Alter

constraints – add foreign key using alter

You can use the **ALTER TABLE** statement to **ADD FOREIGN KEY** on existing column.

```
ALTER TABLE table_name
 ADD [ CONSTRAINT constraint_name ]
  FOREIGN KEY (child_col1, child_col2, . . . child_col_n)
  REFERENCES parent_table (parent_col1, parent_col2, . . . parent_col_n);
```

```
CREATE TABLE users (
  ID INT PRIMARY KEY,
  userName VARCHAR(40),
  password VARCHAR(255),
  email VARCHAR(255) UNIQUE KEY
) ;
```

```
CREATE TABLE login (
  ID INT PRIMARY KEY,
  userID INT,
  loginDate DATE,
  loginTime TIME
) ;
```

- ALTER TABLE login ADD FOREIGN KEY(userID) REFERENCES users(ID);
- ALTER TABLE login ADD constraint fk_userID FOREIGN KEY(userID) REFERENCES users(ID);

```
ALTER TABLE table_name
  DROP  FOREIGN KEY constraint_name
```

Drop Foreign Key Constraint using Alter

constraints – drop foreign key

You can use the **ALTER TABLE** statement to **DROP FOREIGN KEY**.

```
CREATE TABLE users (
  ID INT PRIMARY KEY ,
  userName VARCHAR(40),
  password VARCHAR(255),
  email VARCHAR(255)
) ;
```

```
CREATE TABLE login (
  ID INT PRIMARY KEY,
  userID INT,
  loginDate DATE,
  loginTime TIME,
  FOREIGN KEY(userID) REFERENCES users(ID)
) ;
```

```
CREATE TABLE login (
  ID INT PRIMARY KEY,
  userID INT,
  loginDate DATE,
  loginTime TIME,
  constraint fk_userID FOREIGN KEY(userID)  REFERENCES users(ID)
) ;
```

- ALTER TABLE login DROP FOREIGN KEY fk_userID;
- ALTER TABLE login DROP FOREIGN KEY login_ibfk_1; **// login_ibfk_1 is the default constraint name.**
- SELECT table_name, constraint_name, constraint_type FROM information_schema.table_constraints WHERE table_schema = 'DB2';

1. CREATE TABLE test (c1 INT, c2 INT, c3 INT, check (c3 = SUM(c1)));

// ERROR

SUM(SAL) MIN(SAL) COUNT(*)

AVG(SAL) MAX(SAL) COUNT(JOB)

Check Constraint

CHECK condition expressions must follow some rules.

- Literals, deterministic built-in functions, and operators are permitted.
- Non-generated and generated columns are permitted, except columns with the AUTO_INCREMENT attribute.
- Sub-queries are not permitted.
- Environmental variables (such as CURRENT_USER, CURRENT_DATE, …) are not permitted.
- Non-Deterministic built-in functions (such as AVG, COUNT, RAND, LAST_INSERT_ID, FIRST_VALUE, LAST_VALUE, ...) are not permitted.
- Variables (system variables, user-defined variables, and stored program local variables) are not permitted.
- Stored functions and user-defined functions are not permitted.

Note:

Prior to MySQL 8.0.16, CREATE TABLE permits only the following limited version of table CHECK constraint syntax, which is parsed and ignored.

Remember:

If you omit the constraint name, MySQL automatically generates a name with the following convention:

- table_name_chk_n

constraints – check

col_name data_type CHECK(expr)

The following example creates **USERS** table with **CHECK** column.

```
CREATE TABLE users (
  ID INT PRIMARY KEY,
  userName VARCHAR(40),
  password VARCHAR(255),
  email VARCHAR(255),
  ratings INT CHECK(ratings > 50)
) ;
```

```
CREATE TABLE users (
  ID INT PRIMARY KEY,
  userName VARCHAR(40),
  password VARCHAR(255),
  email VARCHAR(255),
  ratings INT,
  CHECK(ratings > 50)
) ;
```

```
CREATE TABLE users (
  ID INT PRIMARY KEY,
  userName VARCHAR(40),
  password VARCHAR(255),
  email VARCHAR(255),
  ratings INT,
  constraint chk_ratings CHECK(ratings > 50)
) ;
```

```
CREATE TABLE users (
  ID INT PRIMARY KEY,
  userName VARCHAR(40),
  password VARCHAR(255),
  email VARCHAR(255),
  ratings INT,
  constraint chk_ratings  CHECK(ratings > 50),
  constraint chk_email CHECK(LENGTH(email) > 12)
) ;
```

constraints – check

col_name data_type CHECK(expr)

The following example creates **USERS** table with **CHECK** column.

```
CREATE TABLE users (
  ID INT PRIMARY KEY,
  startDate DATE,
  endDate DATE,
 constraint chk_endDate CHECK(endDate > startDate +  INTERVAL 7 day)
) ;
```

- SELECT * FROM check_constraints WHERE CONSTRAINT_SCHEMA = 'z';

```
ALTER TABLE table_name
 ADD   [ CONSTRAINT constraint_name ]
   CHECK (conidiation)
```

Add Check Constraint using Alter

constraints – add check using alter

You can use the **ALTER TABLE** statement to **ADD CHECK KEY** on existing column.

```
ALTER TABLE table_name
 ADD  CONSTRAINT [ constraint_name ]
  CHECK (conidiation)
```

```
CREATE TABLE users (
  ID INT PRIMARY KEY,
  userName VARCHAR(40),
  password VARCHAR(255),
  email VARCHAR(255),
  ratings INT
) ;
```

- `ALTER TABLE users ADD CHECK(ratings > 50);`
- `ALTER TABLE users ADD constraint chk_ratings CHECK(ratings > 50);`

```
ALTER TABLE table_name
  DROP { CHECK | CONSTRAINT } constraint_name
```

drop check constraint

constraints – drop check key

You can use the **ALTER TABLE** statement to **DROP CHECK KEY**.

```
ALTER TABLE table_name
 DROP { CHECK | CONSTRAINT } constraint_name
```

```
CREATE TABLE users (
  ID INT PRIMARY KEY,
  userName VARCHAR(40),
  password VARCHAR(255),
  email VARCHAR(255),
  ratings INT,
  constraint chk_ratings CHECK(ratings > 50)
) ;
```

- `ALTER TABLE users DROP CHECK chk_ratings;`
- `ALTER TABLE users DROP constraint chk_ratings;`
- `ALTER TABLE users DROP CHECK users_chk_1;`

```
CREATE TABLE users (
  ID INT PRIMARY KEY,
  userName VARCHAR(40),
  password VARCHAR(255),
  email VARCHAR(255),
  ratings INT,
  CHECK(ratings > 50)
) ;
```

- `SELECT table_name, constraint_name, constraint_type FROM information_schema.table_constraints WHERE table_schema = 'DB2' AND (table_name LIKE 'U%' OR table_name LIKE 'L%');`

check with (in, like, and between)

The **CHECK** constraint using IN, LIKE, and BETWEEN.

```
CREATE TABLE users (
  ID INT PRIMARY KEY,
  userName VARCHAR(40),
  password VARCHAR(255) CHECK(LENGTH(password) > 5),
  email VARCHAR(255),
  country VARCHAR(255) CHECK(country LIKE ('I%') OR country LIKE ('U%')),
  ratings INT CHECK(ratings BETWEEN 1 and 5 OR ratings BETWEEN 12 and 25),
  isActive BOOL CHECK(isActive IN (1, 0)),
  startDate DATE,
  endDate DATE,
  constraint chk_endDate CHECK(endDate > startDate +  INTERVAL 7 day)
) ;
```

alter table

ALTER TABLE changes the structure of a table.

Note:

- you can add or delete columns,
- create or destroy indexes,
- change the type of existing columns, or
- rename columns or the table itself.
- You cannot change the position of columns in table structure. If not, then what? create a new table with SELECT statement.

syntax

ALTER TABLE tbl_name

[alter_specification [, alter_specification] . . .

- | ADD [COLUMN] *col_name column_definition* [FIRST | AFTER *col_name*]
- | ADD [COLUMN] (*col_name column_definition*, . . .)
- | ADD {INDEX|KEY} [index_name] (*index_col_name*, . . .)
- | ADD [CONSTRAINT [*symbol*]] PRIMARY KEY
- | ADD [CONSTRAINT [*symbol*]] UNIQUE KEY
- | ADD [CONSTRAINT [*symbol*]] FOREIGN KEY *reference_definition*
- | CHANGE [COLUMN] *old_col_name new_col_name* column_definition [FIRST|AFTER *col_name*]
- | MODIFY [COLUMN] *col_name column_definition* [FIRST | AFTER *col_name*]
- | DROP [COLUMN] *col_name*
- | DROP PRIMARY KEY
- | DROP {INDEX|KEY} *index_name*
- | DROP FOREIGN KEY *fk_symbol*
- | RENAME [TO|AS] *new_tbl_name*
- | RENAME COLUMN *old_col_name* TO *new_col_name*
- | ALTER [COLUMN] *col_name* { SET DEFAULT {*literal* | (*expr*)} | SET {VISIBLE | INVISIBLE} | DROP DEFAULT }

Remember:

- **Change Columns** :- You can rename a column using a CHANGE old_col_name new_col_name column_definition clause. To do so, specify the old and new column names and the definition that the column currently has.
- **Modify Columns :-** You can also use MODIFY to change a column's type without renaming it.
- **Dropping Columns :-** If a table contains only one column, the column cannot be dropped. If columns are dropped from a table, the columns are also removed from any index of which they are a part. If all columns that make up an index are dropped, the index is dropped as well.

Note:

- To convert a table from one storage engine to another, use an ALTER TABLE statement that indicates the new engine:

```
ALTER TABLE tbl_name ENGINE = InnoDB;

ALTER TABLE tbl_name ADD col1 INT, ADD col2 INT;

ALTER TABLE tbl_name DROP COLUMN col1, DROP COLUMN col2 , ADD col3 INT;
```

add column

ALTER TABLE tbl_name [alter_specification [, alter_specification] . . .]

alter_specification

- ADD [COLUMN] col_name column_definition [FIRST | AFTER col_name]
- ADD [COLUMN] (col_name column_definition, . . .)

add column

```
CREATE TABLE vehicles (
    vehicleID INT PRIMARY KEY ,
    year INT,
    make VARCHAR(100)
);
```

	Field	Type	Null	Key	Default	Extra
▶	vehicleID	int	NO	PRI	NULL	
	year	int	YES		NULL	
	make	varchar(100)	YES		NULL	

- INSERT INTO vehicles VALUES (111, 2000, 'Honda');
- INSERT INTO vehicles VALUES (112, 2002, 'Hyundai');
- INSERT INTO vehicles VALUES (113, 2000, 'Jeep');
- INSERT INTO vehicles VALUES (114, 2005, 'Toyota');

```
ALTER TABLE vehicles
    ADD ID INT UNIQUE auto_increment first,
    ADD model VARCHAR(100) not null,
    ADD color VARCHAR(50),
    ADD note VARCHAR(255);
```

	Field	Type	Null	Key	Default	Extra
▶	ID	int	NO	UNI	NULL	auto_increment
	vehicleID	int	NO	PRI	NULL	
	year	int	YES		NULL	
	make	varchar(100)	YES		NULL	
	model	varchar(100)	NO		NULL	
	color	varchar(50)	YES		NULL	
	note	varchar(255)	YES		NULL	

	ID	vehicleID	year	make	model	color	note
▶	1	111	2000	Honda		NULL	NULL
	2	112	2002	Hyundai		NULL	NULL
	3	113	2000	Jeep		NULL	NULL
	4	114	2005	Toyota		NULL	NULL
*	NULL	NULL	NULL	NULL	NULL	NULL	NULL

modify column

ALTER TABLE tbl_name [alter_specification [, alter_specification] ...]

alter_specification

- MODIFY [COLUMN] col_name column_definition [FIRST | AFTER col_name]

modify column

- CREATE TABLE vehicles (
  vehicleID INT PRIMARY KEY ,
  year INT,
  make VARCHAR(100),
  model VARCHAR(100) not null,
  color VARCHAR(50),
  note VARCHAR(255)
  );

	Field	Type	Null	Key	Default	Extra
▶	vehicleID	int	NO	PRI	NULL	
	year	int	YES		NULL	
	make	varchar(100)	YES		NULL	
	model	varchar(100)	NO		NULL	
	color	varchar(50)	YES		NULL	
	note	varchar(255)	YES		NULL	

- ALTER TABLE vehicles
  MODIFY year SMALLINT not null,
  MODIFY make VARCHAR(150) not null,
  MODIFY color VARCHAR(20) not null;

	Field	Type	Null	Key	Default	Extra
▶	vehicleID	int	NO	PRI	NULL	
	year	smallint	NO		NULL	
	make	varchar(150)	NO		NULL	
	model	varchar(100)	NO		NULL	
	color	varchar(20)	NO		NULL	
	note	varchar(255)	YES		NULL	

- INSERT INTO vehicles VALUES (111, 2000, 'Honda', 'A1', 'silver', ' Honda was the first Japanese automobile manufacturer to release a dedicated luxury brand, Acura, in 1986.');
- INSERT INTO vehicles VALUES (112, 2002, 'Hyundai', 'AC1', 'white', ' Hyundai operates the world's largest integrated automobile manufacturing facility in Ulsan, South Korea which has an annual production capacity of 1.6 million units.');
- INSERT INTO vehicles VALUES (113, 2000, 'Jeep', 'D2', 'black', ' Fiat Chrysler Automobiles has owned Jeep since 2014. Previous owners include the Kaiser Jeep Corporation and American Motors Corporation. Most Jeeps are American-made, except for a select few models. The Toledo Assembly Complex in Ohio manufactures the Jeep Wrangler.');

rename column

ALTER TABLE tbl_name [alter_specification [, alter_specification] ...]

alter_specification

- RENAME COLUMN old_col_name TO new_col_name

rename column

- CREATE TABLE vehicles (
  vehicleID INT,
  year SMALLINT,
  make VARCHAR(150),
  model VARCHAR(100),
  color VARCHAR(20),
  note VARCHAR(255)
  );

Field	Type	Null	Key	Default	Extra
vehicleID	int	YES		NULL	
year	smallint	YES		NULL	
make	varchar(150)	YES		NULL	
model	varchar(100)	YES		NULL	
color	varchar(20)	YES		NULL	
note	varchar(255)	YES		NULL	

- ALTER TABLE vehicles
  RENAME COLUMN year TO model_year

Field	Type	Null	Key	Default	Extra
vehicleID	int	YES		NULL	
model_year	int	NO		NULL	
make	varchar(150)	YES		NULL	
model	varchar(100)	YES		NULL	
model_color	varchar(20)	YES		NULL	
vehicleCondition	varchar(150)	YES		NULL	

change column

ALTER TABLE tbl_name [alter_specification [, alter_specification] ...]

alter_specification

- CHANGE [COLUMN] old_col_name new_col_name column_definition [FIRST | AFTER col_name]

change column

- ```
  CREATE TABLE vehicles (
     vehicleID INT,
     year SMALLINT,
     make VARCHAR(150),
     model VARCHAR(100),
     color VARCHAR(20),
     note VARCHAR(255)
  );
  ```

- ```
  ALTER TABLE vehicles
   CHANGE year model_year INT,
   CHANGE color model_color VARCHAR(20),
   CHANGE note vehicleCondition VARCHAR(150);
  ```

Field	Type	Null	Key	Default	Extra
vehicleID	int	YES		NULL	
year	smallint	YES		NULL	
make	varchar(150)	YES		NULL	
model	varchar(100)	YES		NULL	
color	varchar(20)	YES		NULL	
note	varchar(255)	YES		NULL	

Field	Type	Null	Key	Default	Extra
vehicleID	int	YES		NULL	
model_year	int	NO		NULL	
make	varchar(150)	YES		NULL	
model	varchar(100)	YES		NULL	
model_color	varchar(20)	YES		NULL	
vehicleCondition	varchar(150)	YES		NULL	

change column

- ```
  CREATE TABLE users (
    ID INT PRIMARY KEY,
    userName VARCHAR(40),
    password VARCHAR(25),
    email VARCHAR(255)
  ) ;
  ```

- ```
  CREATE TABLE login (
    ID INT PRIMARY KEY,
    userID INT,
    loginDate DATE,
    loginTime TIME,
    constraint fk_userID FOREIGN KEY(userID) REFERENCES users(ID)
  ) ;
  ```

- INSERT INTO users VALUES (1, 'rajan', 'ranaj123', 'rajan447.gmail.com');
- INSERT INTO users VALUES (2, 'raj', 'raj', 'raj.gmail.com');

- INSERT INTO login VALUES (1, 1, curdate(), curtime());
- INSERT INTO login VALUES (2, 1, curdate(), curtime());
- INSERT INTO login VALUES (3, 2, curdate(), curtime());
- INSERT INTO login VALUES (4, NULL, curdate(), curtime());

- ALTER TABLE users CHANGE ID userID INT;
- ALTER TABLE login CHANGE userID UID INT;

- INSERT INTO login VALUES (5, NULL, curdate(), curtime());

drop column

ALTER TABLE tbl_name [alter_specification [, alter_specification] ...]

alter_specification

- DROP [COLUMN] col_name

drop column

- CREATE TABLE vehicles (
    vehicleID INT,
    model_year SMALLINT,
    make VARCHAR(150),
    model VARCHAR(100),
    model_color VARCHAR(20),
    vehicleCondition VARCHAR(150)
  );

	Field	Type	Null	Key	Default	Extra
▶	vehicleID	int	YES		NULL	
	model_year	smallint	YES		NULL	
	make	varchar(150)	YES		NULL	
	model	varchar(100)	YES		NULL	
	model_color	varchar(20)	YES		NULL	
	vehicleCondition	varchar(150)	YES		NULL	

- ALTER TABLE vehicles
    CHANGE model_year year INT not null,
    DROP model,
    DROP model_color,
    DROP vehicleCondition;

	Field	Type	Null	Key	Default	Extra
▶	vehicleID	int	YES		NULL	
	year	int	NO		NULL	
	make	varchar(150)	YES		NULL	

alter table

Sample table

```
CREATE TABLE vehicles (
vehicleID INT PRIMARY KEY ,
year INT,
make VARCHAR(100)
);
```

Add new columns to a table

```
ALTER TABLE vehicles
ADD model VARCHAR(100) NOT NULL,
ADD color VARCHAR(50),
ADD note VARCHAR(255);
```

Modify columns

```
ALTER TABLE vehicles
MODIFY year SMALLINT NOT NULL,
MODIFY color VARCHAR(20) NOT NULL,
MODIFY make VARCHAR(150) NOT NULL;
```

Rename columns

```
ALTER TABLE vehicles
CHANGE year model_year SMALLINT NOT NULL,
CHANGE color model_color VARCHAR(20),
CHANGE note vehicleCondition VARCHAR(150);
```

DROP columns

```
ALTER TABLE vehicles
CHANGE model_year year INT NOT NULL,
DROP model,
DROP model_color,
DROP vehicleCondition;
```

drop table

Remember:

- DROP and TRUNCATE are DDL commands, whereas DELETE is a DML command.
- DELETE operations can be rolled back (undone), while DROP and TRUNCATE operations cannot be rolled back (DDL statements are auto committed).
- Dropping a TABLE also drops any TRIGGERS for the table.
- Dropping a TABLE also drops any INDEX for the table.
- Dropping a TABLE will not drops any VIEW for the table.
- If you try to drop a PARENT/MASTER TABLE, it will not get dropped.

drop table

DROP [TEMPORARY] TABLE [IF EXISTS] tbl_name [, tbl_name] ...

Note:

- All table data and the table definition are removed/dropped.
- If it is desired to delete only the records but to leave the table definition for future use, then the ***DELETE*** command should be used instead of ***DROP TABLE***.

- DROP login;
- DROP TABLE users;
- DROP TABLE login, users;

create table using different engines

create table with engine

- **MEMORY** storage engine tables are visible to another client.
- Structure is stored and rows will be removed, after re-starting mysql server (MYSQL80) from Services.

e.g.
```
CREATE TABLE temp(c1 INT,  c2 INT) ENGINE = MEMORY;
 INSERT INTO temp VALUES(10, 10);
 SELECT * FROM temp;
 re-start mysql server.
 SELECT * FROM temp;
```

- **TEMPORARY** storage engine tables are not visible to another client.
- Structure and rows is removed, after exit.

e.g.
```
CREATE TEMPORARY TABLE temp(c1 INT,  c2 INT);
 INSERT INTO temp VALUES(10, 10);
 SELECT * FROM temp;
 EXIT
```

```
show engines;
set default_storage_engine = memory;
```

- **CSV** storage engine tables are visible to another client.
- The CSV storage engine stores data in text files using comma-separated values format.
- The storage engine for the table doesn't support nullable (NULL) columns.

e.g.
```
CREATE TABLE csv(
    ID INT not null,
    ename VARCHAR(10) not null,
    job VARCHAR(10) not null,
    sal INT not null) ENGINE = CSV;
 INSERT INTO csv VALUES(1, 'saleel', 'manager', 3400);
 SELECT * FROM csv;
```

create table with engine

- **BLACKHOLE** tables are visible to another client.
- storage engine acts as a “black hole” that accepts data but throws it away and does not store it.
- Triggers can be written on this type of tables

e.g.
```
CREATE TABLE temp(c1 INT,  c2 INT) ENGINE = BLACKHOLE;
INSERT INTO temp VALUES(1, 1);
SELECT * FROM temp;
```

-
```
DROP TRIGGER IF EXISTS triggername;
delimiter $$
CREATE TRIGGER triggername BEFRE INSERT ON temp FOR EACH ROW
begin
  INSERT INTO temp1 VALUES (NEW.c1, NEW.c2);
end $$
delimiter ;
```

table partitioning

Original Table

CUSTOMER ID	FIRST NAME	LAST NAME	FAVORITE COLOR
1	TAEKO	OHNUKI	BLUE
2	O.V.	WRIGHT	GREEN
3	SELDA	BAĞCAN	PURPLE
4	JIM	PEPPER	AUBERGINE

Vertical Partitions

VP1

CUSTOMER ID	FIRST NAME	LAST NAME
1	TAEKO	OHNUKI
2	O.V.	WRIGHT
3	SELDA	BAĞCAN
4	JIM	PEPPER

VP2

CUSTOMER ID	FAVORITE COLOR
1	BLUE
2	GREEN
3	PURPLE
4	AUBERGINE

Horizontal Partitions

HP1

CUSTOMER ID	FIRST NAME	LAST NAME	FAVORITE COLOR
1	TAEKO	OHNUKI	BLUE
2	O.V.	WRIGHT	GREEN

HP2

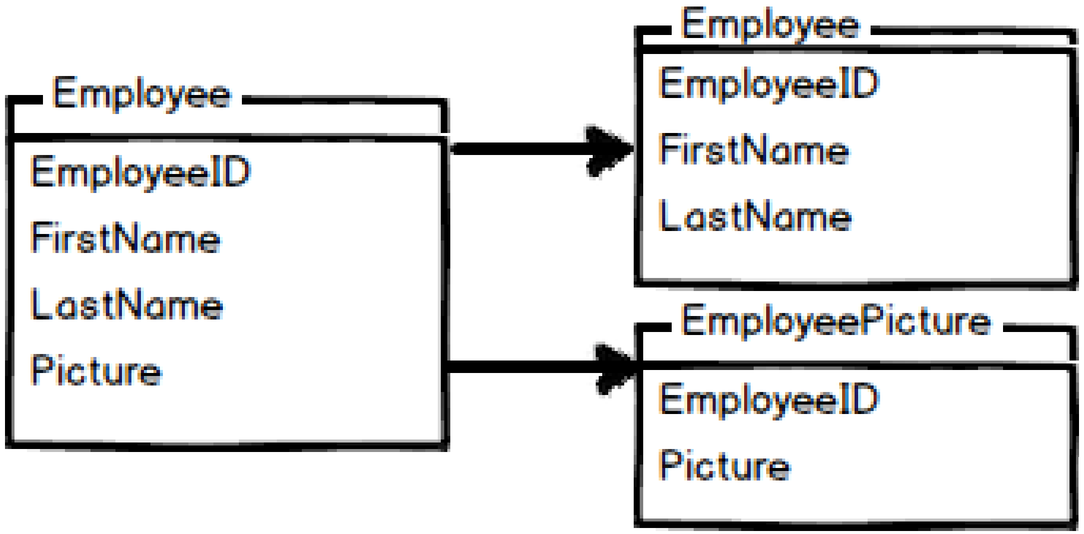
CUSTOMER ID	FIRST NAME	LAST NAME	FAVORITE COLOR
3	SELDA	BAĞCAN	PURPLE
4	JIM	PEPPER	AUBERGINE

table partitioning

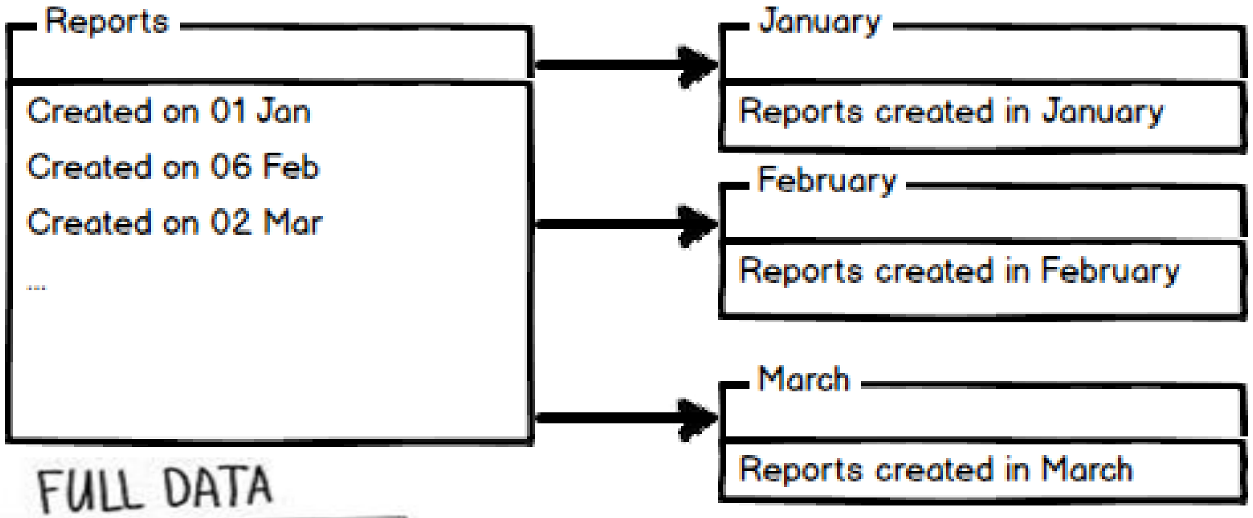
What is a database table partitioning?

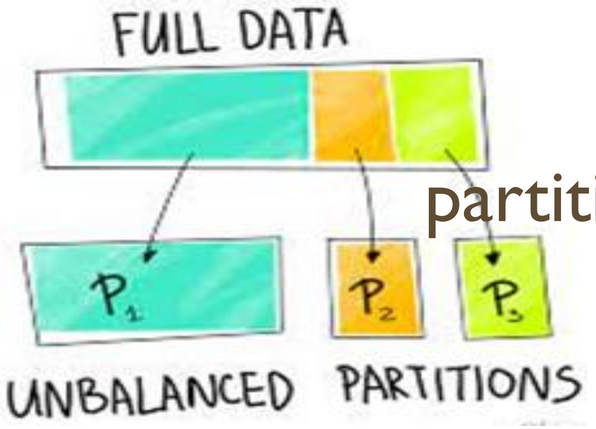
Partitioning is the database process where very large tables are divided into multiple smaller parts. By splitting a large table into smaller, individual tables. The main of goal of partitioning is to aid in maintenance of large tables and to reduce the overall response time to read and load data for particular SQL operations.

Vertical Partitioning



Horizontal Partitioning





partition skew

MySQL has mainly six types of partitioning, which are given below:

- RANGE Partitioning
- LIST Partitioning
- COLUMNS Partitioning
- HASH Partitioning
- KEY Partitioning
- Subpartitioning

RANGE Partitioning

```
e.g. CREATE TABLE employee(
        empno  INT,
        ename  VARCHAR(10),
        salary INT
     )
     PARTITION BY RANGE (salary) (
        PARTITION p0 VALUES LESS THAN (2000),
        PARTITION p1 VALUES LESS THAN (4000),
        PARTITION p2 VALUES LESS THAN (6000),
        PARTITION p3 VALUES LESS THAN MAXVALUE
     );
```

- `INSERT INTO employee PARTITION(p0) VALUES(1, 'saleel', 1500);`
- `SELECT * FROM employee PARTITION(p0);`
- `UPDATE employee PARTITION(p0) set salary = 3000 WHERE empno = 1; // Invalid statement`
- `DELETE FROM employee PARTITION(p0);`

Warehouse	storeID
AC Warehouse	1, 3, 5, 7
National	2, 4, 6, 8
Global	10, 12, 14, 16
Migrant System	11, 13, 15, 17

LIST Partitioning

```
e.g. CREATE TABLE item(
        itemID  INT,
        itemDesc  VARCHAR(10),
        storeID INT
     )
     PARTITION BY LIST(storeID) (
        PARTITION p0 VALUES IN(1, 3, 5, 7),
        PARTITION p1 VALUES IN(2, 4, 6, 8),
        PARTITION p2 VALUES IN(10, 12, 14, 16),
        PARTITION p3 VALUES IN(11, 13, 15, 17)
     );
```

create temporary table

Note:

- it is possible to create, alter, drop, and write (Insert, Update, and Delete rows) to TEMPORARY tables.

temporary table

Remember:

- You can use the *TEMPORARY* keyword when creating a table.
- A *TEMPORARY* table is visible only to the current session, and is dropped automatically when the session is closed.
- Use *TEMPORARY* table with the same name as the original can be useful when you want to try some statements that modify the contents of the table, without changing the original table.
- The permanent (original) table becomes hidden (inaccessible) to the client who creates the *TEMPORARY* table with same name as the original.
- If you issue a DROP TABLE statement, the *TEMPORARY* table is removed and the original table reappears, it is possible, only when then original *tbl_name* and temporary *tbl_name* are same.
- The original table also reappears if you rename the *TEMPORARY* table.

  e.g. ALTER TABLE **dept** RENAME TO d;

  Temporary table_name

temporary table

e.g.

```sql
CREATE TEMPORARY TABLE student (
    ID INT PRIMARY KEY,
    namefirst VARCHAR(45),
    namelast VARCHAR(45),
    DOB DATE,
    emailID VARCHAR(128)
);

CREATE TEMPORARY TABLE temp (
    ID INT PRIMARY KEY,
    firstName VARCHAR(45),
    phone INT,
    city VARCHAR(10) DEFAULT 'PUNE',
    salary INT,
    comm INT,
    total INT GENERATED ALWAYS AS(salary + comm) VIRTUAL
);
```

create temporary table ... like

Use CREATE TABLE ... LIKE to create an empty table based on the definition of another table.

```
CREATE TEMPORARY TABLE [IF NOT EXISTS] new_tbl LIKE orig_tbl;
```

- CREATE TEMPORARY TABLE tempEmployee LIKE employee;

Remember:

- LIKE works only for base tables, not for VIEWS.
- You can use the TEMPORARY keyword when creating a table. A TEMPORARY table is visible only to the current session, and is dropped automatically when the session is closed.
- Use TEMPORARY table with the same name as the original can be useful when you want to try some statements that modify the contents of the table, without changing the original table.

- CREATE TEMPORARY TABLE *new_tbl* SELECT * FROM *orig_tbl* LIMIT 0;

Do not use the * operator in your SELECT statements. Instead, use column names. Reason is that in MySQL Server scans for all column names and replaces the * with all the column names of the table(s) in the SELECT statement. Providing column names avoids this search-and-replace, and enhances performance.

continue with SELECT statement…

```
SELECT what_to_select
FROM which_table
WHERE conditions_to_satisfy;
```

The asterisk symbol “ * ” can be used in the SELECT clause to denote “all attributes.”

- SELECT 'HELLO' ' WORLD';
- SELECT 'HELLO' AS 'WORLD';
- SELECT ename `EmployeeName` FROM emp;
- SELECT ename AS `EmployeeName` FROM emp;

column - alias

A programmer can use an alias to temporarily assign another name to a **column** or **table** for the duration of a ***SELECT*** query**.**

In the selection-list, a quoted column alias can be specified using identifier **(`)** or string quote **(' or ")** characters.

Note:

- Assigning an alias_name does not actually rename the column or table.
- You cannot use alias in an expression.

select statement - alias

SELECT A_1 [[AS] alias_name], A_2 [[AS] alias_name], . . ., A_N FROM *r* [[AS] alias_name]

column-name as new-name

table-name as new-name

Remember:

- A select_expr can be given an alias using **AS alias_name**. The alias is used as the expression's column name and can be used in **GROUP BY, HAVING,** or **ORDER BY** clauses.
- The **AS** keyword is optional when aliasing a select_expr with an identifier.
- Standard SQL **disallows** references to column aliases in a ***WHERE*** clause.
- A table reference can be aliased using **tbl_name alias_name** or **tbl_name AS alias_name**
- If the column alias contains spaces, **put it in quotes**.
- Alias name is **max 256 characters**.

- SELECT empno AS EmployeeID, ename EmployeeName FROM emp;
- SELECT ID AS 'Employee ID', ename "Employee Name" FROM emp;
- SELECT * FROM emp employee;

comparison functions and operator

Comparison operations result in a value of 1 **(TRUE),** 0 **(FALSE)**, or **NULL**.

assignment _operator

= (assignment), :=

- The value on the right hand side may be a literal value, another variable storing a value, or any legal expression that yields a scalar value, including the result of a query (provided that this value is a scalar value). You can perform multiple assignments in the same SET statement. You can perform multiple assignments in the same statement.
- Unlike **=,** the **:=** operator is never interpreted as a comparison operator. This means you can use := in any valid SQL statement (not just in SET statements) to assign a value to a variable.

comparison functions and operator

1. ***arithmetic_operators:***
   * | / | DIV | % |MOD | - | +
2. ***comparison_operator:***
   = | <=> | >= | > | <= | < | <> | !=
3. ***boolean_ predicate:***
   IS [NOT] *NULL*
   | *expr* <=> *null*
4. ***predicate*:**
   expr [NOT] LIKE *expr* [ESCAPE *char*]
   | *expr* [NOT] IN (*expr1, expr2, . . .*)
   | *expr* [NOT] IN (*subquery*)
   | *expr* [NOT] BETWEEN *expr1* AND *expr2*
5. ***logical_operators***
   { AND | && } | { OR | || }
6. ***assignment _operator***
   = (assignment), :=

operand meaning: the quantity on which an operation is to be done.

e.g.

1. *operand1* * *operand2*
2. *operand1* = *operand2*
3. *operand* IS [NOT] *NULL*
4. *operand* [NOT] LIKE 'pattern'
5. *expr* AND *expr*
6. *Operand := 1001*

- SELECT 23 DIV 6 ; #3
- SELECT 23 / 6 ; #3 .8333

Note:

- AND has higher precedence than OR.

- WHERE col * 4 < 16
- WHERE col < 16 / 4

- SELECT CONCAT(1, "saleel");

column - expressions

"Strings are automatically converted to numbers and numbers to strings as necessary." This means that in order to compare a string to a number, it tries to parse a number from the start of the string. In this case there is no number there, so it converts to 0, and 0 = 0 is true.

select statement - expressions

Column EXPRESSIONS

SELECT A_1, A_2, A_3, A_4, expressions, . . . FROM *r*

- SELECT 1001 + 1;
- SELECT 1001 + '1';
- SELECT '1' + '1' ;
- SELECT '1' + 'a1';
- SELECT '1' + '1a';
- SELECT 'a1' + 1;
- SELECT '1a' + 1;
- SELECT 1 + -1;
- SELECT 1 + -2;
- SELECT -1 + -1;
- SELECT -1 - 1;

- SELECT -1 - -1;
- SELECT 123 * 1;
- SELECT -123 * 1;
- SELECT 123 * -1 ;
- SELECT -123 * -1;
- SELECT 2 * 0;
- SELECT 2435 / 1;
- SELECT 2 / 0;
- SELECT '2435Saleel' / 1;

- SELECT sal, sal + 1000 AS 'New Salary' FROM emp;
- SELECT sal, comm, sal + comm FROM emp;
- SELECT sal, comm, sal + IFNULL(comm, 0) FROM emp;
- SELECT ename, ename = ename FROM emp;
- SELECT ename, ename = 'smith' FROM emp;
- SELECT c1, c1 / 1 R1 FROM numberString;

Note:

If any expression evaluated with NULL, returns NULL.

- SELECT 2 + NULL ;
- SELECT 2 - NULL ;

- SELECT 2 * NULL ;
- SELECT 2 / NULL ;

coalesce()

Return the first non-NULL argument

coalesce()

TODO

- SELECT primaryphone, bphone, cphone, hphone, IFNULL(COALESCE(bphone, cphone, hphone), 'Contact customer care') 'Active Phone' FROM coalesce;

Note:

In SQL, the same name can be used for two (or more) attributes as long as the attributes are in different relations. If this is the case, and a multi-table query refers to two or more attributes with the same name, we must ***qualify*** the attribute name with the relation name to prevent ambiguity. This is done by prefixing the relation name to the attribute name and separating the two by a period (**.**).

identifiers

Certain objects within MySQL, including database, table, index, column, alias, view, stored procedure, stored functions, triggers, partition, tablespace, and other object names are known as **identifiers**.

identifiers

The maximum length for each type of identifiers like (Database, Table, Column, Index, Constraint, View, Stored Program, Compound Statement Label, User-Defined Variable, Tablespace) is 64 characters, whereas for Alias is 256 characters.

- You can refer to a table within the default database as
  1. tbl_name
  2. db_name.tbl_name.

- You can refer to a column as
  1. col_name
  2. tbl_name.col_name
  3. db_name.tbl_name.col_name.

Note:

- You need not specify a ***tbl_name*** or ***db_name.tbl_name*** prefix for a column reference unless the reference would be ambiguous.
- The identifier quote character is the backtick (`)

- DATEDIFF(CURDATE(), hiredate) / 365.25

datetime functions

sysdate(), now(), curdate(), curtime()

In MySQL, the **NOW()** function returns a default value for a **DATETIME**.
MySQL inserts the current **date and time** into the column whose default value is NOW().

In MySQL, the **CURDATE()** returns the current date in 'YYYY-MM-DD'. **CURRENT_DATE()** and **CURRENT_DATE** are the **synonym of CURDATE().**

In MySQL, the **CURTIME()** returns the value of current time in 'HH:MM:SS'. **CURRENT_TIME()** and **CURRENT_TIME** are the **synonym of CURTIME().**

sysdate(), now(), curdate(), curtime()

NOW() returns a constant time that indicates the time at which the statement began to execute. (Within a stored function or trigger, NOW() returns the time at which the function or triggering statement began to execute.) This differs from the behavior for SYSDATE(), which returns the exact time at which it executes.

- SELECT SYSDATE()
- SELECT NOW()
- SELECT CURDATE()
- SELECT CURTIME()

Result in something like this:

SYSDATE()	**NOW()**	**CURDATE()**	**CURTIME()**
2017-02-11 10:22:31	2017-02-11 10:22:31	2017-02-11	10:22:31

```
mysql> SELECT NOW(), SLEEP(7), NOW();
mysql> SELECT SYSDATE(), SLEEP(7), SYSDATE();
```

+ or - operator

Date arithmetic also can be performed using INTERVAL together with the + or - operator

date + INTERVAL expr unit + INTERVAL expr unit + INTERVAL expr unit + . . .
date - INTERVAL expr unit - INTERVAL expr unit - INTERVAL expr unit - . . .

- SELECT NOW(), NOW() + INTERVAL 1 DAY;
- SELECT NOW(), NOW() + INTERVAL '1-3' YEAR_MONTH;

unit Value	expr	unit Value	expr
SECOND	SECONDS	DAY_HOUR	'DAYS HOURS' e.g. '1 1'
MINUTE	MINUTES	DAY_MINUTE	'DAYS HOURS:MINUTES' e.g. '1 3:34'
HOUR	HOURS	DAY_SECOND	'DAYS HOURS:MINUTES:SECONDS'
DAY	DAYS	HOUR_MINUTE	'HOURS:MINUTES' e.g. '3:34'
WEEK	WEEKS	HOUR_SECOND	'HOURS:MINUTES:SECONDS'
MONTH	MONTHS	MINUTE_SECOND	'MINUTES:SECONDS' e.g. '27:34'
QUARTER	QUARTERS	YEAR_MONTH	'YEARS-MONTHS' e.g. '1-3'
YEAR	YEARS		

ADDDATE() is a synonym for **DATE_ADD()**

ADDDATE(date, INTERVAL expr unit) / DATE_ADD (date, INTERVAL expr unit)

- SELECT NOW(), ADDDATE(NOW(), INTERVAL 1 DAY);
- SELECT NOW(), ADDDATE(NOW(), 1);

unit Value	ExpectedexprFormat
SECOND	SECONDS
MINUTE	MINUTES
HOUR	HOURS
DAY	DAYS
WEEK	WEEKS
MONTH	MONTHS
QUARTER	QUARTERS
YEAR	YEARS

subdate()

SUBDATE() is a synonym for **DATE_SUB()**

SUBDATE(date, INTERVAL expr unit) / DATE_SUB (date, INTERVAL expr unit)

- SELECT NOW(), SUBDATE(NOW(), INTERVAL 1 DAY);
- SELECT NOW(), SUBDATE(NOW(), 1);

unit Value	ExpectedexprFormat
SECOND	SECONDS
MINUTE	MINUTES
HOUR	HOURS
DAY	DAYS
WEEK	WEEKS
MONTH	MONTHS
QUARTER	QUARTERS
YEAR	YEARS

extract

The EXTRACT() function is used to return a single part of a date/time, such as year, month, day, hour, minute, etc.

```
EXTRACT(unit FROM date)
```

Unit Value				
MICROSECOND	SECOND	MINUTE	HOUR	DAY
WEEK	MONTH	QUARTER	YEAR	
MINUTE_SECOND	HOUR_SECOND	DAY_SECOND	DAY_HOUR	
HOUR_MINUTE	DAY_MINUTE	YEAR_MONTH		

- `SELECT EXTRACT(MONTH FROM NOW());`
- `SELECT EXTRACT(YEAR_MONTH FROM NOW()) ;`

Note:

- There must no space between extract function and ().

e.g.

```
SELECT EXTRACT (MONTH FROM NOW());   # error
```

datetime functions

Syntax	Result
DAY(date)	DAY() is a **synonym for DAYOFMONTH().**
DAYNAME(date)	Returns the name of the weekday for date.
DAYOFMONTH(date)	Returns the day of the month for date, in the range 1 to 31
DAYOFWEEK(date)	Returns the weekday index for date (1 = Sunday, 2 = Monday, …, 7 = Saturday).
DAYOFYEAR(date)	Returns the day of the year for date, in the range 1 to 366
LAST_DAY(date)	Takes a date or datetime value and returns the corresponding value for the last day of the month. Returns NULL if the argument is invalid.
MONTH(date)	Returns the month for date, in the range 1 to 12 for January to December
MONTHNAME(date)	Returns the full name of the month for date.
YEAR(date)	Returns the year in 4 digit

- SELECT DAYOFWEEK(NOW()), WEEKDAY(NOW());
- SELECT DAYOFWEEK(ADDDATE(NOW(), INTERVAL 1 DAY)), WEEKDAY(ADDDATE(NOW(), INTERVAL 1 DAY));

datetime functions

Syntax	Result
WEEKDAY(date)	Returns the weekday index for date (0 = Monday, 1 = Tuesday, … 6 = Sunday).
WEEKOFYEAR(date)	Returns the calendar week of the date as a number in the range from 1 to 53.
QUARTER(date)	Returns the quarter of the year for date, in the range 1 to 4.
HOUR(time)	Returns the hour for time. The range of the return value is 0 to 23 for time-of-day values.
MINUTE(time)	Returns the minute for time, in the range 0 to 59.
SECOND(time)	Returns the second for time, in the range 0 to 59.
DATEDIFF(expr1, expr2)	Returns the number of days between two dates or datetimes.
STR_TO_DATE(str, format)	Convert a string to a date.

- SELECT NOW(), NOW() + INTERVAL 1 DAY, WEEKDAY(NOW() + INTERVAL 1 DAY);
- SELECT * FROM emp WHERE DAY(hiredate) = 17;
- SELECT YEAR(hiredate), (YEAR(hiredate) % 4 = 0 AND YEAR(hiredate) % 100 != 0) OR YEAR(hiredate) % 400 = 0 R1 FROM emp ;
- SELECT STR_TO_DATE('24/05/2022', '%d/%m/%Y');

datetime formats

datetime formats

Formats	Description
%a	Abbreviated weekday name (Sun-Sat)
%b	Abbreviated month name (Jan-Dec)
%c	Month, numeric (1-12)
%D	Day of month with English suffix (0th, 1st, 2nd, 3rd, �)
%d	Day of month, numeric (01-31)
%e	Day of month, numeric (1-31)
%f	Microseconds (000000-999999)
%H	Hour (00-23)
%h	Hour (01-12)

- SELECT DATE_FORMAT(NOW(), '%a');

datetime formats

Formats	Description
%I	Hour (01-12)
%i	Minutes, numeric (00-59)
%j	Day of year (001-366)
%k	Hour (0-23)
%l	Hour (1-12)
%M	Month name (January-December)
%m	Month, numeric (01-12)
%p	AM or PM
%r	Time, 12-hour (hh:mm:ss followed by AM or PM)
%S	Seconds (00-59)
%s	Seconds (00-59)

- `SELECT DATE_FORMAT(NOW(), '%j');`

datetime formats

Formats	Description
%T	Time, 24-hour (hh:mm:ss)
%U	Week (00-53) where Sunday is the first day of week
%u	Week (00-53) where Monday is the first day of week
%V	Week (01-53) where Sunday is the first day of week, used with %X
%v	Week (01-53) where Monday is the first day of week, used with %x
%W	Weekday name (Sunday-Saturday)
%w	Day of the week (0=Sunday, 6=Saturday)
%X	Year for the week where Sunday is the first day of week, four digits, used with %V
%x	Year for the week where Monday is the first day of week, four digits, used with %v
%Y	Year, numeric, four digits
%y	Year, numeric, two digits

- SELECT DATE_FORMAT(NOW(), '%Y');

string functions

string functions

Syntax	Result
ASCII(str)	Returns the numeric value of the leftmost character of the string str. Returns 0 if str is the empty string. Returns NULL if str is NULL. e.g. • SELECT ASCII(ename) FROM emp;
CHAR(N, , . . .)	CHAR() interprets each argument N as an integer and returns a string consisting of the characters given by the code values of those integers. **NULL values are skipped**. e.g. • SELECT CHAR(65, 66, 67); / SELECT CAST(CHAR(65 66, 67) AS CHAR);
CONCAT(str1, str2, . . .)	Returns the string that results from concatenating the arguments. CONCAT() **returns NULL if any argument is NULL**. e.g. • SELECT CONCAT('Mr. ' , ename) FROM emp; • SELECT CONCAT('My', NULL, 'SQL’); #op will be NULL
ELT(N, str1, str2, str3, . . .)	ELT() returns the Nth element of the list of strings: str1 if N = 1, str2 if N = 2, and so on. Returns NULL if N is less than 1 or greater than the number of arguments. e.g. • SELECT ELT(1, 'Bank', 'Of', 'India', 'Kothrud', 'Pune'); • SELECT ELT(1, ename, job, sal) FROM emp; • SELECT hiredate, ELT(MONTH(hiredate),'Winter', 'Winter', 'Spring', 'Spring', 'Spring', 'Summer', 'Summer', 'Summer', 'Autumn', 'Autumn', 'Autumn', 'Winter') R1 FROM emp;

string functions

Syntax	Result
STRCMP(expr1, expr2)	STRCMP() returns 0 if the strings are the same, -1 if the first argument is smaller than the second according to the current sort order, and 1 otherwise.
LCASE(str)	Returns lower case string. LCASE() **is a synonym for** LOWER().
UCASE(str)	Returns upper case string. UCASE() **is a synonym for** UPPER().
LENGTH(str)	Returns the length of the string.
LPAD(str, len, padstr)	Returns the string str, left-padded with the string padstr to a length of len characters.
RPAD(str, len, padstr)	Returns the string str, right-padded with the string padstr to a length of len characters.
REPEAT(str, count)	Returns a string consisting of the string str repeated count times. If count is less than 1, returns an empty string. Returns NULL if str or count are NULL.

- SELECT UCASE(ename) FROM emp;
- SELECT sal, LPAD(sal, 20, '*') FROM emp;

string functions

Syntax	Result
LEFT(str, len)	Returns the leftmost len characters from the string str, or NULL if any argument is NULL.
RIGHT(str, len)	Returns the rightmost len characters from the string str, or NULL if any argument is NULL.
LTRIM(str)	Returns the string str with leading space characters removed.
RTRIM(str)	Returns the string str with trailing space characters removed.
TRIM(str)	Returns the string str with leading and trailing space characters removed.
BINARY value	Convert a value to a binary string.

- SELECT ename, BINARY ename FROM emp;

string functions

Syntax	Result
INSTR(str, substr)	Returns the position of the first occurrence of substring substr in string str.
REPLACE(str, from_str, to_str)	Returns the string str with all occurrences of the string from_str replaced by the string to_str. REPLACE() performs a case-sensitive match when searching for from_str. e.g. • SELECT REPLACE('Hello', 'l', 'x');
REVERSE(str)	Returns the string str with the order of the characters reversed.
SUBSTR(str, pos, len)	**SUBSTR() is a synonym for SUBSTRING().** e.g. • SELECT SUBSTR ('This is the test by IWAY', 6); • SELECT SUBSTR ('This is the test by IWAY', -4, 4);
MID(str, pos, len)	MID function **is a synonym for** SUBSTRING**.**

- SELECT ename, job, IF(ISNULL(phone), '**********', RPAD(LEFT(phone, 4), 10, '*')) FROM emp;
- SELECT ename, job, phone, IF(ISNULL(phone), REPEAT('*',10), RPAD(LEFT(phone, 4), 10, '*')) FROM emp;
- SELECT \`user name\`, IF(LENGTH(SUBSTR(\`user name\`, INSTR(\`user name\`," "))) = 0,"Weak User", \`user name\`) R1 FROM emp;
- UPDATE emp SET job = REPLACE(job, job, LOWER(job));

string functions - examples

- SELECT sal, REPEAT('$', sal/100) FROM emp;
- SELECT emailid, REPEAT('*', LENGTH(emailid)) FROM emp;
- SELECT pwd, REPEAT('*', LENGTH(pwd)) password FROM emp;
- SELECT c1, CONCAT(REPEAT('0', 10 - LENGTH(c1)) , c1) FROM leading_zeroes;
- SELECT ename, job, IF(ISNULL(phone), '**********', RPAD(LEFT(phone, 4), 10, '*')) FROM emp;
- SELECT \`user name\`, IF(LENGTH(SUBSTR(\`user name\`, INSTR(\`user name\`," "))) = 0,"Weak User", \`user name\`) R1 FROM emp;
- SELECT LENGTH('saleel') - LENGTH(REPLACE('saleel', 'e', ""));
- SELECT empno, datePresent, LENGTH(datePresent) - LENGTH(REPLACE(datePresent, ",", "")) + 1 "Days Present" FROM emp_attendance;
- SELECT CandidateID, REPLACE(REPLACE(response, ',', ''), 'n', '') R1, LENGTH(REPLACE(REPLACE(response, ',', '') ,'n', '')) R2 FROM vote_response;
- SELECT c1, c1 / 1, SUBSTR(c1, LENGTH(c1 / 1) + 1) FROM numberString;
- SELECT c1, REVERSE(c1) / 1, LENGTH(REVERSE(c1) / 1), REVERSE(SUBSTR(REVERSE(c1), LENGTH(REVERSE(c1) / 1) + 1)) FROM Stringnumber;
- UPDATE emp SET job := REPLACE(job, 'officers', 'Officers');

string functions - examples

- `SELECT * FROM emp1 WHERE ename = BINARY "sherlock";`
- `SELECT * FROM emp1 WHERE ename = BINARY "Sherlock";`
- `SELECT * FROM emp1 WHERE ename = BINARY UPPER(ename);`
- `SELECT * FROM emp1 WHERE ename = BINARY LOWER(ename);`
- `SELECT CONCAT(UCASE(LEFT(ename, 1)), LCASE(SUBSTRING(ename, 2))) "Title Case" FROM;`
- `SELECT * FROM emp1 WHERE ename = BINARY CONCAT(UCASE(LEFT(ename, 1)), LCASE(SUBSTRING(ename, 2)));`

string functions

- SELECT * FROM emp WHERE LEFT(ename, 1) IN ('a', 'e', 'o', 'i', 'u');
- SELECT * FROM emp WHERE REGEXP_LIKE(ename, '(a|e|i|o|u)');
- SELECT * FROM emp WHERE REGEXP_LIKE(ename, '^(a|m)'); //starts with
- SELECT * FROM emp WHERE REGEXP_LIKE(ename, '(n|r)$'); //ends with

- SELECT "abc,,abc,,,,,bc,,,,,,abc" ; / SELECT REPLACE(REPLACE(REPLACE("abc,,abc,,,,,bc,,,,,,abc", ",", ".,"),",.",""),".,",",") R1 ;

mathematical functions

mathematical functions

Syntax	Result
ABS(x)	Returns the absolute value of X.
CEIL(x)	CEIL() is a synonym for CEILING().
CEILING(x)	Returns CEIL value.
FLOOR(x)	Returns FLOOR value.
MOD(n, m), n % m, n MOD m	Returns the remainder of N divided by M. MOD(N,0) returns NULL.
POWER(x, y)	This is a synonym for POW().
RAND()	Returns a random floating-point value
ROUND(x) ROUND(x, d)	Rounds the argument X to D decimal places. The rounding algorithm depends on the data type of X. D defaults to 0 if not specified. D can be negative to cause D digits left of the decimal point of the value X to become zero.
TRUNCATE(x, d)	Returns the number X, truncated to D decimal places. If D is 0, the result has no decimal point or fractional part. D can be negative to cause D digits left of the decimal point of the value X to become zero.

mathematical functions

```
SELECT FLOOR(RAND() * (b – a + 1) + a );
```

e.g.

- `SELECT CEIL(1.23);`
- `SELECT CEIL(-1.23);`
- `SELECT FLOOR(1.23);`
- `SELECT FLOOR(-1.23);`
- `SELECT ROUND(-1.23);`
- `SELECT ROUND(-1.58);`
- `SELECT ROUND(RAND() * 100);`
- `SELECT FLOOR(RAND() * 899999 + 100000) OTP;`
- `SELECT weight, TRUNCATE(weight, 0) AS kg,  MID(weight, INSTR(weight, ".") + 1) AS gms FROM mass_table;`
- `SELECT weight, TRUNCATE(weight, 0) AS kg, RIGHT(MOD(weight , 1), 2) AS gms FROM mass_table;`

Note:

- TABLE statement always displays all columns of the table.
- TABLE statement does not support any WHERE clause.
- TABLE statement can be used with temporary tables.

table statement...

TABLE is a DML statement introduced in MySQL 8.0.19 which returns rows and columns of the named table.

table statement

The TABLE statement in some ways acts like SELECT. You can order and limit the number of rows produced by TABLE using ORDER BY and LIMIT clauses, respectively.

```
TABLE tbl_name [ORDER BY col_name] [LIMIT number [OFFSET number]]
```

- `TABLE emp;`
- `TABLE emp ORDER BY 2;`
- `TABLE emp ORDER BY 2 LIMIT 1, 2;`
- `TABLE t1 UNION TABLE t2;`

Remember:

- Here, "*" is known as metacharacter (all columns)

select statement… syntax

SELECT is used to retrieve rows selected from one or more tables (using JOINS), and can include UNION statements and SUBQUERIES.

syntax

select statement

modifiers

SELECT [ALL / DISTINCT / DISTINCTROW] identifier.* / identifier.A_1 [[as] alias_name], identifier.A_2 [[as] alias_name], identifier.A_3 [[as] alias_name], expression1 [[as] alias_name], expression2 [[as] alias_name] . . .

- [FROM <identifier.r_1> [as] alias_name], <identifier.r_2> [as] alias_name], . . .]
- [WHERE < where_condition1 > { and | or } < where_condition2 > . . .]
- [GROUP BY < { col_name | expr | position }, . . . [WITH ROLLUP] >]
- [HAVING < having_condition1 > { and | or } < having_condition2 > . . .]
- [ORDER BY < { col_name | expr | position } [ASC | DESC], . . . >]
- [LIMIT < { [offset,] row_count | row_count OFFSET offset } >]
- [FOR { UPDATE }]
- [{ INTO OUTFILE '*file_name*' | INTO DUMPFILE '*file_name*' | INTO *var_name* [, *var_name*], . . . }]

Remember:

- **ALL** (**modifier is default**) specifies that all matching rows should be returned, including duplicates.
- **DISTINCT** (**modifier**) specifies removal of duplicate rows from the result set.
- **DISTINCTROW** (**modifier**) is a synonym for **DISTINCT**.
- It is an error to specify both modifiers.
- Whenever you use **DISTINCT**, sorting takes place in server.

sequence of clauses

WHERE → GROUP BY → HAVING → ORDER BY → LIMIT

select statement… execution

FROM → WHERE → GROUP BY → HAVING → SELECT → DISTINCT → ORDER BY → LIMIT

select statement... (is checks for)

Syntax Check

MySQL Database must check each SQL statement for syntactic validity.

```
mysql> SELECT *  FORM emp;

ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MySQL server version for the right syntax to use near 'FORM emp' at line 1
```

Semantic Check

A semantic check determines whether a statement is meaningful, for example, whether the objects and columns in the statement exist.

```
mysql> SELECT *  FROM nonexistent_table;

ERROR 1146 (42S02): Table 'db1.nonexistent_table' doesn't exist
```

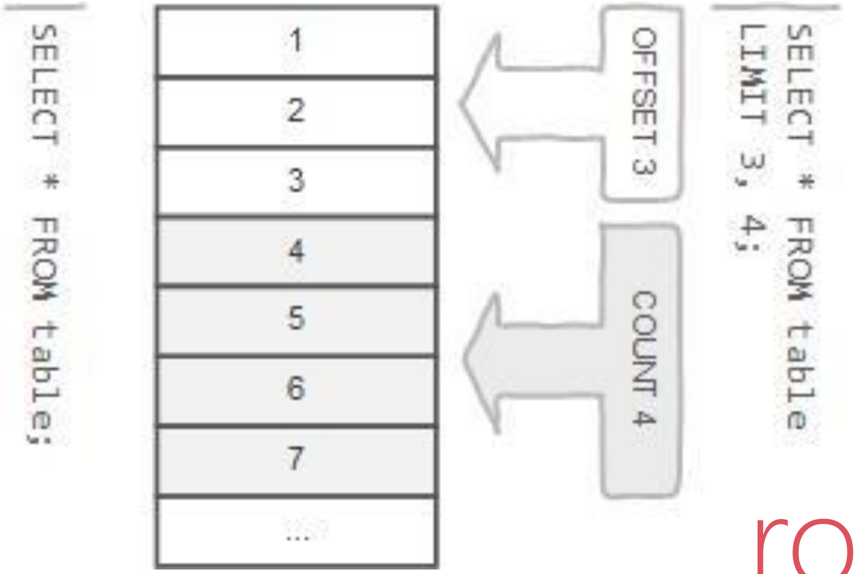
UUID()/ UUID_SHORT()

A UUID is a Universal Unique Identifier and 128-bit long value.

Remember:

- UUID values in MySQL are **unique** across tables, databases, and servers..

- SELECT UUID() AS R1, UUID_SHORT() AS R2 FROM *tbl_name*;



row limiting clause

LIMIT is applied after HAVING

Remember:

- LIMIT enables you to pull a section of rows from the middle of a result set. Specify two values: The number of rows to skip at the beginning of the result set, and the number of rows to return.

Note:

- Limit value are not to be given within **(. . .)**
- Limit takes one or two numeric arguments, which must both be **non-negative** integer value.

---

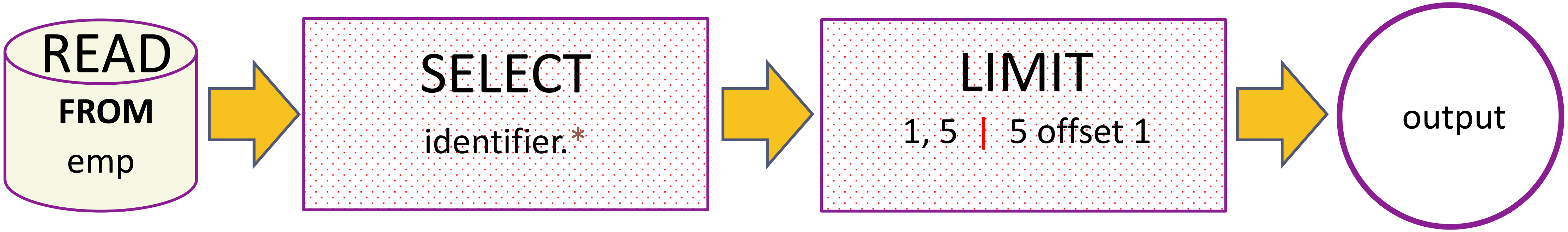
select - limit

SELECT A_1, A_2, A_3, . . . FROM *r*

[LIMIT { [offset,] row_count | row_count OFFSET offset }]

You can specify an offset using OFFSET from where SELECT will start returning records. By default ***offset is zero.***

- SELECT * FROM emp LIMIT 5 OFFSET 1;



- SELECT * FROM student LIMIT 5;
- SELECT * FROM student LIMIT 1, 5;
- SELECT * FROM student LIMIT 5 offset 1;
- SELECT RAND(), student.* FROM student ORDER BY 1 LIMIT 1;
- SELECT student.* FROM student ORDER BY RAND() LIMIT 1;

select - limit

This variable is used to return the maximum number of rows from SELECT statements. Its default value is unlimited. But if you changed the limit then SELECT statement returns the rows equals to the value.

SQL_SELECT_LIMIT = { value | DEFAULT }

This variable does not apply to SELECT statement that executed in the stored procedures or functions.

- SET *SQL_SELECT_LIMIT* = 2;
- SET *SQL_SELECT_LIMIT* = DEFAULT;
- SELECT * FROM emp;

Nulls by default occur at the top, but you can use *IsNull* to assign default values, that will put it in the position you require. . The *ISNULL()* function tests whether an expression is NULL. If expression is a NULL value, the ISNULL() function returns 1. Otherwise, it returns 0.

- SELECT id AS 'a' FROM *tbl_name* ORDER BY `a`;
- SELECT id AS 'a' FROM *tbl_name* ORDER BY 'a';

order by clause

SQL allows the user to order the tuples in the result of a query by the values of one or more of the attributes that appear in the query result, by using the ORDER BY clause.

Remember:

- The default sort order is ascending **ASC**, with smallest values first. To sort in descending (reverse) order, add the **DESC** keyword to the name of the column you are sorting by.
- You can sort on multiple columns, and you can sort different columns in different directions.
- If the **ASC** or **DESC** modifier is not provided in the ORDER BY clause, the results will be sorted by expression in **ASC** (ascending) order. This is equivalent to ORDER BY expression ASC.

select - order by

When doing an ORDER BY, NULL values are placed **first** if you do ORDER BY ... ASC and **last** if you do ORDER BY ... DESC.

SELECT $\boldsymbol{A_1}$, $\boldsymbol{A_2}$, $\boldsymbol{A_3}$, $\boldsymbol{A_n}$ FROM ***r***

[ORDER BY {$\boldsymbol{A_1}$, $\boldsymbol{A_2}$, $\boldsymbol{A_3}$, . . . | expr | position} [ASC | DESC] , . . .]

"Ordered by attributes A_1, A_2, A_3 …"

- Tuples are sorted by specified attributes
- Results are sorted by A_1 first
- Within each value of A_1, results are sorted by A_2 then within each value of A_2, results are sorted by A_3

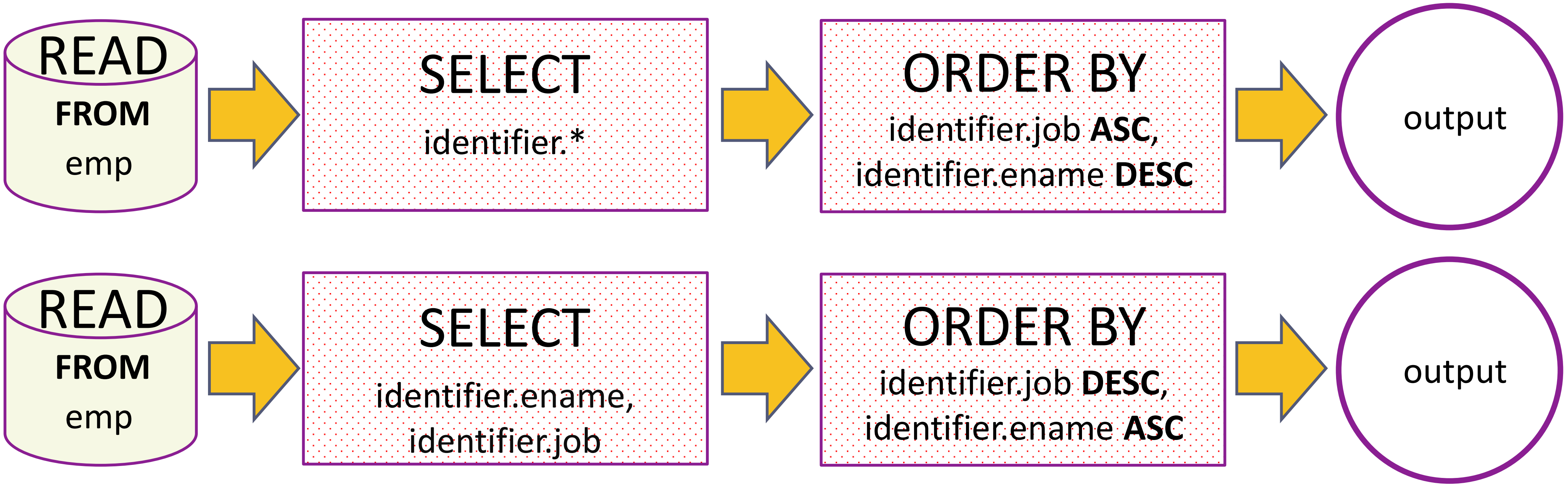
- SELECT * FROM ***r*** ORDER BY *key_part1, key_part2;* // optimizer does not use the index.
- SELECT *key_part1*, *key_part2* FROM ***r*** ORDER BY *key_part1*, *key_part2*; // optimizer uses the index.

select - order by

The ORDER BY clause is used to sort the records in your result set.

SELECT $\boldsymbol{A}_1$, $\boldsymbol{A}_2$, $\boldsymbol{A}_3$, $\boldsymbol{A}_n$ FROM ***r***

[ORDER BY {$\boldsymbol{A}_1$, $\boldsymbol{A}_2$, $\boldsymbol{A}_3$, . . . | expr | position} [ASC | DESC] , . . .]



select - order by

When doing an ORDER BY, NULL values are presented **first** if you do ORDER BY ... ASC

- SELECT * FROM emp ORDER BY comm ASC;

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO	BONUSID	USER NAME	PWD	isActive
7369	SMITH	CLERK	7902	1980-12-17 00:00:00	800.00	NULL	20	2	NULL	NULL	0
7415	AARAV	CLERK	7902	1981-12-31 00:00:00	3350.00	NULL	10	NULL	NULL	NULL	0
7421	THOMAS	CLERK	7920	1981-07-19 00:00:00	1750.00	NULL	10	1	NULL	NULL	0
7566	JONES	MANAGER	7839	1981-04-02 00:00:00	2975.00	NULL	20	4	NULL	NULL	1
7698	BLAKE	MANAGER	7839	1981-05-01 00:00:00	2850.00	NULL	30	1	NULL	NULL	1
7782	CLARK	MANAGER	7839	1981-06-09 00:00:00	2450.00	NULL	10	3	NULL	NULL	1
7788	SCOTT	ANALYST	7566	1982-12-09 00:00:00	3000.00	NULL	20	3	NULL	NULL	1
7839	KING	PRESIDENT	NULL	1981-11-17 00:00:00	5000.00	NULL	10	1	NULL	NULL	1
7876	ADAMS	CLERK	7788	1983-01-12 00:00:00	1100.00	NULL	20	1	NULL	NULL	1
7900	JAMES	CLERK	7698	1981-12-03 00:00:00	950.00	NULL	30	2	NULL	NULL	1
7902	FORD	ANALYST	7566	1981-12-03 00:00:00	3000.00	NULL	20	4	NULL	NULL	0
7919	HOFFMAN	MANAGER	7566	1982-03-24 00:00:00	4150.00	NULL	30	3	NULL	NULL	1
7934	MILLER	CLERK	7782	1982-01-23 00:00:00	1300.00	NULL	10	2	NULL	NULL	0
7844	TURNER	SALESMAN	7698	1981-09-08 00:00:00	1500.00	0.00	30	5	NULL	NULL	1
7499	ALLEN	SALESMAN	7698	1981-02-20 00:00:00	1600.00	300.00	30	4	NULL	NULL	1
7521	WARD	SALESMAN	7698	1981-02-22 00:00:00	1250.00	500.00	30	1	NULL	NULL	1
7949	ALEX	MANAGER	7698	1982-01-24 00:00:00	1250.00	500.00	30	5	NULL	NULL	1
7654	MARTIN	SALESMAN	7698	1981-09-28 00:00:00	1250.00	1400.00	30	6	NULL	NULL	1
7920	GRASS	SALESMAN	7919	1980-02-14 00:00:00	2575.00	2700.00	30	5	NULL	NULL	1
7945	AARUSH	SALESMAN	7902	1980-02-14 00:00:00	1350.00	2700.00	30	NULL	NULL	NULL	0
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

select - order by

When doing an ORDER BY, NULL values are presented **last** if you do ORDER BY ... DESC.

- SELECT * FROM emp ORDER BY comm DESC;

	EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO	BONUSID	USER NAME	PWD	isActive
▶	7920	GRASS	SALESMAN	7919	1980-02-14 00:00:00	2575.00	2700.00	30	5	NULL	NULL	1
	7945	AARUSH	SALESMAN	7902	1980-02-14 00:00:00	1350.00	2700.00	30	NULL	NULL	NULL	0
	7654	MARTIN	SALESMAN	7698	1981-09-28 00:00:00	1250.00	1400.00	30	6	NULL	NULL	1
	7521	WARD	SALESMAN	7698	1981-02-22 00:00:00	1250.00	500.00	30	1	NULL	NULL	1
	7949	ALEX	MANAGER	7698	1982-01-24 00:00:00	1250.00	500.00	30	5	NULL	NULL	1
	7499	ALLEN	SALESMAN	7698	1981-02-20 00:00:00	1600.00	300.00	30	4	NULL	NULL	1
	7844	TURNER	SALESMAN	7698	1981-09-08 00:00:00	1500.00	0.00	30	5	NULL	NULL	1
	7369	SMITH	CLERK	7902	1980-12-17 00:00:00	800.00	NULL	20	2	NULL	NULL	0
	7415	AARAV	CLERK	7902	1981-12-31 00:00:00	3350.00	NULL	10	NULL	NULL	NULL	0
	7421	THOMAS	CLERK	7920	1981-07-19 00:00:00	1750.00	NULL	10	1	NULL	NULL	0
	7566	JONES	MANAGER	7839	1981-04-02 00:00:00	2975.00	NULL	20	4	NULL	NULL	1
	7698	BLAKE	MANAGER	7839	1981-05-01 00:00:00	2850.00	NULL	30	1	NULL	NULL	1
	7782	CLARK	MANAGER	7839	1981-06-09 00:00:00	2450.00	NULL	10	3	NULL	NULL	1
	7788	SCOTT	ANALYST	7566	1982-12-09 00:00:00	3000.00	NULL	20	3	NULL	NULL	1
	7839	KING	PRESIDENT	NULL	1981-11-17 00:00:00	5000.00	NULL	10	1	NULL	NULL	1
	7876	ADAMS	CLERK	7788	1983-01-12 00:00:00	1100.00	NULL	20	1	NULL	NULL	1
	7900	JAMES	CLERK	7698	1981-12-03 00:00:00	950.00	NULL	30	2	NULL	NULL	1
	7902	FORD	ANALYST	7566	1981-12-03 00:00:00	3000.00	NULL	20	4	NULL	NULL	0
	7919	HOFFMAN	MANAGER	7566	1982-03-24 00:00:00	4150.00	NULL	30	3	NULL	NULL	1
	7934	MILLER	CLERK	7782	1982-01-23 00:00:00	1300.00	NULL	10	2	NULL	NULL	0
*	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

select - order by

SELECT $\boldsymbol{A}_1$, $\boldsymbol{A}_2$, $\boldsymbol{A}_3$, $\boldsymbol{A}_n$ FROM ***r***

[ORDER BY {$\boldsymbol{A}_1$, $\boldsymbol{A}_2$, $\boldsymbol{A}_3$, . . . | expr | position} [ASC | DESC] , . . .]

- SELECT * FROM emp ORDER BY comm;
- SELECT * FROM emp ORDER BY comm IS NULL ;
- SELECT * FROM emp ORDER BY comm IS NOT NULL ;
- SELECT * FROM emp ORDER BY 1 + 1;
- SELECT * FROM emp ORDER BY True;
- SELECT ename, LENGTH(ename) FROM emp ORDER BY LENGTH(ename), ename DESC ;
- SELECT * FROM emp ORDER BY IF(job = 'manager', 3, IF(job = 'salesman', 2, NULL)) ;
- SELECT * FROM emp ORDER BY FIELD(job, 'manager', 'salesman') ;
- SELECT * FROM emp ORDER BY ISNULL(comm), comm ;
- SELECT ename `e` FROM emp ORDER BY `e` ;
- SELECT ename `e` FROM emp ORDER BY e ;
- SELECT ename 'e' FROM emp ORDER BY 'e' ;
- SELECT * FROM emp ORDER BY CASE WHEN ename='sharmin' THEN 0 ELSE 1 END, ename;

Remember:

In **WHERE** clause operations can be performed using…

- *CONSTANTS*
- *TABLE columns*
- *FUNCTION calls (PRE-DEFINED / UDF)*

* In SQL, a logical expression is often called a *predicate*.

where clause

The WHERE Clause is used when you want to retrieve specific information from a table excluding other irrelevant data.

Note:

Expressions in WHERE clause can use.

- *Arithmetic operators*
- *Comparison operators*
- *Logical operators*

Note:

- All comparisons return FALSE when either argument is NULL, so no rows are ever selected.

select - where

We can use a conditional clause called WHERE clause to filter out results. Using WHERE clause, we can specify a selection criteria to select required records from a table.

SELECT A_1, A_2, A_3, . . . FROM r_1, r_2, r_3, . . . [WHERE P]

- r_i are the relations (tables)
- A_i are attributes (columns)
- P is the selection predicate

SQL permits us to use the notation (v_1, v_2,...,v_n) to denote a tuple of arity (attribute) n containing values v_1, v_2,...,v_n.

WHERE (a_1, a_2) <= (b_1, b_2)

WHERE (EMP.DEPTNO, DNAME) = (DEPT.DEPTNO, 'SALES');

Remember:

- A predicate is a condition expression that evaluates to a boolean value, either **true** or **false**.
- Predicates can be used as follows: In a SELECT statement's ***WHERE*** clause or ***HAVING*** clause to determine which rows are relevant to a particular query.

A value of zero is considered false. Nonzero values are considered true.

- `SELECT true, false, TRUE, FALSE, True, False;`

select - where

SELECT A_1, A_2, A_3, . . . FROM r_1, r_2, r_3, . . . [WHERE *P*]

2. *comparison_operator:*

= | <=> | >= | > | <= | < | <> | !=

5. *logical_operators*

{ AND | && } | { OR | || }

What will be the result of the query below?

- SELECT 1 = 1;
- SELECT True = 1;
- SELECT True = 2;
- SELECT True = True;
- SELECT 0 = 0;
- SELECT False = False;
- SELECT False = 1;
- SELECT 'a' = 1;
- SELECT 'a' = 0;

- SELECT * FROM emp WHERE ename = 0;
- SELECT * FROM emp WHERE ename = 1;
- SELECT * FROM emp WHERE ename = False;
- SELECT * FROM emp WHERE ename = True;
- SELECT * FROM emp WHERE True AND False;
- SELECT * FROM emp WHERE True OR False;
- SELECT * FROM emp WHERE True AND 1;
- SELECT * FROM emp WHERE True OR 0;

Note:

AND has higher precedence than **OR.**

- EXPLAIN ANALYZE SELECT * FROM emp WHERE job = 'salesman' OR job = 'manager' AND sal > 2000;

select - where

SELECT $\boldsymbol{A_1}$, $\boldsymbol{A_2}$, $\boldsymbol{A_3}$, . . . FROM $\boldsymbol{r_1}$, $\boldsymbol{r_2}$, $\boldsymbol{r_3}$, . . . [WHERE ***P***]

WHERE state = 'NY' OR 'CA' --Illegal

WHERE salary > 20000 AND < 30000 –Illegal

WHERE state NOT = 'CA' --Illegal

Logical Operators		
AND, &&	Logical AND	e.g. SELECT 1 AND 1; / SELECT 1 AND 0; SELECT 0 AND NULL; / SELECT NULL AND 0; SELECT 1 AND NULL; / SELECT NULL AND 1;
OR, ||	Logical OR	e.g. SELECT 1 OR 1; / SELECT 1 OR 0; SELECT 0 OR NULL; / SELECT NULL OR 0; SELECT 1 OR NULL; / SELECT NULL OR 1;
NOT, !	Negates value	e.g. SELECT NOT 1;

- **Logical AND.** Evaluates to 1 if all operands are nonzero and not NULL, to 0 if one or more operands are 0, otherwise NULL is returned.
- **Logical OR.** When both operands are non-NULL, the result is 1 if any operand is nonzero, and 0 otherwise. With a NULL operand, the result is 1 if the other operand is nonzero, and NULL otherwise. If both operands are NULL, the result is NULL.
- **Logical NOT.** Evaluates to 1 if the operand is 0, to 0 if the operand is nonzero, and NOT NULL returns NULL.

SELECT $\boldsymbol{A_1}, \boldsymbol{A_2}, \boldsymbol{A_3}$, . . . FROM $\boldsymbol{r_1}, \boldsymbol{r_2}, \boldsymbol{r_3}$, . . . [WHERE ***P***]

Comparison Functions and Operators	
LEAST(value1, value2, . . .)	With two or more arguments, returns the smallest argument.
GREATEST(value1, value2, . . .)	With two or more arguments, returns the largest argument.
(expr, [expr] . . .)	Multiple columns in expr. (sub-query returning multiple columns to compare)
COALESCE(value, . . .)	Returns the first non-NULL value in the list, or NULL if there are no non-NULL values.

- ```
  SELECT GREATEST(10, 20, 30),      # 30
         LEAST(10, 20, 30);         # 10
  ```

- ```
  SELECT GREATEST(10, null, 30),    # null
         LEAST(10, NULL , 30);      # null
  ```

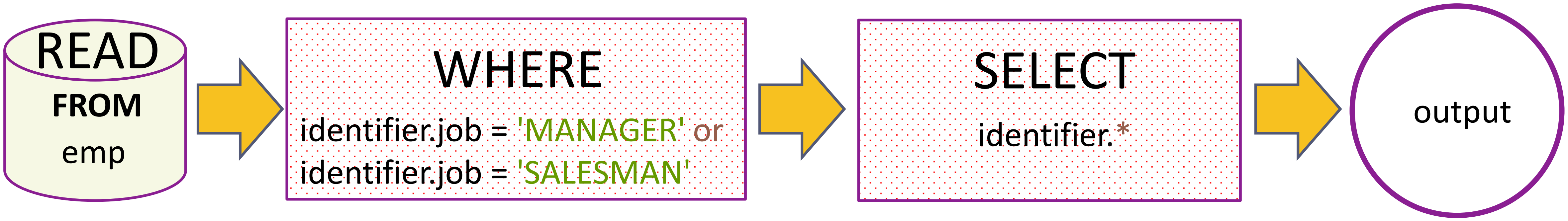
- ```
  SELECT * FROM emp WHERE (deptno, pwd) = (SELECT deptno, pwd FROM dept WHERE deptno = 30);
  ```

Remember:

- If any argument is NULL, the both functions return NULLs immediately without doing any comparison..
  ```

select - where

- SELECT * FROM emp WHERE job = 'MANAGER' OR job = 'SALESMAN';



EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO	BONUSID	USER NAME	PWD	phone	isActive
7499	ALLEN	SALESMAN	7698	1981-02-20	1600	300	30	4	ALWAYS TESTE	sales@2017	7032300096	1
7521	WARD	SALESMAN	7698	1981-02-22	1250	500	30	1	WARD	sales@2017	7132300034	1
7566	JONES	MANAGER	7839	1981-04-02	2975	NULL	20	4	HONEYCOMB	a12recmpm	7132300039	1
7654	MARTIN	SALESMAN	7698	1981-09-28	1250	1400	30	6	LIFE RACER	sales@2017	7132300050	1
7698	BLAKE	MANAGER	7839	1981-05-01	2850	NULL	30	1	BIG BEN	sales@2017	7132300027	1
7782	CLARK	MANAGER	7839	1981-06-09	2450	NULL	10	3	CLARK	r50mpm	7032300001	1
7844	TURNER	SALESMAN	7698	1981-09-08	1500	0	30	5	SAND DUST	sales@2017	NULL	1
7919	HOFFMAN	MANAGER	7566	1982-03-24	4150	NULL	30	3	INTERVAL	sales@2017	NULL	1

combining and & or - where

Note:

AND has higher precedence than **OR.**

- SELECT * FROM andor WHERE ename = 'saleel' AND city = 'pune' OR city = 'baroda';
- SELECT * FROM andor WHERE ename = 'saleel' AND (city = 'pune' OR city = 'baroda');

- SELECT ename, job, comm FROM emp WHERE comm = 0 OR comm IS NULL AND job = 'CLERK';
- SELECT ename, job, comm FROM emp WHERE (comm = 0 OR comm IS NULL) AND job = 'CLERK';

- EXPLAIN ANALYZE SELECT * FROM emp WHERE job = 'salesman' OR job = 'manager' AND sal > 2000;

select - where

SELECT A_1, A_2, A_3, . . . FROM r_1, r_2, r_3, . . . [WHERE P]

What will be the output of the following statement?

- SELECT "Hello" # "World " FROM dual;
- SELECT 10 + 10 as Result FROM dual WHERE False;
- SELECT 10 + 10 as Result FROM dual WHERE True;
- SELECT 10 + 10 as Result FROM dual WHERE 10 - 10;
- SELECT 10 + 10 as Result FROM dual WHERE 10 - 0;
- SELECT 10 + 10 as Result FROM dual WHERE 10 - 30;
- SELECT '5' * '5' as Result FROM dual;
- SELECT 5 * 5 - '-5' as Result FROM dual;

- SELECT * FROM emp WHERE comm IS UNKNOWN;
- SELECT * FROM emp WHERE comm IS NOT UNKNOWN;

- *operand* IS [NOT] *NULL*

3. *boolean_ predicate:*

IS [NOT] NULL
| *expr* <=> *null*

is null / is not null

- "*IS NULL*" is the keyword that performs the Boolean comparison. It returns true if the supplied value is NULL and false if the supplied value is not NULL.
- "*IS NOT NULL*" is the keyword that performs the Boolean comparison. It returns true if the supplied value is not NULL and false if the supplied value is null.

Note:

- IS UNKNOWN is synonym of *IS NULL*.
- IS NOT UNKNOWN is synonym of *IS NOT NULL*.

Remember:

is null / is not null

SELECT * FROM emp WHERE comm = NULL; # will return Empty set

- SELECT empno, ename, job, sal, comm FROM emp WHERE comm IS NOT NULL;
- SELECT empno, ename, job, sal, comm FROM emp WHERE comm IS NOT UNKNOWN;

	empno	ename	job	sal	comm
▶	7499	ALLEN	SALESMAN	1600.00	300.00
	7521	WARD	SALESMAN	1250.00	500.00
	7654	MARTIN	SALESMAN	1250.00	1400.00
	7844	TURNER	SALESMAN	1500.00	0.00
	7920	GRASS	SALESMAN	2575.00	2700.00
	7945	AARUSH	SALESMAN	1350.00	2700.00
	7949	ALEX	MANAGER	1250.00	500.00

- SELECT empno, ename, job, sal, comm FROM emp WHERE comm is TRUE;

	empno	ename	job	sal	comm
▶	7499	ALLEN	SALESMAN	1600.00	300.00
	7521	WARD	SALESMAN	1250.00	500.00
	7654	MARTIN	SALESMAN	1250.00	1400.00
	7920	GRASS	SALESMAN	2575.00	2700.00
	7945	AARUSH	SALESMAN	1350.00	2700.00
	7949	ALEX	MANAGER	1250.00	500.00

select – boolean

- BOOL and BOOLEAN are synonym of TINYINT(1)

A value of zero is considered false. Nonzero values are considered true.

```
SELECT true, false, TRUE, FALSE, True, False;
```

- SELECT * FROM tasks WHERE completed;
- SELECT * FROM tasks WHERE completed is True;
- SELECT * FROM tasks WHERE completed = 1;
- SELECT * FROM tasks WHERE completed = True;

id	title	completed
2	Task2	1
4	Task4	1
8	Task8	1
9	Task9	12
10	Task10	58
11	Task11	1
13	Task13	1
NULL	NULL	NULL

id	title	completed
2	Task2	1
4	Task4	1
8	Task8	1
11	Task11	1
13	Task13	1
NULL	NULL	NULL

- SELECT * FROM tasks WHERE NOT completed;
- SELECT * FROM tasks WHERE completed is False;
- SELECT * FROM tasks WHERE completed = 0;
- SELECT * FROM tasks WHERE completed = False;

id	title	completed
1	Task1	0
3	Task3	0
7	Task7	0
12	Task12	0
NULL	NULL	NULL

select – boolean

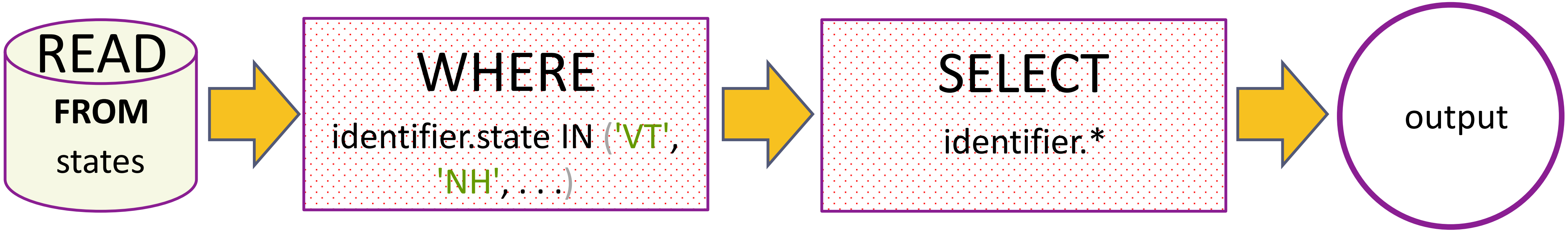
- BOOL and BOOLEAN are synonym of TINYINT(1)

A value of zero is considered false. Nonzero values are considered true.

```
SELECT true, false, TRUE, FALSE, True, False;
```

What will be the result of the query below?

- SELECT * FROM emp WHERE 1;
- SELECT * FROM emp WHERE True;
- SELECT * FROM emp WHERE 0;
- SELECT * FROM emp WHERE False;
- SELECT * FROM emp WHERE ename = '' OR 0;
- SELECT * FROM emp WHERE ename = '' OR 1;
- SELECT * FROM emp WHERE ename = '' OR 1 = 1;
- SELECT * FROM emp WHERE ename = 'smith' OR True;
- SELECT * FROM emp WHERE ename = 'smith' AND True;
- SELECT * FROM emp WHERE ename IN('smith', True);
- SELECT * FROM emp WHERE ename = 'smith' OR False;
- SELECT * FROM emp WHERE ename = 'smith' AND False;
- SELECT * FROM emp WHERE ename IN('smith', False);



4. *predicate*:

expr [NOT] IN (*expr1*, *expr2*, . . .)

| *expr* [NOT] IN (*subquery*)

in

The IN statement is used in a WHERE clause to choose items from a set. The IN operator allows you to determine if a specified value matches any value in a set of values or value returned by a subquery.

```
SELECT . . . FROM r1 WHERE (
    state = 'VT'  OR
    state = 'NH' OR
    state = 'ME' OR
    state = 'MA' OR
    state = 'CT'   OR
    state = 'RI'
);
```

- SELECT . . . FROM $\mathbf{r}_1$ WHERE state IN ('VT', 'NH', 'ME', 'MA', 'CT', 'RI');
- SELECT . . . FROM $\mathbf{r}_1$ WHERE state IN (SELECT . . .);

A IN (***B1***, ***B2***, ***B3***, etc.)   A is found in the list (B1, B2, etc.)

in

syntax

column | expression IN (v1, v2, v3, . . .)
column | expression IN (subquery)

Remember:

- If a value in the column or the expression is equal to any value in the list, the result of the IN operator is TRUE.
- The IN operator is equivalent to multiple OR operators.
- To negate the IN operator, you use the NOT IN operator.

- SELECT empno, ename, job, hiredate, sal, comm, deptno, isactive FROM emp WHERE job IN ('salesman', 'manager');

	empno	ename	job	hiredate	sal	comm	deptno	isactive
▶	7499	ALLEN	SALESMAN	1981-02-20	1600.00	300.00	30	1
	7521	WARD	SALESMAN	1981-02-22	1250.00	500.00	30	1
	7566	JONES	MANAGER	1981-04-02	2975.00	NULL	20	1
	7654	MARTIN	SALESMAN	1981-09-28	1250.00	1400.00	30	1
	7698	BLAKE	MANAGER	1981-05-01	2850.00	NULL	30	1
	7782	CLARK	MANAGER	1981-06-09	2450.00	NULL	10	1
	7844	TURNER	SALESMAN	1981-09-08	1500.00	0.00	30	1
	7919	HOFFMAN	MANAGER	1982-03-24	4150.00	NULL	30	1

Problem with NOT IN:

not in

a

c1	c2
1	1
2	1
3	1
4	1
5	1

b

c1	c2
1	7
NULL	7
3	7

- `SELECT * FROM a WHERE c1 NOT IN(1, 2, NULL);`
- `SELECT * FROM a WHERE c1 NOT IN(SELECT c1 FROM b );`

  Empty set (0.00 sec)

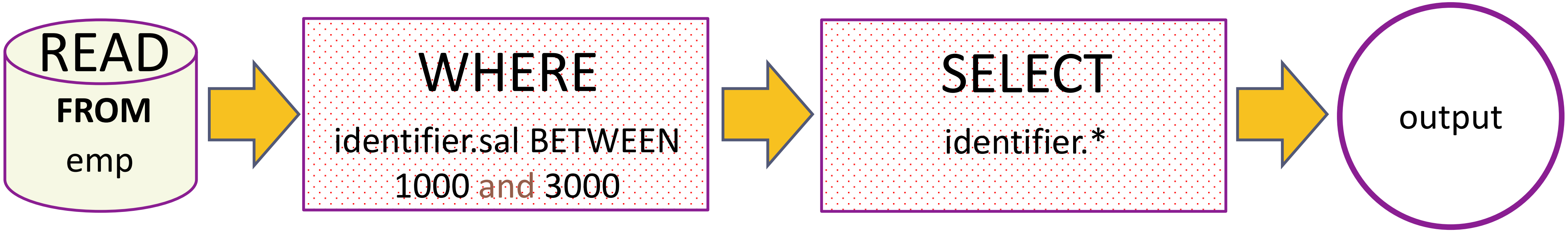
"color NOT IN (Red, Blue, NULL)" This is equivalent to: "NOT(color=Red OR color=Blue OR color=NULL)" *in*

Remember:

- On the left side of the IN() predicate, the row constructor contains only column references.
- On the right side of the IN() predicate, there is more than one row constructor.

What will be the result of the query below?

- SELECT * FROM emp WHERE deptno IN (10);
- SELECT * FROM emp WHERE deptno IN (10, 20);
- SELECT * FROM emp WHERE False IN (10, 20, 0);
- SELECT * FROM emp WHERE True IN (10, 20, 1);
- SELECT * FROM emp WHERE 10 IN (10, 20);
- SELECT * FROM emp WHERE 7788 IN (empno, mgr);
- SELECT * FROM emp WHERE 1 IN (10, 20, True, False);
- SELECT * FROM emp WHERE deptno IN (10, 20) OR True;
- SELECT * FROM emp WHERE deptno IN (10, 20) AND True;
- SELECT * FROM emp WHERE deptno IN (SELECT deptno FROM dept);
- SELECT * FROM emp WHERE deptno IN (SELECT deptno FROM dept WHERE dname='accounting');
- SELECT * FROM emp WHERE deptno IN (TABLE deptno); # ERROR 1241 (21000): Operand should contain 1 column(s)



4. ***predicate***:

expr [NOT] BETWEEN *expr1* AND *expr2*

between

The BETWEEN operator is a logical operator that allows you to specify a range to test.

A BETWEEN ***B*** AND ***C***	A is between B and C

between

syntax

WHERE salary BETWEEN (20000 AND 30000) – Illegal

column | expression BETWEEN start_expression AND end_expression

Remember:

- The BETWEEN operator returns TRUE if the expression to test is greater than or equal to the value of the start_expression and less than or equal to the value of the end_expression.
- You can use the greater than or equal to (**>=**) and less than or equal to (**<=**) to substitute the BETWEEN operator.

Note:

- if any input to the BETWEEN or NOT BETWEEN is NULL, then the result is UNKNOWN.

e.g.

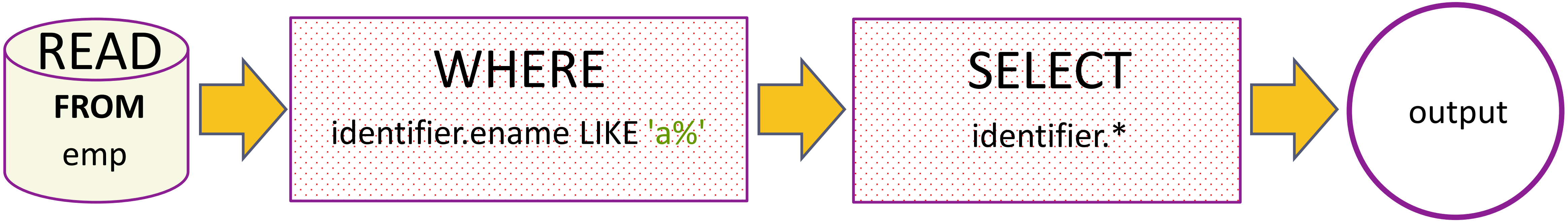
SELET empno, ename, job, hiredate, sal, comm, deptno, isactive FROM emp $\boxed{\text{WHERE sal BETWEEN 1000 AND } \textbf{NULL};}$

- SELECT * FROM salespeople WHERE FORMAT(comm, 2) > 0.1 AND FORMAT(comm, 2) < 0.26;

between

- SELECT empno, ename, job, hiredate, sal, comm, deptno, isactive FROM emp WHERE sal BETWEEN 1000 AND 3000;

	empno	ename	job	hiredate	sal	comm	deptno	isactive
▶	7421	THOMAS	CLERK	1981-07-19	1750.00	NULL	10	0
	7499	ALLEN	SALESMAN	1981-02-20	1600.00	300.00	30	1
	7521	WARD	SALESMAN	1981-02-22	1250.00	500.00	30	1
	7566	JONES	MANAGER	1981-04-02	2975.00	NULL	20	1
	7654	MARTIN	SALESMAN	1981-09-28	1250.00	1400.00	30	1
	7698	BLAKE	MANAGER	1981-05-01	2850.00	NULL	30	1
	7782	CLARK	MANAGER	1981-06-09	2450.00	NULL	10	1
	7788	SCOTT	ANALYST	1982-12-09	3000.00	NULL	20	1
	7844	TURNER	SALESMAN	1981-09-08	1500.00	0.00	30	1
	7876	ADAMS	CLERK	1983-01-12	1100.00	NULL	20	1
	7902	FORD	ANALYST	1981-12-03	3000.00	NULL	20	0
	7920	GRASS	SALESMAN	1980-02-14	2575.00	2700.00	30	1



4. *predicate*:

expr [NOT] LIKE *expr* [ESCAPE *char*]

like

The LIKE operator is a logical operator that tests whether a string contains a specified pattern or not.

like - string comparison functions

syntax

column | expression LIKE 'pattern' [ESCAPE escape_character]

Remember:

- **%** matches any number of characters, even zero characters.
- _ matches exactly one character.
- If we use default escape character '\', then don't use ESCAPE keyword.

Note:

- The ESCAPE keyword is used to escape pattern matching characters such as the (%) percentage and underscore (_) if they form part of the data.
- If you do not specify the ESCAPE character, \ is assumed.

---

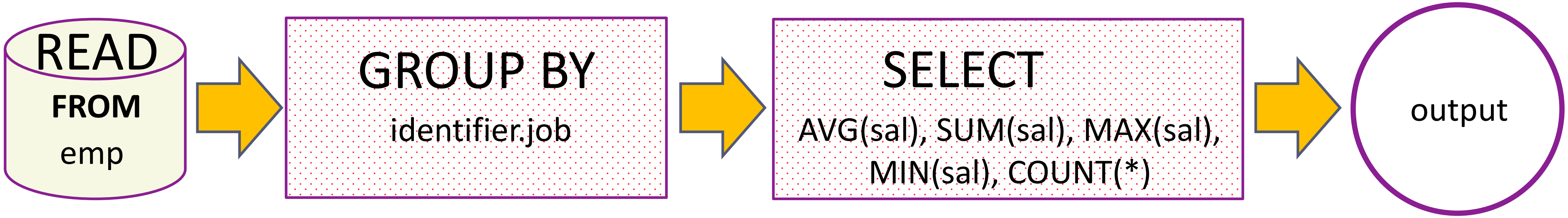
like

- SELECT empno, ename, job, hiredate, sal, comm, deptno, isactive FROM emp WHERE ename LIKE 'a%';

	empno	ename	job	hiredate	sal	comm	deptno	isactive
▶	7415	AARAV	CLERK	1981-12-31	3350.00	NULL	10	0
	7499	ALLEN	SALESMAN	1981-02-20	1600.00	300.00	30	1
	7876	ADAMS	CLERK	1983-01-12	1100.00	NULL	20	1
	7945	AARUSH	SALESMAN	1980-02-14	1350.00	2700.00	30	0
	7949	ALEX	MANAGER	1982-01-24	1250.00	500.00	30	1

What will be the result of the query below?

- SELECT * FROM emp WHERE ename LIKE 's%';
- SELECT * FROM emp WHERE 'saleel' LIKE 's%';
- SELECT * FROM emp WHERE True LIKE '1';
- SELECT * FROM emp WHERE True LIKE '1%';
- SELECT * FROM emp WHERE True LIKE 001;
- SELECT * FROM emp WHERE True LIKE 100;
- SELECT * FROM emp WHERE False LIKE 100 OR 0;
- SELECT * FROM emp WHERE False LIKE 0 AND 1;



aggregate functions

SUM, AVG, MAX, MIN, COUNT, and GROUP_CONCAT

SELECT . . . . . FROM table_name WHERE <condition> / GROUP BY column_name

this is invalid

SUM(colNM) / AVG(colNM) / MAX(colNM)
MIN(colNM) / COUNT(*) / COUNT(colNM)

- SET *SQL_MODE* = ' ';
- SET *SQL_MODE* = IGNORE_SPACE;

Remember:

None of the below two queries get executed unsuccessfully. The reason is that a condition in a WHERE clause cannot contain any aggregate function (or group function) without a subquery!

- SELECT empno, ename, sal, deptno FROM emp WHERE sal = MAX(sal); #error
- SELECT empno, ename, sal, deptno FROM emp WHERE MAX(sal) = sal; #error

Remember:

There are 3 places where aggregate functions can appear in a query.

- in the SELECT-LIST/FIELD-LIST (the items before the FROM clause).
- in the ORDER BY clause.
- in the HAVING clause.

Note:

- The aggregate functions allow you to perform the calculation of a set of rows and **return a *single* value**.
- The WHERE clause cannot refer to aggregate functions. e.g. WHERE SUM(sal) = 5000 # Invalid, Error
- The HAVING clause can refer to aggregate functions. e.g. HAVING SUM(sal) = 5000 # Valid, No Error
- Nesting of aggregate functions are not allowed.

  e.g.

  ```
  SELECT MAX(COUNT(*)) FROM emp GROUP BY deptno;
  ```
- Blank space between aggregate functions like (SUM, MIN, MAX, COUNT) are not allowed.

  e.g.

  ```
  SELECT SUM (sal) FROM emp;
  ```
- The GROUP BY clause is often used with an aggregate function to perform calculation and **return a single value for each subgroup**.
- To eliminate duplicates before applying the aggregate function is available by including the keyword DISTINCT.

Things to… Remember: aggregate functions

TODO

AVG([DISTINCT] *expr*)

- If there are no matching rows, AVG() **returns NULL.**
- AVG() may take a numeric argument, and it returns a average of non-NULL values.

e.g.

- `SELECT AVG(1) "R1";`
- `SELECT AVG(NULL) "R1";`
- `SELECT AVG(1) "R1" WHERE True;`
- `SELECT AVG(1) "R1" WHERE False;`
- `SELECT AVG(1) "R1" FROM emp;`
- `SELECT AVG(sal) "R1" FROM emp WHERE empno = -1;`
- `SELECT AVG(sal) "Avg Salary" FROM emp;`
- `SELECT job, AVG(sal) "Avg Salary" FROM emp GROUP BY job;`

Things to… Remember: *aggregate functions*

TODO

SUM([DISTINCT] *expr*)

- If there are no matching rows, SUM() **returns NULL.**
- SUM() may take a numeric argument , and it returns a sum of non-NULL values.

e.g.

- SELECT SUM(1) "R1";
- SELECT SUM(NULL) "R1";
- SELECT SUM(2 + 2 * 2);
- SELECT SUM(1) "R1" WHERE True;
- SELECT SUM(1) "R1" WHERE False;
- SELECT SUM(1) "R1" FROM emp;
- SELECT SUM(sal) "R1" FROM emp WHERE empno = -1;
- SELECT SUM(sal) "Total Salary" FROM emp;
- SELECT job, SUM(sal) "Total Salary" FROM emp GROUP BY job;

Things to… Remember: *aggregate functions*

TODO

SUM([DISTINCT] *expr*)

- If there are no matching rows, SUM() **returns NULL.**
- SUM() may take a numeric argument , and it returns a sum of non-NULL values.

r = { -2, 1, 2, -1, 3, -2, 1, 2, 1 }

- SELECT SUM(c1) "R1" FROM r;
- SELECT SUM(IF(c1 >= 0, c1, NULL)) FROM r;
- SELECT SUM(IF(c1 < 0, c1, NULL)) FROM r;

- SELECT custId, type, amount, CASE type WHEN 'd' THEN amount WHEN 'c' THEN amount * -1 END amount FROM transactions;

Things to… Remember: *aggregate functions*

TODO

MAX([DISTINCT] *expr*)

- If there are no matching rows, MAX() **returns NULL**.
- MAX() may take a string, number, and date argument, and it returns a maximum of non-NULL values.

e.g.

- `SELECT MAX(1) "R1";`
- `SELECT MAX(NULL) "R1";`
- `SELECT MAX('VIKAS');`
- `SELECT MAX(1) "R1" WHERE True;`
- `SELECT MAX(1) "R1" WHERE False;`
- `SELECT MAX(1) "R1" FROM emp;`
- `SELECT MAX(sal) "R1" FROM emp WHERE empno = -1;`
- `SELECT MAX(sal) "Maximum Salary" FROM emp;`
- `SELECT job, MAX(sal) "Maximum Salary" FROM emp GROUP BY job;`

Things to… Remember: *aggregate functions*

TODO

MIN([DISTINCT] *expr*)

- If there are no matching rows, MIN() **returns NULL.**
- MIN() may take a string, number, and date argument, and it returns a minimum of non-NULL values.

e.g.

- SELECT MIN(1) "R1";
- SELECT MIN(NULL) "R1";
- SELECT MIN(1) "R1" WHERE True;
- SELECT MIN(1) "R1" WHERE False;
- SELECT MIN(1) "R1" FROM emp;
- SELECT MIN(sal) "R1" FROM emp WHERE empno = -1;
- SELECT MIN(sal) "Minimum Salary" FROM emp;
- SELECT job, MIN(sal) "Minimum Salary" FROM emp GROUP BY job;

Things to… Remember:

aggregate functions

TODO

COUNT([DISTINCT] *expr*)

- If there are no matching rows, COUNT() **returns 0.**
- Returns a count of the number of non-NULL values.
- COUNT(*) is somewhat different in that it returns a count of the number of rows retrieved, whether or not they contain NULL values.
- COUNT (*) is a special implementation of the COUNT function that returns the count of all the rows in a specified table.
- COUNT (*) also considers Nulls and duplicates.

e.g.

- SELECT COUNT(*) "R1";
- SELECT COUNT(NULL) "R1";
- SELECT COUNT(*) "R1" WHERE True;
- SELECT COUNT(*) "R1" WHERE False;
- SELECT COUNT(0) FROM emp;
- SELECT COUNT(1) FROM emp;
- SELECT COUNT(*) FROM emp WHERE empno = -1;
- SELECT COUNT(comm) "R1" FROM emp;
- SELECT job, COUNT(*) "R1" FROM emp GROUP BY job;

Note:

- **COUNT (*):** Returns a number of rows in a table including duplicates rows and rows containing null values in any of the columns.
- **COUNT (EXP):** Returns the number of non-null values in the column identified by expression.
- **COUNT (DISTINCT EXP):** Returns the number of unique, non-null values in the column identified by expression.

Things to… Remember: *aggregate functions*

TODO

```
GROUP_CONCAT([DISTINCT] expr
             [ORDER BY {unsigned_integer | col_name | expr}  [ASC | DESC] [,col_name . . .]]
             [SEPARATOR str_val])
```

e.g.

- SELECT job, GROUP_CONCAT(ename) FROM emp GROUP BY job;
- SELECT deptno, GROUP_CONCAT(ename) FROM emp group BY deptno;

- SELECT job, CONCAT(GROUP_CONCAT(ename),' (', COUNT(*), ')') FROM emp GROUP BY job;
- SELECT job, CONCAT(GROUP_CONCAT(sal),' (', MAX(sal), ')') FROM emp GROUP BY job;
- SELECT job, CONCAT(GROUP_CONCAT(sal),' (', SUM(sal), ')') FROM emp GROUP BY job;

```sql
SELECT DISTINCT COUNT(JOB) FROM EMP

SELECT COUNT(DISTINCT JOB) FROM EMP
```

- SET *SQL_MODE* = '';
- SET *SQL_MODE* = 'ONLY_FULL_GROUP_BY';

$$G_{A_1, A_2, \ldots, A_n,} G_{F_1(A_1), F_2(A_2), \ldots, F_m(A_m)} (r)$$

group by clause

Remember:

- Standard SQL does not allow you to use an ALIAS in the GROUP BY clause, however, MySQL supports this.

Note:

- DISTINCT (if used outside an aggregation function) that is superfluous.

e.g.

```sql
SELECT DISTINCT COUNT(ename) FROM emp;
```

select - group by

- Columns selected for output can be referred to in ORDER BY and GROUP BY clauses using column names, column aliases, or column positions. Column positions are integers and begin with 1

- If you use GROUP BY, output rows are sorted according to the GROUP BY columns as if you had an ORDER BY for the same columns. To avoid the overhead of sorting that GROUP BY produces, add ORDER BY NULL.

- If a query includes GROUP BY but you want to avoid the overhead of sorting the result, you can suppress sorting by specifying ORDER BY NULL.

For example:

- `SELECT job, COUNT(*) FROM emp GROUP BY job ORDER BY NULL;`
- `SELECT * FROM emp ORDER BY FIELD (job, 'MANAGER', 'SALESMAN');`

This function's will produce a single value for an entire group or a table.

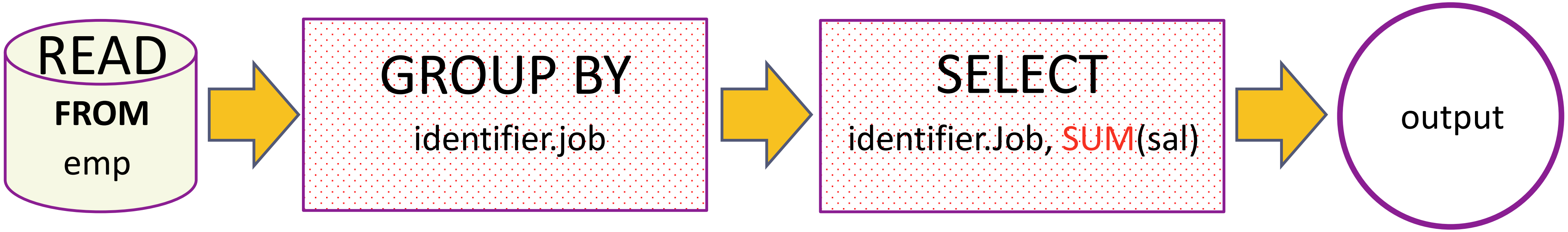
select - group by

You can use GROUP BY to group values from a column, and, if you wish, perform calculations on that column.

SELECT $\boldsymbol{G_1}, \boldsymbol{G_2}, \ldots, \boldsymbol{F_1}(\boldsymbol{A_1}), \boldsymbol{F_2}(\boldsymbol{A_2}), \ldots$ FROM $\boldsymbol{r_1}, \boldsymbol{r_2}, \boldsymbol{r_3} \ldots$

[GROUP BY {$\boldsymbol{G_1}, \boldsymbol{G_2}, \ldots$ | expr | position}, . . . [WITH ROLLUP]]

- SELECT job, SUM(sal) FROM emp GROUP BY job;
- SELECT job, SUM(sal) FROM emp GROUP BY job WITH ROLLUP;



job	sum(sal)
CLERK	9250
SALESMAN	9525
MANAGER	13675
ANALYST	6000
PRESIDENT	5000

job	sum(sal)
ANALYST	6000
CLERK	9250
MANAGER	13675
PRESIDENT	5000
SALESMAN	9525
NULL	43450

select - group by

- SET *SQL_MODE* = '';
- SET *SQL_MODE* = 'ONLY_FULL_GROUP_BY';

Examples:

- SELECT job, sal + 1001 FROM emp GROUP BY job;
- SELECT job, COUNT(job) FROM emp GROUP BY COUNT(job); # error
- SELECT job, sal + 1001 FROM emp GROUP BY sal + 1001;
- SELECT LENGTH(ename) R1 FROM emp GROUP BY R1;
- SELECT job, SUM(sal) FROM emp GROUP BY job WITH ROLLUP;
- SELECT COALESCE (job, 'Total'), SUM(sal) FROM emp GROUP BY job WITH ROLLUP;

Remember:

- The WHERE clause **cannot refer** to aggregate functions. [WHERE SUM(sal) = 5000 # Error]
- The HAVING clause **can refer** to aggregate functions. [HAVING SUM(sal) = 5000 # No Error]

having clause

The MySQL **HAVING clause** is used in the SELECT statement to specify filter conditions for a group of rows. **HAVING clause** is often used with the GROUP BY clause. When using with the GROUP BY clause, we can apply a filter condition to the columns that appear in the GROUP BY clause.

Note:

- Columns given in **HAVING** clause must be present in selection-list.

e.g.

1. SELECT COUNT(*) FROM emp HAVING deptno=10; *
2. SELECT deptno, COUNT(*) FROM emp GROUP BY deptno HAVING job='manager'; *

* ERROR: Unknown column '. . .' in 'having clause'

- **HAVING** is merged with **WHERE** if you do not use GROUP BY or Aggregate Functions (COUNT(), . . .)

select - having

SELECT $\boldsymbol{G_1}$, $\boldsymbol{G_2}$, . . . , $\boldsymbol{F_1(A_1)}$, $\boldsymbol{F_2(A_2)}$, . . . FROM $\boldsymbol{r_1}$, $\boldsymbol{r_2}$, $\boldsymbol{r_3}$ . . .

[GROUP BY {$\boldsymbol{G_1}$, $\boldsymbol{G_2}$, . . . | expr | position}, . . . [WITH ROLLUP]]

[HAVING having_condition]

- SELECT COUNT(*), job FROM emp GROUP BY job HAVING COUNT(*) > 2;

	count(*)	job
▶	6	CLERK
	6	SALESMAN
	5	MANAGER

When WHERE and HAVING clause are used together in a SELECT query with aggregate function, WHERE clause is applied first on individual rows and only rows which pass the condition is included for creating groups. Once group is created, HAVING clause is used to filter groups based upon condition specified.

difference between where and having clause

where and having clause

Remember:

- ***WHERE*** clause can be used with - SELECT, UPDATE, and DELETE statements, where as ***HAVING*** clause can only be used with the SELECT statement.
- ***WHERE*** clause filters rows before aggregation (GROUPING), where as, ***HAVING*** clause filters groups, after the aggregations are performed.
- ***WHERE*** is used before the ‘GROUP BY’ clause if required and ***HAVING*** is used after the ‘GROUP BY’ clause.
- Aggregate functions (SUM***,*** MIN***,*** MAX***,*** AVG and COUNT) cannot be used in the ***WHERE*** clause, unless it is in a sub query contained in a ***WHERE*** or ***HAVING*** clause, whereas, aggregate functions can be used in ***HAVING*** clause.

Note:

- The WHERE clause acts as a pre-filter where as HAVING clause acts as a post-filter.

where vs having

WHERE Vs HAVING

WHERE	HAVING
Implemented in row operations.	Implemented in column operations.
Single row	Summarized row or group or rows.
It only fetches the data from particular rows or table according to the condition.	It only fetches the data from grouped data according to the condition.
Aggregate Functions **c**cannot appear in WHERE clause.	Aggregate Functions Can appear in HAVING clause.
Used with SELECT and other statements such as UPDATE, DELETE or either one of them.	Used with SELECT statement only.
Pre-filter	Post-filter
GROUP BY Comes after WHERE.	GROUP BY Comes before HAVING.

window function

Use ORDER BY *expr* with PARTITION BY *expr* to see the effect of PARTITION BY *expr*.

- RANK() OVER(PARTITION BY *expr* [, *expr*] . . . ORDER BY *expr* [ASC | DESC] [, *expr* [ASC | DESC]] . . .)
- DENSE_RANK() OVER(PARTITION BY *expr* [, *expr*] . . . ORDER BY *expr* [ASC|DESC] [, *expr* [ASC | DESC]] . . .)
- ROW_NUMBER() OVER([PARTITION BY *expr* [, *expr*] . . . ORDER BY *expr* [ASC|DESC] [, *expr* [ASC | DESC]] . . .])

Note:

MySQL does not support these window function features.

- DISTINCT syntax for aggregate functions.
- Nested window functions
- Window function cannot be the part of WHERE condition

FIFA / Forbes

window function- examples

- SELECT ROW_NUMBER() OVER() R1, emp.* FROM emp;
- SELECT RANK() OVER(PARTITION BY job ORDER BY sal) R1, ename, sal, job FROM emp;
- SELECT DENSE_RANK() OVER(PARTITION BY job ORDER BY sal) R1, ename, sal, job FROM emp;
- SELECT ordid, total, SUM(total) OVER(ORDER BY ordid) FROM ord;
- SELECT * FROM (SELECT ROW_NUMBER() OVER() R1, emp.* FROM emp) d WHERE R1> (SELECT COUNT(*) - 2 FROM emp);

- SELECT custId, type, amount, CASE type WHEN 'd' THEN amount WHEN 'c' THEN amount * -1 END amount FROM transactions;
- SELECT year, quarter, amount, SUM(amount) OVER(PARTITION BY year ORDER BY quarter) R1 FROM quarter_revenue;
- SELECT custId, type, amount, SUM(CASE type WHEN 'd' THEN amount WHEN 'c' THEN amount * -1 END) OVER(PARTITION BY custID ORDER BY _id) amount FROM transactions;

user-defined variables

user-defined variables

TODO

Remember:

- A user variable name can contain other characters if you quote it as a string or identifier (for example, @'my-var', @"my-var", or @`my-var`).
- User-defined variables are session specific. A user variable defined by one client cannot be seen or used by other clients.
- All variables for a given client session are automatically freed when that client exits.
- User variable names are not case sensitive. Names have a maximum length of 64 characters.
- If the value of a user variable is selected in a result set, it is returned to the client as a string.
- If you refer to a variable that has not been initialized, it has a value of NULL and a type of string.

  e.g. `SELECT @variable_name;`

user-defined variables

You can store a value in a user-defined variable in one statement and refer to it later in another statement. This enables you to pass values from one statement to another.

SET *@variable_name* = *expr* [, *@variable_name* = *expr*] . . .

Remember:

- for SET, either = or := can be used as the assignment operator.
- You can also assign a value to a user variable in statements (SELECT, ...) other than SET. In this case, the assignment operator must be := and **not** = because latter is treated as the **comparison operator =**.

- `set @v1 = 1001, @v2 := 2, @v3 = 'Saleel';`
- `set @v1 = 1001, @v2 = 2, @v3 := @v1 + @v2;`
- `SELECT @v1 := MIN(sal), @v2 := MAX(SAL) FROM emp;`
- `SELECT @v1, @v2, @v3;`

```
SELECT VARIABLE_NAME , VARIABLE_VALUE FROM
PERFORMANCE_SCHEMA.USER_VARIABLES_BY_THREAD;
```

user-defined variables

Note:

- User variables are intended to provide data values. They cannot be used directly in an SQL statement as an identifier or as part of an identifier.

e.g.

```
SET @v1 = 'ENAME';                #WHERE ENAME IS COLUMN NAME.
SELECT @v1 FROM emp;
```

	@x
	ename
	ename
	ename
	ename
	ename
	ename
	ename
	ename
	ename
	ename
	ename
	ename

rownum

```
mysql> SELECT * FROM (SELECT @cnt := @cnt + 1 "R1", emp.* FROM emp, (SELECT @cnt := 0) T1) T2 WHERE "R1" > @cnt - 7;
```

select - rownum

```
mysql> SET @rank = 0;
mysql> SELECT @row := @row + 1 as rownum , emp.* FROM emp;
mysql> SELECT @row := @row + 1 as rownum , emp.* FROM emp,  (SELECT @row := 0) as E;
mysql> SELECT @row := @row + 1 ,E.* FROM (SELECT job, sal FROM emp  GROUP BY job ORDER BY SAL DESC) E , (SELECT
       @row := 0) EE;
```

ROWNUM	EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO	BONUSID	USER NAME	PWD
1	7839	KING	PRESIDENT	NULL	1981-11-17 00:00:00	5000.00	NULL	10	1	KING	r50mpm
2	7698	BLAKE	MANAGER	7839	1981-05-01 00:00:00	2850.00	NULL	30	1	BLAKE	sales@2017
3	7782	CLARK	MANAGER	7839	1981-06-09 00:00:00	2450.00	NULL	10	3	CLARK	r50mpm
4	7566	JONES	MANAGER	7839	1981-04-02 00:00:00	2975.00	NULL	20	4	JONES	a12recmpm
5	7654	MARTIN	SALESMAN	7698	1981-09-28 00:00:00	1250.00	1400.00	30	6	MARTIN	sales@2017
6	7499	ALLEN	SALESMAN	7698	1981-02-20 00:00:00	1600.00	300.00	30	4	ALLEN	sales@2017
7	7844	TURNER	SALESMAN	7698	1981-09-08 00:00:00	1500.00	0.00	30	5	TURNER	sales@2017
8	7900	JAMES	CLERK	7698	1981-12-03 00:00:00	950.00	NULL	30	2	JAMES	sales@2017
9	7521	WARD	SALESMAN	7698	1981-02-22 00:00:00	1250.00	500.00	30	1	WARD	sales@2017
10	7902	FORD	ANALYST	7566	1981-12-03 00:00:00	3000.00	NULL	20	4	FORD	a12recmpm

Examples:

common sql statements mistakes

- SELECT ename, job, sal, comm FROM emp WHERE comm = NULL; #using comparison operator to check NULL
- SELECT job, COUNT(job) FROM emp; #not giving group by clause
- SELECT job, COUNT(job) FROM emp WHERE COUNT(job) > 4; #use of aggregate function in where clause
- SELECT job, deptno, COUNT(job) FROM emp GROUP BY job; #not giving all the columns in group by clause
- SELECT ename, COUNT(job) FROM emp GROUP BY ename; #grouping by a unique key
- SELECT ename, sal, sal + 1000 R1 FROM emp WHERE R1 > 2400; #use of alias name in where clause
- SELECT ename, sal FROM emp WHERE sal BETWEEN (1000 and 4000); #use of () in between comparison operator

r1 = { col1, col2, col3 }

- INSERT INTO ***r1*** VALUSE(10, 10); #number of values are less than the number of columns in the table
- INSERT INTO ***r1*** VALUSE(10, 10, 10, 10); #number of values are more than the number of columns in the table

Remember:

- A subquery must be enclosed in parentheses.
- Use single-row operators with single-row subqueries, and use multiple-row operators with multiple-row subqueries.
- If a subquery (inner query) returns a null value to the outer query, the outer query will not return any rows when using certain comparison operators in a WHERE clause.
- If ORDER BY occurs within a subquery and also is applied in the outer query, the outermost ORDER BY takes precedence.
- If LIMIT occurs within a subquery and also is applied in the outer query, the outermost LIMIT takes precedence.

sub-queries

A subquery is a SELECT statement within another statement.

Note:

- You may use comparison operators such as **<>**, **<**, **>**, **<=**, and **>=** with a single row subquery.
- Multiple row subquery returns one or more rows to the outer SQL statement. You may use the **IN**, **ANY**, or **ALL** operator in outer query to handle a subquery that returns multiple rows.

subqueries

A subquery is a SELECT statement within another statement.

Remember:

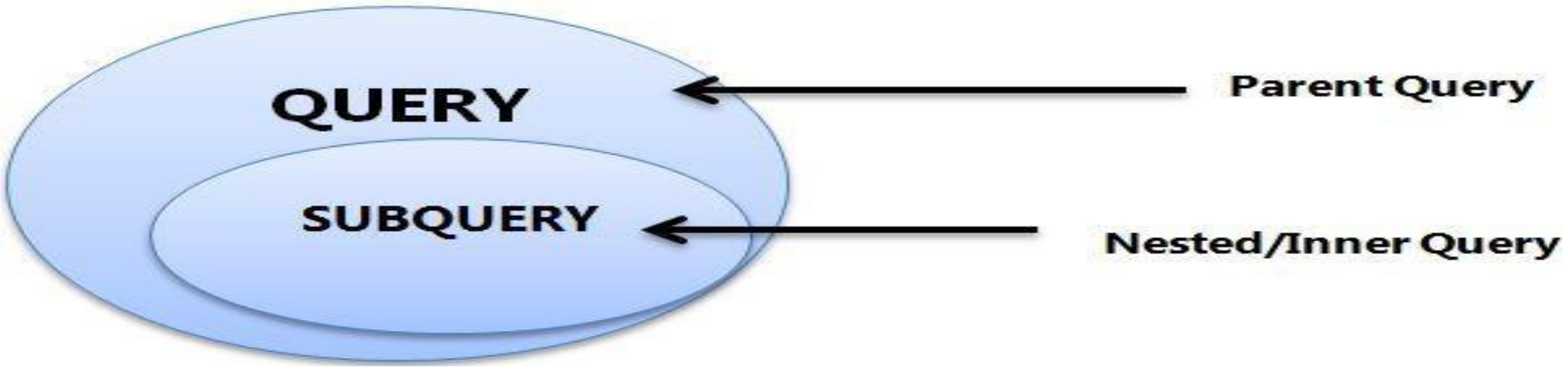
A subquery may occur in:

- A SELECT clause
- A FROM clause
- A WHERE clause
- A HAVING clause

Note:

A subquery's outer statement can be any one of:

- SELECT
- INSERT
- UPDATE
- DELETE
- CREATE



- INSERT . . . SELECT . . .
- UPDATE . . . SELECT . . .
- DELETE . . . SELECT . . .
- CREATE TABLE . . . AS SELECT . . .
- CREATE VIEW . . . AS SELECT . . .
- DECLARE CURSOR . . . AS SELECT . . .
- EXPLAIN SELECT . . .

single row subqueries

A single row subquery returns ***zero or one row*** to the outer SQL statement. You can place a subquery in a ***WHERE*** clause, a ***HAVING*** clause, or a ***FROM*** clause of a SELECT statement.

Outer Query

Subquery or Inner query

```
SELECT FIRSTNAME, LASTNAME FROM
EMP WHERE DEPTNO = (SELECT DEPTNO FROM EMP
                    WHERE DNAME = 'SALES')
```

multiple row and column subqueries

A multiple row subquery returns ***one or more rows*** to the outer SQL statement. You may use the ***IN***, ***ANY***, or ***ALL*** operator in outer query to handle a subquery that returns multiple rows.

Outer Query

Subquery or Inner query

```
SELECT FIRSTNAME, LASTNAME FROM
EMP WHERE DEPTNO IN (SELECT DEPTNO FROM DEPT
                     WHERE DNAME = 'RESEARCH' OR
                     DNAME = 'SALES')
```

types of subqueries

- The Subquery as Scalar Operand – SELECT clause
- Comparisons using Subqueries – WHERE / HAVING clause (*Single row subquery*)
- Subqueries in the FROM Clause – INLINE VIEWS (*Derived Tables*)
- Subqueries with ALL, ANY, IN, or SOME – WHERE / HAVING clause (*Multiple row subquery*)
- Subqueries with EXISTS or NOT EXISTS

WITH var(param) as (SELECT) [CET] Common Table Expressions

```
WITH a(p1, p2, p3, p4) AS (SELECT * FROM dept) SELECT p1, p2, p3, p4 FROM a;
```

the subquery as scalar operand

the subquery as scalar operand

TODO

SELECT A_1, A_2, A_3, (***subquery***) as A_4, . . . FROM ***r***

Remember:

- A scalar subquery is a subquery that returns **exactly one column value from one row**.
- A scalar subquery is a simple operand, and you can use it almost anywhere a single column value is legal.

Note:

- If the subquery returns 0 rows then the value of scalar subquery expression is **null**.
- if the subquery returns more than one row then MySQL returns an **error**.

Think:

- `SELECT (SELECT 1, 2); #error`
- `SELECT (SELECT ename, sal FROM emp); #error`
- `SELECT (SELECT * FROM emp); #error`
- `SELECT (SELECT NULL + 1);`
- `SELECT ename, (SELECT dname FROM dept WHERE emp.deptno = dept.deptno) R1 FROM emp ;`

the subquery as scalar operand

e.g.

- SELECT (SELECT stdprice FROM price WHERE prodid = 100890 AND enddate IS NOT NULL) AS "Standard Price", (SELECT minprice FROM price WHERE prodid = 100890 AND enddate IS NOT NULL) AS "Minimum Price";

	Standard Price	Minimum Price
	54.00	40.50

- SELECT (SELECT stdprice FROM price WHERE prodid = 100890 AND enddate IS NOT NULL) - (SELECT minprice FROM price WHERE prodid = 100890 AND enddate IS NOT NULL) AS "Price Difference";

	Price Difference
	13.50

subquery in the from clause

subqueries in the from clause

TODO

SELECT $\boldsymbol{A_1}$, $\boldsymbol{A_2}$, $\boldsymbol{A_3}$, (***subquery***) as $\boldsymbol{A_4}$, . . . FROM (***subquery***) [AS] name . . .

Note:

- Every table in a FROM clause must have a name, therefore the [AS] name clause is mandatory.

- SET @x := 0;
  SELECT * FROM (SELECT @x := @x + 1 as R1, emp.* FROM emp) DT WHERE R1 = 5;
- SELECT * FROM (SELECT @cnt := @cnt + 1 R1, MOD(@cnt,2) R2, emp.* FROM emp, (SELECT @cnt:=0) DT1) DT2 WHERE R2 = 0;
- SELECT MIN(R1) FROM (SELECT COUNT(job) R1 FROM emp GROUP BY job) DT;
- SELECT MAX(R1) FROM (SELECT COUNT(*) R1 FROM actor_movie GROUP BY actorid) DT

	MAX(R1)
	5

- SELECT AVG(SUM(column1)) FROM t1 GROUP BY column1; //ERROR
- SELECT AVG(sum_column1)
  FROM (SELECT SUM(column1) AS sum_column1
  FROM t1 GROUP BY column1) AS t1;

comparisons using subquery

comparisons using subqueries

Comparison Operators like : =, !=/<>, >, >=, <, <= ,<=>

TODO

SELECT A_1, A_2, A_3, (***subquery***) as A_4, . . . FROM ***r*** WHERE ***p*** = (***subquery***)

Remember:

- A subquery can be used before or after any of the comparison operators.
- The subquery can return **at most one value**.
- The value can be the result of an arithmetic expression or a function.

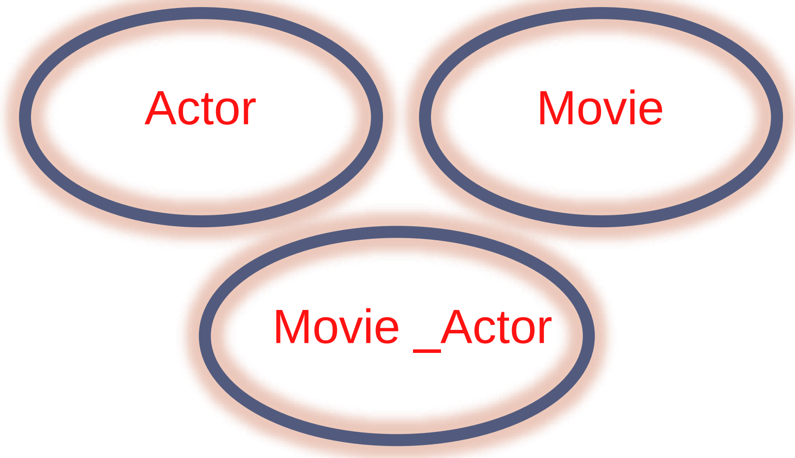
```
SELECT * FROM emp WHERE deptno = (SELECT 5 + 5);
SELECT * FROM emp WHERE sal = (SELECT MAX(sal) FROM emp);
SELECT MAX(sal) FROM emp WHERE sal < (SELECT MAX(sal) FROM emp);
SELECT * FROM emp WHERE sal > (SELECT sal FROM emp GROUP BY sal ORDER BY sal DESC limit 3, 1) ORDER BY sal DESC;
```

Following statements will raise an error.

```
SELECT * FROM emp WHERE deptno = (SELECT deptno FROM dept WHERE deptno IN(10, 20));
```

comparisons using subqueries

movie : (movieid, name, release_date)
actor : (actorid, name)
actor_movie : (actorid, movieid)




- ```
  SELECT a.actorid, a.name FROM actor a, actor_movie am WHERE a.actorid = am.actorid GROUP BY am.actorid HAVING COUNT(*) = (SELECT MAX(R1) FROM (SELECT COUNT(*) "R1" FROM actor_movie GROUP BY actorid) M);
  ```

	actorid	name
	2	Akshav Kumar
	3	Salman Khan
	7	Madhuri Dixit
  ```

Remember:

- When used with a subquery, the word IN is an alias for =ANY
- NOT IN is not an alias for <>ANY, but for <>ALL

subquery with in, all, any, some

subqueries with in, all, any, some

The word SOME is an alias for ANY.

- *operand comparison_operator* ANY (*subquery*)
- *operand* IN (*subquery*)
- *operand comparison_operator* SOME (*subquery*)
- *operand comparison_operator* ALL (*subquery*)

- The **ANY** keyword, which must follow a comparison operator, means return TRUE if the comparison is TRUE for ANY of the values in the column that the subquery returns.
- The word **ALL**, which must follow a comparison operator, means return TRUE if the comparison is TRUE for ALL of the values in the column that the subquery returns.
- **IN** and **=ANY** are ***not synonyms*** when used with an expression list. **IN** can take an expression list, but **= ANY** cannot.

- `SELECT * FROM emp WHERE deptno IN (5 + 5, 10 + 10);`
- `SELECT * FROM emp WHERE job =ANY (SELECT job FROM emp WHERE deptno IN(10, 20)) ;`
- `SELECT * FROM emp WHERE deptno =ANY (10, 20);    //error`

subqueries with in, all, any, some

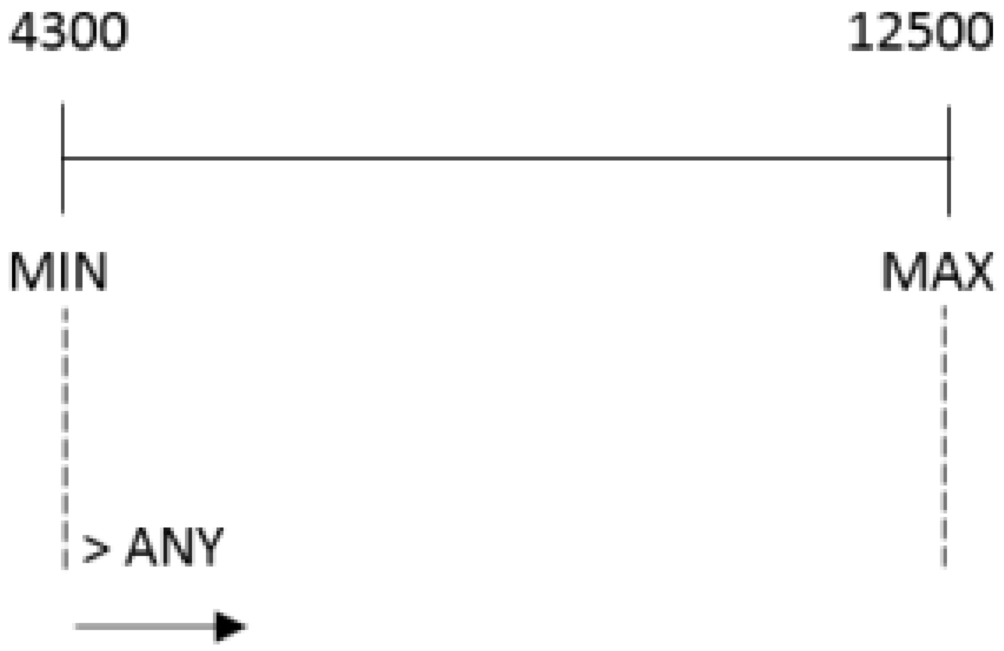
TODO

SELECT A_1, A_2, A_3, (***subquery***) as A_4, . . . FROM (***subquery***) [AS] Alias WHERE ***p*** IN (***subquery***)
SELECT A_1, A_2, A_3, (***subquery***) as A_4, . . . FROM (***subquery***) [AS] Alias WHERE ***p*** ANY (***subquery***)
SELECT A_1, A_2, A_3, (***subquery***) as A_4, . . . FROM (***subquery***) [AS] Alias WHERE ***p*** ALL (***subquery***)

- Remember:
- SELECT * FROM emp WHERE deptno = SELECT deptno FROM dept WHERE dname = 'SALES'; // error
- SELECT * FROM emp WHERE deptno IN SELECT deptno FROM dept WHERE dname = 'SALES'; // error
- SELECT * FROM emp WHERE deptno IN SELECT * FROM dept WHERE dname = 'SALES'; // error

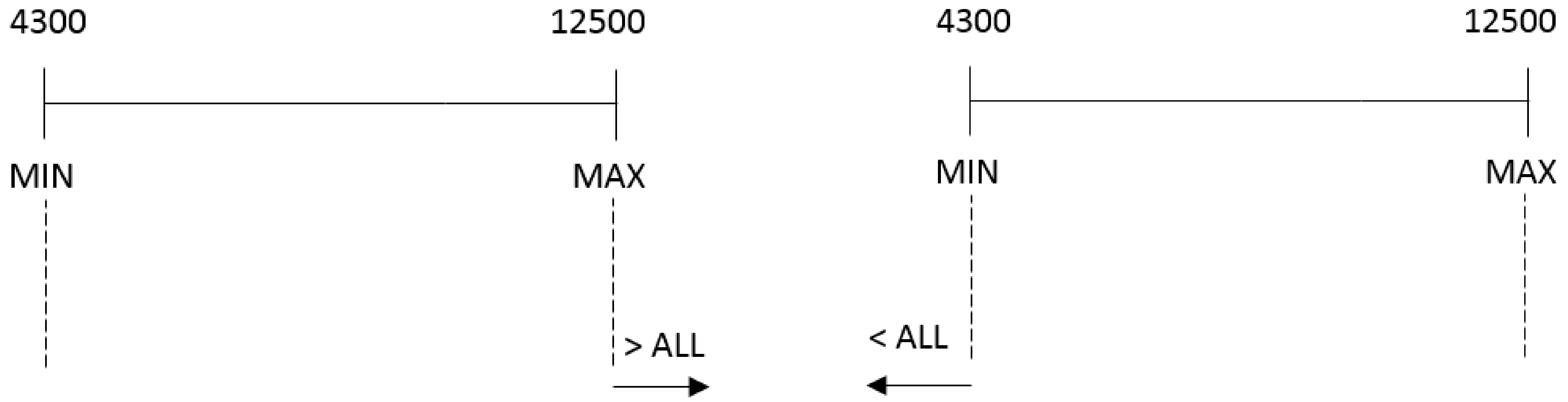
any / some

- "x = ANY (...)": The value must match one or more values in the list to evaluate to TRUE.
- "x != ANY (...)": The value must not match one or more values in the list to evaluate to TRUE.
- "x > ANY (...)": The value must be greater than the smallest value in the list to evaluate to TRUE.
- "x < ANY (...)": The value must be smaller than the biggest value in the list to evaluate to TRUE.
- "x >= ANY (...)": The value must be greater than or equal to the smallest value in the list to evaluate to TRUE.
- "x <= ANY (...)": The value must be smaller than or equal to the biggest value in the list to evaluate to TRUE.



all

- "x = ALL (...)": The value must match all the values in the list to evaluate to TRUE.
- "x != ALL (...)": The value must not match any values in the list to evaluate to TRUE.
- "x > ALL (...)": The value must be greater than the biggest value in the list to evaluate to TRUE.
- "x < ALL (...)": The value must be smaller than the smallest value in the list to evaluate to TRUE.
- "x >= ALL (...)": The value must be greater than or equal to the biggest value in the list to evaluate to TRUE.
- "x <= ALL (...)": The value must be smaller than or equal to the smallest value in the list to evaluate to TRUE.



all

empty table

The expression is TRUE, if table T2 is empty.

```
SELECT * FROM EMP WHERE DEPTNO >ALL (SELECT C1 FROM T2) //
```
This statement will return all rows from EMP table.

subqueries with in, all, any, some

You can use a subquery after a comparison operator, followed by the keyword IN, ALL, ANY, or SOME.

- SELECT * FROM emp WHERE deptno IN (SELECT deptno FROM emp WHERE deptno = 10 OR deptno = 20);
- SELECT * FROM emp WHERE sal >ALL (SELECT sal FROM emp WHERE ename = 'ADAMS' OR ename = 'TURNER');
- SELECT * FROM emp WHERE sal >ANY (SELECT sal FROM emp WHERE ename = 'ADAMS' OR ename = 'TURNER');
- SELECT * FROM emp WHERE sal >SOME (SELECT sal FROM emp WHERE ename = 'ADAMS' OR ename = 'TURNER');

SELECT * FROM d1 WHERE c1 not in (SELECT min(c1) FROM d1 GROUP BY deptno, dname, loc, walletid) ORDER BY deptno;

- SELECT * FROM emp WHERE EXISTS (SELECT 1);

subquery with exists or not exists

subqueries with exists or not exists

The EXISTS operator tests for the existence of rows in the results set of the subquery. If a subquery row value is found, EXISTS subquery returns TRUE and in this case NOT EXISTS subquery will return FALSE.

SELECT ***A***$_1$, ***A***$_2$, ***A***$_3$, ***A***$_4$, . . . FROM ***r*** WHERE [NOT] EXISTS (***subquery***)

The records will be displayed from outer SELECT statement….

- SELECT * FROM emp WHERE EXISTS (SELECT * FROM dept WHERE emp.deptno = dept.deptno);
- SELECT * FROM dept WHERE NOT EXISTS (SELECT deptno FROM emp WHERE emp.deptno = dept.deptno);
- SELECT * FROM emp m WHERE EXISTS (SELECT * FROM emp e WHERE e.mgr = m.empno);
- SELECT * FROM emp m WHERE NOT EXISTS (SELECT * FROM emp e WHERE e.mgr = m.empno);

- SELECT * FROM dept WHERE deptno IN (SELECT * FROM emp WHERE emp.deptno = dept.deptno);
- SELECT * FROM dept WHERE deptno NOT IN (SELECT * FROM emp WHERE emp.deptno = dept.deptno);

- SELECT * FROM emp f WHERE NOT EXISTS (SELECT * FROM emp m WHERE f.deptno = m.deptno AND gender = 'm');
- SELECT * FROM emp m WHERE NOT EXISTS (SELECT true FROM emp f WHERE m.deptno = f.deptno AND f.gender = 'f');

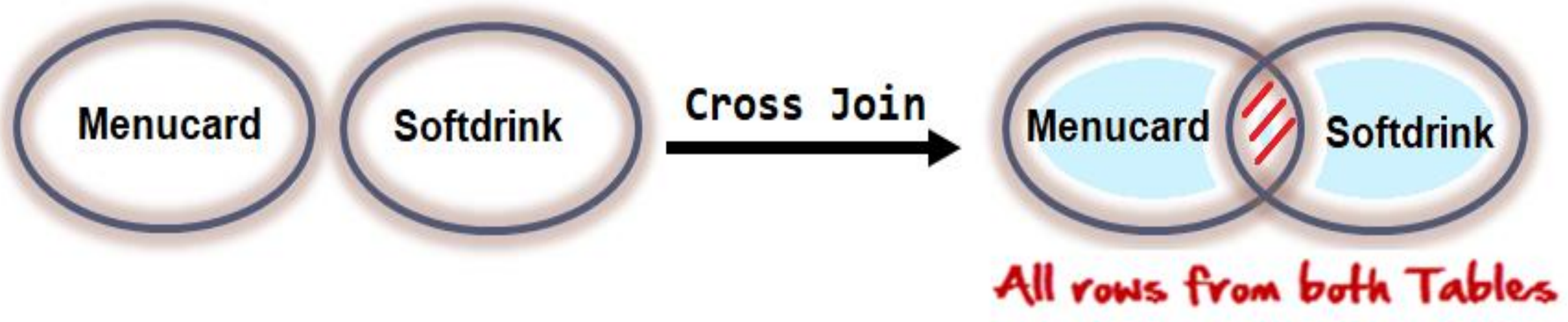
joins

JOINS are used to **retrieve data from multiple tables**.

JOIN is performed whenever **two or more tables** are joined in a SQL statement.

Type of JOINS

- Cartesian or Product Join – Cross Join
- Equijoin – Inner Join
- Natural Join
- Simple Join
- Outer Join – Right Outer Join, Left Outer Join
- Self Join



cartesian or product join

- **Cartesian/Product means** Number of Rows present in Table 1 Multiplied by Number of Rows present in Table 2.
- **Cross Join in MySQL** does not require any common column to **join** two table.

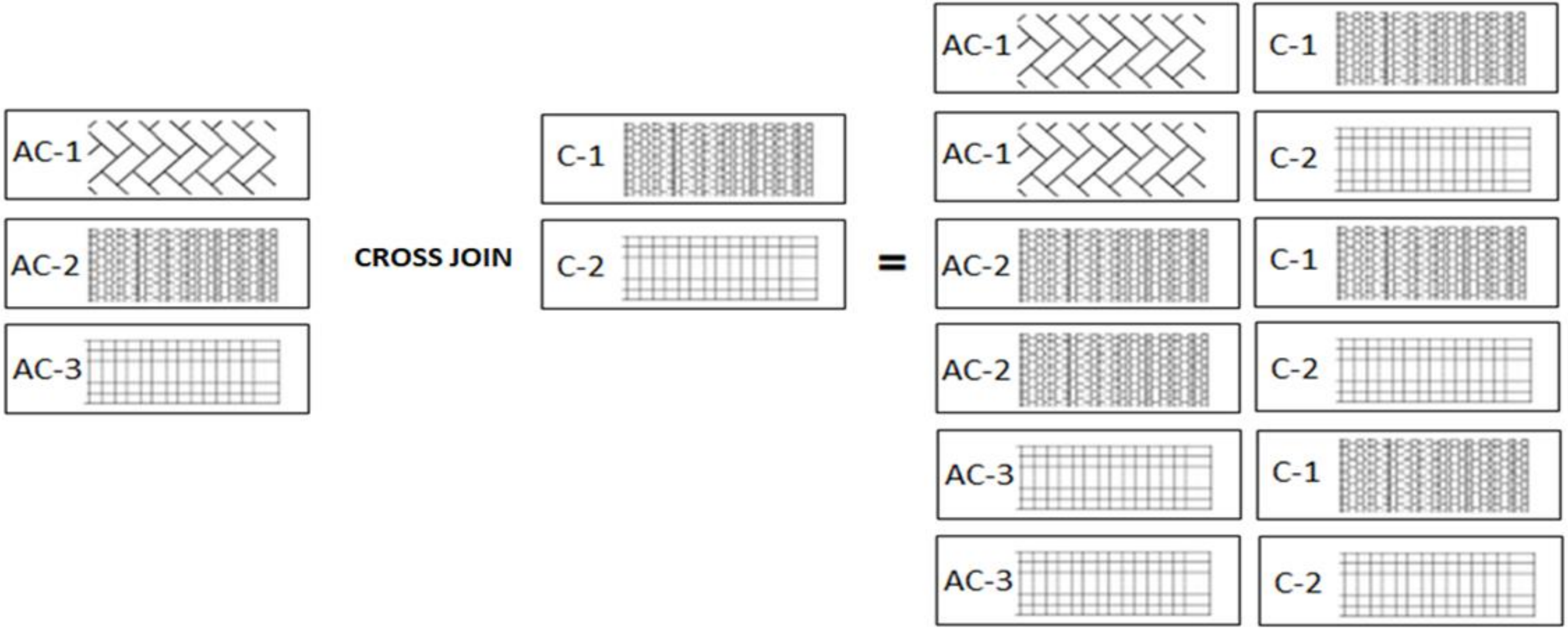
The result of $R(A_1, A_2, \ldots, A_n) \times S(B_1, B_2, \ldots, B_m)$ is a relation Q with degree n + m attributes $Q(A_1, A_2, \ldots, A_n, B_1, B_2, \ldots, B_m)$, in that order.

Degree $d(R \times S) = d(R) + d(S)$.

Cardinality $|R \times S| = |R| * |S|$

joins - cartesian or product

The CROSS JOIN gets a row from the first table (r_1) and then creates a new row for every row in the second table (r_2). It then does the same for the next row for in the first table (r_1) and so on.



joins - cartesian or product

Cartesian or Product joins are joins without a join condition. Each row of one table is combined with each row of another table. The result is referred to as a Cartesian product.

SELECT $\boldsymbol{A_1}$, $\boldsymbol{A_2}$, $\boldsymbol{A_3}$, . . . FROM $\boldsymbol{r_1}$, $\boldsymbol{r_2}$, . . .

- Warehouse/product
- Product/sales_channel
- Cards

$\boldsymbol{r}_1 = \{1, 2\}$
$\boldsymbol{r}_2 = \{a, b, c\}$

$\boldsymbol{r}_1 \text{ x } \boldsymbol{r}_2$

R = { (1, a),
(2, a),
(1, b),
(2, b),
(1, c),
(2, c) }

$\boldsymbol{r}_1 = \{1, 2, 3\}$
$\boldsymbol{r}_2 = \{a, b\}$

$\boldsymbol{r}_1 \text{ x } \boldsymbol{r}_2$

R = { (1, a),
(1, b),
(2, a),
(2, b),
(3, a),
(4, b) }

$\boldsymbol{r}_1 = \{1, 2\}$
$\boldsymbol{r}_2 = \{a, b, null\}$

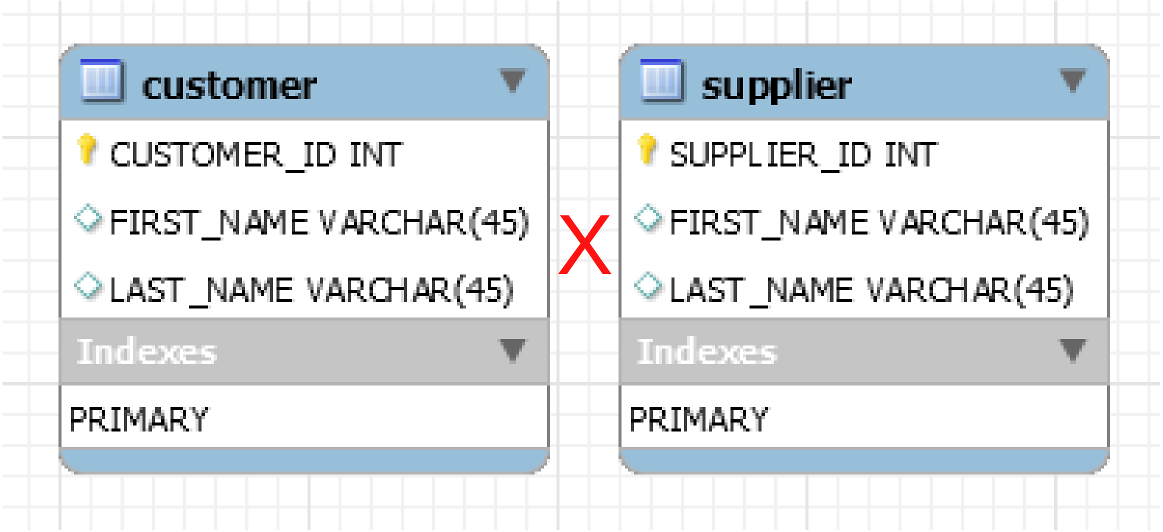
$\boldsymbol{r}_1 \text{ x } \boldsymbol{r}_2$

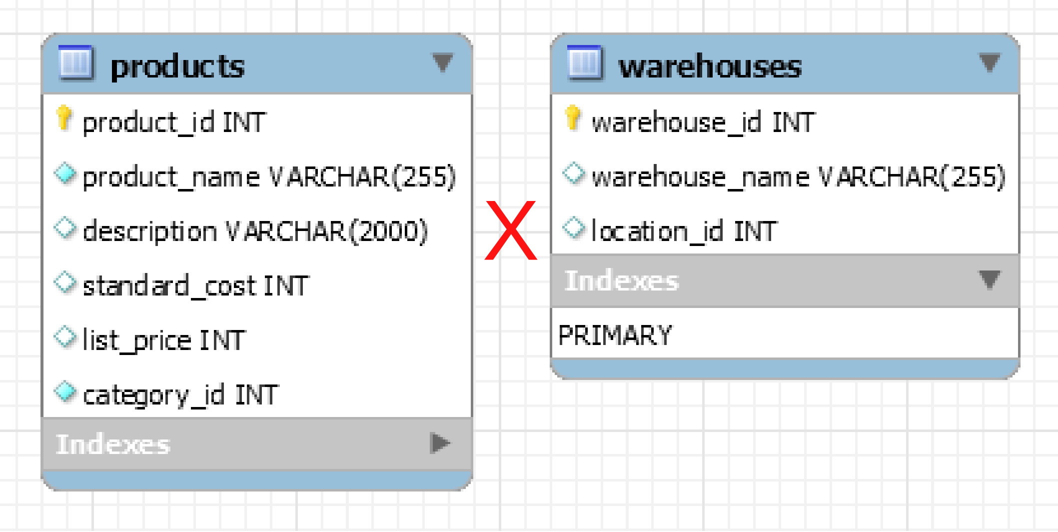
R = { (1, a),
(2, a),
(1, b),
(2, b),
(1, null),
(2, null) }

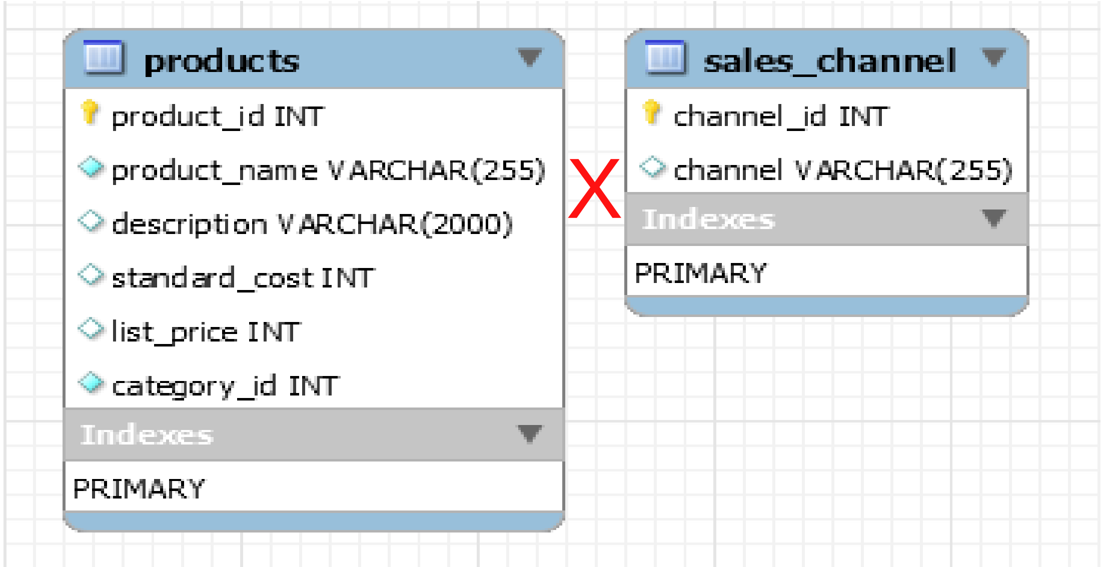
joins - cartesian or product

Cartesian or Product joins are joins without a join condition. Each row of one table is combined with each row of another table. The result is referred to as a Cartesian product.

SELECT $\boldsymbol{A}_1$, $\boldsymbol{A}_2$, $\boldsymbol{A}_3$, . . . FROM $\boldsymbol{r}_1$, $\boldsymbol{r}_2$, . . .







- Warehouse/product
- Product/sales_channel
- Cards

joins - cartesian or product

SELECT $\boldsymbol{A}_1$, $\boldsymbol{A}_2$, $\boldsymbol{A}_3$, . . . FROM $\boldsymbol{r}_1$, $\boldsymbol{r}_2$, . . .

- SELECT * FROM menucard, softdrink;

ID	NAME	RATE
1	Extra Long Cheeseburger	100
2	Double Stacker	125
3	Double Cheeseburger	100
4	Hamburger	85
5	Classic Grilled Dog	95
6	Chili Cheese Grilled Dog	115
7	Flame Grilled Chicken Burger	135
8	Original Chicken Sandwich	55
9	McALLO TIKKI	45
10	Veg Maharaja Mac	75
11	Big Spicy Chicken Wrap	100
12	McVeggie Schezwan	85

ID	NAME	RATE
1	Coca-Cola	45
2	Mello Yello	75
3	Diet Coke	60
4	Frozen Fanta Cherry	65
5	Iced Tea	35

ID	NAME	RATE	ID	NAME	RATE
1	Extra Long Cheeseburger	100	1	Coca-Cola	45
1	Extra Long Cheeseburger	100	2	Mello Yello	75
1	Extra Long Cheeseburger	100	3	Diet Coke	60
1	Extra Long Cheeseburger	100	4	Frozen Fanta Cherry	65
1	Extra Long Cheeseburger	100	5	Iced Tea	35
2	Double Stacker	125	1	Coca-Cola	45
2	Double Stacker	125	2	Mello Yello	75
2	Double Stacker	125	3	Diet Coke	60
2	Double Stacker	125	4	Frozen Fanta Cherry	65
2	Double Stacker	125	5	Iced Tea	35
3	Double Cheeseburger	100	1	Coca-Cola	45
3	Double Cheeseburger	100	2	Mello Yello	75
3	Double Cheeseburger	100	3	Diet Coke	60
3	Double Cheeseburger	100	4	Frozen Fanta Cherry	65
3	Double Cheeseburger	100	5	Iced Tea	35
4	Hamburger	85	1	Coca-Cola	45
4	Hamburger	85	2	Mello Yello	75
4	Hamburger	85	3	Diet Coke	60
4	Hamburger	85	4	Frozen Fanta Cherry	65
4	Hamburger	85	5	Iced Tea	35

joins - cartesian or product

SELECT A_1, A_2, A_3, . . . FROM r_1, r_2, . . .

- SELECT mnu.name, sftdrink.name, mnu.rate, sftdrink.rate, mnu.rate + sftdrink.rate as "Total" FROM menucard mnu, softdrink sftdrink;

ID	NAME	RATE
1	Extra Long Cheeseburger	100
2	Double Stacker	125
3	Double Cheeseburger	100
4	Hamburger	85
5	Classic Grilled Dog	95
6	Chili Cheese Grilled Dog	115
7	Flame Grilled Chicken Burger	135
8	Original Chicken Sandwich	55
9	McALLO TIKKI	45
10	Veg Maharaja Mac	75
11	Big Spicy Chicken Wrap	100
12	McVeggie Schezwan	85

ID	NAME	RATE
1	Coca-Cola	45
2	Mello Yello	75
3	Diet Coke	60
4	Frozen Fanta Cherry	65
5	Iced Tea	35

name	name	rate	rate	Total
Extra Long Cheeseburger	Coca-Cola	100	45	145
Extra Long Cheeseburger	Mello Yello	100	75	175
Extra Long Cheeseburger	Diet Coke	100	60	160
Extra Long Cheeseburger	Frozen Fanta Cherry	100	65	165
Extra Long Cheeseburger	Iced Tea	100	35	135
Double Stacker	Coca-Cola	125	45	170
Double Stacker	Mello Yello	125	75	200
Double Stacker	Diet Coke	125	60	185
Double Stacker	Frozen Fanta Cherry	125	65	190
Double Stacker	Iced Tea	125	35	160
Double Cheeseburger	Coca-Cola	100	45	145
Double Cheeseburger	Mello Yello	100	75	175
Double Cheeseburger	Diet Coke	100	60	160
Double Cheeseburger	Frozen Fanta Cherry	100	65	165
Double Cheeseburger	Iced Tea	100	35	135
Hamburger	Coca-Cola	85	45	130
Hamburger	Mello Yello	85	75	160
Hamburger	Diet Coke	85	60	145
Hamburger	Frozen Fanta Cherry	85	65	150
Hamburger	Iced Tea	85	35	120
Classic Grilled Dog	Coca-Cola	95	45	140
Classic Grilled Dog	Mello Yello	95	75	170
Classic Grilled Dog	Diet Coke	95	60	155

joins - cartesian or product

- SELECT name, COUNT(*) "Total Employees", rate * COUNT(*) "Total Cost" FROM emp, softdrink GROUP BY name;

	NAME	TOTAL EMPLOYEES	TOTAL COST
	Coca-Cola	30	1350
	Diet Coke	30	1800
	Frozen Fanta Cherry	30	1950
	Iced Tea	30	1050
	Mello Yello	30	2250

joins – cross join

The CROSS JOIN produced a result set which is the product of rows of two associated tables when no WHERE clause is used with CROSS JOIN. In this join, the result set appeared by multiplying each row of the first table with all rows in the second table if no condition introduced with CROSS JOIN.

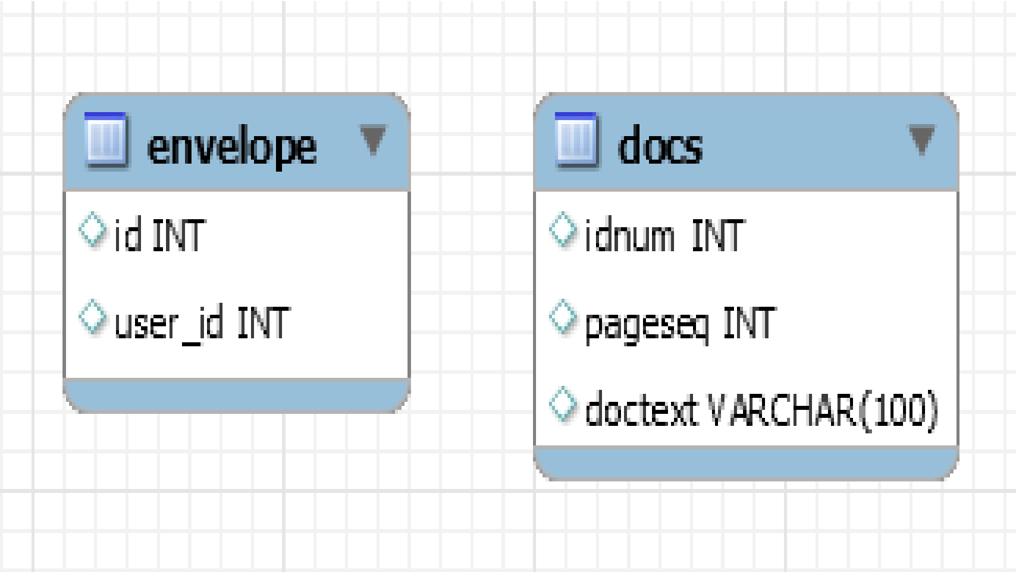
SELECT A_1, A_2, A_3, . . . FROM r_1 CROSS JOIN r_2, . . .

envelope Table

id	user_id
1	1
2	2
3	3

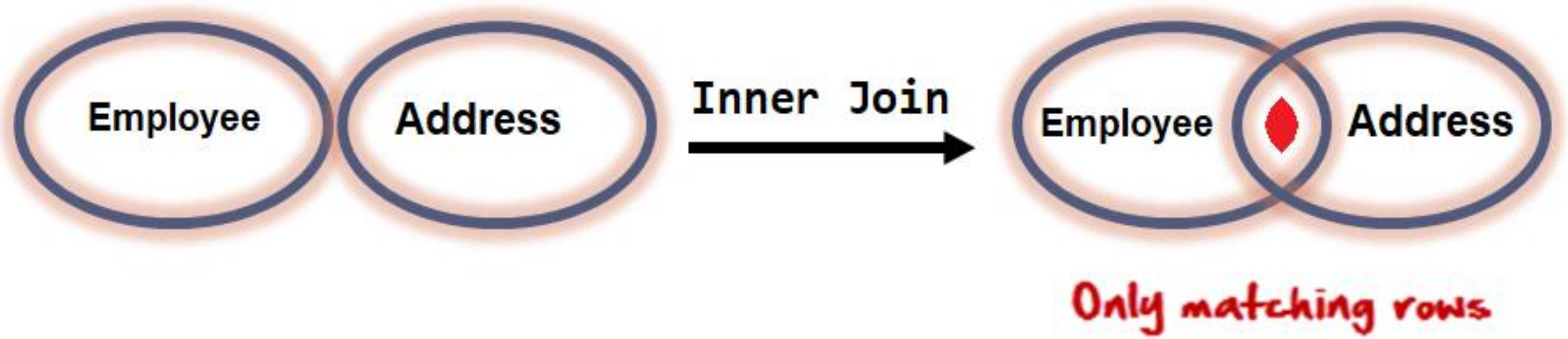
docs Table

idnum	pageseq	doctext
1	5	NULL
2	6	NULL
NULL	0	NULL



- SELECT * FROM envelope CROSS JOIN docs;

id	user_id	idnum	pageseq	doctext
1	1	1	5	NULL
2	2	1	5	NULL
3	3	1	5	NULL
1	1	2	6	NULL
2	2	2	6	NULL
3	3	2	6	NULL
1	1	NULL	0	NULL
2	2	NULL	0	NULL
3	3	NULL	0	NULL



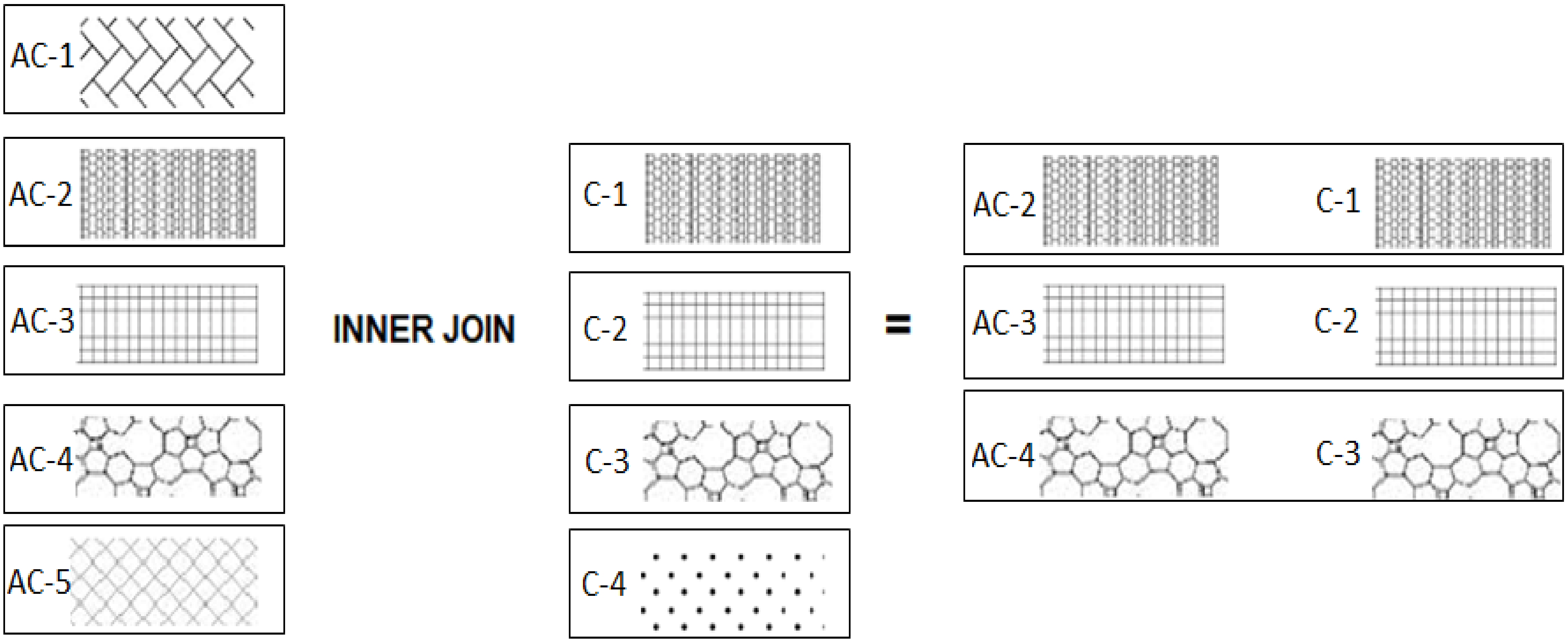
equi join

An **equi join / Inner Join** is a join with a join condition containing an equality operator.
An equijoin returns only those rows that have equivalent values for the specified columns. Rows that match remain in the result, those that don't are rejected. The match condition is commonly called the **join condition**. **equi join / Inner Join** returns rows when there is at least one match in both tables.

The result of $R(A_1, A_2, \ldots, A_n) \bowtie_{\text{<join condition>}} S(B_1, B_2, \ldots, B_m)$ is a relation Q with degree **n + m** attributes **$Q(A_1, A_2, \ldots, A_n, B_1, B_2, \ldots, B_m)$, in that order**. Q has one tuple for each combination of tuples—one from R and one from S—whenever the combination satisfies the join condition.

equi join example

The following table illustrates the inner join of two tables r_1(AC-1, AC-2, AC-3, AC-4, AC-5) and r_2(C-1, C-2, C-3, C-4). The result includes rows: (2,A), (3,B), and (4,C) as they have the same patterns.



joins – equi join

EQUI JOIN performs a JOIN against equality or matching column(s) values of the associated tables. An equal sign (=) is used as comparison operator in the where clause to refer equality.

SELECT $\boldsymbol{A}_1, \boldsymbol{A}_2, \boldsymbol{A}_3, \ldots$ FROM $\boldsymbol{r}_1, \boldsymbol{r}_2$ WHERE $\boldsymbol{r}_1.\boldsymbol{A}_1 = \boldsymbol{r}_2.\boldsymbol{A}_1$

$\boldsymbol{r}_1 = \{ 1, 2, 3, 4 \}$

$\boldsymbol{r}_2 = \{ (1, a), (2, b), (1, c), (3, d), (2, e), (1, f) \}$

$\boldsymbol{r}_1 = \boldsymbol{r}_2$

R = {(1,1,a),
(2,2,b),
(1,1,c),
(3,3,d),
(2,2,e),
(1,1,f)}

Remember:

A general join condition is of the form <condition> AND <condition> AND . . . AND <condition>, where each <condition> is of the form Ai θ Bj, **Ai is an attribute of R, Bj is an attribute of S**.

joins – equi join

- SELECT * FROM emp , dept WHERE emp.deptno = dept.deptno;

	EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO	BONUSID	USER NAME	PWD	isActive	DEPTNO	DNAME	LOC	PWD
▶	7369	SMITH	CLERK	7902	1980-12-17	800.00	NULL	20	2	SMITH	a12recmpm	0	20	RESEARCH	DALLAS	a12recmpm
	7415	AARAV	CLERK	7902	1981-12-31	3350.00	NULL	10	NULL	AARAV	NULL	0	10	ACCOUNTING	NEW YORK	r50mpm
	7421	THOMAS	CLERK	7920	1981-07-19	1750.00	NULL	10	1	THOMAS	r50mpm	0	10	ACCOUNTING	NEW YORK	r50mpm
	7499	ALLEN	SALESMAN	7698	1981-02-20	1600.00	300.00	30	4	ALLEN	sales@2017	1	30	SALES	CHICAGO	sales@2017
	7521	WARD	SALESMAN	7698	1981-02-22	1250.00	500.00	30	1	WARD	sales@2017	1	30	SALES	CHICAGO	sales@2017
	7566	JONES	MANAGER	7839	1981-04-02	2975.00	NULL	20	4	JONES	a12recmpm	1	20	RESEARCH	DALLAS	a12recmpm
	7654	MARTIN	SALESMAN	7698	1981-09-28	1250.00	1400.00	30	6	MARTIN	sales@2017	1	30	SALES	CHICAGO	sales@2017
	7698	BLAKE	MANAGER	7839	1981-05-01	2850.00	NULL	30	1	BLAKE	sales@2017	1	30	SALES	CHICAGO	sales@2017
	7782	CLARK	MANAGER	7839	1981-06-09	2450.00	NULL	10	3	CLARK	r50mpm	1	10	ACCOUNTING	NEW YORK	r50mpm
	7788	SCOTT	ANALYST	7566	1982-12-09	3000.00	NULL	20	3	SCOTT	a12recmpm	1	20	RESEARCH	DALLAS	a12recmpm
	7839	KING	PRESIDENT	NULL	1981-11-17	5000.00	NULL	10	1	KING	r50mpm	1	10	ACCOUNTING	NEW YORK	r50mpm
	7844	TURNER	SALESMAN	7698	1981-09-08	1500.00	0.00	30	5	TURNER	sales@2017	1	30	SALES	CHICAGO	sales@2017
	7876	ADAMS	CLERK	7788	1983-01-12	1100.00	NULL	20	1	ADAMS	a12recmpm	1	20	RESEARCH	DALLAS	a12recmpm
	7900	JAMES	CLERK	7698	1981-12-03	950.00	NULL	30	2	JAMES	sales@2017	1	30	SALES	CHICAGO	sales@2017
	7902	FORD	ANALYST	7566	1981-12-03	3000.00	NULL	20	4	FORD	a12recmpm	0	20	RESEARCH	DALLAS	a12recmpm
	7919	HOFFMAN	MANAGER	7566	1982-03-24	4150.00	NULL	30	3	HOFFMAN	sales@2017	1	30	SALES	CHICAGO	sales@2017
	7920	GRASS	SALESMAN	7919	1980-02-14	2575.00	2700.00	30	5	GRASS	sales@2017	1	30	SALES	CHICAGO	sales@2017
	7934	MILLER	CLERK	7919	1982-01-23	1300.00	NULL	10	2	MILLER	r50mpm	0	10	ACCOUNTING	NEW YORK	r50mpm

Remember:

- SELECT * FROM emp, dept WHERE emp.deptno = dept.deptno AND dname = 'accounting';
- SELECT * FROM emp, dept WHERE (emp.deptno, dname) = (dept.deptno, 'accounting');

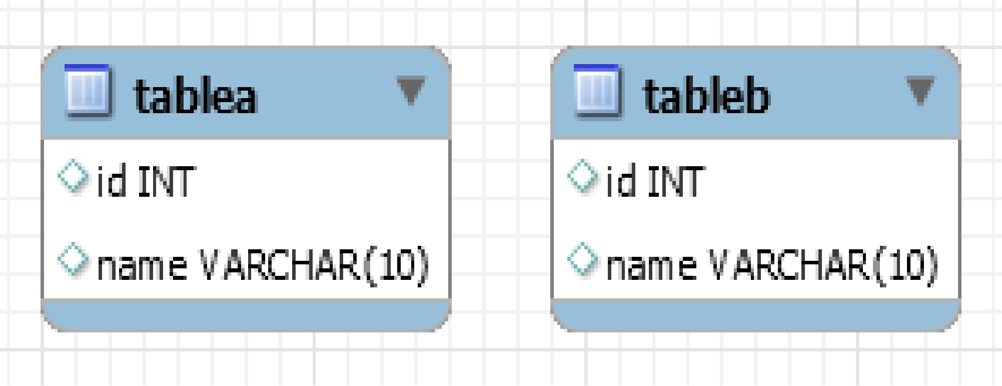
joins – equi join

tableA Table

id	name
5	aa
1	a
2	b
3	y
NULL	d
5	NULL
1	NULL
1	b
8	a

tableB Table

id	name
1	a
2	x
4	b
NULL	c
6	NULL
NULL	NULL
7	z
2	NULL
5	z
9	u



- SELECT * FROM tableA , tableB WHERE tableA.id = tableB.id;

id	name	id	name
1	a	1	a
1	NULL	1	a
1	b	1	a
2	b	2	x
2	b	2	NULL
5	aa	5	z
5	NULL	5	z

- SELECT * FROM tableA , tableB WHERE tableA.name = tableB.name;

id	name	id	name
1	a	1	a
8	a	1	a
2	b	4	b
1	b	4	b

ON Contrition

- When this join condition gets applied none of the columns of the relation will get eliminated in the result set.
- In order to apply this join condition, on any two tables they need not to have any common column.

on condition and using attribute

USING Attribute Contrition

- When all the common columns are used in the join predicate then the result would be same as Natural join.
- In the result set of the join the duplicates of the columns used in the predicate gets eliminated.
- It should not have a qualifier(table name or Alias) in the referenced columns.

Note:

- **ON** clause is optional, If not given then *INNER JOIN* works like *CROSS JOIN.*

joins – on & using clause example

The ON clause

The ON clause is used to join tables where the column names don't match in both tables.

JOINING CONDITION

```
SELECT * FROM EMP
INNER JOIN DEPT
ON EMP.DEPTNO = DEPT.ID
```

The USING clause

The USING clause is used if several columns share the same name but you don't want to join using all of these common columns. The columns listed in the USING clause can't have any qualifiers in the statement.

```
SELECT * FROM EMP
INNER JOIN DEPT
USING(DEPTNO)
```

JOINING CONDITION

inner join

The inner join is one of the most commonly used joins in SQL. The inner join clause allows you to query data from two or more related tables.

INNER JOIN returns rows when there is at least one match in both tables.

joins – inner join

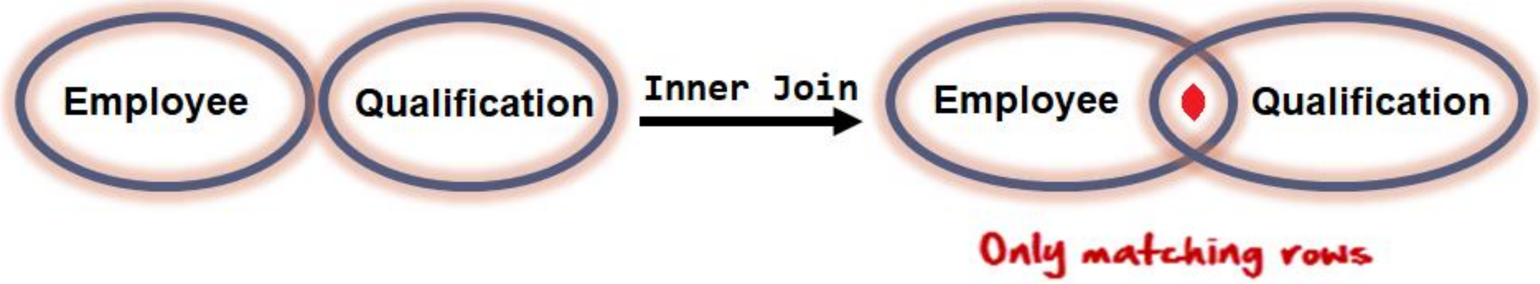
The INNER JOIN selects all rows from both participating tables as long as there is a match between the columns. An SQL INNER JOIN is same as JOIN clause, combining rows from two or more tables.

SELECT $\boldsymbol{A_1}$, $\boldsymbol{A_2}$, $\boldsymbol{A_3}$, . . . FROM $\boldsymbol{r_1}$ [INNER] JOIN $\boldsymbol{r_2}$ ON $\boldsymbol{r_1}$. $\boldsymbol{A_1}$ = $\boldsymbol{r_2}$. $\boldsymbol{A_1}$

- SELECT * FROM employee emp INNER JOIN qualification quali ON emp.id = quali.employeeid;

ID	FIRSTNAME	LASTNAME	GENDER	HIREDATE	ID	EMPLOYEEID	NAME	Stream	ADDMISSIONYEAR	INSTITUTE	UNIVERSITY	YEAROFPASSING	PERCENTAGE	GRADE
1	Denis	Murphy	M	1964-06-12	1	1	10	General	1957-08-02	Alabama	Stanford University	1958	62.00	D
1	Denis	Murphy	M	1964-06-12	2	1	12	Science	1959-06-22	Alaska	Harvard University	1960	56.00	D
1	Denis	Murphy	M	1964-06-12	3	1	BE	IT	1960-06-12	Arizona	Harvard University	1964	75.00	B
2	Jenny	Ross	F	1964-10-25	4	2	10	General	1957-01-19	Alaska	University of Chicago	1958	67.00	C
2	Jenny	Ross	F	1964-10-25	5	2	12	Commerce	1959-10-23	New York	Yale University	1960	67.00	C
2	Jenny	Ross	F	1964-10-25	6	2	B.Com	Accounting	1960-06-12	Arkansas	Yale University	1964	69.00	C
3	David	Ross	M	1964-10-25	7	3	10	General	1957-11-25	Arizona	Yale University	1958	86.00	A
3	David	Ross	M	1964-10-25	8	3	12	Science	1959-02-17	California	California University	1960	57.00	D
3	David	Ross	M	1964-10-25	9	3	BE	IT	1960-06-12	Florida	University of Florida	1964	85.00	A
4	Fred	NULL	M	1965-10-31	10	4	10	General	1958-03-19	Idaho	Pennsylvania University	1959	89.00	A
4	Fred	NULL	M	1965-10-31	11	4	12	Commerce	1960-05-21	New Ham...	Yale University	1961	96.00	A+
4	Fred	NULL	M	1965-10-31	12	4								
5	Helen	Taylor	F	1965-01-12	13	5								

ON clause is optional, If not given then INNER JOIN works like CROSS JOIN



INNER JOIN returns rows when there is at least one match in both tables.

joins – inner join

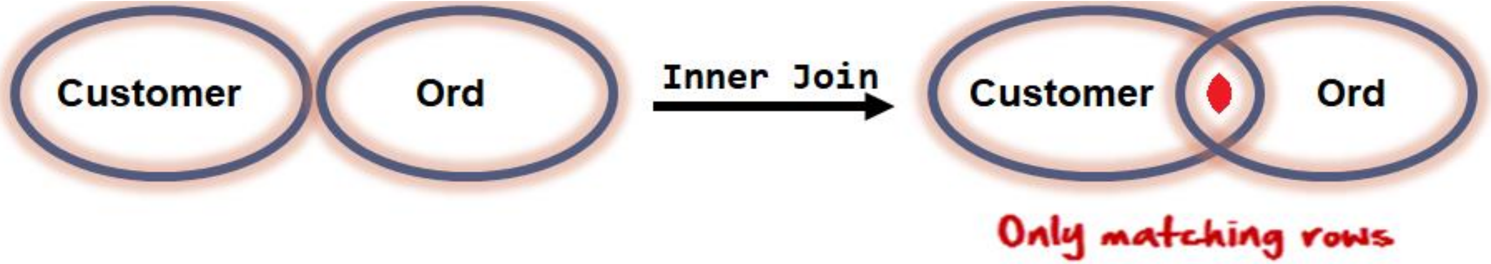
The INNER JOIN selects all rows from both participating tables as long as there is a match between the columns. An SQL INNER JOIN is same as JOIN clause, combining rows from two or more tables.

SELECT $\boldsymbol{A}_1, \boldsymbol{A}_2, \boldsymbol{A}_3, \ldots$ FROM $\boldsymbol{r}_1$ [INNER] JOIN $\boldsymbol{r}_2$ ON $\boldsymbol{r}_1.\boldsymbol{A}_1 = \boldsymbol{r}_2.\boldsymbol{A}_1$

- SELECT * FROM customer INNER JOIN ord USING (custid);

CUSTID	NAME	ADDRESS	CITY	STATE	ZIP	AREA	PHONE	REPID	CREDITLIMIT	COMMENTS	ORDID	ORDERDATE	COMMPLAN	SHIPDATE	STA
106	SHAPE UP	908 SEQUOIA	PALO ALTO	CA	94301	415	364-9777	7521	6000.00	Support intensive. Orders small a...	601	1986-05-01 00:00:00	A	1986-05-30 00:00:00	In Pr
102	VOLLYRITE	9722 HAMILTON	BURLINGAME	CA	95133	415	644-3341	7654	7000.00	Company doing heavy promotion ...	602	1986-06-05 00:00:00	B	1986-06-20 00:00:00	On H
102	VOLLYRITE	9722 HAMILTON	BURLINGAME	CA	95133	415	644-3341	7654	7000.00	Company doing heavy promotion ...	603	1986-06-05 00:00:00	NULL	1986-06-05 00:00:00	Canc
106	SHAPE UP	908 SEQUOIA	PALO ALTO	CA	94301	415	364-9777	7521	6000.00	Support intensive. Orders small a...	604	1986-06-15 00:00:00	A	1986-06-30 00:00:00	Reso
106	SHAPE UP	908 SEQUOIA	PALO ALTO	CA	94301	415	364-9777	7521	6000.00	Support intensive. Orders small a...	605	1986-07-14 00:00:00	A	1986-07-30 00:00:00	Dispu
100	JOCKSPORTS	345 VIEWRIDGE	BELMONT	CA	96711	415	598-6609	7844	5000.00	Very friendly people to work with ...	606	1986-07-14 00:00:00	A	1986-07-30 00:00:00	Shipp
104	EVERY MOUNTAIN	574 SURRY RD.	CUPERTINO	CA	93301	408	996-2323	7499	10000.00	Customer with high market share ...	607	1986-07-18 00:00:00	C	1986-07-18 00:00:00	In Pr
104	EVERY MOUNTAIN	574 SURRY RD.	CUPERTINO	CA	93301	408	996-2323	7499	10000.00	Customer with high market share ...	608	1986-07-25 00:00:00	C	1986-07-25 00:00:00	Shipp
100	JOCKSPORTS	345 VIEWRIDGE	BELMONT	CA	96711	415	598-6609	7844	5000.00	Very friendly people to work with ...	609	1986-08-01 00:00:00	B	1986-08-15 00:00:00	On H
101	TKB SPORT SHOP	490 BOLI RD.	REDWOOD CITY	CA	94061	415	368-1223	7521	10000.00	Rep called 5/8 about change in or...	610	1987-01-07 00:00:00	A	1987-01-08 00:00:00	In Pr
102	VOLLYRITE	9722 HAMILTON	BURLINGAME	CA	95133	415	644-3341	7654	7000.00	Company doing heavy promotion ...	611	1987-01-11 00:00:00	B	1987-01-11 00:00:00	Shipp
104	EVERY MOUNTAIN	574 SURRY RD.	CUPERTINO	CA	93301	408	996-2323	7499	10000.00	Customer with high market share ...	612	1987-01-15 00:00:00	C	1987-01-20 00:00:00	Canc
108	NORTH WOODS ...	98 LONE PINE ...	HIBBING	MN	55649	612	566-9123	7844	8000.00	NULL	613	1987-02-01 00:00:00	NULL	1987-02-01 00:00:00	Shipp
102	VOLLYRITE	9722 HAMILTON	BURLINGAME	CA	95133	415	644-3341	7654	7000.00	Company doing heavy promotion ...	614	1987-02-01 00:00:00	NULL	1987-02-05 00:00:00	In Pr
107	WOMENS SPORTS	VALCO VILLAGE	SUNNYVALE	CA	93301	408	967-4398	7499	10000.00	First sporting goods store geared ...	615	1987-02-01 00:00:00	NULL	1987-02-06 00:00:00	In Pr
103	JUST TENNIS	HILLVIEW MALL	BURLINGAME	CA	97544	415	677-9312	7521	3000.00	Contact rep about new line of ten...	616	1987-02-03 00:00:00	NULL	1987-02-10 00:00:00	Reso
105	K + T SPORTS	3476 EL PASEO	SANTA CLARA	CA	91003	408	376-9966	7844	5000.00	Tends to order large amounts of ...	617	1987-02-05 00:00:00	NULL	1987-03-03 00:00:00	Shipp
102	VOLLYRITE	9722 HAMILTON	BURLINGAME	CA	95133	415	644-3341	7654	7000.00	Company doing heavy promotion ...	618	1987-02-15 00:00:00	A	1987-03-06 00:00:00	On H
104	EVERY MOUNTAIN	574 SURRY RD.	CUPERTINO	CA	93301	408	996-2323	7499	10000.00	Customer with high market share ...	619	1987-02-22 00:00:00	NULL	1987-02-04 00:00:00	In Pr
100	JOCKSPORTS	345 VIEWRIDGE	BELMONT	CA	96711	415	598-6609	7844	5000.00	Very friendly people to work with ...	620	1987-03-12 00:00:00	NULL	1987-03-12 00:00:00	Canc
100	JOCKSPORTS	345 VIEWRIDGE	BELMONT	CA	96711	415	598-6609	7844	5000.00	Very friendly people to work with ...	621	1987-03-15 00:00:00	A	1987-01-01 00:00:00	Shipp

ON clause is optional, If not given then INNER JOIN works like CROSS JOIN



In general, the join condition for NATURAL JOIN is constructed by equating each pair of join attributes that have the same name in the two relations and combining these conditions with AND.

natural join

The NATURAL JOIN is such a join that performs the same task as an INNER JOIN. NATURAL JOIN does not use any comparison operator. We can perform a NATURAL JOIN only if there is at least one common attribute that exists between two relations. In addition, the attributes must have the same name. When this join condition gets applied always the duplicates of the common columns get eliminated from the result.

Remember:

The standard definition of NATURAL JOIN requires that the two join attributes (or each pair of join attributes) have the same name in both relations. **If this is not the case, a renaming operation is applied first.**
e.g.

- SELECT * FROM r NATURAL JOIN (SELECT a1 AS c1, a2 FROM s) t1;

joins – natural join

Joins two tables based on common column names. Hence one must confirm the common columns before using a NATURAL JOIN

The NATURAL JOIN is such a join that performs the same task as an INNER JOIN.

SELECT $\boldsymbol{A}_1$, $\boldsymbol{A}_2$, $\boldsymbol{A}_3$, . . . FROM $\boldsymbol{r}_1$ NATURAL [INNER] JOIN $\boldsymbol{r}_2$ NATURAL [INNER] JOIN $\boldsymbol{r}_3$ . . .

- SELECT * FROM emp NATURAL JOIN dept;

- The associated tables have one or more pairs of identically column-names.
- The columns must be of the same name.
- The columns datatype may differ.
- Don't use ON / USING clause in a NATURAL JOIN.
- When this join condition gets applied always the duplicates of the common columns get eliminated from the result.

A **NATURAL JOIN** can be used with a **LEFT OUTER** join**,** or a **RIGHT OUTER** join.

If the column-names are not same, then NATURAL JOIN will work as CROSS JOIN.

SELECT * FROM EMP
NATURAL JOIN DEPT

INNER Vs NATURAL

inner join vs natural join

INNER JOIN	NATURAL JOIN
Inner Join joins two table on the basis of the column which is explicitly specified in the ON clause.	Natural Join joins two tables based on same attribute name.
In Inner Join, The resulting table will contain all the attribute of both the tables including duplicate columns also	In Natural Join, The resulting table will contain all the attributes of both the tables but keep only one copy of each common column
In Inner Join, only those records will return which exists in both the tables	Same as Inner Join
SYNTAX: • SELECT * FROM **r_1** INNER JOIN **r_2** ON **$r_1.A_1$ = $r_2.A_1$**; • SELECT * FROM **r_1** INNER JOIN **r_2** USING(**A_1**, [**A_2**]);	SYNTAX: • SELECT * FROM **r_1** NATURAL JOIN **r_2**;

simple join

TODO

joins – simple join

The SIMPLE JOIN is such a join that performs the same task as an INNER JOIN.

SELECT $\boldsymbol{A}_1$, $\boldsymbol{A}_2$, $\boldsymbol{A}_3$, . . . FROM $\boldsymbol{r}_1$ SIMPLE JOIN $\boldsymbol{r}_2$ USING ($\boldsymbol{A}_1$, . . .)

- SELECT * FROM emp SIMPLE JOIN dept USING(deptno)

SELECT * FROM EMP
SIMPLE JOIN DEPT
USING(DEPTNO)

JOINING CONDITION

The ON clause is required for a left or right outer join.

The LEFT OUTER JOIN operation keeps every tuple in the first, or left, relation R in R ⟕ S, if no matching tuple is found in S, then the attributes of S in the join result are filled or padded with NULL values.

The RIGHT OUTER JOIN keeps every tuple in the second, or right, relation S in the result of R ⟖ S, if no matching tuple is found in R, then the attributes of R in the join result are filled or padded with NULL values.

outer joins

In an outer join, along with rows that satisfy the matching criteria, we also include some or all rows that do not match the criteria.

```
CREATE TABLE r1 (id INT, c1 VARCHAR(10));
CREATE TABLE r2 (id INT, c1 VARCHAR(10));

INSERT INTO r1 VALUES (4,'AC-1'), (1,'AC-2'),(2,'AC-3'),(3,'AC-4'),(5,'AC-5');
INSERT INTO r2 VALUES (1,'C-1'), (2,'C-2'),(3,'C-3'),(7,'C-4');
```

Suppose, we want to join two tables: r1 and r2. SQL left outer join returns all rows in the left table (r1) and all the matching rows found in the right table (r2). It means the result of the SQL left join always contains the rows in the left table. . **If no matching rows found in the right table, NULL are displayed.**

left outer joins

r_1 = {1, 2, 3, 4}

r_2 = {(1, a), (2, b), (1, c), (3, d), (2, e), (1, f), (5, z)}

r_1 left join r_2

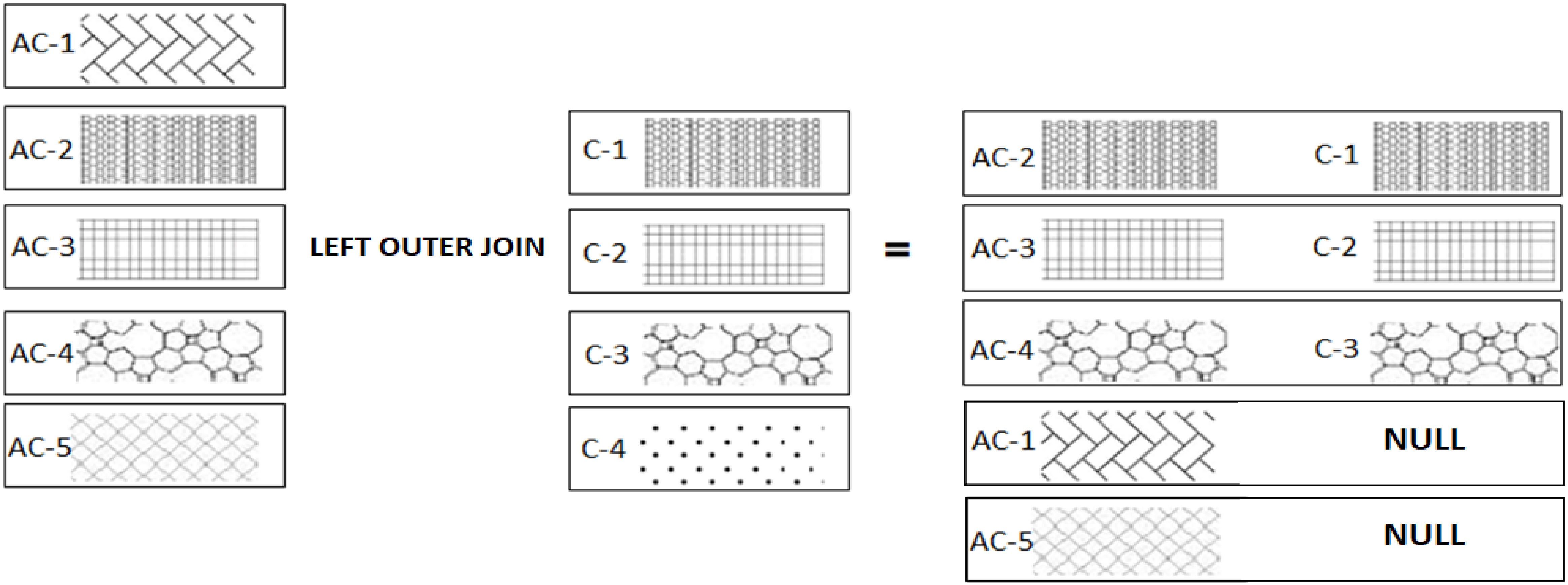
R = {(1, 1, a),
(2, 2, b),
(1, 1, c),
(3, 3, d),
(2, 2, e),
(1, 1, f),
(4, NULL, NULL}

```
SELECT * FROM r1 LEFT JOIN r2 ON r1.c1 = r2.c1;
```

c1	c1	c2
1	1	a
2	2	b
1	1	c
3	3	d
2	2	e
1	1	f
4	NULL	NULL

joins – left outer join

The following example the LEFT JOIN of two tables r_1(AC-1, AC-2, AC-3, AC-4, AC-5) and r_2(C-1, C-2, C-3, C-4). The LEFT JOIN will match rows from the r_1 table with the rows from r_2 table using patterns:

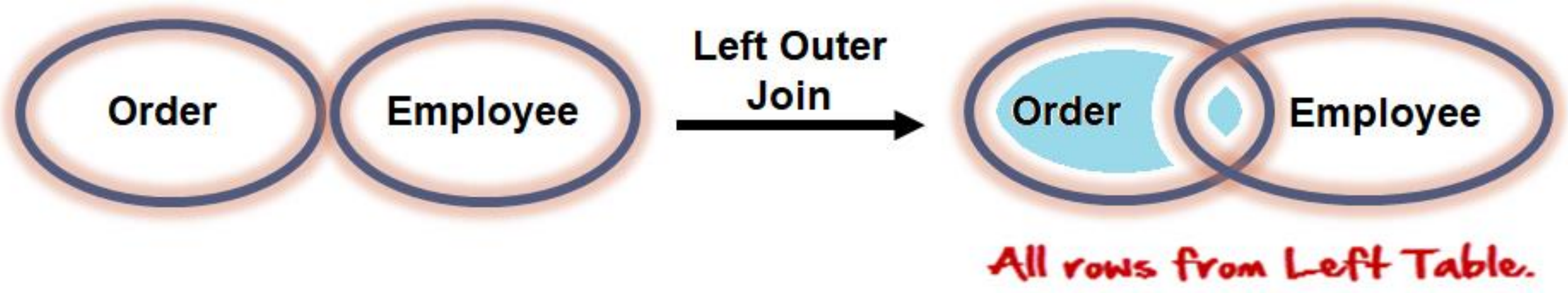


joins – left outer join

The LEFT JOIN keyword returns all rows from the left table ($\boldsymbol{r}_1$), with the matching rows in the right table ($\boldsymbol{r}_2$). **The result is NULL in the right side when there is no match.**

SELECT $\boldsymbol{A}_1$, $\boldsymbol{A}_2$, $\boldsymbol{A}_3$, . . . FROM $\boldsymbol{r}_1$ LEFT [OUTER] JOIN $\boldsymbol{r}_2$ ON $\boldsymbol{r}_1$. $\boldsymbol{A}_1$ = $\boldsymbol{r}_2$. $\boldsymbol{A}_1$

```
SELECT * FROM orders ord LEFT OUTER JOIN employee emp ON emp.id = ord.employeeid;
```



joins – left outer join

- SELECT * FROM student LEFT OUTER JOIN student_order ON student.id = student_order.studentid ;

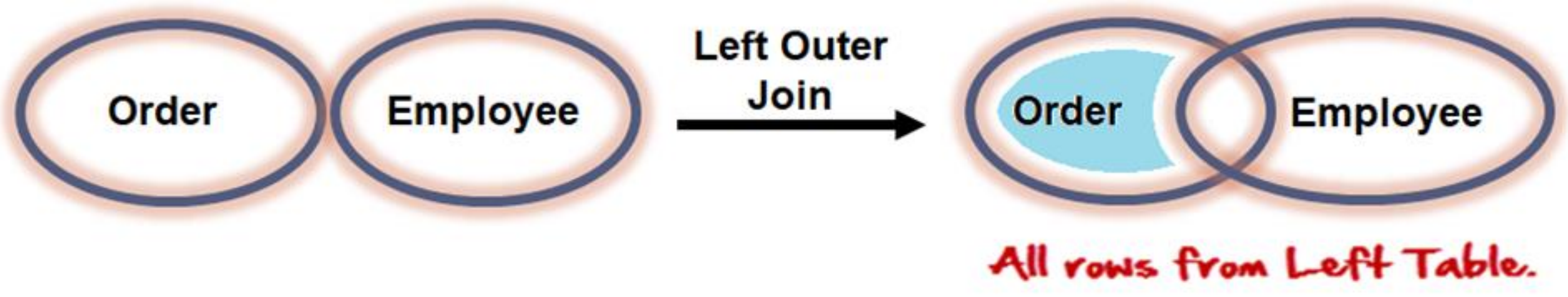
	ID	namefirst	namelast	DOB	emailID	ID	studentID	orderdate	amount
	6	lala	prasad	1980-12-01	lala.prasad@gmail.com	26	6	2019-02-02	280
	6	lala	prasad	1980-12-01	lala.prasad@gmail.com	30	6	2019-07-10	750
	7	sharmin	bagde	1986-12-14	sharmin.bagde@gmail.com	10	7	2019-10-10	2500
	7	sharmin	bagde	1986-12-14	sharmin.bagde@gmail.com	33	7	2019-06-23	945
	8	vrushali	bagde	1984-12-29	vrushali.bagde@gmail.com	21	8	2019-01-12	4500
	8	vrushali	bagde	1984-12-29	vrushali.bagde@gmail.com	40	8	2019-01-12	650
	9	vasant	khande	1992-10-26	vasant.khande@gmail.com	NULL	NULL	NULL	NULL
	10	nitish	patil	1990-10-26	nitish.patil@gmail.com	11	10	2019-11-11	150
	10	nitish	patil	1990-10-26	nitish.patil@gmail.com	22	10	2019-11-02	650
	10	nitish	patil	1990-10-26	nitish.patil@gmail.com	34	10	2019-01-19	225
	11	neel	save	1975-10-30	neel.save@gmail.com	NULL	NULL	NULL	NULL
	12	deep	save	1986-11-30	deep.save@gmail.com	5	12	2019-05-03	655
	12	deep	save	1986-11-30	deep.save@gmail.com	6	12	2019-05-04	1000
	12	deep	save	1986-11-30	deep.save@gmail.com	28	12	2019-02-02	45
	12	deep	save	1986-11-30	deep.save@gmail.com	29	12	2019-01-12	190
	13	nrupali	save	1981-12-01	nrupali.save@gmail.com	13	13	2019-11-02	655
	13	nrupali	save	1981-12-01	nrupali.save@gmail.com	36	13	2019-01-12	180
	14	supriya	karnik	1983-12-15	supriya.karnik@gmail.com	12	14	2019-07-21	340
	14	supriya	karnik	1983-12-15	supriya.karnik@gmail.com	35	14	2019-10-10	325
	15	bandish	karnik	1987-12-30	bandish.karnik@gmail.com	NULL	NULL	NULL	NULL
	16	sangita	karnik	1990-12-01	sangita.karnik@gmail.com	NULL	NULL	NULL	NULL
	17	sangita	menon	1989-10-26	sangita.menon@gmail.com	NULL	NULL	NULL	NULL
	18	rahul	shah	1982-06-12	rahul.shah@gmail.com	NULL	NULL	NULL	NULL

joins – left outer join

The LEFT JOIN keyword returns all rows from the left table (***r***$_1$), with the matching rows in the right table (***r***$_2$). **The result is NULL in the right side table when there is no match.**

SELECT $\boldsymbol{A}_1$, $\boldsymbol{A}_2$, $\boldsymbol{A}_3$, . . . FROM $\boldsymbol{r}_1$ LEFT [OUTER] JOIN $\boldsymbol{r}_2$ ON $\boldsymbol{r}_1$. $\boldsymbol{A}_1$ = $\boldsymbol{r}_2$. $\boldsymbol{A}_1$ WHERE $\boldsymbol{r}_2$. $\boldsymbol{A}_1$ IS NULL

```
SELECT * FROM orders ord LEFT OUTER JOIN employee emp ON emp.id = ord.employeeid  WHERE emp.id IS NULL;
```



joins – left outer join

- SELECT * FROM student LEFT OUTER JOIN student_order ON student.id = student_order.studentid WHERE student_order.studentID IS NULL;

	ID	namefirst	namelast	DOB	emailID	ID	studentID	orderdate	amount
▶	3	ulka	joshi	1970-10-25	ulka.joshi@gmail.com	NULL	NULL	NULL	NULL
	9	vasant	khande	1992-10-26	vasant.khande@gmail.com	NULL	NULL	NULL	NULL
	11	neel	save	1975-10-30	neel.save@gmail.com	NULL	NULL	NULL	NULL
	15	bandish	karnik	1987-12-30	bandish.karnik@gmail.com	NULL	NULL	NULL	NULL
	16	sangita	karnik	1990-12-01	sangita.karnik@gmail.com	NULL	NULL	NULL	NULL
	17	sangita	menon	1989-10-26	sangita.menon@gmail.com	NULL	NULL	NULL	NULL
	18	rahul	shah	1982-06-12	rahul.shah@gmail.com	NULL	NULL	NULL	NULL
	19	bhavin	patel	1983-11-13	bhavin.patel@gmail.com	NULL	NULL	NULL	NULL
	20	kaushal	patil	1982-07-30	kaushal.patil@gmail.com	NULL	NULL	NULL	NULL
	21	pankaj	gandhi	1982-07-30	pankaj.gandhi@gmail.com	NULL	NULL	NULL	NULL
	22	rajan	patel	1982-07-30	rajan.patel@gmail.com	NULL	NULL	NULL	NULL
	23	bhavin	patel	1982-07-30	bhavin.patel@gmail.com	NULL	NULL	NULL	NULL
	24	mukesh	bhavsar	1982-07-30	mukesh.bhavsar@gmail.com	NULL	NULL	NULL	NULL
	25	dilu	khande	1982-07-30	dilu.khande@gmail.com	NULL	NULL	NULL	NULL
	26	sonam	khan	1972-05-13	sonam.khan@gmail.com	NULL	NULL	NULL	NULL
	27	rohit	patil	1976-12-31	rohit.patil@gmail.com	NULL	NULL	NULL	NULL
	28	raj	bubber	1982-02-28	raj.bubber@gmail.com	NULL	NULL	NULL	NULL
	29	sharmin	patil	1999-11-10	sharmin.patil@gmail.com	NULL	NULL	NULL	NULL

joins – left outer join

The LEFT JOIN keyword returns all rows from the left table ($\boldsymbol{r}_1$), with the matching rows in the right table ($\boldsymbol{r}_2$). **The result is NULL in the right side table when there is no match.**

SELECT $\boldsymbol{A}_1$, $\boldsymbol{A}_2$, $\boldsymbol{A}_3$, . . . FROM $\boldsymbol{r}_1$ LEFT [OUTER] JOIN $\boldsymbol{r}_2$ USING ($\boldsymbol{A}_1$, . . .)

- SELECT * FROM emp LEFT OUTER JOIN dept USING(deptno);

SELECT $\boldsymbol{A}_1$, $\boldsymbol{A}_2$, $\boldsymbol{A}_3$, . . . FROM $\boldsymbol{r}_1$ NATURAL LEFT [OUTER] JOIN $\boldsymbol{r}_2$

- SELECT * FROM emp NATURAL LEFT OUTER JOIN dept;

Suppose, we want to join two tables: r1 and r2. Right outer join returns all rows in the right table (r1) and all the matching rows found in the left table (r2). It means the result of the SQL right join always contains the rows in the right table. . If no matching rows found in the left table, NULL are displayed.

right outer joins

$\boldsymbol{r}_1$ = {1, 2, 3, 4}
$\boldsymbol{r}_2$ = {(1, a), (2, b), (1, c), (3, d), (2, e), (1, f), (5, z)}

$\boldsymbol{r}_1$ right join $\boldsymbol{r}_2$

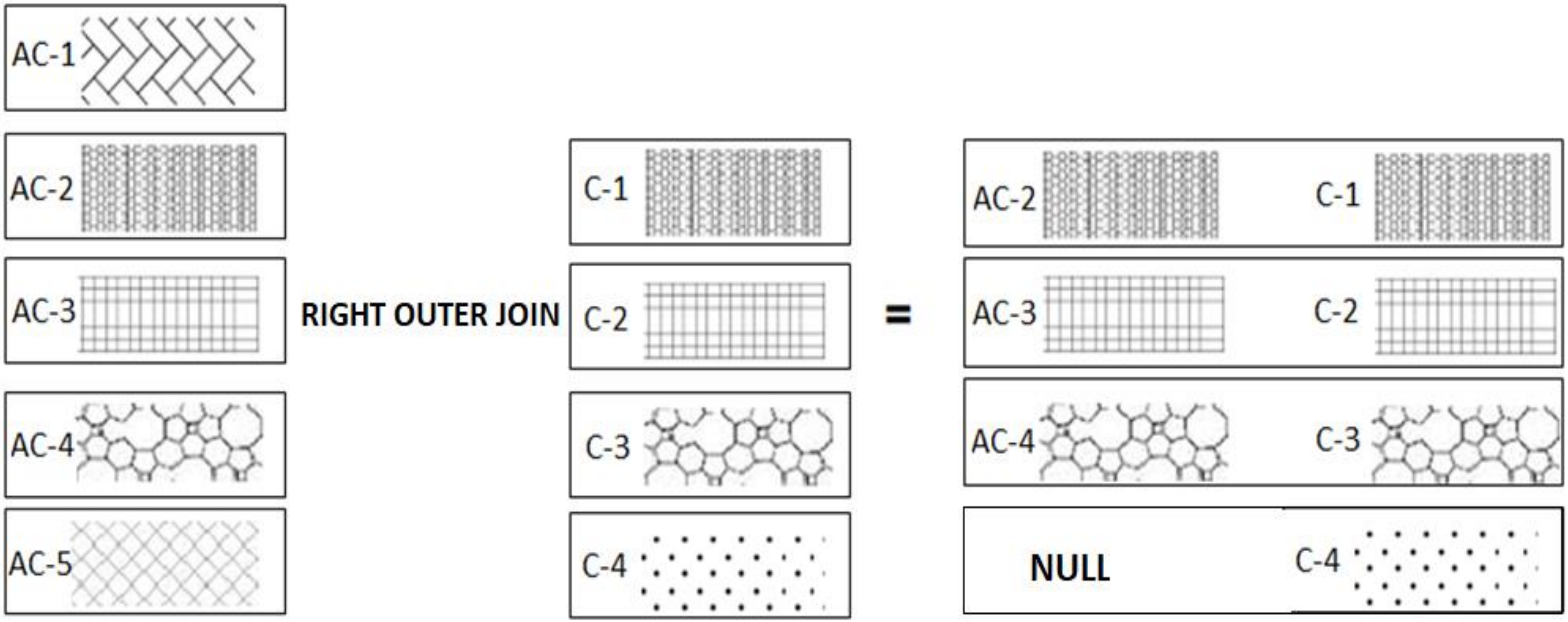
R = {(1, 1, a),
(1, 1, c),
(1, 1, f),
(2, 2, b),
(2, 2, e),
(3, 3, d),
(NULL, 5, z)}

```
SELECT * FROM r1 RIGHT JOIN r2 ON r1.c1 = r2.c1;
```

c1	c1	c2
1	1	a
1	1	c
1	1	f
2	2	b
2	2	e
3	3	d
NULL	5	z

joins – right outer join

The following example the RIGHT OUTER JOIN of two tables r_1(AC-1, AC-2, AC-3, AC-4, AC-5) and r_2(C-1, C-2, C-3, C-4). The RIGHT JOIN will match rows from the r_1 table with the rows from r_2 table using patterns:

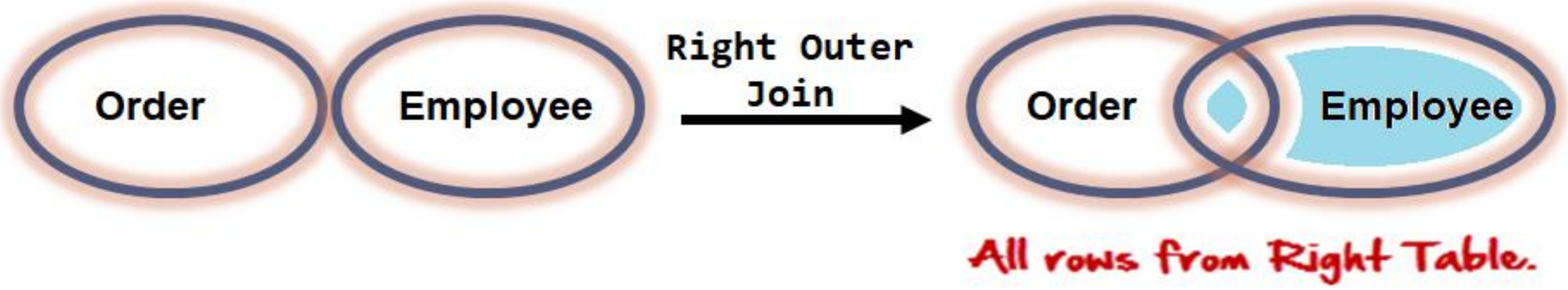


joins – right outer join

The RIGHT JOIN keyword returns all rows from the right table (***r***$_2$), with the matching rows in the left table (***r***$_1$). **The result is NULL in the left side table when there is no match.**

SELECT A_1, A_2, A_3, . . . FROM r_1 RIGHT [OUTER] JOIN r_2 ON r_1. A_1 = r_2. A_1

```
SELECT * FROM orders ord RIGHT OUTER JOIN employee emp ON emp.id = ord.employeeid;
```



joins – right outer join

- SELECT * FROM student RIGHT OUTER JOIN student_order ON student.id = student_order.studentid;

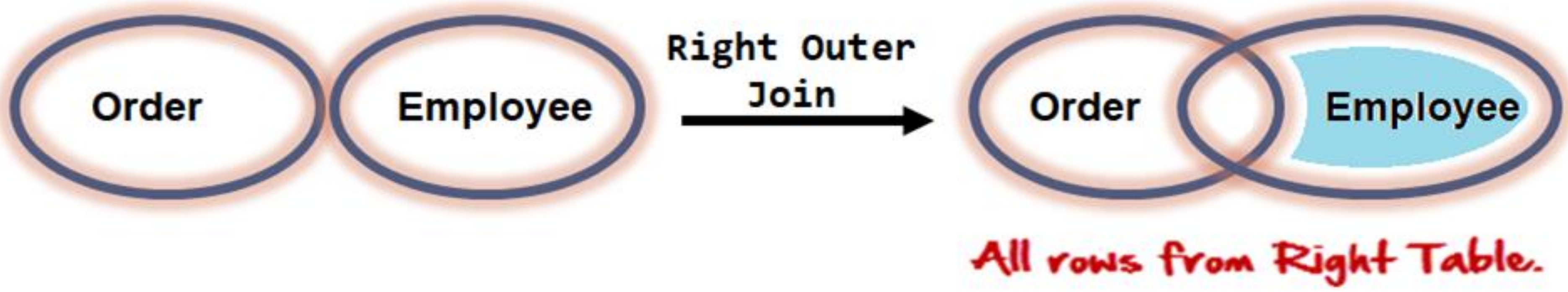
	ID	namefirst	namelast	DOB	emailID	ID	studentID	orderdate	amount
	6	lala	prasad	1980-12-01	lala.prasad@gmail.com	7	6	2019-11-11	4000
	1	saleel	bagde	1986-12-14	saleel.bagde@gmail.com	8	1	2019-07-19	1270
	5	ruhan	bagde	1984-01-12	ruhan.bagde@gmail.com	9	5	2019-04-07	2000
	7	sharmin	bagde	1986-12-14	sharmin.bagde@gmail.com	10	7	2019-10-10	2500
	10	nitish	patil	1990-10-26	nitish.patil@gmail.com	11	10	2019-11-11	150
	14	supriya	karnik	1983-12-15	supriya.karnik@gmail.com	12	14	2019-07-21	340
	13	nrupali	save	1981-12-01	nrupali.save@gmail.com	13	13	2019-11-02	655
	4	rahul	patil	1982-10-31	rahul.patil@gmail.com	14	4	2019-01-12	1000
	NULL	NULL	NULL	NULL	NULL	15	NULL	2019-04-07	4000
	NULL	NULL	NULL	NULL	NULL	16	NULL	2019-10-10	1270
	NULL	NULL	NULL	NULL	NULL	17	NULL	2019-11-11	4588
	NULL	NULL	NULL	NULL	NULL	18	NULL	2019-07-21	1200
	NULL	NULL	NULL	NULL	NULL	19	NULL	2019-11-02	125
	NULL	NULL	NULL	NULL	NULL	20	NULL	2019-01-12	350
	8	vrushali	bagde	1984-12-29	vrushali.bagde@gmail.com	21	8	2019-01-12	4500
	10	nitish	patil	1990-10-26	nitish.patil@gmail.com	22	10	2019-11-02	650
	4	rahul	patil	1982-10-31	rahul.patil@gmail.com	23	4	2019-10-19	700

joins – right outer join

The RIGHT JOIN keyword returns all rows from the right table ($\boldsymbol{r}_2$), with the matching rows in the left table ($\boldsymbol{r}_1$). **The result is NULL in the left side table when there is no match.**

SELECT $\boldsymbol{A}_1$, $\boldsymbol{A}_2$, $\boldsymbol{A}_3$, . . . FROM $\boldsymbol{r}_1$ RIGHT [OUTER] JOIN $\boldsymbol{r}_2$ ON $\boldsymbol{r}_1$. $\boldsymbol{A}_1$ = $\boldsymbol{r}_2$. $\boldsymbol{A}_1$ WHERE $\boldsymbol{r}_1$. $\boldsymbol{A}_1$ IS NULL

```
SELECT * FROM orders ord RIGHT OUTER JOIN employee emp ON emp.id = ord.employeeid  WHERE ord.employeeid IS NULL;
```



joins – right outer join

- SELECT * FROM student RIGHT OUTER JOIN student_order ON student.id = student_order.studentid WHERE student.ID IS NULL;

ID	namefirst	namelast	DOB	emailID	ID	studentID	orderdate	amount
NULL	NULL	NULL	NULL	NULL	15	NULL	2019-04-07	4000
NULL	NULL	NULL	NULL	NULL	16	NULL	2019-10-10	1270
NULL	NULL	NULL	NULL	NULL	17	NULL	2019-11-11	4588
NULL	NULL	NULL	NULL	NULL	18	NULL	2019-07-21	1200
NULL	NULL	NULL	NULL	NULL	19	NULL	2019-11-02	125
NULL	NULL	NULL	NULL	NULL	20	NULL	2019-01-12	350

joins – right outer join

The RIGHT JOIN keyword returns all rows from the right table (***r***$_2$), with the matching rows in the left table (***r***$_1$). **The result is NULL in the left side table when there is no match.**

SELECT $\boldsymbol{A}_1$, $\boldsymbol{A}_2$, $\boldsymbol{A}_3$, . . . FROM $\boldsymbol{r}_1$ RIGHT [OUTER] JOIN $\boldsymbol{r}_2$ USING ($\boldsymbol{A}_1$, . . .)

```
SELECT * FROM emp RIGHT OUTER JOIN dept USING(deptno);
```

SELECT $\boldsymbol{A}_1$, $\boldsymbol{A}_2$, $\boldsymbol{A}_3$, . . . FROM $\boldsymbol{r}_1$ NATURAL RIGHT [OUTER] JOIN $\boldsymbol{r}_2$

```
SELECT * FROM emp NATURAL RIGHT OUTER JOIN dept;
```

left join vs right join

LEFT JOIN Vs RIGHT JOIN

LEFT OUTER JOIN	RIGHT OUTER JOIN	FULL OUTER JOIN
All the tuples of the left table remain in the result.	All the tuples of the right table remain in the result.	All the tuples from left as well as right table remain in the result.
The tuples of left table that does not have a matching tuple in right table are extended with NULL value for attributes of the right table.	The tuples of right table that does not have a matching tuple in left table are extended with NULL value for attributes of the left table.	The tuples of left as well as the right table that does not have the matching tuples in the right and left table respectively are extended with NULL value for attributes of the right and left tables.

TODO

self joins

TODO

joins – self join

A SELF JOIN is a join in which a table is joined with itself (which is also called Unary relationships), especially when the table has a FOREIGN KEY which references its own PRIMARY KEY.

SELECT $\boldsymbol{r}_x.\boldsymbol{A}_1, \boldsymbol{r}_x.\boldsymbol{A}_2, \boldsymbol{r}_y.\boldsymbol{A}_1, \boldsymbol{r}_y.\boldsymbol{A}_2, \ldots$ FROM $\boldsymbol{r}_1\ \boldsymbol{r}_x,\ \boldsymbol{r}_1\ \boldsymbol{r}_y$ WHERE $\boldsymbol{r}_x.\boldsymbol{A}_1 = \boldsymbol{r}_y.\boldsymbol{A}_1$

```
SELECT distinct e1.* FROM emp e1 , emp e2 WHERE e1.sal = e2.sal AND e1.empno != e2.empno ORDER BY e1.sal;
```

```sql
SELECT C1 FROM T1 UNION SELECT C1 FROM T2
ORDER BY C1

(SELECT C1 FROM T1 ORDER BY C1) UNION
(SELECT C1 FROM T2 ORDER BY C1)

SELECT C1 FROM T1 ORDER BY C1 UNION
SELECT C1 FROM T2 ORDER BY C1   //ERROR
```

(UNION ALL, EXCEPT ALL, INTERSECT ALL)

set operation in sql

Set operators are used to join the results of two (or more) SELECT statements.

There are set union (**UNION**), set difference (**EXCEPT**), and set intersection (**INTERSECT**) operations. The relations resulting from these set operations are sets of tuples; that is, duplicate tuples are eliminated from the result.

Remember:

- The result set column names are taken from the column names of the first SELECT statement.
- SELECT statement should have the same data type. (Not in MySQL)
- UNION: To apply ORDER BY or LIMIT to an individual SELECT, place the clause inside the parentheses that enclose the SELECT.

  e.g. (SELECT ...) UNION (SELECT ...)

- ```
  CREATE TABLE Facebook (
    ID INT PRIMARY KEY,
    name VARCHAR(45),
    location VARBINARY(45)
  );
  ```
- ```
  CREATE TABLE LinkedIn (
    ID INT PRIMARY KEY,
    name VARCHAR(45),
    location VARBINARY(45)
  );
  ```

```
SELECT name FROM students        /* Fetch the union of queries */
UNION
SELECT name FROM contacts;

SELECT name FROM students        /* Fetch the union of queries with duplicates*/
UNION ALL
SELECT name FROM contacts;

SELECT name FROM students        /* Fetch names from students */
MINUS                            /* that aren't present in contacts */
SELECT name FROM contacts;

SELECT name FROM students        /* Fetch names from students */
INTERSECT                        /* that are present in contacts as well */
SELECT name FROM contacts;
```

union

syntax

```
SELECT . . . UNION [ALL | DISTINCT]
SELECT . . . [UNION [ALL | DISTINCT]
SELECT . . .]
```

- SELECT DISTINCT * FROM duplicate;
- SELECT * FROM duplicate UNION SELECT * FROM duplicate;
- SELECT deptno, dname, loc, walletid FROM (SELECT ROW_NUMBER() OVER(PARTITION BY deptno) R1, duplicate.* FROM duplicate) T1 WHERE R1=1;

Note:

- it is used to combine the result sets of 2 or more SELECT statements.
- it removes duplicate rows between the various SELECT statements.
- each SELECT statement within the UNION operator must have the same number of fields in the result sets.
- default behaviour for UNION is that duplicate rows are removed from the result.

- (SELECT deptno FROM emp LIMIT 1) UNION (SELECT deptno FROM dept LIMIT 1);
- SELECT 'EMP' as 'Table Name', COUNT(*) FROM emp UNION SELECT 'DEPT', COUNT(*) FROM dept UNION SELECT 'BONUS', COUNT(*) FROM bonus;
- SELECT COUNT(*) FROM customer UNION SELECT COUNT(*) FROM ord;
- SELECT * FROM emp WHERE deptno NOT IN (SELECT deptno FROM emp m WHERE m.deptno NOT IN (SELECT deptno FROM emp f WHERE gender = 'F') UNION SELECT deptno FROM emp m WHERE m.deptno NOT IN (SELECT deptno FROM emp f WHERE gender = 'M'));

union

books

bookID	bookName	Type	Cost
1	DS	Hardcover	950
1	DS	Hardcover	950
2	JavaScript	Paperback	700
2	JavaScript	Paperback	700

newbooks

bookID	bookName	Type	Cost
1	Redis	Paperback	850
1	Redis	Paperback	850
2	JavaScript	Paperback	700
2	JavaScript	Paperback	700

Output

bookID	bookName	Type	Cost
1	DS	Hardcover	950
2	JavaScript	Paperback	700
1	Redis	Paperback	850

- SELECT * FROM books UNION SELECT * FROM newbooks;

Note:
The following statement will give an error

- SELECT bookName, type FROM books ORDER BY bookname
  UNION
  SELECT bookName, type FROM newbooks;

Duplicate rows not repeated in result set

union all

books

bookID	bookName	Type	Cost
1	DS	Hardcover	950
1	DS	Hardcover	950
2	JavaScript	Paperback	700
2	JavaScript	Paperback	700

newbooks

bookID	bookName	Type	Cost
1	Redis	Paperback	850
1	Redis	Paperback	850
2	JavaScript	Paperback	700
2	JavaScript	Paperback	700

Output

bookID	bookName	Type	Cost
1	DS	Hardcover	950
1	DS	Hardcover	950
2	JavaScript	Paperback	700
2	JavaScript	Paperback	700
1	Redis	Paperback	850
1	Redis	Paperback	850
2	JavaScript	Paperback	700
2	JavaScript	Paperback	700

- SELECT * FROM books UNION ALL SELECT * FROM newbooks;

- SELECT * FROM emp UNION ALL SELECT * FROM emp;

Duplicate rows are repeated in result set

intersect / intersect all

books

bookID	bookName	Type	Cost
1	DS	Hardcover	950
1	DS	Hardcover	950
2	JavaScript	Paperback	700
2	JavaScript	Paperback	700

newbooks

bookID	bookName	Type	Cost
1	Redis	Paperback	850
1	Redis	Paperback	850
2	JavaScript	Paperback	700
2	JavaScript	Paperback	700

Output

bookID	bookName	Type	Cost
2	JavaScript	Paperback	700

Output

bookID	bookName	Type	Cost
2	JavaScript	Paperback	700
2	JavaScript	Paperback	700

An INTERSECT query returns the intersection of 2 or more datasets. If a record exists in both data sets, it will be included in the INTERSECT results.

- SELECT * FROM books INTERSECT SELECT * FROM newbooks;
- SELECT * FROM books INTERSECT ALL SELECT * FROM newbooks;

- SELECT bookName, type FROM books WHERE EXISTS (SELECT bookname, type FROM newbooks WHERE books.bookName = newbooks.bookName);
- SELECT bookName, type FROM books WHERE bookName IN (SELECT bookName FROM newbooks);

except / except all

books

bookID	bookName	Type	Cost
1	DS	Hardcover	950
1	DS	Hardcover	950
2	JavaScript	Paperback	700
2	JavaScript	Paperback	700

newbooks

bookID	bookName	Type	Cost
1	Redis	Paperback	850
1	Redis	Paperback	850
2	JavaScript	Paperback	700
2	JavaScript	Paperback	700

Output

bookID	bookName	Type	Cost
1	DS	Hardcover	950

Output

bookID	bookName	Type	Cost
1	DS	Hardcover	950
1	DS	Hardcover	950

An EXCEPT returns rows from first dataset, which are not available in the second dataset.

- SELECT * FROM books EXCEPT SELECT * FROM newbooks;
- SELECT * FROM books EXCEPT ALL SELECT * FROM newbooks;

- SELECT bookName, type FROM books WHERE NOT EXISTS (SELECT bookName, type FROM newbooks WHERE books.bookName = newbooks.bookName);
- SELECT bookName, type FROM newbooks WHERE NOT EXISTS (SELECT bookName, type FROM books WHERE books.bookName = newbooks.bookName);

Note:

except

- There is no MINUS operator in MySQL, you can easily simulate this type of query using either the EXCEPT , NOT IN clause or the NOT EXISTS clause.

1.
```
SELECT * FROM books          /* Fetch  everything from books */
EXCEPT                       /* that are not present in newbooks */
SELECT * FROM newbooks;
```

2.
```
SELECT * FROM newbooks  /* Fetch everything  from newbooks */
EXCEPT                  /* that are not present in books */
SELECT * FROM books;
```

truncate table

Remember:

- DROP and TRUNCATE are DDL commands, whereas DELETE is a DML command.
- DELETE operations can be rolled back, while DROP and TRUNCATE operations cannot be rolled back.
- The TRUNCATE TABLE statement removes all the data/rows of a table and resets the auto-increment value to zero.

truncate table

Logically, TRUNCATE TABLE is similar to a DELETE statement that deletes all rows, or a sequence of DROP TABLE and CREATE TABLE statements.

```
TRUNCATE [TABLE] tbl_name
```

Remember:

- Truncate operations drop and re-create the table, which is much faster than deleting rows one by one.
- Truncate operations cause an implicit commit, and so cannot be rolled back.
- Truncate does not cause ON DELETE triggers to fire.
- Truncate cannot be performed for parent-child foreign key relationships.
- Truncate retain Identity and reset to the seed (start value) value.
- Cannot truncate a table referenced in a foreign key constraint.

DELETE Vs TRUNCATE

delete vs truncate

DELETE	TRUNCATE
You can specify the tuple that you want to delete.	It deletes all the tuples from a relation.
DELETE is a Data Manipulation Language command.	TRUNCATE is a Data Definition Language command.
DELETE command can have WHERE clause.	TRUNCATE command do not have WHERE clause.
DELETE command activates the trigger applied on the table and causes them to fire.	TRUNCATE command does not activate the triggers to fire.
DELETE command eliminate the tuples one-by-one.	TRUNCATE delete the entire data page containing the tuples.
DELETE command lock the row/tuple before deleteing it.	TRUNCATE command lock data page before deleting table data.
DELETE command acts slower as compared to TRUNCATE.	TRUNCATE is faster as compared to DELETE.
DELETE records transaction log for each deleted tuple.	TRUNCATE record transaction log for each deleted data page.
DELETE command can be followed either by COMMIT or ROLLBACK.	TRUNCATE command can't be ROLLBACK.

DROP Vs TRUNCATE

drop vs truncate

DROP	TRUNCATE
The DROP command is used to remove table definition and its contents.	Whereas the TRUNCATE command is used to delete all the rows from the table.
In the DROP command, VIEW of table does not exist.	In the TRUNCATE command, VIEW of table exist.
In the DROP command, integrity constraints will be removed.	In the TRUNCATE command, integrity constraints will not be removed.
In the DROP command, INDEX associated to the table will be removed.	In the TRUNCATE command, INDEX associated to the table will not be removed.
In the DROP command, TRIGGER associated to the table will execute.	In the TRUNCATE command, TRIGGER associated to the table will not execute.
In the DROP command, TRIGGER associated to the table will be removed.	In the TRUNCATE command, TRIGGER associated to the table will be not removed.

rename table

Change the table name.

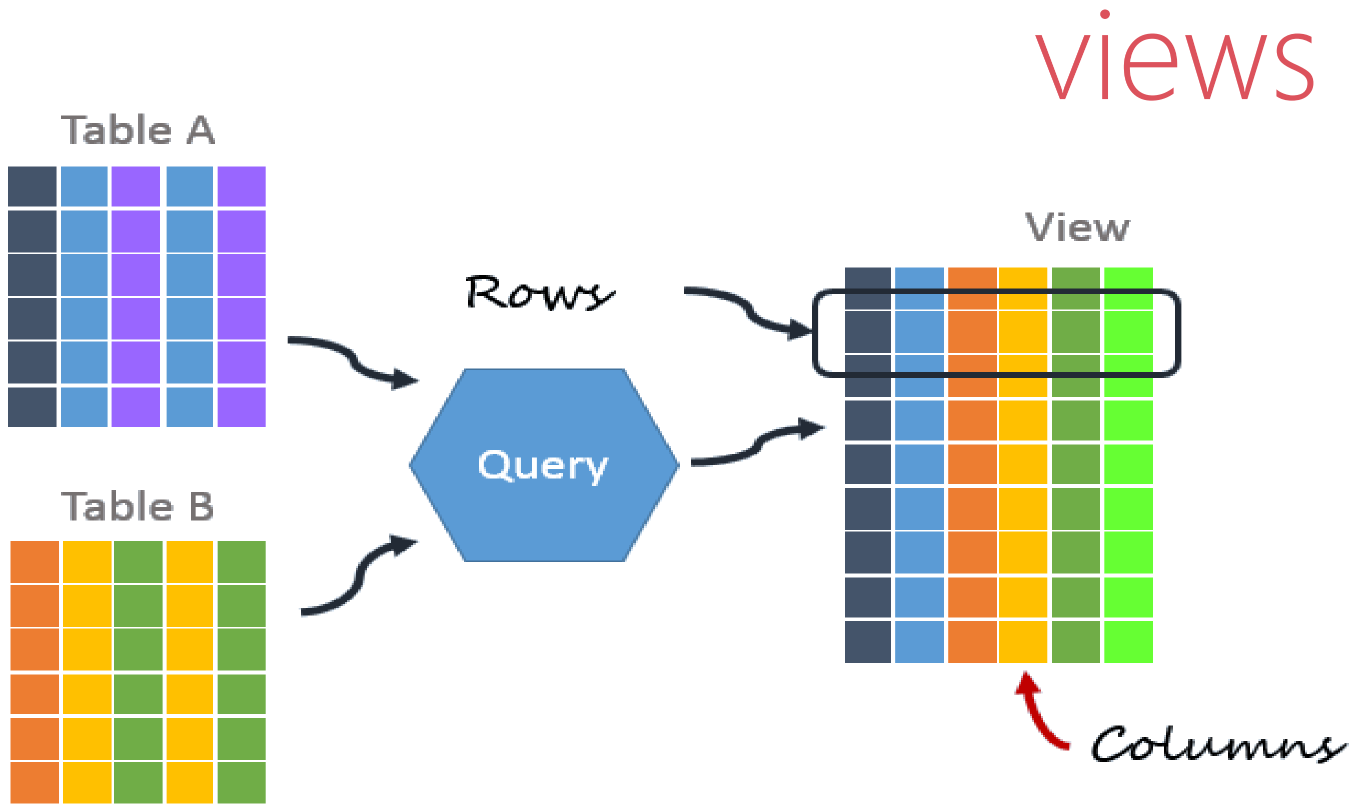
```
RENAME TABLE old_tbl_name TO new_tbl_name
```

- RENAME TABLE emp TO employee;

A ***VIEW*** in SQL as a logical subset of data from one or more tables. Views are used to restrict data access. A ***VIEW*** contains no data of its own but its like window through which data from tables can be viewed or changed. The table on which a View is based are called BASE Tables.

There are 2 types of Views in SQL:

- **Simple View** : Simple views can only contain a single base table.
- **Complex View** : Complex views can be constructed on more than one base table. In particular, complex views can contain: join conditions, a group by clause, a order by clause.



Remember:

view

- it can be described as **virtual/derived** table which derived its data from one or more than one base table.
- View names may appear in a query in any place where a relation name may appear.
- it is stored in the database.
- it can be created using tables of same database or different database.
- it is used to implement the security mechanism in the SQL.
- It can have max 64 char (view name).

Rules:

- If a VIEW is defined as SELECT * on a table, new columns added to the base table later do not become part of the VIEW, and columns dropped from the base table will result in an error when selecting from the VIEW.
- A VIEW must have unique column names with no duplicates, just like a base table. By default, the names of the columns retrieved by the SELECT statement are used for the VIEW column names.
- The VIEW definition cannot refer to a TEMPORARY table, and you cannot create a TEMPORARY VIEW.
- You cannot associate a TRIGGER with a VIEW.

Note:

- If we drop the BASE TABLE, the VIEW will not be dropped.
- A VIEW definition (structure) is not permanently stored as part of the database.

- DESC dept;
- CREATE VIEW v1 AS SELECT * FROM dept;
- DROP TABLE dept;
- DESC v1;

Try this

Views are not updatable in the following cases:

- A table in the FROM clause is reference by a subquery in the WHERE statement.
- There is a subquery in the SELECT clause.
- The SQL statement defining the view joins tables.
- One of the tables in the FROM clause is a non-updatable view.
- The SELECT statement of the view contains an aggregate function such as SUM(), COUNT(), MAX(), MIN(), and so on.
- The keywords DISTINCT, GROUP BY, HAVING clause, LIMIT clause, UNION, or UNION ALL appear in the defining SQL statement.

difference between simple and complex view

SIMPLE VIEW	COMPLEX VIEW
Contains only one base table or is created from only one table, it may include WHERE clause and ORDER BY clause.	Contains more than one base tables or is created from more than one tables.
We cannot use group functions like MAX(), COUNT(), etc.	We can use group functions.
Does not contain groups of data.	It can conatin groups of data.
DML operations could be performed through a simple view.	DML operations could not always be performed through a complex view.
INSERT, DELETE and UPDATE are directly possible on a simple view.	We cannot apply INSERT, DELETE and UPDATE on complex view directly.
Simple view does not contain group by, , having clause, limit clause, distinct, pseudo column like rownum, columns defined by expressions.	It can contain group by, having clause, limit clause, distinct, pseudocolumn like rownum, columns defined by expressions.
Does not include NOT NULL columns from base tables.	NOT NULL columns that are not selected by simple view can be included in complex view.

create view

The select_statement is a SELECT statement that provides the definition of the view. The select_statement can select from base tables or other views.

```
CREATE [OR REPLACE]  VIEW view_name [(column_list)]
    AS select_statement  [WITH CHECK OPTION]
```

UPDATE AND DELETE on VIEW (with check option given on view) will work only when the DATA MATCHES IN WHERE CLAUSE.

- CREATE VIEW v1 as SELECT * FROM dept;
- CREATE VIEW v1(A_1, A_2) as SELECT deptno, dname FROM dept;
- CREATE or REPLACE VIEW v1 as SELECT * FROM dept WITH CHECK OPTION;

desc INFORMATION_SCHEMA.VIEWS;

licence table

create view

	ID	customerID	licenceClass	licenceType	licenceNumber	ValidFrom	ValidTo	agentID
▶	1	1	LMV	Light motor vehicles including motorcars, jeeps, taxis, delivery vans	RQFY8GZNDF9E	*********	*********	1
	2	2	LMV	Light motor vehicles including motorcars, jeeps, taxis, delivery vans	ZFVHYH4OAHGS	*********	*********	2
	3	1	HMV	Heavy Motor Vehicles	20CMZQ6ERXJ4	*********	*********	3
	4	2	HMV	Heavy Motor Vehicles	DNIE1K9R5BG6	*********	*********	1
	5	3	LMV	Light motor vehicles including motorcars, jeeps, taxis, delivery vans	Y3CNWQ6MKPCG	*********	*********	2
	6	3	HMV	Heavy Motor Vehicles	Y6DC2IRD2EWZ	*********	*********	1
	7	4	HGMV	Heavy Goods Motor Vehicle	2EFFSXY04OAW	*********	*********	3
	8	5	HMV	Heavy Motor Vehicles	GC1BMWKCTVQ4	*********	*********	2
	9	6	LMV	Light motor vehicles including motorcars, jeeps, taxis, delivery vans	2148PC50IR3P	*********	*********	1
	10	7	HPMV	Heavy passenger motor vehicle/Heavy transport vehicle	N4NODNCFJENP	*********	*********	2
	11	8	HGMV	Heavy Goods Motor Vehicle	EBPW9M34FKOI	*********	*********	2
	12	9	HPMV	Heavy passenger motor vehicle/Heavy transport vehicle	940MGEL4HO00	*********	*********	3
	13	10	LMV	Light motor vehicles including motorcars, jeeps, taxis, delivery vans	JWRDAETHDU5Z	*********	*********	1
	14	11	HGMV	Heavy Goods Motor Vehicle	Z95XCS7W9NAU	*********	*********	2
	15	12	HGMV	Heavy Goods Motor Vehicle	1YJ12NQX8HAJ	*********	*********	1
	16	13	LMV	Light motor vehicles including motorcars, jeeps, taxis, delivery vans	1XMTETH8E6JS	*********	*********	1
	17	14	HPMV	Heavy passenger motor vehicle/Heavy transport vehicle	0WEMMTPVTBPM	*********	*********	2
*	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

all are Simple View

- CREATE or REPLACE VIEW agent1_view AS SELECT * FROM licence WHERE agentID = 1 ORDER BY validTo;
- CREATE or REPLACE VIEW agent2_view AS SELECT * FROM licence WHERE agentID = 2;
- CREATE or REPLACE VIEW agent3_view AS SELECT * FROM licence WHERE agentID = 3;

create user and grant/revoke privileges

create user

TODO

CREATE USER [IF NOT EXISTS] '*user_name*' @'*localhost*' IDENTIFIED BY '*password*'

SET PASSWORD FOR '*user_name*'@'*localhost*' = '*auth_string*'

DROP USER [IF EXISTS] '*user_name*' @'*localhost*'

- CREATE USER 'saleel'@'localhost' IDENTIFIED BY 'saleel';
- SET PASSWORD FOR 'saleel'@'localhost' = '*sharmin*';
- DROP USER 'saleel'@'localhost';

grant/revoke privileges

TODO

GRANT *priv_type* ON *object_type* TO '*user_name*'@'*localhost*'

REVOKE *priv_type* ON *object_type* FROM '*user_name*'@'*localhost*'

Privilege	Privilege
ALL [PRIVILEGES]	SELECT
CREATE	INSERT
ALTER	UPDATE
DROP	DELETE
EXECUTE	

- GRANT ALL PRIVILEGES ON db1.* TO 'saleel'@'localhost';
- GRANT ALL PRIVILEGES ON *.* TO 'saleel'@'localhost';

- GRANT INSERT, UPDATE ON emp TO 'saleel';
- REVOKE INSERT, UPDATE ON emp FROM 'saleel';

Try Out

create view

```
CREATE TABLE customer (
    ID INT PRIMARY KEY ,
    name VARCHAR(50),
    description TEXT
);

CREATE TABLE orders (
     orderID INT ,
     customerID INT,
     orderDate DATE,
     amount INT,
     constraint fk_customerID FOREIGN KEY(customerID) REFERENCES customer(ID));


INSERT INTO customer VALUES (1, 'saleel', 'description Text 1'), (2, 'vrushali', 'description Text 2'), (3, 'sharmin',  'description Text 3'), (4, 'ruhan', 'description Text 4');

INSERT INTO orders VALUES(1, 1, NOW(), 3000), (2, 1, NOW(), 1000), (3, 2, NOW(), 100), (4, 2, NOW(), 300), (5, 2, NOW(), 200);
```

Try Out

create view

- CREATE or REPLACE VIEW v1 AS SELECT * FROM customer, orders WHERE ID = customerID;
- CREATE or REPLACE VIEW v2 AS SELECT customer.* FROM customer, orders WHERE ID = customerID;
- CREATE or REPLACE VIEW v3 AS SELECT orders.* FROM customer, orders WHERE ID = customerID;

- INSERT INTO v1(ID, name, description, orderID, customerID, orderdate, amount) VALUES (10,'S10',"D1", 10, 1, NOW(), 111); // Error: Can not modify more than one base table through a join view 'db5.v1’

// We may get Error: Can not insert into join view 'db5.v2' without fields list.

- INSERT INTO v1(ID, name, description) VALUES(1, 'neel', 'description Text 5');
- INSERT INTO v1(orderID, customerID, orderDate, amount) VALUES(1, 1, now(), 7000);
- INSERT INTO v2(ID, name, description) VALUES(5, 'neel', 'description Text 5');
- INSERT INTO v3(orderID, customerID, orderdate, amount) VALUES(6, 1, NOW(), 200);

SHOW CREATE VIEW Syntax

```
SHOW CREATE VIEW view_name

show create VIEW v1;


SHOW [FULL] TABLES [{FROM | IN} db_name]
    [LIKE 'pattern' | WHERE expr]


show full tables where table_type like 'VIEW';
```

alter / drop view

This statement changes the definition of a view, which must exist.

```
ALTER VIEW view_name [(column_list)]
    AS select_statement
    [WITH CHECK OPTION]
```

e.g.

- ALTER VIEW studentview AS SELECT namefirst, namelast, emailid FROM student;

DROP VIEW removes one or more views.

```
DROP VIEW [IF EXISTS]
   view_name [, view_name] ...
```

e.g.

- DROP VIEW studentview;
- DROP VIEW studentid10view, studentviewwithcheck;
- DROP VIEW studentTotalMarksView, studentAddressView;

MySQL indexes (PRIMARY KEY, UNIQUE, INDEX, and FULLTEXT) are stored in B-trees.

index

- it is a schema object.
- it is used by the server to speed up the retrieval of rows.
- it reduces disk I/O(input/output) process.
- it helps to speed up select queries where clauses, but it slows down data input, with the update and the insert statements.
- it can be created or dropped with no effect on the data.
- multiple columns index may consist of up to 16 columns.

index

Indexes are used to find rows with specific column values quickly. Without an index, MySQL must begin with the first row and then read through the entire table to find the relevant rows. If the table has an index for the columns in question, MySQL can quickly determine the position (**from the index file**) to seek to in the middle of the data file without having to look at all the data. This is much faster than reading every row sequentially.

- To find the rows matching a WHERE clause quickly.
- If the table has a multiple-column index, any leftmost prefix of the index can be used by the optimizer to look up rows. For example, if you have a three-column index on (col1, col2, col3), you have indexed search capabilities on (col1), (col1, col2), and (col1, col2, col3).

Note:

- Index name can have max 64 char.
- It is not possible to create an INDEX on a VIEW.
- If we drop the BASE TABLE, the INDEX will be dropped automatically.

create index

Indexes are used to find rows with specific column values quickly.

```
CREATE [UNIQUE] INDEX index_name
   ON tbl_name (index_col_name,...)
```

e.g.

- CREATE INDEX indexOnName ON emp(ename);
- CREATE INDEX indexOnUniversity ON student_qualifications(university);
- CREATE UNIQUE INDEX uniqueIndexOnName ON emp(ename);

clustered and non-clustered index

Indexing in MySQL is a process that helps us to return the requested data from the table very fast. If the table does not have an index, it scans the whole table for the requested data.

MySQL allows two different types of Indexing:

- Clustered Index
- Non-Clustered Index

Clustered Index:-

- Clustered index is used to optimize the speed of most common lookups and DML operations like INSERT, UPDATE, and DELETE command.
- Clustered indexes sort and store the data rows in the table based on their key (primary key) values that can be sorted in only one direction.
- If the table column contains a **primary key** or **unique key**, MySQL creates a clustered index.
- Data retrieval is faster than non-cluster index

Non-Clustered Index:-

- The indexes other than PRIMARY indexes (clustered indexes) called a non-clustered index.
- The non-clustered indexes are also known as secondary indexes.
- The non-clustered index and table data are both stored in different places.
- It is not sorted (ordering) the table data.
- Extra space is required to store logical structure
- Data update is faster than clustered index

SHOW INDEX Syntax

To get the index of a table, you specify the table name after the FROM keyword. The statement will return the index information associated with the table in the current database.

```
SHOW {INDEX | INDEXES | KEYS}
    {FROM | IN} tbl_name
    [{FROM | IN} db_name]
    [WHERE expr]
```

e.g.

- SHOW INDEX FROM emp;
- SHOW INDEX FROM student_qualifications;

SHOW INDEX returns table index information.

drop index

DROP INDEX drops the index named index_name from the table tbl_name.

```
DROP INDEX index_name ON tbl_name
```

e.g.

- DROP INDEX indexOnName ON emp;
- DROP INDEX indexOnUniversity ON student_qualifications;
- DROP INDEX uniqueIndexOnName ON emp;

select … into

select … into

An INTO clause should not be used in a nested SELECT because such a SELECT must return its result to the outer context.

The SELECT ... INTO form of SELECT enables a query result to be stored in variables or written to a file.

SELECT . . . INTO var_list

SELECT . . . INTO OUTFILE

SELECT . . . INTO DUMPFILE

- Selects column values and stores them into variables.
- Writes the selected rows to a file. Column and line terminators can be specified to produce a specific output format.
- Writes a single row to a file without any formatting.

select ... into var_list

select … into var_list

The SELECT ... INTO form of SELECT enables a query result to be stored in variables or written to a file.

SELECT . . . INTO var_list

- The selected values are assigned to the variables.
- The number of variables must match the number of columns.
- The query should return a single row.
- If the query returns no rows, a warning with error code 1329 occurs (No data), and the variable values remain unchanged.
- If the query returns multiple rows, error 1172 occurs (Result consisted of more than one row).
- The statement may retrieve multiple rows, you can use LIMIT 1 to limit the result set to a single row.

select … into var_list

The SELECT ... INTO form of SELECT enables a query result to be stored in variables or written to a file.

SELECT . . . INTO var_list

- ```
  SET @x = 0;
  SET @y = null;
  SELECT empno, ename INTO @x, @y FROM emp WHERE empno = 7788;
  ```

- ```
  SET @x = 0;
  SET @y = null;
  SELECT MAX(sal), MIN(sal) INTO @x, @y FROM emp WHERE empno = 7788;
  ```

```
+-------------------------+---------------------------------------------------------------+
| variable_name           | value                                                         |
+-------------------------+---------------------------------------------------------------+
| secure_file_priv        | C:/ProgramData/MySQL/MySQL Server 8.0/Uploads                 |
+-------------------------+---------------------------------------------------------------+
```

In this example, I can only read files from the / Uploads / directory.

select ... into outfile

If not working then do changes in ***my.ini*** file.

```
secure_file_priv = ""
SHOW VARIABLES LIKE "secure_file_priv";
```

select … into outfile

Writes the selected rows to a file. Column and line terminators can be specified to produce a specific output format.

SELECT . . . INTO OUTFILE

- SELECT identifier.* FROM emp INTO OUTFILE "/tmp/emp.csv" ;
- SELECT identifier.* FROM emp INTO OUTFILE "/tmp/emp.txt" ;
- SELECT identifier.* FROM emp INTO OUTFILE "/tmp/emp.csv" FIELDS TERMINATED BY ',’;
- SELECT identifier.* FROM emp INTO OUTFILE "/tmp/emp.csv" FIELDS TERMINATED BY ',';
- SELECT identifier.* FROM emp INTO OUTFILE "/tmp/emp.csv" FIELDS TERMINATED BY ',' LINES TERMINATED by '\n';
- SELECT identifier.* FROM emp INTO OUTFILE "/tmp/emp.csv" FIELDS TERMINATED BY ',' OPTIONALLY ENCLOSED BY '"' LINES TERMINATED BY '\n';
- SELECT "DEPT", "DNAME", "LOC", "PWD", "STARTEDON" UNION SELECT * FROM dept;

- TABLE emp INTO OUTFILE "/tmp/emp.csv";
- TABLE emp INTO OUTFILE "/tmp/emp.txt";

select … into dumpfile

select … into dumpfile

If you use INTO DUMPFILE instead of INTO OUTFILE, MySQL writes only one row into the file, without any column or line termination and without performing any escape processing. This is useful if you want to store a BLOB value in a file.

SELECT . . . INTO DUMPFILE

- `SELECT identifier.* FROM emp WHERE empno = 7788 INTO DUMPFILE "/tmp/emp.txt";`

- mysqldump -uroot -p db1 >> d:\bk.sql
- mysqldump -u[username] -p[password] --all-databases > d:\db_backup.sql
- mysqldump -P 3306 -h 192.168.100.26 -usaleel -psaleel **db_name** > db_backup.sql
- mysqldump -P 3306 -h 192.168.100.26 -usaleel -psaleel **db_name table_name** > db_backup.sql
- mysqldump -P 3306 -h 192.168.100.26 -usaleel -psaleel **db_name table_name --WHERE ="deptno=10"** > db_backup.sql
- mysqldump -P 3306 -h 192.168.100.26 -usaleel -psaleel **db_name table_name --WHERE ="job='manager'"** > db_backup.sql
- mysqldump --column-statistics=0 -P 3306 -h 192.168.100.26 -usaleel -psaleel db_name > db_backup.sql
- mysql -P 3306 –h192.168.100.74 -uroot -proot db2 < d:\ backup_fileName.sql
- mysql -P 3306 –h192.168.100.74 -uroot -proot < d:\ backup_fileName.sql db2

snapshots

To create a raw data snapshot of MyISAM tables, you can use standard copy tools such as cp or copy, a remote copy tool such as scp or rsync, an archiving tool such as zip or tar, or a file system snapshot tool such as dump, providing that your MySQL data files exist on a single file system. If you are replicating only certain databases, copy only those files that relate to those tables.

```
CountryName,CapitalName,CapitalLatitude,CapitalLongitude,CountryCode,ContinentName,remark
Somaliland,Hargeisa,9.55,44.05,NULL,Africa,
South Georgia and South Sandwich Islands,King Edward Point,-54.283333,-36.5,GS,Antarctica,
French Southern and Antarctic Lands,Port-aux-Français,-49.35,70.216667,TF,Antarctica,
Palestine,Jerusalem,31.76666667,35.233333,PS,Asia,
Aland Islands,Mariehamn,60.116667,19.9,AX,Europe,
Nauru,Yaren,-0.5477,166.920867,NR,Australia,
Saint Martin,Marigot,18.0731,-63.0822,MF,North America,
Tokelau,Atafu,-9.166667,-171.833333,TK,Australia,
Western Sahara,El-Aaiún,27.153611,-13.203333,EH,Africa,
```

```
load data infile "D:\abc1.csv" into table a fields terminated by ","
ignore 1 rows (id,name,@dt) SET dt =
STR_TO_DATE(@dt,'%d-%m-%Y');
```

import .csv / .tsv file

```
CREATE TABLE countries (
CountryName VARCHAR(45),
CapitalName VARCHAR(45),
CapitalLatitude VARCHAR(45),
CapitalLongitude VARCHAR(45),
CountryCode VARCHAR(45),
ContinentName VARCHAR(45),
remark VARCHAR(45)
);
```

```
LOAD DATA INFILE 'path/file-name.csv' INTO TABLE countries
FIELDS TERMINATED BY ','  or FIELDS TERMINATED BY '\t'
LINES TERMINATED BY '\n'
IGNORE 1 ROWS;
```

- SELECT "DEPT", "DNAME", "LOC", "PWD", "STARTEDON" UNION SELECT * FROM dept;

Import .CSV file with dateFormat

```
moduleID,moduleName,duration,startedON
1,OracleCR,6 months,23-10-2022
2,PIG,2 months,12-10-2022
3,Neo4j,4 months,20-10-2022
4,Cassandra,7 months,03-10-2022
5,HIVE,3 months,09-10-2022
6,MongoDB,2 months,25-10-2022
7,Redis,1 months,06-10-2022
```

```
CREATE TABLE module (
moduleID INT,
moduleName VARCHAR(45),
duration VARCHAR(45),
startedON DATE
);
```

```
LOAD DATA INFILE 'path/file-name.csv' INTO TABLE module
FIELDS TERMINATED BY ','
LINES TERMINATED BY '\n'
IGNORE 1 ROWS
(moduleID,modulename,moduleDuration,@startedOn)
SET startedOn = STR_TO_DATE(@startedOn,'%d-%m-%Y')
;
```

cluster

A cluster comprises multiple interconnected computers or servers that appear as if they are one server to end users and applications.

data dictionary

A data dictionary contains metadata i.e data about the database. The data dictionary is very important as it contains information such as what is in the database, who is allowed to access it, where is the database physically stored etc. The users of the database normally don't interact with the data dictionary, it is only handled by the database administrators.

The data dictionary in general contains information about the following –

- Names of all the database tables and their schemas.
- Details about all the tables in the database, such as their owners, their security constraints, when they were created etc.
- Physical information about the tables such as where they are stored and how.
- Table constraints such as primary key attributes, foreign key information etc.
- Information about the database views that are visible.

data dictionary - information_schema

Data Dictionary
INFORMATION_SCHEMA.COLUMNS
INFORMATION_SCHEMA.TABLES
INFORMATION_SCHEMA.TABLE_CONSTRAINTS
INFORMATION_SCHEMA.STATISTICS
INFORMATION_SCHEMA.KEY_COLUMN_USAGE
INFORMATION_SCHEMA.ROUTINES
INFORMATION_SCHEMA.PARAMETERS
INFORMATION_SCHEMA.TRIGGERS

"Live as if you were to die tomorrow. Learn as if you were to live forever"