

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 }

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 [Cultural means: the ideas, customs, and social behaviour of a particular people or society..], 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" refers to a **table** within the database that follows the principles of the relational model **OR** an **entity** in ERD) 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. (Referential integrity constraint is the state of a database in which all values of all foreign keys are valid.)

Table also called Relation

CustomerID	CustomerName	Status
1	Google	Active
2	Amazon	Active
3	Apple	Inactive

Primary Key

Domain
Ex: NOT NULL

Tuple OR Row

Total # of rows is **Cardinality**

Column OR Attributes

Total # of column is **Degree**

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

File System VS DBMS

```
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];
```

file-oriented system

File Anomalies

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  
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
```

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

file-oriented system

File Anomalies

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
```

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.
- **Flexibility:** File systems provide flexibility in storing various types of data, including text documents, images, audio, video, and more
- **Cost-Effectiveness:** File systems often do not incur licensing costs, making them cost-effective for basic data storage needs.
- **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.

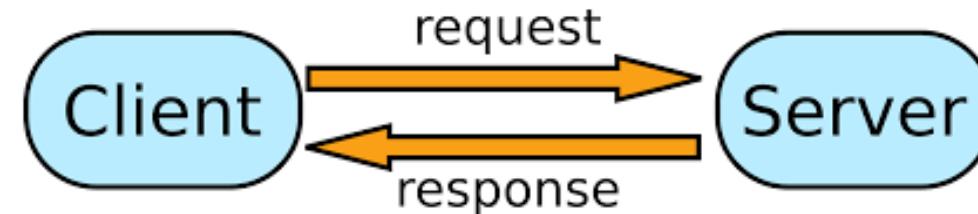


relational database management system?

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 a machine that provides service to another computer program, known as the client.

object relational database management system?

An object database is a database management system in which information is represented in the form of objects.

PostgreSQL is the most popular pure ORDBMS. Some popular databases including Microsoft SQL Server, Oracle, and IBM DB2 also support objects and can be considered as ORDBMS.

Advantage of ORDBMS

- Function/Procedure overloading.
- Extending server functionality with external functions written in C or Java.
- User defined data types.
- Inheritance of tables under other tables.

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 (column) 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, 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, 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

Remember:

- A **Binary Large Object (BLOB)** is a MySQL data type that can store binary data such as multimedia, and PDF files.
- A **Character Large Object(CLOB)** is a MySQL data type which is used to store large amount of textual data. Using this datatype, you can store data up to 2,147,483,647 characters.
- A number is a mathematical value used to count, measure, and label.



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?

An entity in DBMS is a real-world object that has certain properties called attributes that define the nature of the 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**.

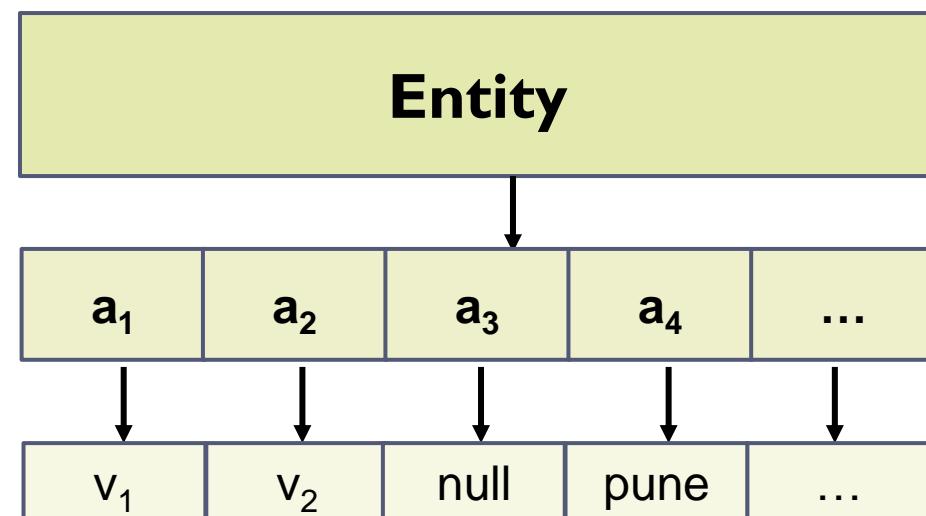
Every entity has its own characteristics.

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 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**
(Can't be divided further)
- **Single Value Attribute**
(Only One value)
- **Stored Attribute**
(Only One value)
- **Complex Attribute**
(Composite & Multivalued)

--VS--

- Composite Attribute**
(Can be divided further)
- Multi Valued Attribute**
(Multiple values)
- Derived Attribute**
(Virtual)

- **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.

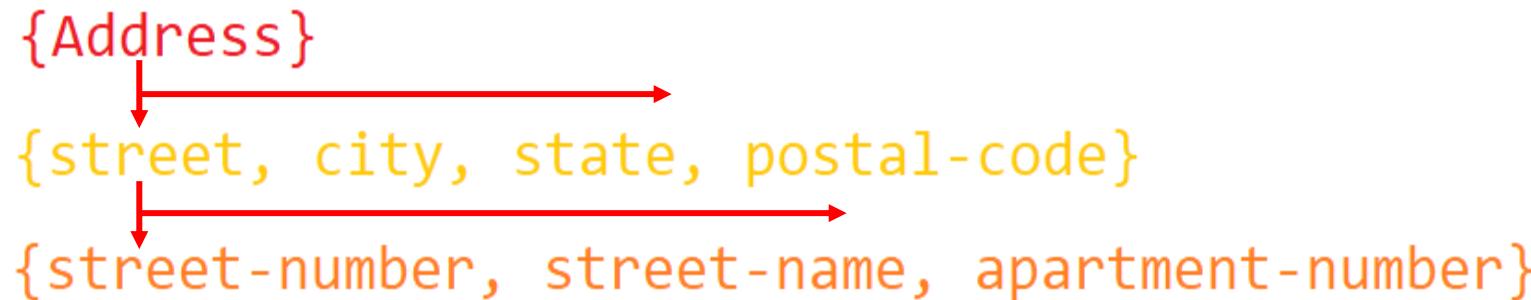
Composite VS Multi Valued Attribute

composite / multi valued attributes

Composite Attribute

Person Entity

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



Multi Valued Attribute

Person Entity

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

What is an Prime, Non-Prime Attribute?

Prime attribute (*Entity integrity*)

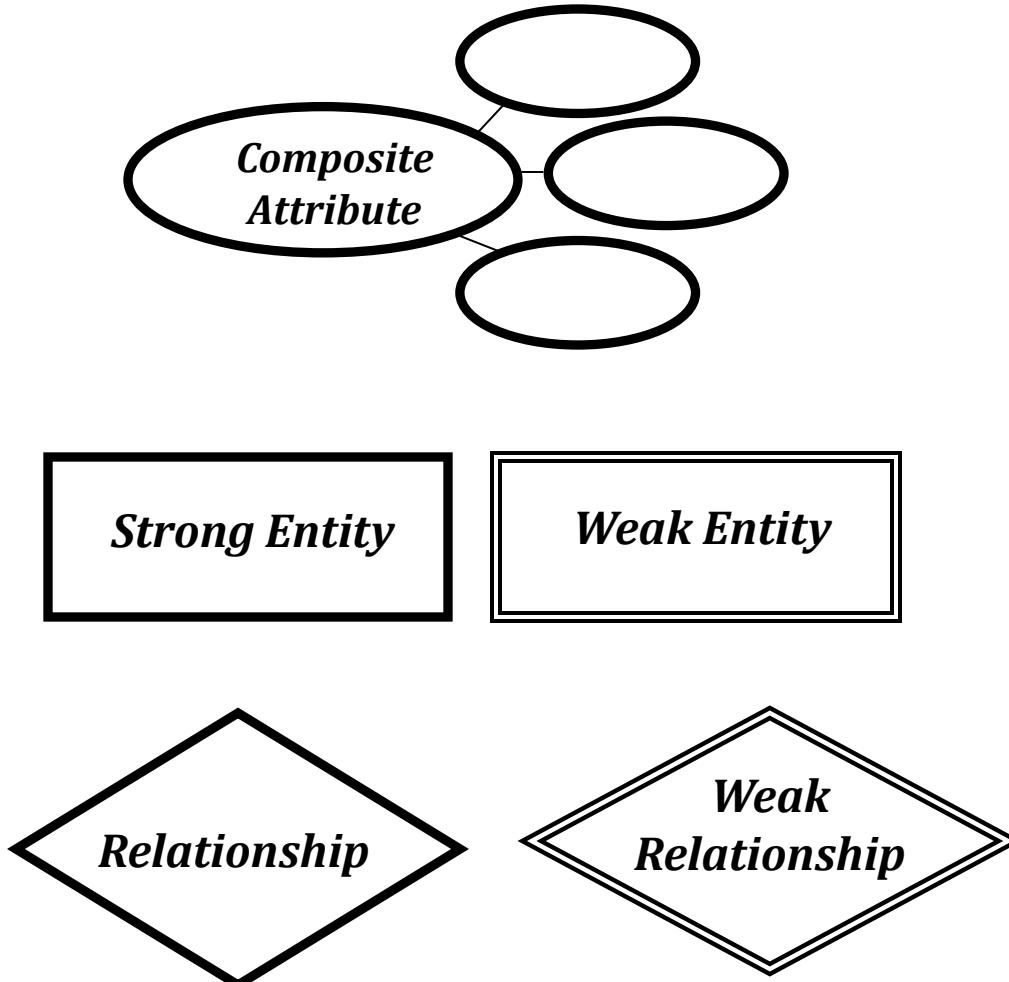
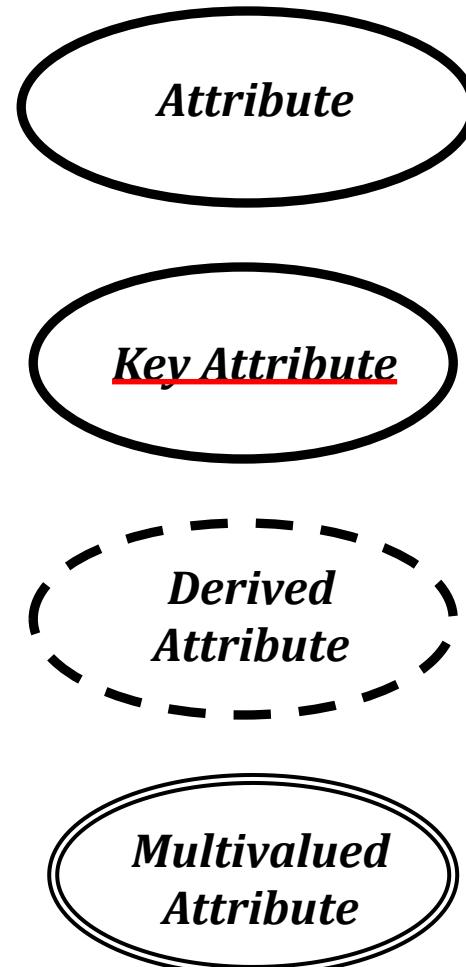
An attribute, which is a **part of the prime-key** (candidate key), is known as a prime attribute.

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

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 relationship between one strong and one weak entity is represented by a double diamond. This relationship is also known as identifying relationship.

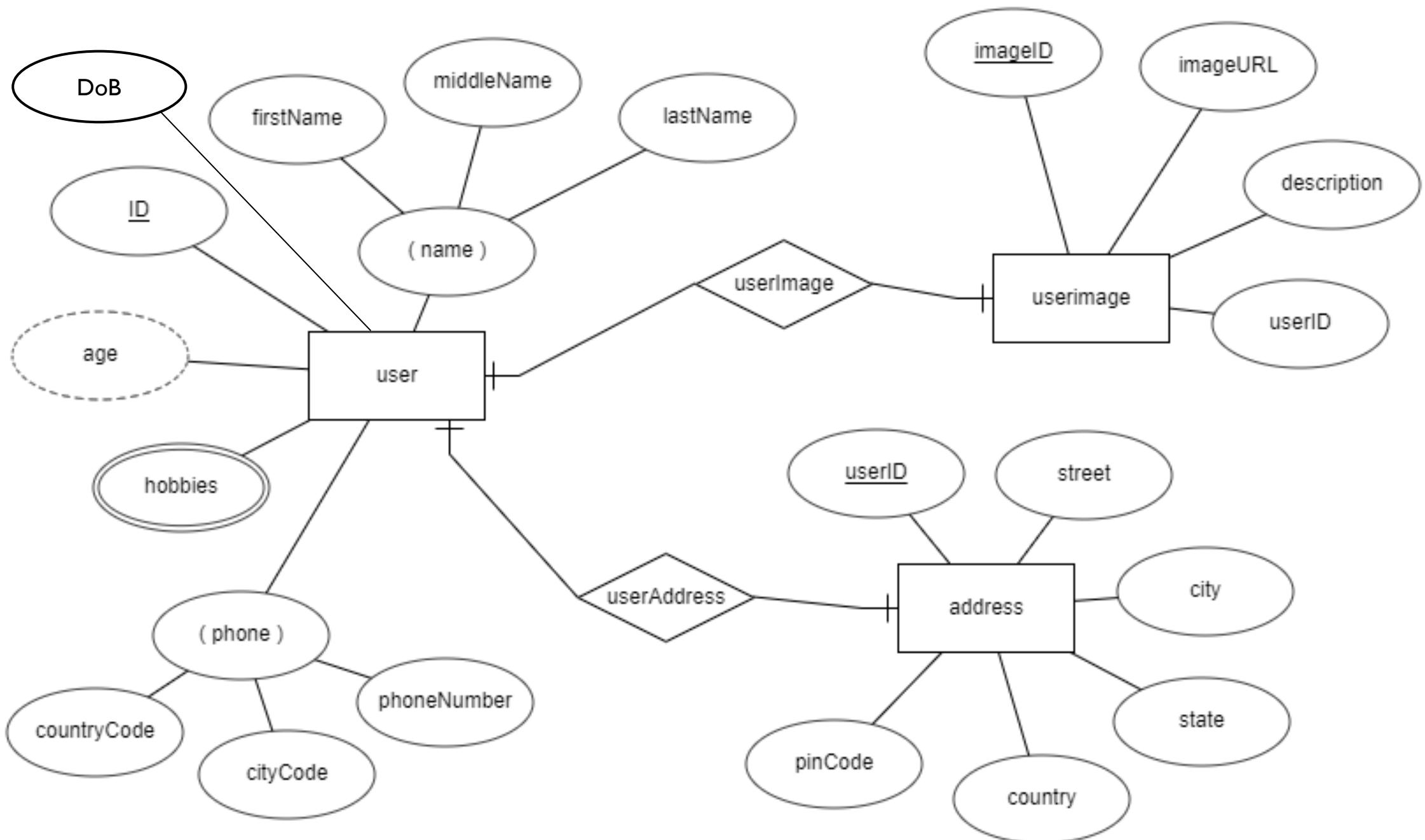
Example 1 – A loan entity can not be created for a customer if the customer doesn't exist

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

Example 3 – A customer address entity can not be created for the customer if the customer 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 $d(R)$.
- **Cardinality $|R|$:** Total number of **tuples/rows** present in a relation/table, **is called cardinality of a relation** and is denoted by $|R|$.
Cardinality is the numerical relationship between rows of one table and rows in another. Common cardinalities include *one-to-one*, *one-to-many*, and *many-to-many*.
- **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 $d(R)$** .
 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)

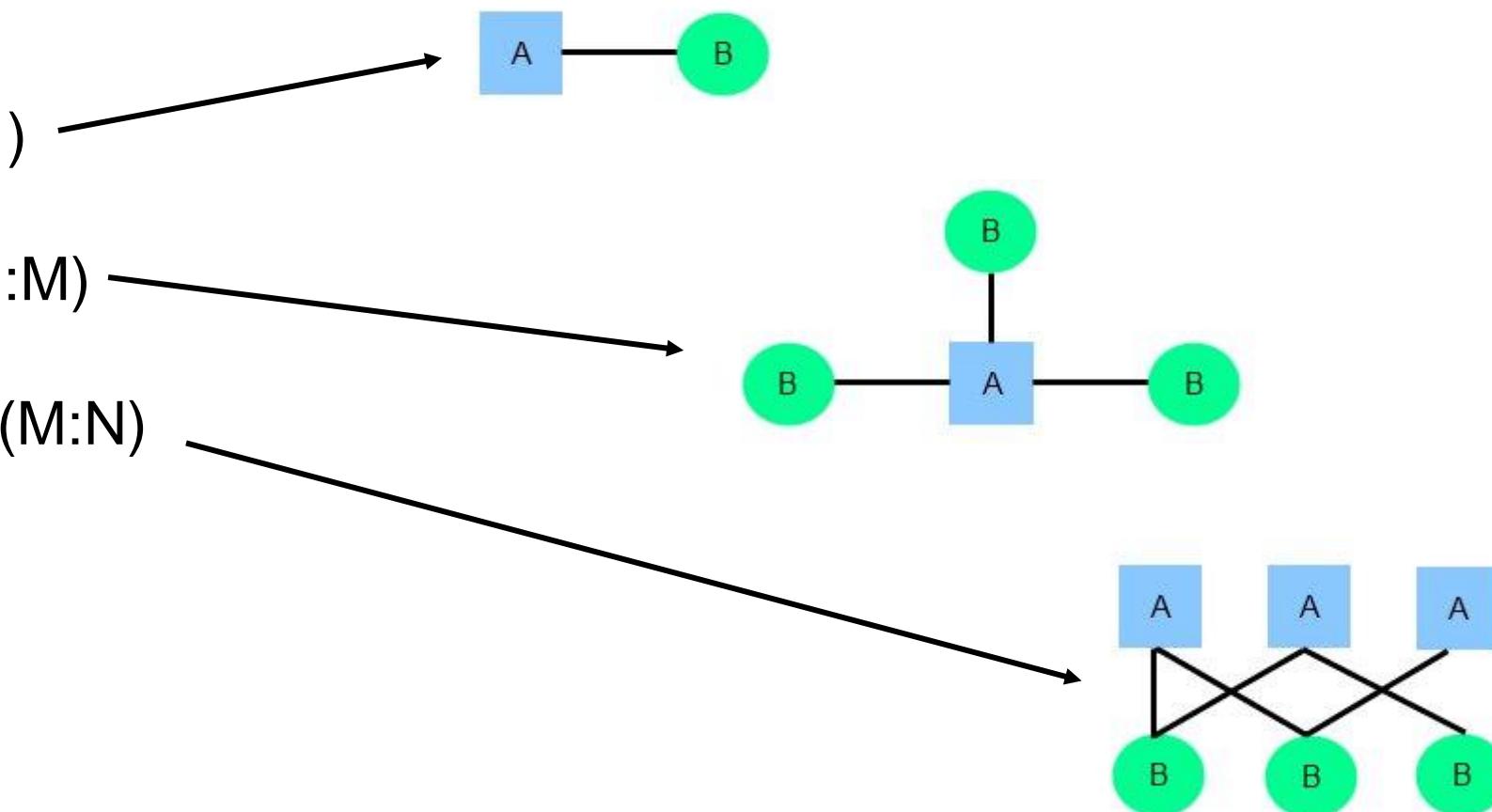
Three types of integrity constraints: **entity integrity**, **referential integrity** and **domain integrity**:

- **Entity integrity:** Entity Integrity Constraint is used to ensure the uniqueness of each record in 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 $t_1[\text{FK}] = t_2[\text{PK}]$ 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..

Common relationships

Common relationship

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

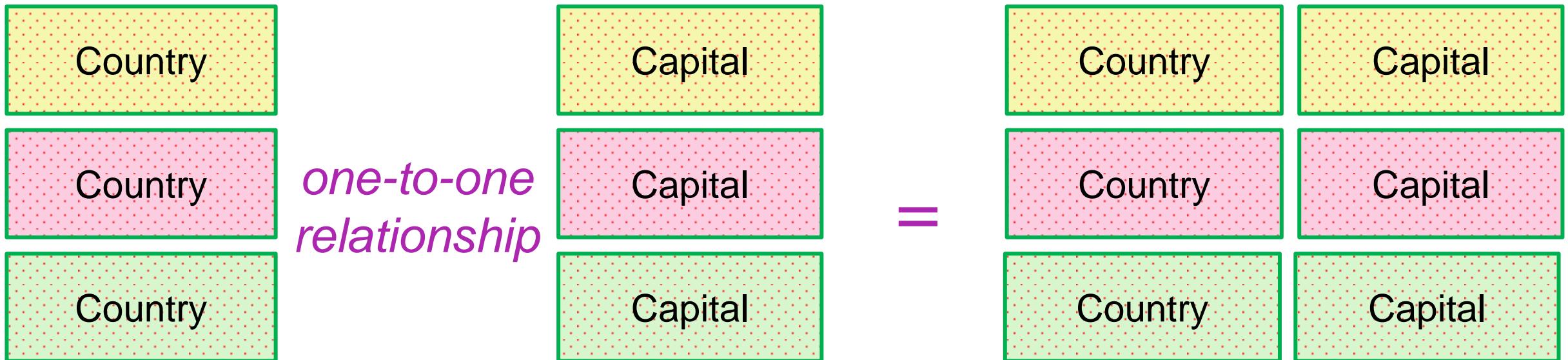


one-to-one relationship

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.



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 rows 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*

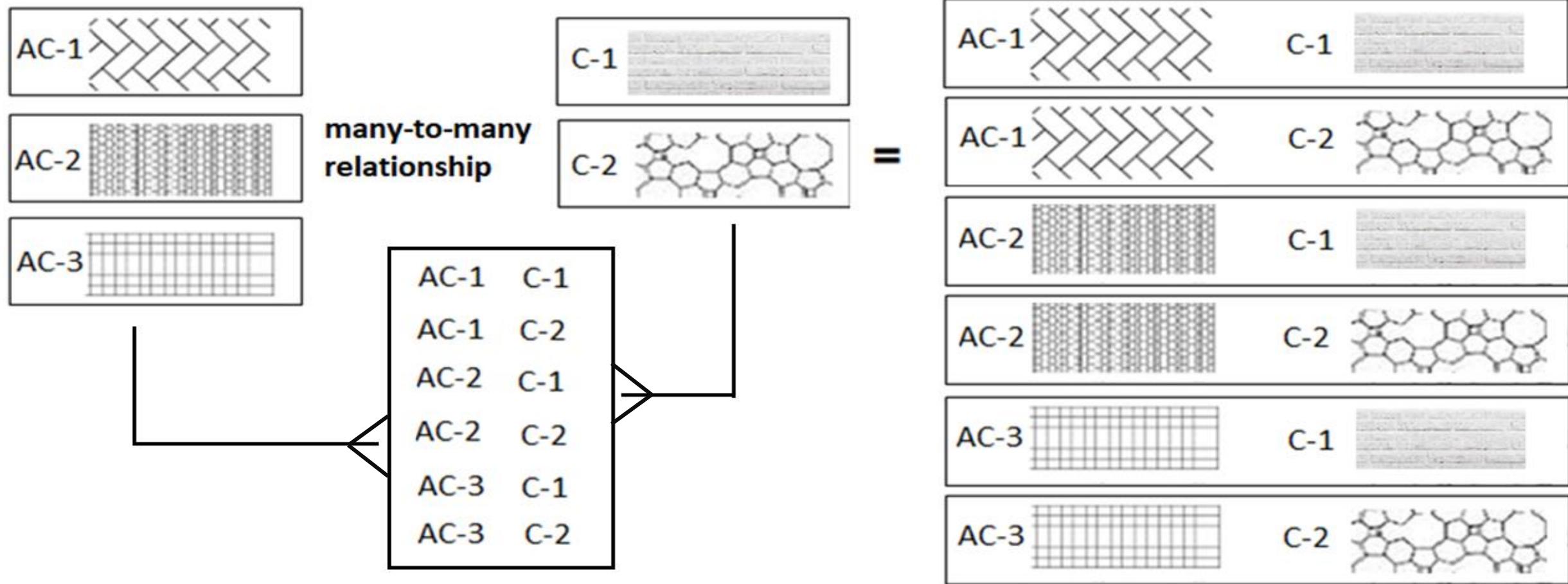
Order-1
Order-1
Order-2
Order-1
Order-2
Order-3
Order-1

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

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.



Schema: A schema is a collection of database objects (like table, columns , primary key, foreign key, views, etc.) associated with one particular database username. This username is called the schema owner. You may have one or multiple schemas in a database.



What is schema and instance

Instance

- The data stored in database at a particular moment of time is called instance of database.

For example, lets say we have a single table student in the database, today the table has 100 records, so today the instance of the database has 100 records. Lets say we are going to add another 100 records in this table by tomorrow so the instance of database tomorrow will have 200 records in table.

An instance of a relation is a set of tuples, also called records

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:

what is sql?

- EXPLICIT or IMPLICIT commit will commit the data.

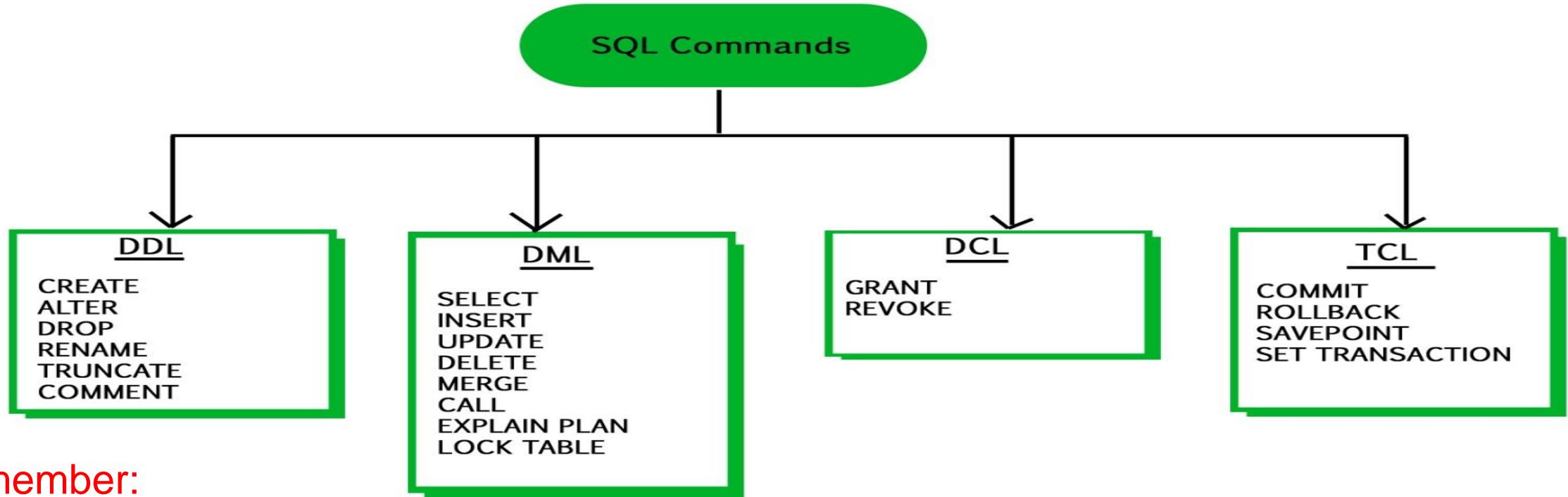
SQL (Structured Query Language) is a database language designed and developed for managing data in relational database management systems (RDBMS). SQL is common language for all Relational Databases.



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.

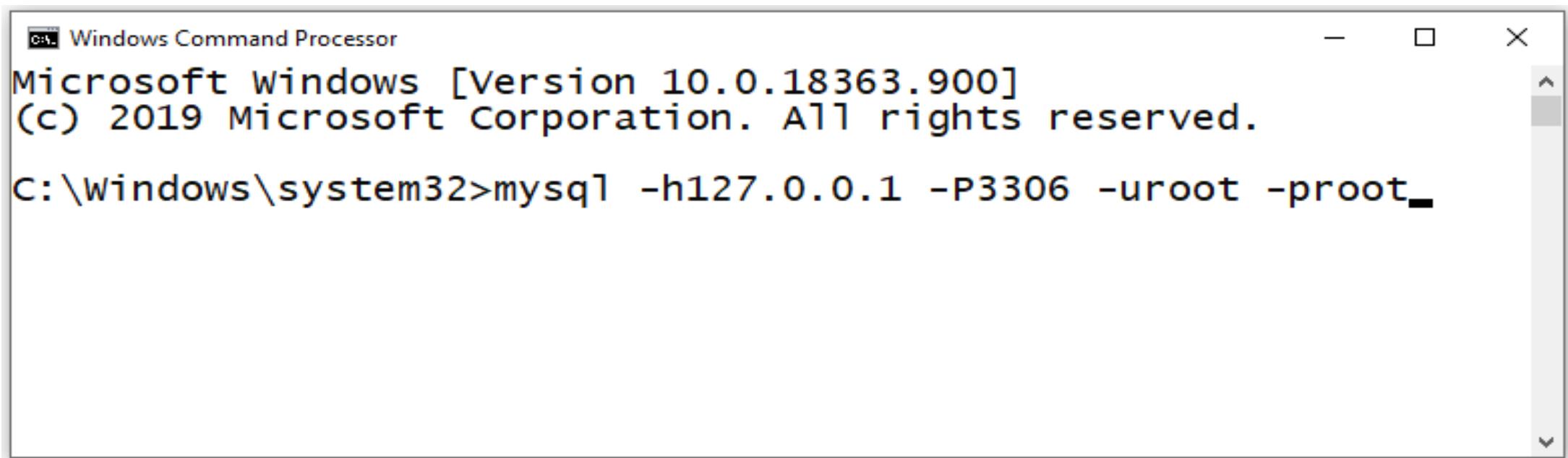
Reconnect to the server	<code>\r</code>
Execute a system shell command	<code>!\</code>
Exit mysql	<code>\q</code>
Change your mysql prompt.	<code>prompt str or \R str</code>

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]



A screenshot of a Windows Command Processor window. The title bar reads "Windows Command Processor". The window displays the following text:

```
Microsoft Windows [Version 10.0.18363.900]
(c) 2019 Microsoft Corporation. All rights reserved.

C:\Windows\system32>mysql -h127.0.0.1 -P3306 -uroot -proot_-
```

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

datatypes

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

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)		

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

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

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

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';

syntax

```
CREATE [TEMPORARY] TABLE [IF NOT EXISTS] tbl_name  
  (create_definition, . . .)  
  [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

create table

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`

col_name *data_type* **DEFAULT** *value*

default value

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

- BLOB, TEXT, GEOMETRY or JSON column can't have a default value.
e.g. **CREATE TABLE** temp(c1 **TEXT DEFAULT('PUNE')**);

```
INSERT [IGNORE] [INTO] tbl_name [PARTITION (partition_name [, partition_name] ...)] [  
(col_name, . . .) ] { VALUES | VALU E } ( { expr | DEFAULT }, . . . ), ( . . . ), . . .
```

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**

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
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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

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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)

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

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

single-table update

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

```
DELETE FROM tbl_name  
[WHERE where_condition]
```

single-table delete

DELETE is used to delete tuples from a relation.

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*

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**.
- If a table has a PRIMARY KEY or UNIQUE NOT NULL index that consists of a single column that has an integer type, you can use **_rowid** to refer to the indexed column in SELECT statements.

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.
- **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.**

col_name data_type **PRIMARY KEY**

PRIMARY KEY constraint

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.

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.

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

Add / Drop Primary Key

```
ALTER TABLE table_name  
  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.

col_name data_type **UNIQUE 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.

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

Add / Drop Unique Key

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

```
[CONSTRAINT symbol] FOREIGN KEY (col_name, ...) REFERENCES tbl_name  
(col_name,...)  
[ON DELETE reference_option]  
[ON UPDATE reference_option]
```

reference_option: CASCADE | SET NULL

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.

```
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 / Drop Foreign Key

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

col_name *data_type* CHECK (expr)

Check Constraint

constraints – check

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

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

Add / Drop Check Constraint

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

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*, . . .)
- | **MODIFY [COLUMN]** *col_name column_definition* [**FIRST** | **AFTER** *col_name*]
- | **DROP [COLUMN]** *col_name*
- | **RENAME [TO|AS]** *new_tbl_name*
- | **RENAME COLUMN** *old_col_name* **TO** *new_col_name*
- | **ALTER [COLUMN]** *col_name* { **SET DEFAULT** {*literal* | (*expr*)} | **DROP DEFAULT** | **SET { VISIBLE | INVISIBLE }** }

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

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 drop any VIEW for the table.
- If you try to drop a PARENT/MASTER TABLE, it will not get dropped.

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



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 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 rows 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 columns in a table that you want to return by your query.

R

EMPNO	ENAME	JOB	HIREDATE	DEPTNO
1	Saleel	Manager	1995-01-01	10
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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.

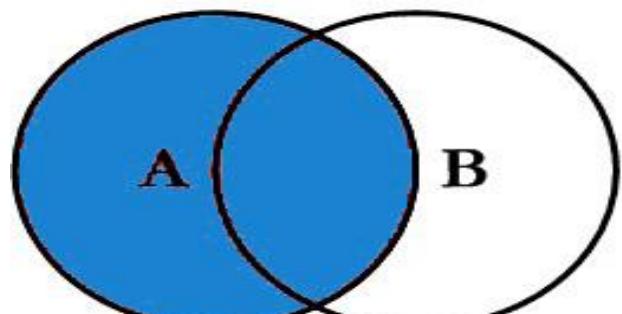
R

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

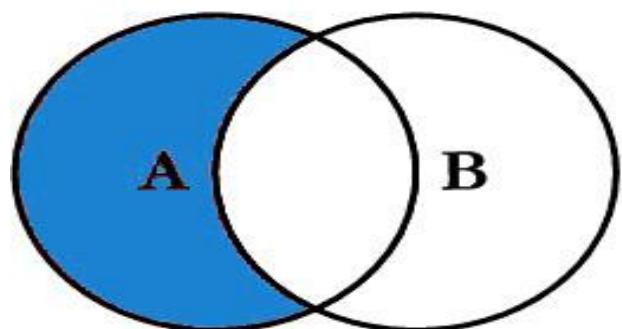
S

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

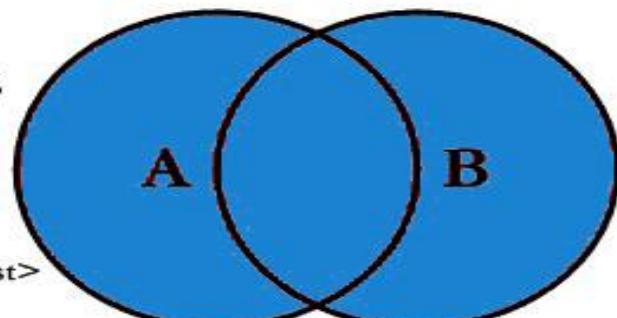
SQL JOINS



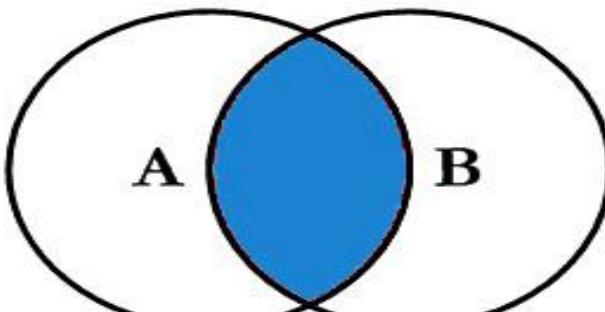
```
SELECT <select_list>  
FROM TableA A  
LEFT JOIN TableB B  
ON A.Key = B.Key
```



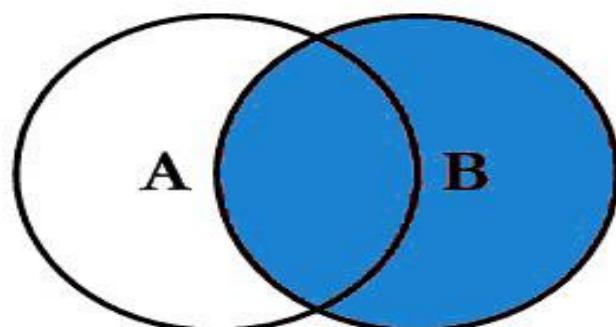
```
SELECT <select_list>  
FROM TableA A  
LEFT JOIN TableB B  
ON A.Key = B.Key  
WHERE B.Key IS NULL
```



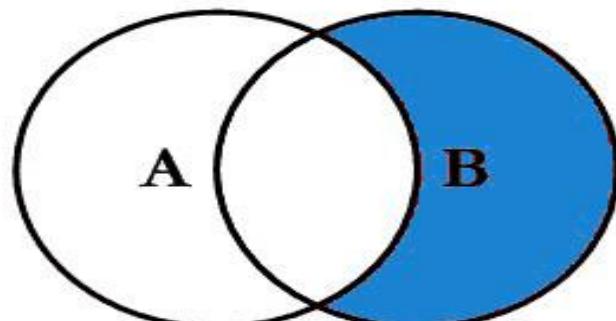
```
SELECT <select_list>  
FROM TableA A  
FULL OUTER JOIN TableB B  
ON A.Key = B.Key
```



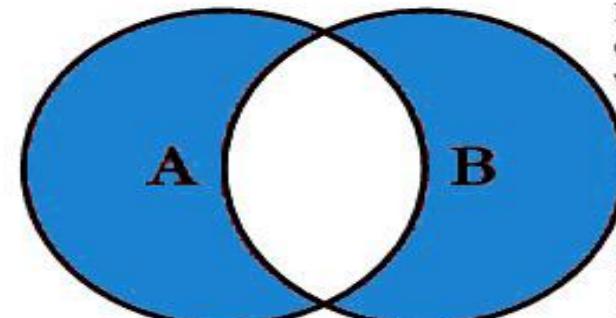
```
SELECT <select_list>  
FROM TableA A  
INNER JOIN TableB B  
ON A.Key = B.Key
```



```
SELECT <select_list>  
FROM TableA A  
RIGHT JOIN TableB B  
ON A.Key = B.Key
```



```
SELECT <select_list>  
FROM TableA A  
RIGHT JOIN TableB B  
ON A.Key = B.Key  
WHERE A.Key IS NULL
```



```
SELECT <select_list>  
FROM TableA A  
FULL OUTER JOIN TableB B  
ON A.Key = B.Key  
WHERE A.Key IS NULL  
OR B.Key IS NULL
```

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>

column-list
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)

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 A1 [ [AS] alias_name], A2 [ [AS] alias_name], ..., AN 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**.

assignment_operator

= (assignment), :=

comparison functions and operator

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

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.

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

Note:

- AND has higher precedence than OR.

column - expressions

select statement - expressions

Column EXPRESSIONS

`SELECT A1, A2, A3, A4, 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 ;`

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`.

control flow functions

control flow functions - ifnull

IFNULL function

MySQL IFNULL() takes two expressions, if the first expression is not NULL, it returns the first expression. Otherwise, it returns the second expression, **it returns either numeric or string value.**

IFNULL(expression1, expression2)

IF function

If **expr1 is TRUE or expr1 <> 0 or expr1 <> NULL**, then **IF()** returns **expr2**, otherwise it returns **expr3**, **it returns either numeric or string value.**

IF(expr1, expr2 , expr3)

control flow functions - case

CASE function

Returns the result for the first condition that is true. If there was no matching result value, the result after ELSE is returned, or NULL if there is no ELSE part.

CASE value **WHEN** [compare_value] **THEN** result [**WHEN** [compare_value] **THEN** result . . .]
[**ELSE** result] **END**

CASE WHEN [condition] **THEN** result [**WHEN** [condition] **THEN** result . . .] [**ELSE** result] **END**

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()**.

+ 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()

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() 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		

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
<code>WEEKDAY(date)</code>	Returns the weekday index for date (0 = Monday, 1 = Tuesday, ... 6 = Sunday).
<code>WEEKOFYEAR(date)</code>	Returns the calendar week of the date as a number in the range from 1 to 53.
<code>QUARTER(date)</code>	Returns the quarter of the year for date, in the range 1 to 4.
<code>HOUR(time)</code>	Returns the hour for time. The range of the return value is 0 to 23 for time-of-day values.
<code>MINUTE(time)</code>	Returns the minute for time, in the range 0 to 59.
<code>SECOND(time)</code>	Returns the second for time, in the range 0 to 59.
<code>DATEDIFF(expr1, expr2)</code>	Returns the number of days between two dates or datetimes.
<code>STR_TO_DATE(str, format)</code>	Convert a string to a date. <code>SELECT STR_TO_DATE('24/05/2022', '%d/%m/%Y');</code>

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)

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

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.
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.
CONCAT(str1, str2, . . .)	Returns the string that results from concatenating the arguments. CONCAT()
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.

string functions

Syntax	Result
<code>STRCMP(expr1, expr2)</code>	<code>STRCMP()</code> 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.
<code>LCASE(str)</code>	Returns lower case string. <code>LCASE()</code> is a synonym for <code>LOWER()</code>.
<code>UCASE(str)</code>	Returns upper case string. <code>UCASE()</code> is a synonym for <code>UPPER()</code>.
<code>LENGTH(str)</code>	Returns the length of the string.
<code>LPAD(str, len, padstr)</code>	Returns the string str, left-padded with the string padstr to a length of len characters.
<code>RPAD(str, len, padstr)</code>	Returns the string str, right-padded with the string padstr to a length of len characters.
<code>REPEAT(str, count)</code>	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.
<code>INSTR(str, substr)</code>	Returns the position of the first occurrence of substring substr in string str.
<code>REPLACE(str, from_str, to_str)</code>	Returns the string str with all occurrences of the string from_str replaced by the string to_str. <code>REPLACE()</code> performs a case-sensitive match when searching for from_str.
<code>REVERSE(str)</code>	Returns the string str with the order of the characters reversed.
<code>SUBSTR(str, pos, len)</code>	SUBSTR() is a synonym for <code>SUBSTRING()</code>.

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.

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

table statement...

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

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

modifiers

SELECT [ALL / DISTINCT / DISTINCTROW] **identifier.* / identifier.A₁ [[as] alias_name], identifier.A₂ [[as] alias_name], identifier.A₃ [[as] alias_name], expression1 [[as] alias_name], expression2 [[as] alias_name] . . .**

- [**FROM** <**identifier.r₁**> [as] alias_name], <**identifier.r₂**> [as] alias_name], . . .]
- [**WHERE** < where_condition1 > { **and** | **or** } < where_condition2 > . . .]
- [**GROUP BY** < { col_name | expr | position }, . . . >]
- [**HAVING** < having_condition1 > { **and** | **or** } < having_condition2 > . . .]
- [**ORDER BY** < { col_name | expr | position } [**ASC** | **DESC**], . . . >]
- [**LIMIT** < { [offset,] row_count | row_count **OFFSET** offset } >]
- [{ **INTO OUTFILE** '*file_name*' | **INTO DUMPFILE** '*file_name*' | **INTO** *var_name* [, *var_name*], . . . }]

select statement

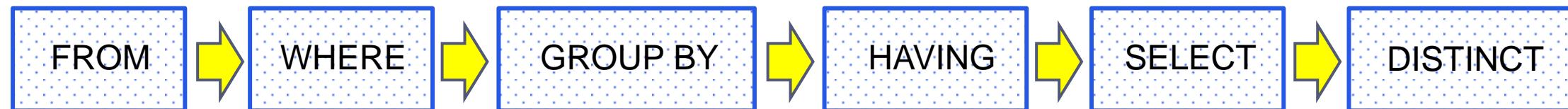
Remember:

- **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.

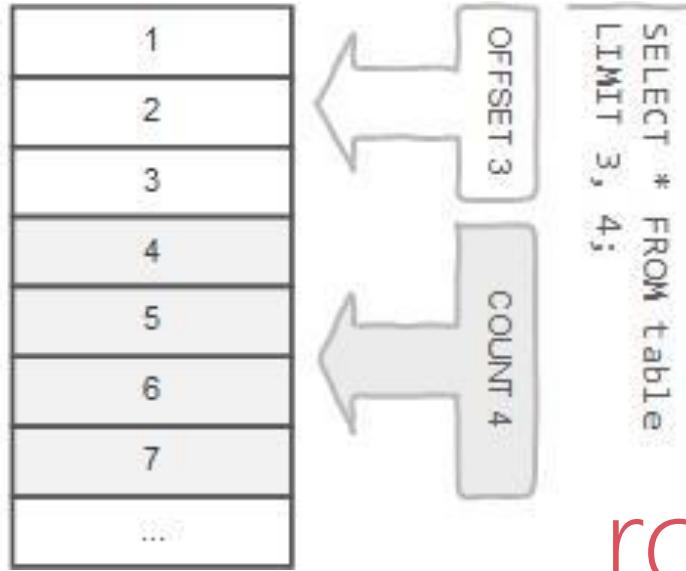
sequence of clauses



select statement... execution



```
SELECT * FROM table;
```



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.
-

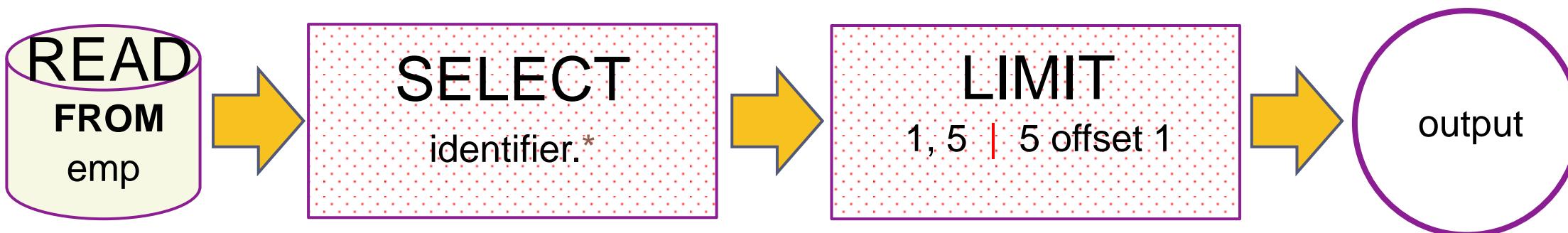
select - limit

`SELECT A1, A2, A3, ... 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;`

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 A_1, A_2, A_3, A_n FROM r

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

"Ordered by attributes $A_1, A_2, A_3 \dots$ "

- 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

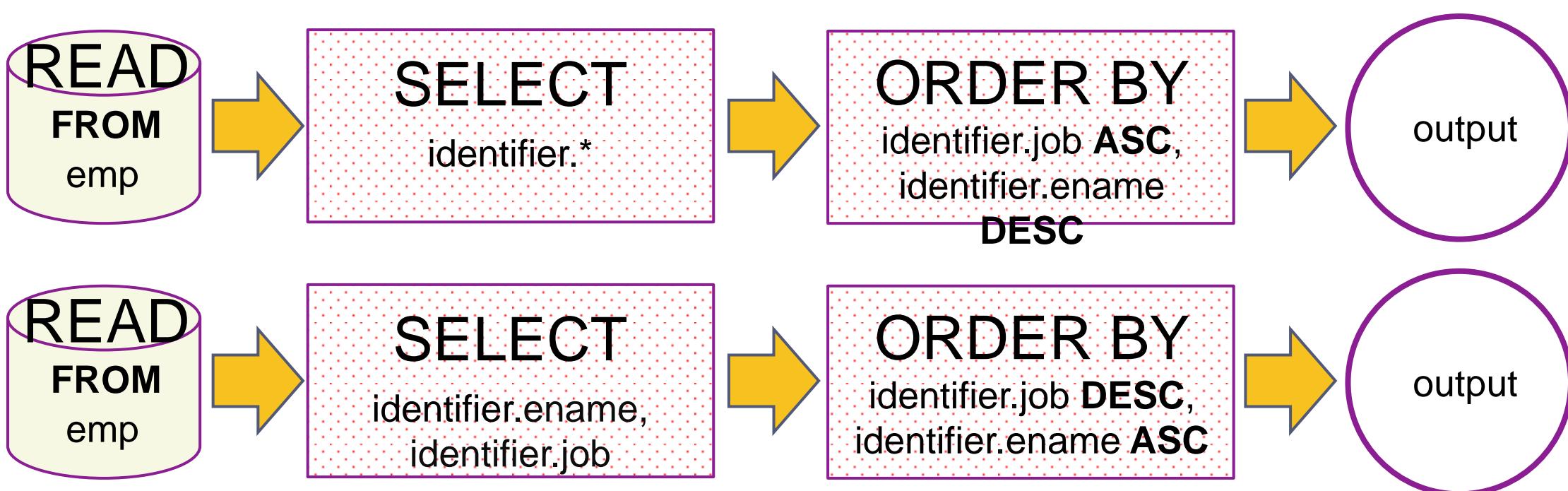
- **SELECT * FROM r ORDER BY key_part1, key_part2;** // optimizer does not use the index.
- **SELECT key_part1, key_part2 FROM r ORDER BY key_part1, key_part2;** // optimizer uses the index.

select - order by

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

SELECT A_1, A_2, A_3, A_n FROM r

[**ORDER BY { A_1, A_2, A_3, \dots | 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;`

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;`

`SELECT A1, A2, A3, An FROM r`

select - order by

`[ORDER BY {A1, A2, A3, . . . | 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 sal FROM emp ORDER BY -sal;`
- `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, \dots FROM r_1, r_2, r_3, \dots [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, \dots, v_n) to denote a tuple of arity (attribute) n containing values v_1, v_2, \dots, v_n .

WHERE $(a_1, a_2) \leq (b_1, b_2)$

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, \dots FROM r_1, r_2, r_3, \dots [WHERE P]

2. comparison_operator:

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

5. logical_operators

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

What will be the result of the query below?

- SELECT 1 = 1; • SELECT * FROM emp WHERE ename = 0;
- SELECT True = 1; • SELECT * FROM emp WHERE ename = 1;
- SELECT True = 2; • SELECT * FROM emp WHERE ename = False;
- SELECT True = True; • SELECT * FROM emp WHERE ename = True;
- SELECT 0 = 0; • SELECT * FROM emp WHERE True AND False;
- SELECT False = False; • SELECT * FROM emp WHERE True OR False;
- SELECT False = 1; • SELECT * FROM emp WHERE True AND 1;
- SELECT 'a' = 1; • SELECT * FROM emp WHERE True OR 0;
- SELECT 'a' = 0;

WHERE state = 'NY' OR 'CA' --Illegal
WHERE salary > 20000 AND < 30000 –
Illegal
WHERE state NOT = 'CA' --Illegal

Note:

AND has higher precedence than OR.

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

select - where

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

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 non-zero 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 A_1, A_2, A_3, \dots FROM r_1, r_2, r_3, \dots [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(value₁, value₂, ...) Returns the first non-NULL value in the list, or NULL if there are no non-

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

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

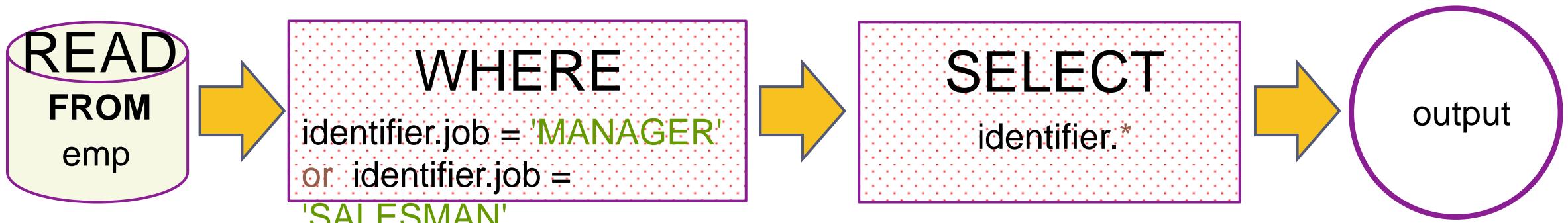
- SELECT * FROM emp WHERE (deptno, pwd) = (SELECT deptno, pwd FROM dept WHERE deptno = 30);

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	a12rempm	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, \dots FROM r_1, r_2, r_3, \dots [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.
- SQL uses a three-valued logic: besides true and false, the result of logical expressions can also be unknown. SQL's three valued logic is a consequence of supporting null to mark absent data.

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;
- 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
	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

	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**. **non-zero** values are considered **true**.

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

The diagram illustrates the evaluation of WHERE clauses for the 'completed' column across three tables. A dashed line separates the first two tables from the third. Red boxes highlight specific rows in each table.

	<code>id</code>	<code>title</code>	<code>completed</code>
1	2	Task2	1
2	4	Task4	1
3	8	Task8	1
4	9	Task9	12
5	10	Task10	58
6	11	Task11	1
7	13	Task13	1
8	NULL	NULL	NULL

	<code>id</code>	<code>title</code>	<code>completed</code>
1	2	Task2	1
2	4	Task4	1
3	8	Task8	1
4	11	Task11	1
5	13	Task13	1
6	NULL	NULL	NULL

	<code>id</code>	<code>title</code>	<code>completed</code>
1	1	Task1	0
2	3	Task3	0
3	7	Task7	0
4	12	Task12	0
5	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;`

The diagram shows a single table where all rows have a completed value of 0. A red box highlights the first row.

	<code>id</code>	<code>title</code>	<code>completed</code>
1	1	Task1	0
2	3	Task3	0
3	7	Task7	0
4	12	Task12	0
5	NULL	NULL	NULL

select – boolean

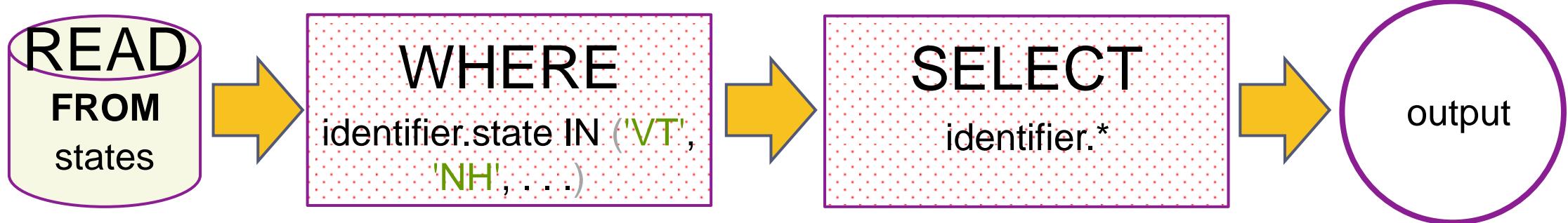
- BOOL and BOOLEAN are synonym of TINYINT(1)

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 r,
WHERE (
  state = 'VT' OR
  state = 'NH' OR
  state = 'ME' OR
  state = 'MA' OR
  state = 'CT' OR
  state = 'RI'
);
  
```



- `SELECT ... FROM r, WHERE state IN ('VT', 'NH', 'ME', 'MA', 'CT', 'RI');`
- `SELECT ... FROM r, WHERE state IN (SELECT ...);`

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

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)"

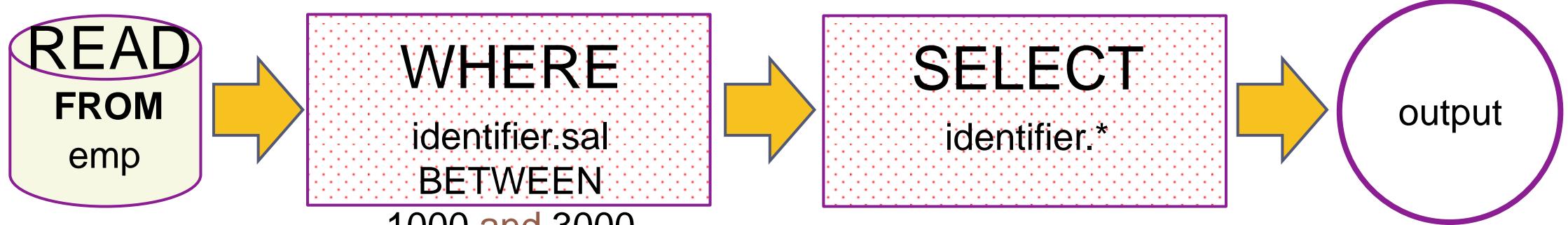
Remember:

in

- 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 (\geq) and less than or equal to (\leq) to substitute the BETWEEN operator.
-

Note:

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

e.g.

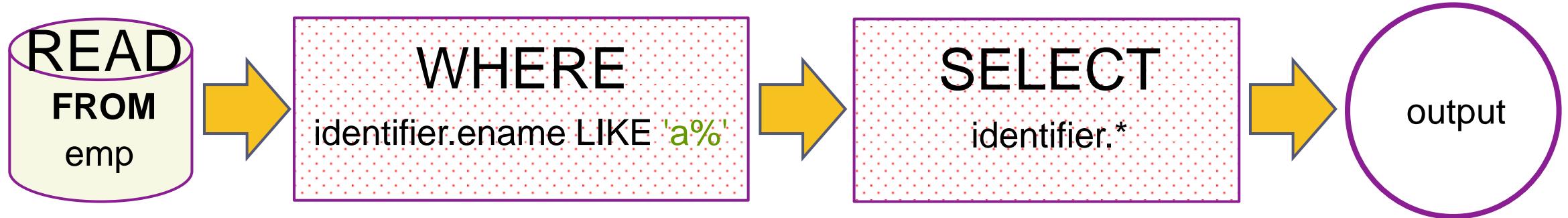
SELECT empno, ename, job, hiredate, sal, comm, deptno, isactive FROM emp WHERE sal BETWEEN 1000 AND NULL;

-
- 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.
-

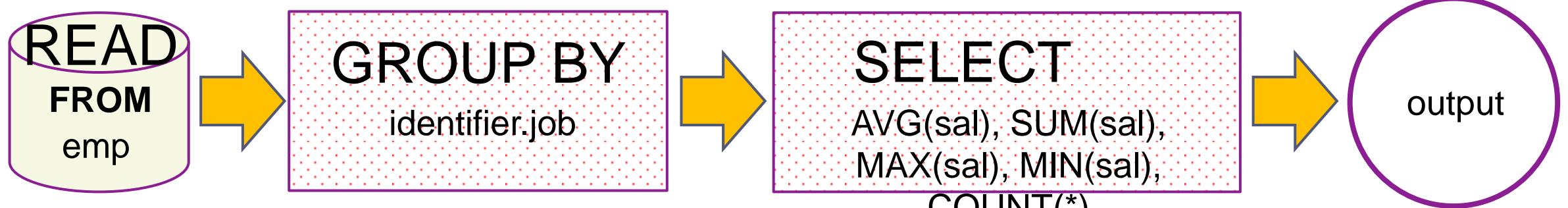
like

- 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`

- `SET SQL_MODE = '';`
- `SET SQL_MODE = IGNORE_SPACE;`

this is invalid

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

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`

aggregate functions

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.

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;`

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;`

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;`

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;`

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;`

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.
- SQL does not allow the use of DISTINCT with COUNT (*)

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.
- **COUNT (DISTINCT *)**: **is illegal**.

Things to... Remember:

aggregate functions

TODO

COUNT([DISTINCT] expr)

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;

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;`

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

group by clause

Remember:

- Standard SQL does not allow you to use an ALIAS in the GROUP BY clause, however, MySQL supports this.
- GROUP BY is used in conjunction with aggregating functions to group the results by the unaggregated columns.

Note:

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

e.g.

```
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.

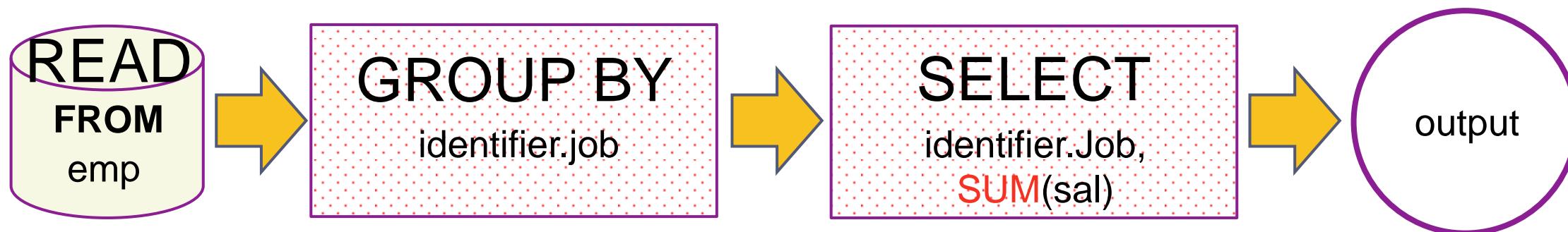
select - group by

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

SELECT $G_1, G_2, \dots, F_1(A_1), F_2(A_2), \dots$ FROM r_1, r_2, \dots

[GROUP BY { G_1, G_2, \dots | 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

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

select - 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';` *

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

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

select - having

SELECT $G_1, G_2, \dots, F_1(A_1), F_2(A_2), \dots$ FROM r_1, r_2, \dots

[GROUP BY { G_1, G_2, \dots | 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, whereas **HAVING** clause can only be used with the **SELECT** statement.
 - **WHERE** clause filters rows before aggregation (GROUPING), whereas, **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 whereas **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 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

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

- `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;
```

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	r50mom
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	r50mom
4	7566	JONES	MANAGER	7839	1981-04-02 00:00:00	2975.00	NULL	20	4	JONES	a12recmom
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	a12recmom

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

joins

joins

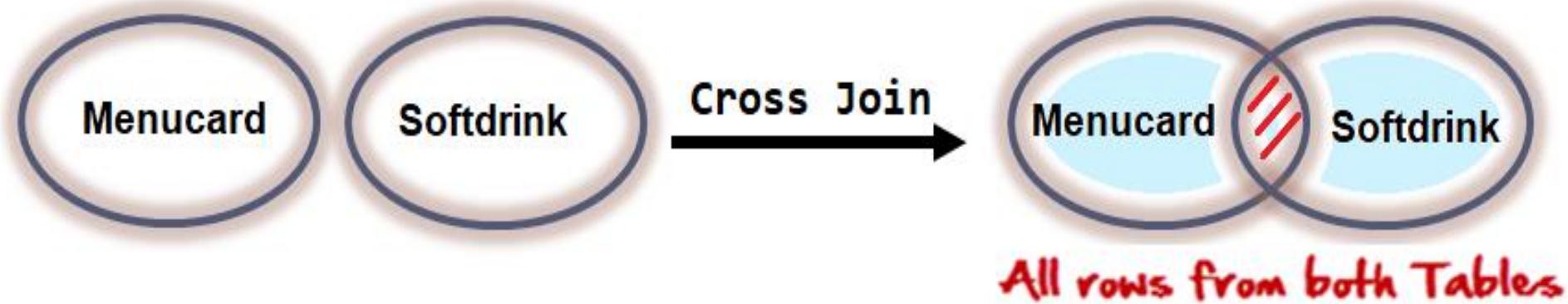
JOINS are used to **retrieve data from multiple tables.**

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

joins

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

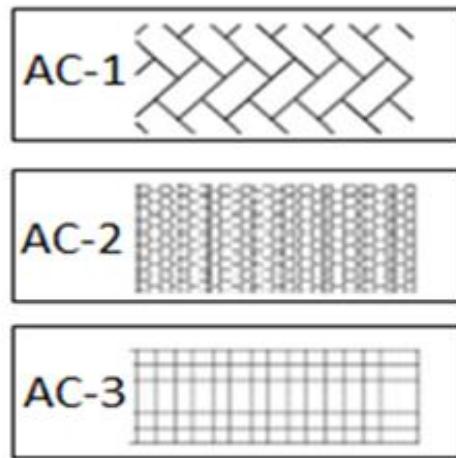
- **Cartesian/Product means** Number of Rows present in Table 1 Multiplied by Number of Rows present in Table 2.
- **Cross Join in MySQL** does not require any common column to **join** two table.

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

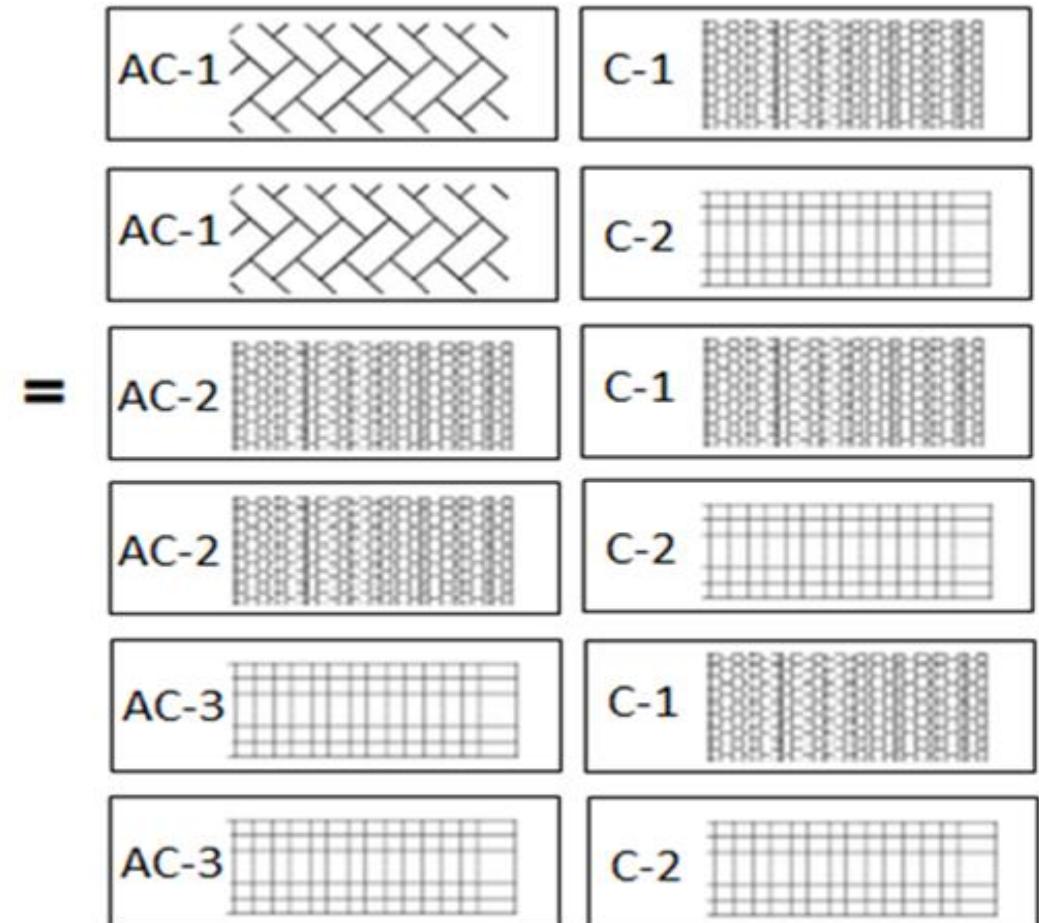
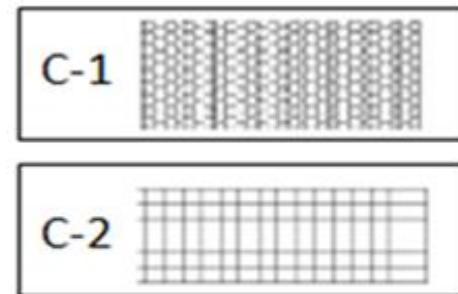
$$\begin{aligned} \text{Degree } d(R \times S) &= d(R) + d(S). \\ \text{Cardinality } |R \times S| &= |R| * |S| \end{aligned}$$

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.



CROSS JOIN



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 A_1, A_2, A_3, \dots FROM r_1, r_2, \dots

$$r_1 = \{1, 2\}$$

$$r_2 = \{a, b, c\}$$

$$r_1 \times r_2$$

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

$$r_1 = \{1, 2, 3\}$$

$$r_2 = \{a, b\}$$

$$r_1 \times r_2$$

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

$$r_1 = \{1, 2\}$$

$$r_2 = \{a, b, \text{null}\}$$

$$r_1 \times r_2$$

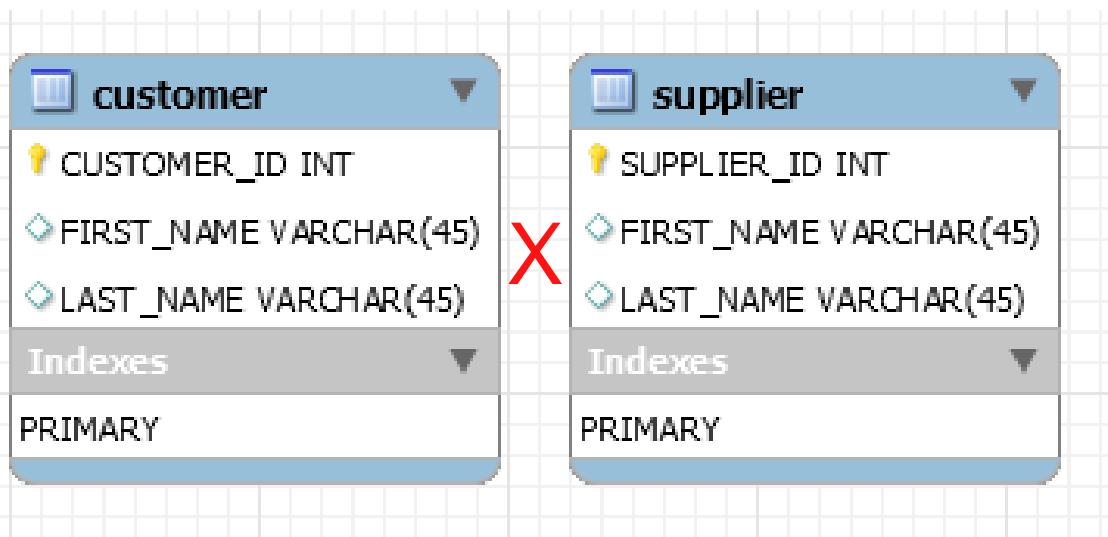
$$R = \{ (1, a), (2, a), (1, b), (2, b), (1, \text{null}), (2, \text{null}) \}$$

- Warehouse/product
- Product/sales_channel
- Cards

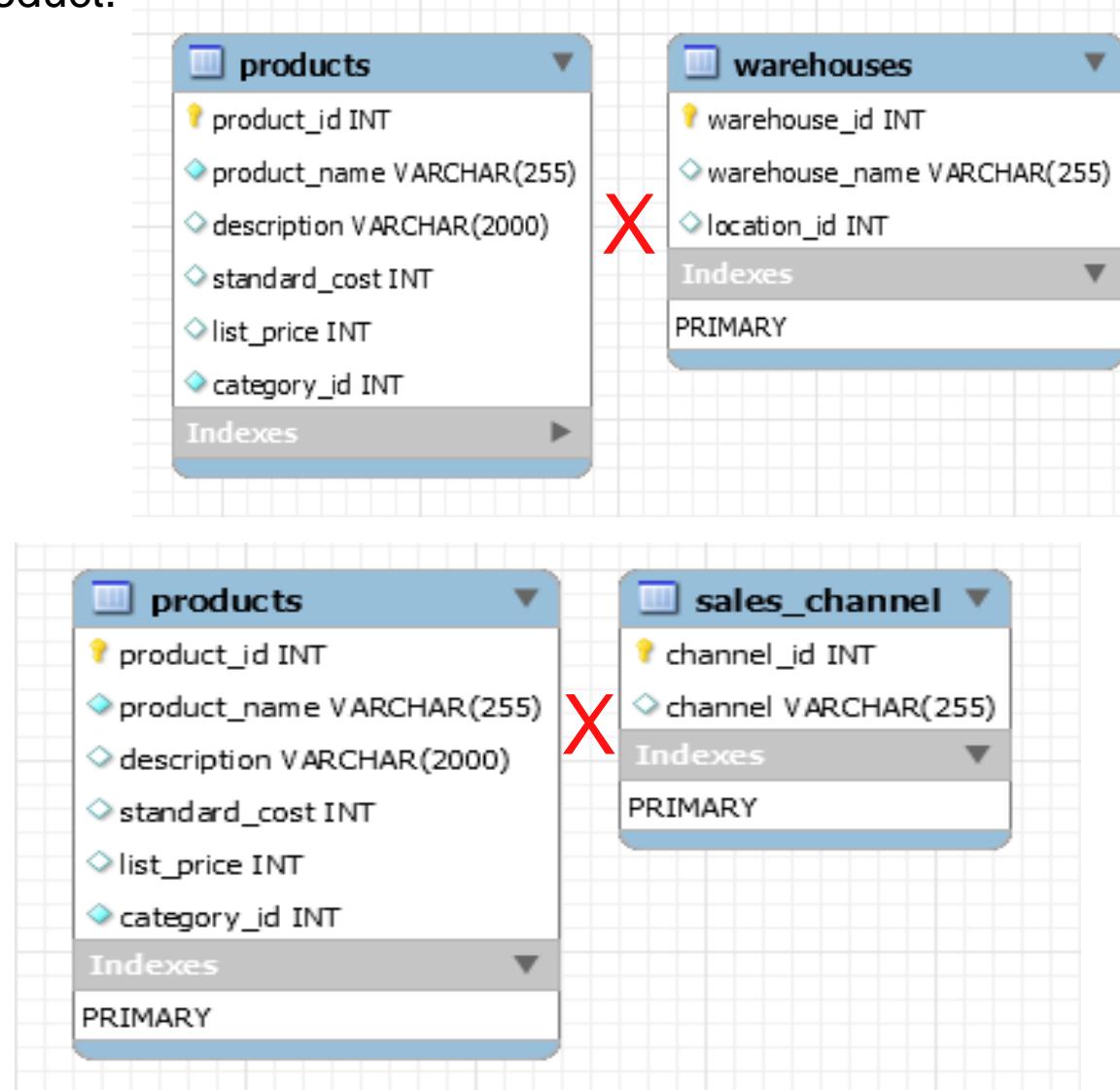
joins - cartesian or product

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 A_1, A_2, A_3, \dots FROM r_1, r_2, \dots



- Warehouse/product
- Product/sales_channel
- Person/Cards



joins - cartesian or product

SELECT A_1, A_2, A_3, \dots FROM r_1, r_2, \dots

- **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, \dots FROM r_1, r_2, \dots

- **SELECT mnu.name, sftdrink.name, mnu.rate, sftdrink.rate, mnu.rate + sftdrink.rate as "Total" FROM menocard 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, \dots FROM r_1 CROSS JOIN r_2, \dots

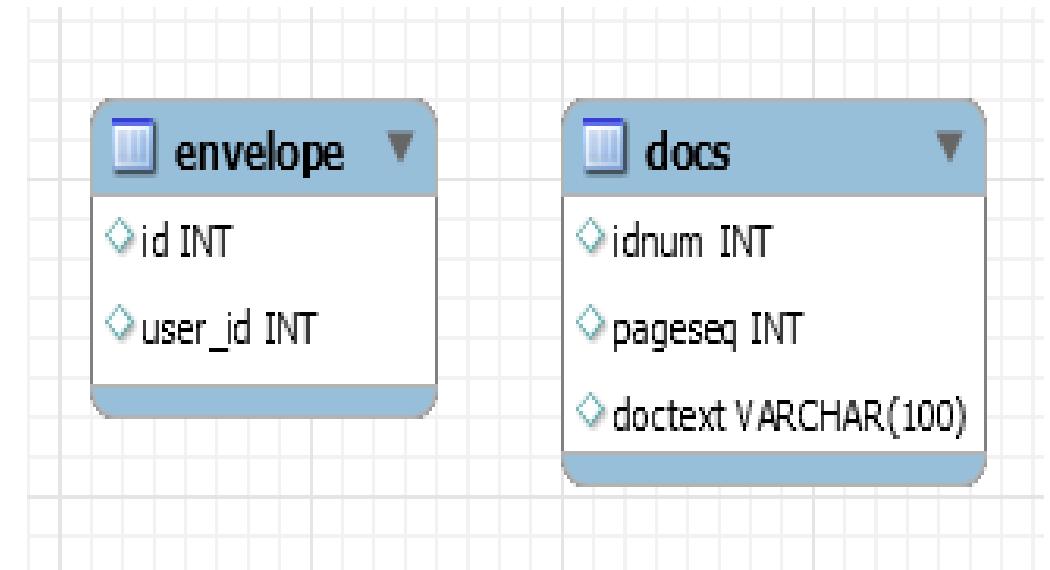
envelope

Table		
	id	user_id
▶	1	1
	2	2
	3	3

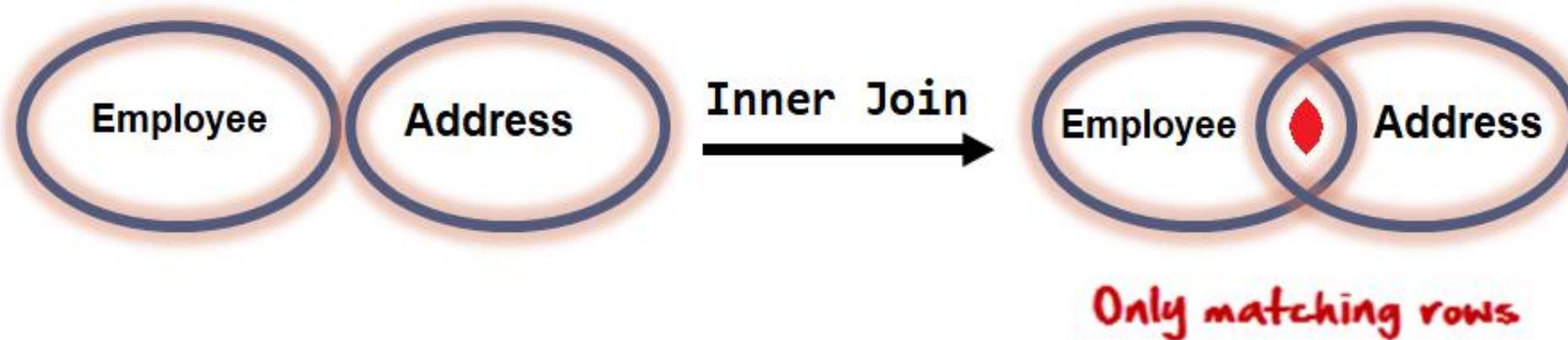
docs

Table			
	idnum	pageseq	doctext
▶	1	5	NULL
	2	6	NULL
	HULL	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	HULL	0	NULL
	2	2	HULL	0	NULL
	3	3	HULL	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.

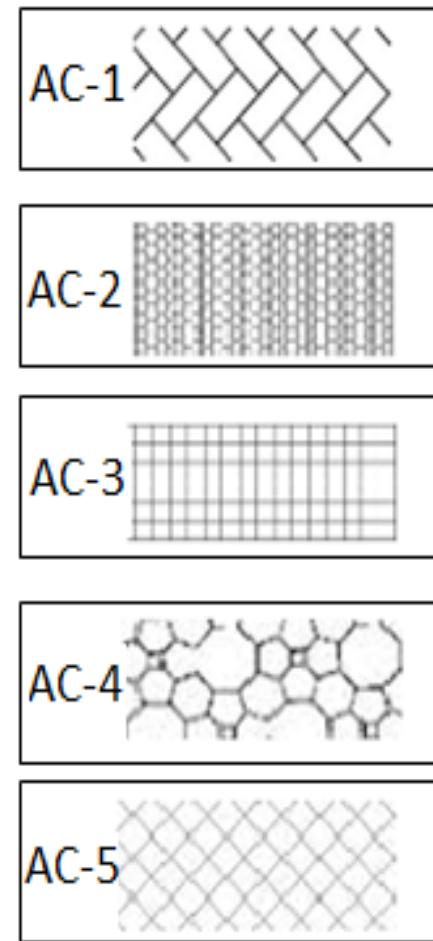
The result of $R(A_1, A_2, \dots, A_n) \bowtie_{\text{join condition}} S(B_1, B_2, \dots, B_m)$ is a relation Q with degree $n + m$ attributes $Q(A_1, A_2, \dots, A_n, B_1, B_2, \dots, B_m)$, **in that order**. Q has one tuple for each combination of tuples—one from R and one from S —whenever the combination satisfies the join condition.

employeeID	Name	deptNo	deptNo	Name
1	Saleel	10 ←	10 →	10 Sales
2	Sharmin	20 ←	20 →	20 Accounting
3	Vrushali	10 ←		30 Manager

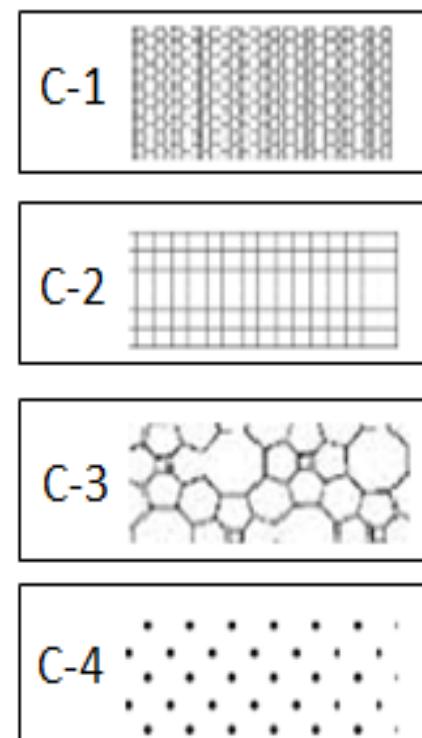
employeeID	Name	deptNo	deptNo	Name
1	Saleel	10	10	Sales
2	Sharmin	20	20	Accounting
3	Vrushali	10	10	Sales

equi join example

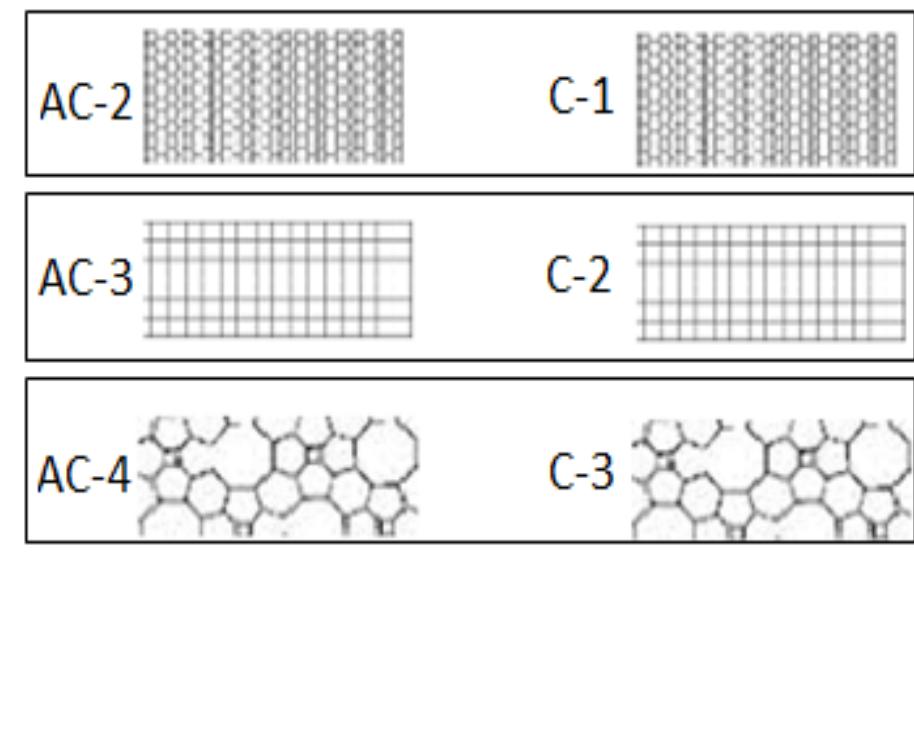
The following table illustrates the inner join of two tables $r_1(\text{AC-1}, \text{AC-2}, \text{AC-3}, \text{AC-4}, \text{AC-5})$ and $r_2(\text{C-1}, \text{C-2}, \text{C-3}, \text{C-4})$. The result includes rows: (2,A), (3,B), and (4,C) as they have the same patterns.



INNER JOIN



=



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 A_1, A_2, A_3, \dots FROM r_1, r_2 WHERE $r_1.A_1 = r_2.A_1$

$r_1 = \{ 1, 2, 3, 4 \}$

$r_2 = \{ (1, a), (2, b), (1, c), (3, d), (2, e), (1, f) \}$

$r_1 = r_2$

$R = \{(1,1,a),$
 $(2,2,b),$
 $(1,1,c),$
 $(3,3,d),$
 $(2,2,e),$
 $(1,1,f)\}$

Remember:

A general join condition is of the form <condition> AND <condition> AND ... AND <condition>, where each <condition> is of the form $A_i \theta B_j$, **A_i is an attribute of R, B_j 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	7	7919	1982-01-23	1300.00	NULL	10	2	MILLER	r50mpm	0	10	ACCOUNTING	NEW YORK	r50mpm

Remember:

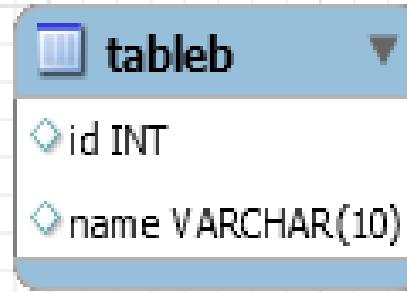
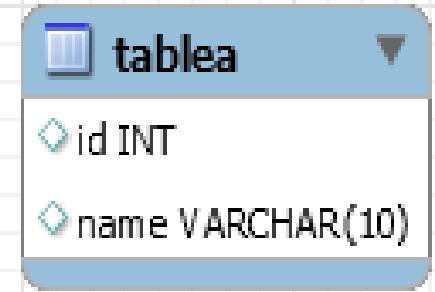
- `SELECT * FROM emp, dept WHERE emp.deptno = dept.deptno AND dname = 'accounting';`
- `SELECT * FROM emp, dept WHERE (emp.deptno, dname) = (dept.deptno, 'accounting');`

tableA Table

	id	name
▶	5	aa
	1	a
	2	b
	3	y
	NONE	d
	5	NONE
	1	NONE
	1	b
	8	a

tableB Table

	id	name
▶	1	a
	2	x
	4	b
	NONE	c
	6	NONE
	NONE	NONE
	7	z
	2	NONE
	5	z
	9	u

joins – equi join

- `SELECT * FROM tableA , tableB WHERE tableA.id = tableB.id;`
- `SELECT * FROM tableA , tableB WHERE tableA.name = tableB.name;`

	id	name	id	name
▶	1	a	1	a
	1	NONE	1	a
	1	b	1	a
	2	b	2	x
	2	b	2	NONE
	5	aa	5	z
	5	NONE	5	z

	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.

```
SELECT * FROM EMP  
INNER JOIN DEPT  
ON EMP.DEPTNO = DEPT.ID
```

JOINING CONDITION



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

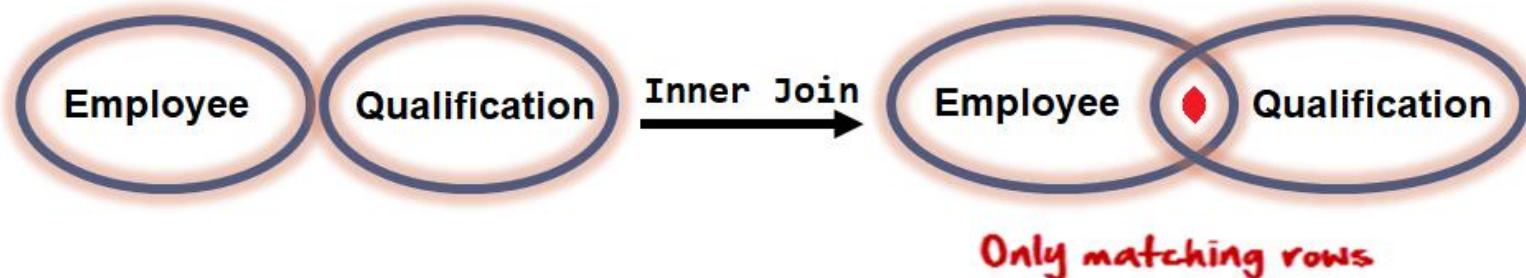
The INNER JOIN selects all rows from both participating tables as long as there is a match between the columns. An SQL INNER JOIN is same as JOIN clause, combining rows from two or more tables.

SELECT A_1, A_2, A_3, \dots FROM r_1 [INNER] JOIN r_2 ON $r_1.A_1 = r_2.A_1$

- **SELECT * FROM employee emp INNER JOIN qualification quali ON emp.id = quali.employeeid;**

ID	FIRSTNAME	LASTNAME	GENDER	HIREDATE	ID	EMPLOYEEID	NAME	Stream	ADMISSIONYEAR	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	11	Mathematics	1961-05-21	Michigan	Johns Hopkins University	1962	77.00	C
5	Helen	Taylor	F	1965-01-10	13	5	11	Mathematics	1961-05-21	Michigan	Johns Hopkins University	1962	77.00	C

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 A_1, A_2, A_3, \dots FROM r_1 [INNER] JOIN r_2 ON $r_1.A_1 = r_2.A_1$

- **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 Pro
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 Hold
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	Canceled
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	Resolved
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	Disputed
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	Shipped
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 Progress
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	Shipped
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 Hold
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 Progress
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	Shipped
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	Canceled
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	Shipped
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 Progress
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 Progress
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	Resolved
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	Shipped
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 Hold
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 Progress
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	Canceled
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	Shipped

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 two tables based on common column names. Hence one must confirm the common columns before using a NATURAL JOIN

joins – natural join

The **NATURAL JOIN** is such a join that performs the same task as an **INNER JOIN**.

SELECT A_1, A_2, A_3, \dots FROM r_1 NATURAL [INNER] JOIN r_2 NATURAL [INNER] JOIN $r_3 \dots$

- **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: <ul style="list-style-type: none">• <code>SELECT * FROM r₁ INNER JOIN r₂ ON r₁.A₁ = r₂.A₁;</code>• <code>SELECT * FROM r₁ INNER JOIN r₂ USING(A₁, [A₂]);</code>	SYNTAX: <ul style="list-style-type: none">• <code>SELECT * FROM r₁ NATURAL JOIN r₂;</code>

simple join

TODO

joins – simple join

The SIMPLE JOIN is such a join that performs the same task as an INNER JOIN.

SELECT A_1, A_2, A_3, \dots FROM r_1 SIMPLE JOIN r_2 USING (A_1, \dots)

- 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 $R \bowtie S$, 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 $R \bowtie S$, 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

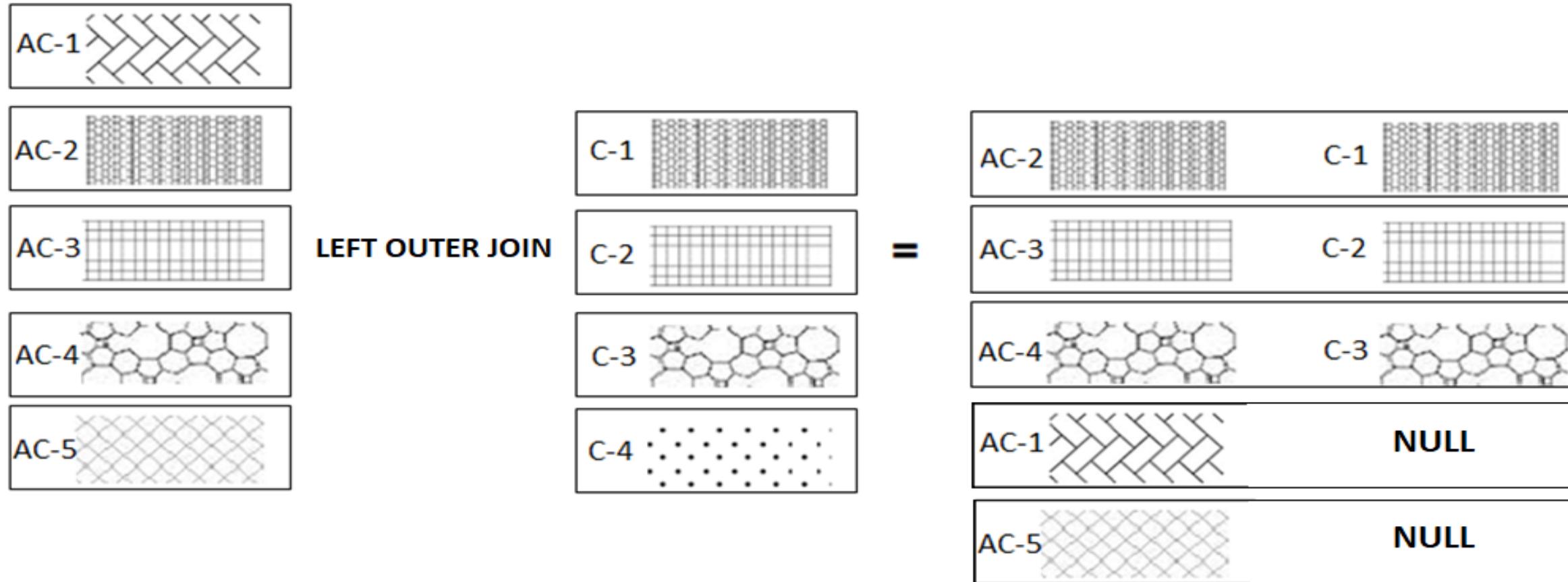
$$R = \{(1, 1, a), (2, 2, b), (1, 1, c), (3, 3, d), (2, 2, e), (1, 1, f), (4, \text{NULL}, \text{NULL})\}$$

`SELECT * FROM r1 LEFT JOIN r2 ON r1.c1 = r2.c1;`

	c1	c1	c2
1	1	1	a
2	2	2	b
1	1		c
3	3	3	d
2		2	e
1	1		f
4		NULL	NULL

joins – left outer join

The following example shows the LEFT JOIN of two tables $r_1(\text{AC-1}, \text{AC-2}, \text{AC-3}, \text{AC-4}, \text{AC-5})$ and $r_2(\text{C-1}, \text{C-2}, \text{C-3}, \text{C-4})$. 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 (r_1), with the matching rows in the right table (r_2).
The result is NULL in the right side when there is no match.

```
SELECT A1, A2, A3, ... FROM r1 LEFT [OUTER] JOIN r2 ON r1.A1 = r2.A1
```

```
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 A_1, A_2, A_3, \dots FROM r_1 LEFT [OUTER] JOIN r_2 ON $r_1.A_1 = r_2.A_1$ WHERE $r_2.A_1$ 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 (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 A_1, A_2, A_3, \dots FROM r_1 LEFT [OUTER] JOIN r_2 USING (A_1, \dots)

- **SELECT * FROM emp LEFT OUTER JOIN dept USING(deptno);**

SELECT A_1, A_2, A_3, \dots FROM r_1 NATURAL LEFT [OUTER] JOIN 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

$$r_1 = \{1, 2, 3, 4\}$$

$$r_2 = \{(1, a), (2, b), (1, c), (3, d), (2, e), (1, f), (5, z)\}$$

r_1 right join r_2

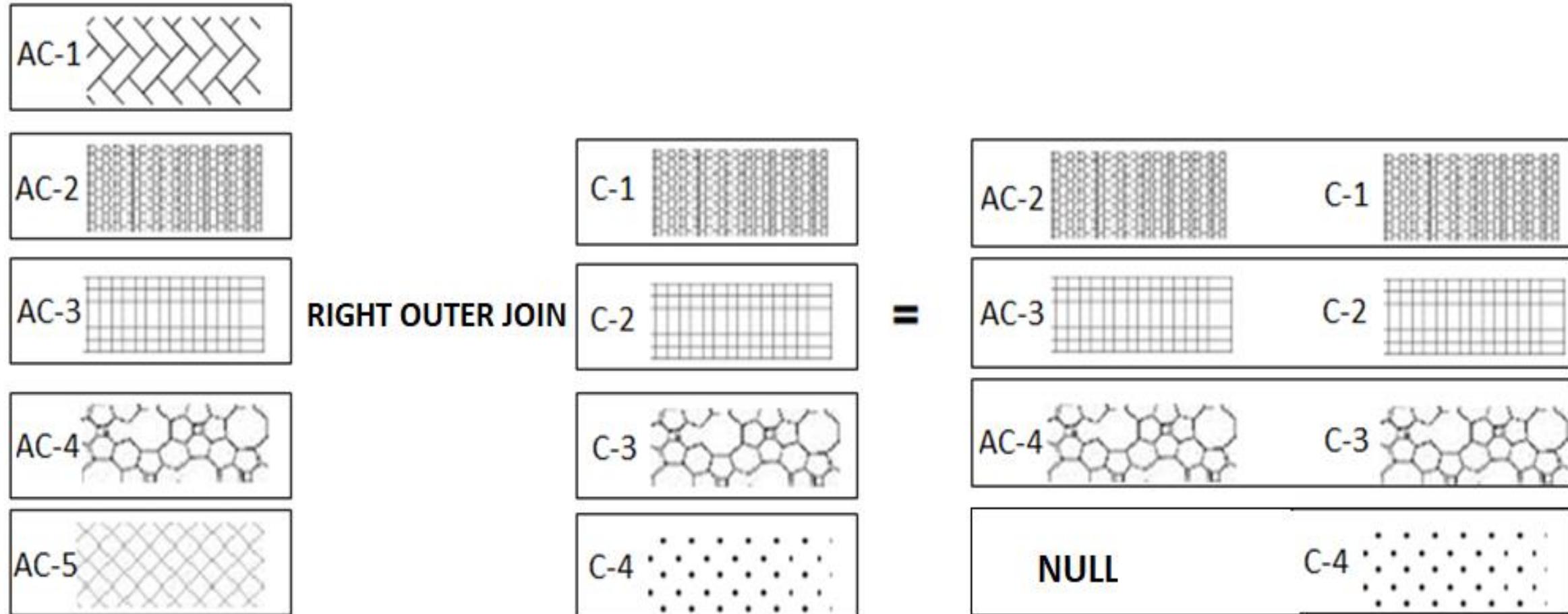
$$R = \{(1, 1, a), (1, 1, c), (1, 1, f), (2, 2, b), (2, 2, e), (3, 3, d), (NULL, 5, z)\}$$

`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 shows the RIGHT OUTER JOIN of two tables $r_1(\text{AC-1}, \text{AC-2}, \text{AC-3}, \text{AC-4}, \text{AC-5})$ and $r_2(\text{C-1}, \text{C-2}, \text{C-3}, \text{C-4})$. 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 A1, A2, A3, ... FROM r1 RIGHT [OUTER] JOIN r2 ON r1. A1 = r2. A1
```

```
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
						15	NULL	2019-04-07	4000
						16	NULL	2019-10-10	1270
						17	NULL	2019-11-11	4588
						18	NULL	2019-07-21	1200
						19	NULL	2019-11-02	125
						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 (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 A1, A2, A3, ... FROM r1 RIGHT [OUTER] JOIN r2 ON r1. A1 = r2. A1 WHERE r1. A1 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 A_1, A_2, A_3, \dots FROM r_1 RIGHT [OUTER] JOIN r_2 USING (A_1, \dots)

SELECT * FROM emp RIGHT OUTER JOIN dept USING(deptno);

SELECT A_1, A_2, A_3, \dots FROM r_1 NATURAL RIGHT [OUTER] JOIN 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. 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.	All the tuples of the right table remain in the result. 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.	All the tuples from left as well as right table remain in the result. 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 $r_x.A_1, r_x.A_2, r_y.A_1, r_y.A_2, \dots$ FROM $r_1 \ r_x, r_1 \ r_y$ WHERE $r_x.A_1 = r_y.A_1$

SELECT distinct e1.* FROM emp e1 , emp e2 WHERE e1.sal = e2.sal AND e1.empno != e2.empno ORDER BY e1.sal;

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.

A subquery is a **SELECT** statement within another statement.

subqueries

Remember:

A subquery may occur in:

- a **SELECT** clause
- a **FROM** clause
- a **WHERE** clause
- a **HAVING** clause

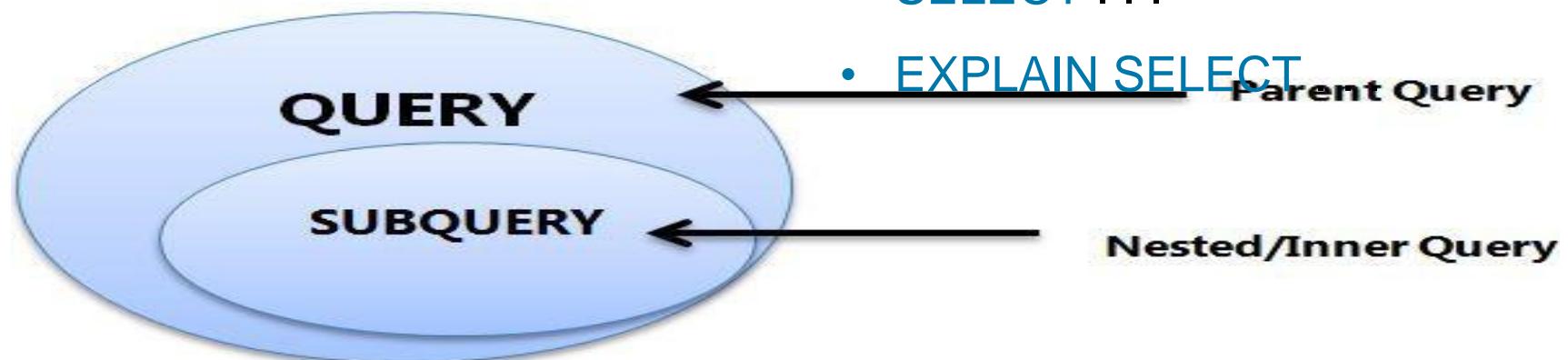
- **INSERT ... SELECT ...**
- **UPDATE ... SELECT ...**
- **DELETE ... SELECT ...**
- **CREATE TABLE ... AS SELECT ...**
- ...
- **CREATE VIEW ... AS SELECT ...**
- ...

Note:

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

- **SELECT**
- **INSERT**
- **UPDATE**
- **DELETE**
- **CREATE**

- **DECLARE CURSOR ... AS SELECT ...**
- **EXPLAIN SELECT**



single row subqueries

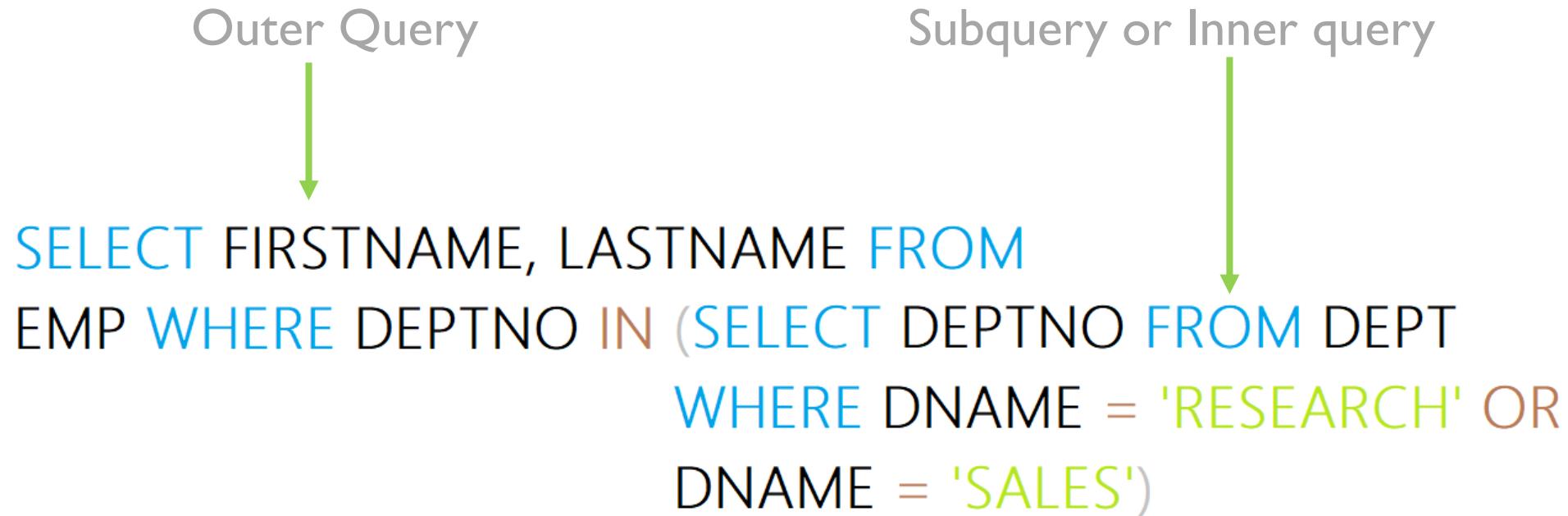
A single row subquery returns **zero or one row** to the outer SQL statement. You can place a subquery in a **WHERE** clause, a **HAVING** clause, or a **FROM** clause of a SELECT statement.

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

Subquery or Inner query
↓

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.



subqueries with insert

TODO

INSERT INTO table_name [(column1 [, column2])] (subquery)

INSERT INTO EMPLOYEE **SELECT * FROM** EMP

INSERT INTO EMPLOYEE (FIRSTNAME, LASTNAME)

SELECT FIRSTNAME, LASTNAME **FROM** EMP

subqueries with update

TODO

`UPDATE table_name SET column_name = (subquery) [WHERE (subquery)]`

subqueries with delete

TODO

`DELETE FROM table_name [WHERE (subquery)]`

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 A1, A2, A3, (subquery) as A4, . . . 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 A1, A2, A3, (subquery) as A4, . . . 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;`
- `SELECT AVG(sum_column1)`
`FROM (SELECT SUM(column1) AS sum_column1`
`FROM t1 GROUP BY`

comparisons using subquery

comparisons using subqueries

TODO

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

SELECT $A_1, A_2, A_3, (\text{subquery}) \text{ as } A_4, \dots \text{ FROM } r \text{ WHERE } p = (\text{subquery})$

Remember:

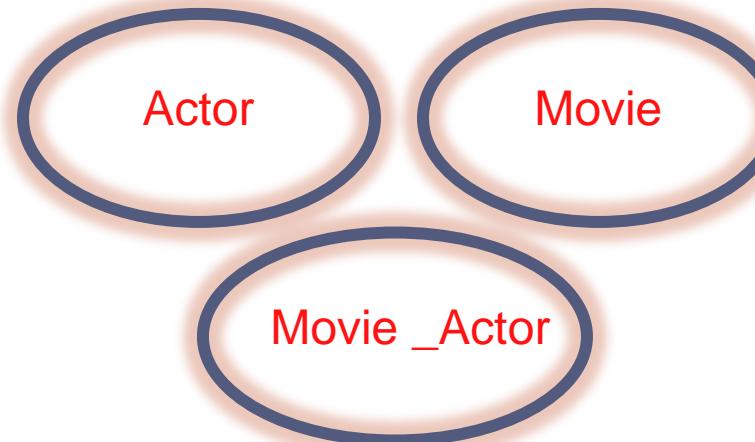
- A subquery can be used before or after any of the comparison operators.
 - The subquery can return **at most one value**.
 - The value can be the result of an arithmetic expression or a function.
-
- `SELECT * FROM emp WHERE deptno = (SELECT 5 + 5);`
 - `SELECT * FROM emp WHERE sal = (SELECT MAX(sal) 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	Akshay 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

- *operand comparison_operator ANY (subquery)* The word SOME is an alias for ANY.
- *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 A1, A2, A3, (subquery) as A4, ... FROM (subquery) [AS] Alias WHERE p IN (subquery)`

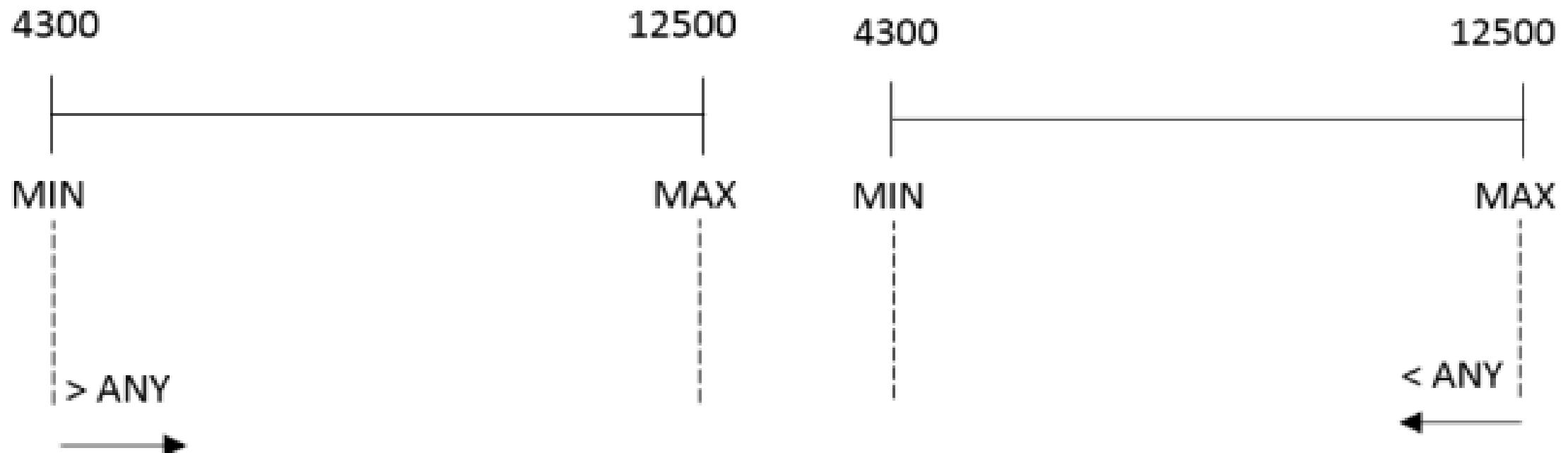
`SELECT A1, A2, A3, (subquery) as A4, ... FROM (subquery) [AS] Alias WHERE p ANY (subquery)`

`SELECT A1, A2, A3, (subquery) as A4, ... 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

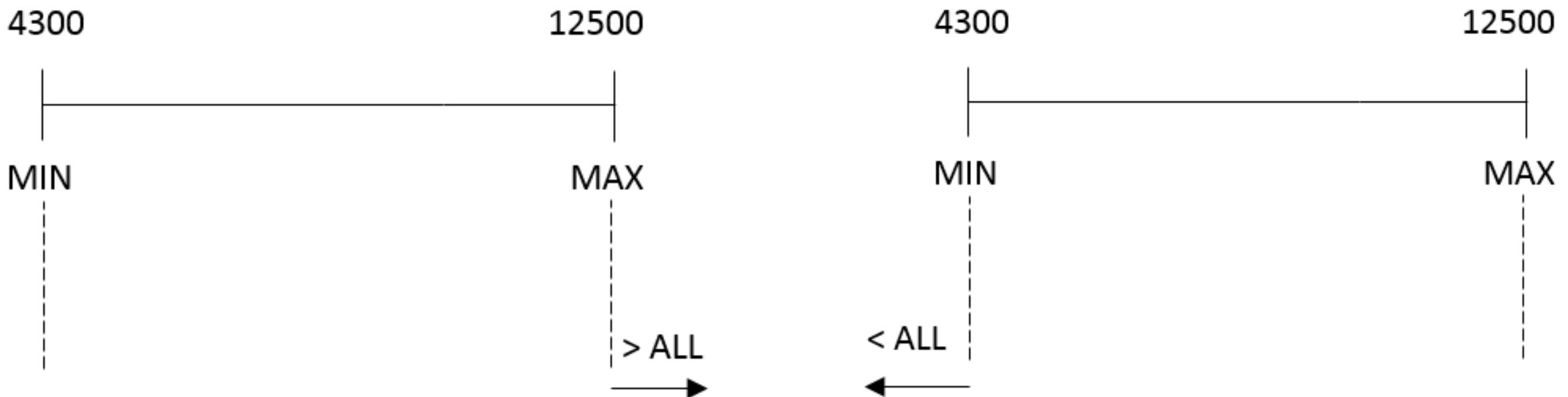
any / some

- "`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

- " $x = \text{ALL}(\dots)$ ": The value must match all the values in the list to evaluate to TRUE.
- " $x \neq \text{ALL}(\dots)$ ": The value must not match any values in the list to evaluate to TRUE.
- " $x > \text{ALL}(\dots)$ ": The value must be greater than the biggest value in the list to evaluate to TRUE.
- " $x < \text{ALL}(\dots)$ ": The value must be smaller than the smallest value in the list to evaluate to TRUE.
- " $x \geq \text{ALL}(\dots)$ ": The value must be greater than or equal to the biggest value in the list to evaluate to TRUE.
- " $x \leq \text{ALL}(\dots)$ ": The value must be smaller than or equal to the smallest value in the list to evaluate to TRUE.



all

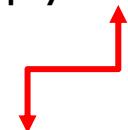
The expression is TRUE, if table T2 is empty.

`SELECT * FROM EMP WHERE DEPTNO >ALL (SELECT C1 FROM T2) //`

This statement will return all rows from EMP table.



empty 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 server WHERE id =ANY (SELECT id FROM runningserver);`
- `SELECT * FROM server WHERE id <ALL (SELECT id FROM runningserver);`
- `SELECT * FROM server WHERE id <ANY (SELECT id FROM runningserver);`

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

row subquery

row subqueries

Scalar or column Subqueries return a single value or a column of values. A row subquery is a subquery variant that returns a single row and can thus return more than one column value. You can use = , >, <, >=, <=, <>, !=, <=>

1. `SELECT * from EMP where deptno, 1 = (SELECT deptno, 1 from DEPT where deptno=10);`
2. `SELECT * FROM emp WHERE ROW (deptno, 1) = (SELECT deptno, 1 FROM dept WHERE deptno = 10);`

- `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 $A_1, A_2, A_3, A_4, \dots$ 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');**

correlated subquery

correlated subqueries

A correlated subquery (**also known as a synchronized subquery**) is a subquery that uses values from the outer query. The subquery is evaluated once for each row processed by the outer query.

Following query find all employees who earn more than the average salary in their department.

- `SELECT * FROM emp e WHERE sal > (SELECT AVG(sal) FROM emp WHERE e.deptno = emp.deptno) ORDER BY deptno;`
- `SELECT ename, sal, job FROM emp WHERE sal > (SELECT AVG(sal) FROM emp E WHERE e.job = emp.job);`
- `SELECT job, MAX(sal) FROM emp WHERE sal < (SELECT MAX(sal) FROM emp E WHERE emp.job = e.job GROUP BY e.job) GROUP BY job;`
- `SELECT DISTINCTROW deptno FROM emp WHERE EXISTS (SELECT deptno FROM dept WHERE emp.deptno = dept.deptno);` (**Intersect**)
- `SELECT DISTINCTROW deptno FROM DEPT WHERE NOT EXISTS (SELECT deptno FROM emp WHERE emp.deptno = dept.deptno);`

Write query to find all employees who have same salary.

- `SELECT e1.* FROM emp e1 WHERE sal IN (SELECT e2.sal FROM emp e2 WHERE e1.sal = e2.sal AND e1.empno <> e2.empno);`

```
SELECT C1 FROM T1 UNION SELECT C1 FROM T2  
ORDER BY C1
```

(UNION ALL, EXCEPT ALL, INTERSECT ALL)

```
(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
```

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 */*
`EXCEPT`
`SELECT name FROM contacts;`
- `SELECT name FROM students` */* Fetch names from students */*
`INTERSECT`
`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;

- It is used to combine two or more result sets (SELECT statements) into a single set
- 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

*Duplicate rows
not repeated
in result set*

- `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;`

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

Note:

- It is used to combine two or more result sets into a single set, including duplicates.
- `SELECT * FROM books UNION ALL SELECT * FROM newbooks;`
- `SELECT * FROM emp UNION ALL SELECT * FROM emp;`
- `SELECT bookname, COUNT(*) FROM (SELECT bookname FROM books UNION ALL SELECT bookname FROM newbooks) b GROUP BY bookname;`

Duplicate rows
are repeated
in result set

It is used to combine two result sets and returns the data which are common in both the 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 data sets. 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);`

It is used to combine two result sets and returns the data from the first result set which is not present in the second result set.

except / except all

books

newbooks

Output

	bookID	bookName	Type	Cost
▶	1	DS	Hardcover	950
	1	DS	Hardcover	950
	2	JavaScript	Paperback	700
	2	JavaScript	Paperback	700

	bookID	bookName	Type	Cost
▶	1	Redis	Paperback	850
	1	Redis	Paperback	850
	2	JavaScript	Paperback	700
	2	JavaScript	Paperback	700

	bookID	bookName	Type	Cost
▶	1	DS	Hardcover	950

Output

An EXCEPT returns rows from first dataset, which are not available in the second dataset.

	bookID	bookName	Type	Cost
▶	1	DS	Hardcover	950
	1	DS	Hardcover	950

- `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;`

create table ... like statement

create table ... like

Use CREATE TABLE ... LIKE to create an empty table based on the definition of another table, including any column attributes and indexes defined in the original table.

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

- LIKE works only for base tables, not for VIEWS.
- You cannot execute CREATE TABLE or CREATE TABLE ... LIKE while a LOCK TABLES statement is in effect.
- `CREATE TABLE e LIKE emp;`

MEMORY tables are visible to another client, but
TEMPORARY tables are not visible to another client.

*create temporary table ... like
statement*

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;`

- LIKE works only for base tables, not for VIEWS.
- You cannot execute CREATE TABLE or CREATE TABLE ... LIKE while a LOCK TABLES statement is in effect.

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.

`CREATE TEMPORARY TABLE e like emp;`

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 table ... select statement

create table ... select

You can create one table from another by adding a SELECT statement at the end of the CREATE TABLE statement.

```
CREATE TABLE new_tbl [AS] SELECT * FROM orig_tbl;
```

You cannot use FOR UPDATE as part of the SELECT in a statement such as CREATE TABLE new_table
SELECT ... FROM old_table FOR UPDATE.

If you attempt to do so, the statement fails.

- `CREATE TABLE e SELECT * FROM emp;`
- `CREATE TABLE e as SELECT * FROM emp;`
- `CREATE TABLE e (ID INT) SELECT * FROM emp;`
- `CREATE TABLE e as SELECT 1+1, ename FROM emp;`
- `CREATE TABLE e as SELECT 1+1 "R1", ename FROM emp;`
- `CREATE TABLE e as SELECT * FROM emp WHERE 1=2;`

Note:

- By default, this statement does not copy all column attributes such as AUTO_INCREMENT

- `SET autocommit = { 0 | 1 }` 0 - disable; 1 - enable
- show variables like 'auto%';
- `SELECT @@AUTOCOMMIT;`

Turning the autocommit off globally. Open **my.ini** file and add the following statement.

[mysqld]

`autocommit = 0`

After adding the line re-start the MySQL server.

commit and rollback

Remember:

- When you **UPDATE** or **DELETE** a row, that row is automatically locked for other users.
- ROW LOCKING IS AUTOMATIC IN MYSQL AND ORACLE.
- When you **UPDATE** or **DELETE** a row, that row becomes READ ONLY for other users.
- Other users can **SELECT** from that table; they will view the old data before your changes.
- Other users can **INSERT** rows into that table.
- Other users can **UPDATE** or **DELETE** "other" rows of that table.
- No other user can **UPDATE** or **DELETE** your locked row, till you have issued a Rollback or Commit.
- To lock the rows manually you require **SELECT** statement with a **FOR UPDATE** clause.
- **LOCKS ARE AUTOMATICALLY RELEASED WHEN YOU ROLLBACK OR COMMIT.**

commit and rollback

To undo MySQL statements you use the ROLLBACK statement. To write the changes into the database within a transaction, you use the COMMIT statement.

START TRANSACTION
[transaction_characteristic]

transaction_characteristic:
| READ WRITE
| READ ONLY

Note:

- It is important to note that MySQL automatically commits the changes to the database by default.
- **START TRANSACTION READ ONLY;**
- **INSERT INTO dept VALUES (60, 'HRD', 'Pune');**
- **COMMIT**

commit and rollback

To undo MySQL statements you use the ROLLBACK statement. To write the changes into the database within a transaction, you use the COMMIT statement.

BEGIN [WORK]
COMMIT [WORK]
SAVEPOINT *identifier*
ROLLBACK [WORK] TO [SAVEPOINT] *identifier*
SET autocommit = {0 | 1}

Note:

- It is important to note that MySQL automatically commits the changes to the database by default.
 - BEGIN WORK
 - INSERT INTO dept VALUES (60, 'HRD', 'Pune');
 - ROLLBACK / COMMIT WORK
-
- SAVEPOINT pt0;
 - INSERT INTO dept VALUES (60, 'HRD', 'Pune');
 - SAVEPOINT pt1;
 - INSERT INTO dept VALUES (61, 'HRD', 'baroda');
 - ROLLBACK TO SAVEPOINT pt1;

select for update

select - for update

Sets a shared mode lock on any rows that are read. Other sessions can read the rows, but cannot modify them until your transaction commits. If any of these rows were changed by another transaction that has not yet committed, your query waits until that transaction ends and then uses the latest values.

- `SELECT * FROM emp FOR UPDATE;`

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 retains Identity and reset to the seed (**start value**) value.
 - Cannot truncate a table referenced in a foreign key constraint.
 - Any AUTO_INCREMENT value is reset to its start value.
-

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 deleting 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.

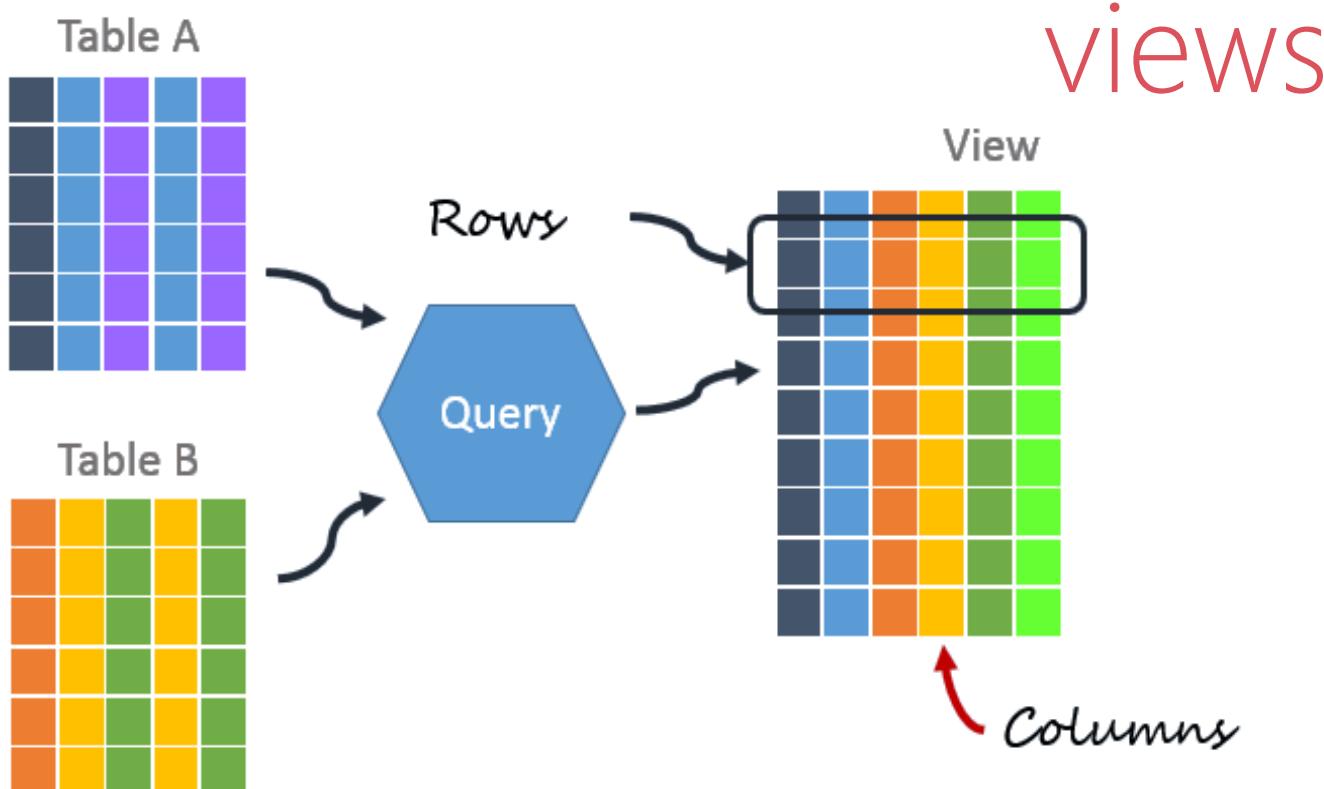
`RENAME TABLE old_tbl_name TO new_tbl_name`

- `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.

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.

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 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);
```

- 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;
- // We may get Error: Can not insert into join view 'db5.v2' without fields list.
- 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'

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;`