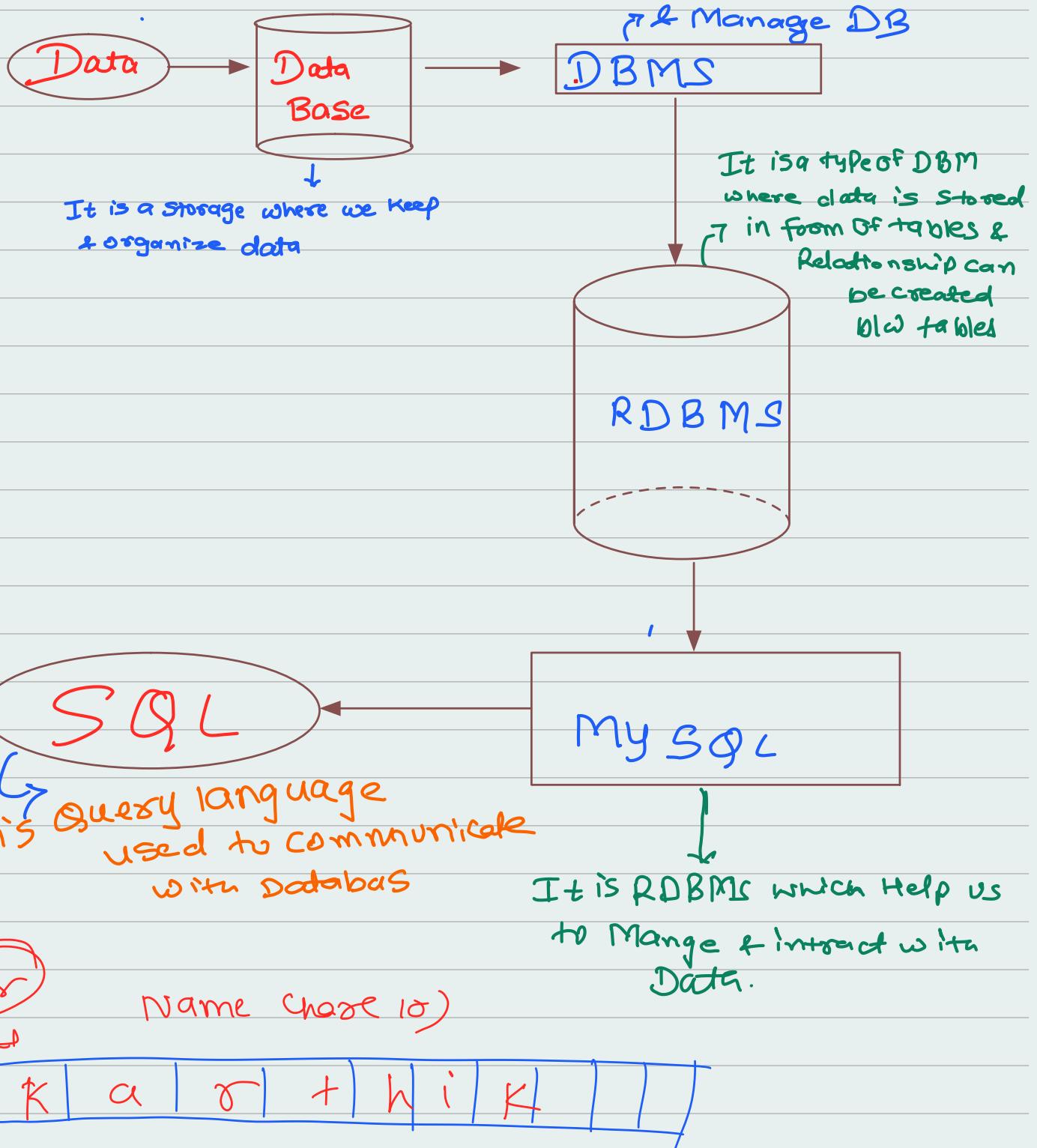


SQL



Char
Name char(10)

K	a	l	o	+	h	i	K		
---	---	---	---	---	---	---	---	--	--

7 Len | 7 Char

1 Data Types

Numerical DT

Data Type	Storage	When to use
INT	4 bytes	Whole Number (age, rolls, quantity)
Small int	2 bytes	Small whole Number (marks)
Big int	8 bytes	Very large whole Number (Address No)
Decimal	Depend on precision as a Decimal	For exactly values (Salary, money)
Number		Exactly Precision
float	4 bytes	Approximate decimal (Scientific Cal)
Double	1 Bit	Larger floating with more precision.

Character/ String DT

Data Type	Storage	When to use
char(n)	Fixed n bytes	for fixed length (Pincode, Gender)
varchar(n)	Variable length	for variable length (Name, city, email)
Text	Up to 65535 char	Large text (Article, Blogs).

Date & Time DT

Data type	Storage	When to use
Date	3 bytes	Store only Date ('2025-09-09')
Time	3 bytes	Store only time ('14:30:00')
Date time	8 bytes	Store both Date & time ('2025-09-09 14:30:00')
Time Stamp	4 bytes	Store date time auto update
Year	1 byte	Store year only ('2025')

SQL

SQL is like a Query language we used to talk to a database. Just like we use English to communicate with each other, we use SQL to communicate with Data.

To do this, SQL gives us different types of Commands. Each with a specific purpose.

Commands

SQL Commands



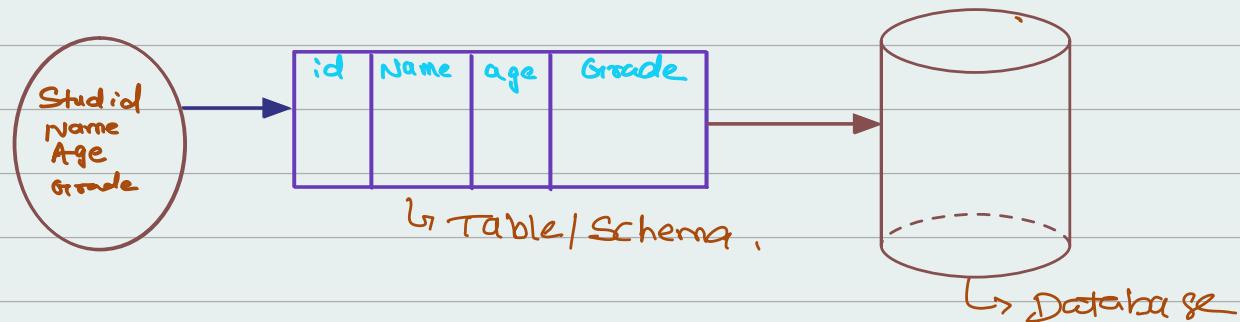
- | | | | | |
|------------|----------|-------------|------------|----------|
| → Create | → Insert | → Grant | → Commit | → Select |
| → Drop | → Update | → Revoke | → Rollback | |
| → Alter | → Delete | → Savepoint | | |
| → Truncate | | | | |

① DDL → Data Definition Language

Used to define and change structure of Database Objects
(Tables, Schema, Indexes).

→ Once we execute, Changes are permanent.

① Create → Create a table & database.



Query:-
Create table tablename (col1, col2, ...
Create table Students (id, name, age, Grade);

② Alter

Used to modify structure of a table.

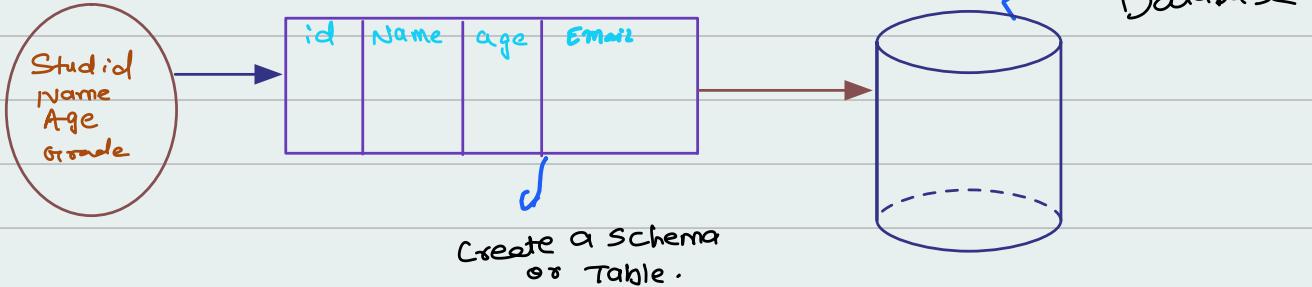
Add, delete, modify a column

It doesn't delete Data.

- Add a New Column
- Modify a Column Size
- Delete a Column.

Let's consider for now we are adding new column Email &

removing Gender



① Add a New Column to table:

Syntax :- Alter table table Add column Datatype ;

→ Alter table Students Add email varchar(100);

Add Multiple Columns

Syntax → Alter Table Students

Add city varchar(50);

Add gender varchar(10);

Add Phone_N

→ Alter table Students Add phone_n

varchar(15)

② Modify the existing column

Syntax :- Alter table tablename Modify columnname Datatype ;

Alter table Students modify age varchar(3);

Alter table Students modify name varchar(100);

③ Change column name

Syntax :- Alter table tablename Change

Alter table Students change id enrollment_id;

④ Drop → Delete a Entire table (Structure + data) permanently.

Syntax :- Alter table tablename Drop column

columnname;

Drop City → Alter table Students Drop column City;

Drop entire table → Drop table Students;

⑤ Truncate:- Delete all Rows from a table but keep the Structure → faster to delete

Syntax! - Truncate table tablename;

→ Truncate table Students;

② DML → Data Manipulation

Language

Commands that manipulate (add, update, delete) data inside a tables

① Insert

→ Insert a Data into table. / Add a new Data

Two types of Insert we have :-

- ① Explicit Insert → safer, flexible
- ② Implicit Insert.

① Explicit Insert

Syntax:- Insert into table_name (col_1, col_2, col_3 ...)

Values (val_1, val_2, val_3 ...);

→ Insert into Students (id, name, age, email, city, Gender);
values (1, "vivek", 24, "vivek@gmail.com", "Hyd", "M");

② Implicit Insert → No need to mention columns

Value must be in exact order

Syntax:- Insert into table_name

values (value1, value2, value3 ...);

Insert into Students

values (2, 'charan', 23, "charan@gmail.com", "Hyd", "M"),
values (3, 'shouki', 24, "shouki@gmail.com", "MH", "F"),
values (4, 'Akash', 23, "Akash@gmail.com", "MH", "F");

② update :- Modify the existing Data

Syntax :- update table name

Set column f = value ;

Where Condition ;

Update Students

Set age = 21

Where id = 1 ;

③ Delete → used to Remove rows from a table .

Syntax → Delete from table name

Where Condition ;

Delete from Students

Where id = 3 ;

Commands	Removes	Keep Structure	Can we use where
Delete	Selected Rows	Yes	Yes
Truncate	All rows	Yes	No
Drop	Table + data	No	No

3' DQL (Data Query Language)

→ used only to Retrive (fetch) Data.

④ DCL (Data Control Language)

Deals with permission & access

① Grant → Give permission

② Revoke → Take Back permission

⑤ TCL (Transaction Control Language)

Deals with Transactions (a set of SQL queries executed as one unit)

① Commit → Save permission

② Rollback → undo changes

Operators

Operators are special symbols / keywords used in SQL queries to perform operations on data.

Types of Operators



Arithmetic Operators

+,-,*,
/, %.

Comparison/Relational Operators

=, !=, <, >
>=, <=

Logical Operators

And or
NOT

Special Operators

IN, LIKE
ISNULL/ISNOTNULL
Between, Exists

Set Operators

Union, Union all
Intersect
Except / Minus

SQL Constraints

What is Constraints?

Constraints in SQL are Rules applied to column in a table.

→ They make sure that the Data stored in database is accurate, reliable & meaningful

Imagine a school Database;

We have two tables :

1. Students → Stores Students details

2. departments → Stores department details.

But Here are the challenges:-

① How do we make sure each Student has unique id?

② How do we stop duplicate email or phone no?

③ How do we ensure a student's percentage never more than 100?

This is where constraints comes in:-

Constraints are like Rules that the database

follows to keep it - accurate, valid and meaningful.

Data for Constraints.

1. department table

dept-id	department name

2. Students table

Stud-id	Name	gender	dob	email	phone no	percentage	dep-id

Types of Constraints

- ① Not NULL
- ② Unique
- ③ Check
- ④ Default
- ⑤ Primary Key
- ⑥ Foreign Key.

① Not NULL: A record cannot have null values.

Prevents blank entries.

Why do we need it?

- Mandatory field (e.g. Student name, DOB)
- Data Completeness.

Eg:- A Student must always have a Name & date of Birth

\

Create table Students (

id int

Name varchar(100) Not NULL,

dob Date Not NULL;

) ;

② Unique:- We cannot have duplicate values.

NULL values are allowed

Why do we need it?

→ Maintain uniqueness in data like email, phone no,

→ Supports authentication.

Eg:- No two students can register with same email.

Create table Students (

id int,

email varchar(100) Unique);

③ Auto Increment

→ Automatically increase numeric value by 1 whenever a new record is inserted.

→ Usually applied on Primary Key.

Why do we need it?

→ Automatic ID Generation

→ Avoid Human Errors

④ Primary Key:-

A primary key uniquely identifies each row in

It automatically Combines two Rules :-

Not NULL + Unique.

Why do we need it?

- ① Unique Identification
- ② Data Integrity
- ③ Relationship
- ④ Performance.

	Not NULL	Unique	Primary Key
NULL	X	✓	X
Duplicate	✓	X	X

Syntax:- id Primary key

Create table Students (

```
    id int PrimaryKey Key Auto-increment,  
    Name varchar(100));
```

⑤ Foreign Key

A foreign key links one table to another

It refers to the primary key of another table.

Why do we need it?

- ① Maintain Data Integrity
- ② Build Relationships
- ③ Prevents Invalid Data

- Foreign Key (id) Reference departments(id)

What is a key?

Create few rules for table.

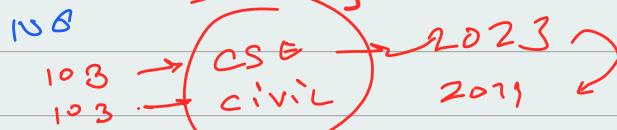
Can we identify a student's admission Just by Student_id?

NO

2 → 2019

2 → 2024

Can we identify admission just by department_id?



Composite

→ we create a id by combining one or more column.

→ duplicate + non-null
unique

student_id

1

department_id

101 → CS

year

2019

Difference b/w Delete, Truncate & Drop

Feature	Delete	Truncate	Drop
Definition	Removal selected rows from table	Remove all rows from table	remove the entire table
Where clause	Allowed	Not allowed	Not applicable
Data Removed	Selected Rows	All Rows	Data + Table Structure
Table structure	Remain	Remain	Removed
Speed	Slow	faster	faster
Auto Increment	No	Yes	Not applicable

Key Type	Definition	Rules / Properties	Example
Primary Key	A column (or set of columns) that uniquely identifies each row in a table.	- Only one primary key per table. - Cannot have NULL values. - Automatically unique .	<code>student_id</code> in Students table
Unique Key	Ensures that the column values are unique , but it's not the main identifier .	- A table can have multiple unique keys. - Can have one NULL (in most DBs).	<code>email</code> in Students table
Foreign Key	A column that links two tables . It refers to the Primary Key in another table.	- Used for relationships . - Can have duplicate values. - Can have NULL (if optional).	<code>department_id</code> in Students → references <code>department_id</code> in Departments
Composite Key	A Primary Key made up of 2 or more columns .	- Combination must be unique. - Useful when no single column is unique.	(<code>student_id</code> , <code>course_id</code>) in Enrollments table

Clauses

Imagine I am a principal of college

→ Show me the names of all the students from CS department who scored above 80, arranged by their percentages

Can we just say this one word like students?

→ No

The Database needs Step by Step instructions.

What's clause?

A Clause is like an instruction or keyword in SQL that tell the database what to do with the Data.

Each clause plays a role in Building the full instructions

Type of clauses

- ① Select
- ② From
- ③ Where
- ④ Group By
- ⑤ Having
- ⑥ Order By
- ⑦ Limit
- ⑧ Offset
- ⑨ Set clause

Order of
Writing SQL
Query.

Department table

PK

department_id	department_name
5	Civil
1	Computer Science
3	Electronics
2	Information Technology
4	Mechanical

Students Table

student_id	full_name	gender	dob	email	phone_number	percentage	total_fees	fees_paid	department_id
1	Deepraj Patil	Male	1998-09-07	deepraj@gmail.com	7689065437	90.78	100000.00	95000.00	1
2	Vivek Patil	Male	2019-09-09	vivek@gmail.com	8756789534	90.67	90000.00	85000.00	2
3	Rahul Sunchu	Male	2018-06-04	rahul@gmail.com	7856789504	98.67	95000.00	95000.00	1
4	Shivraj Patil	Male	2017-05-01	shivraj@gmail.com	9076789534	80.67	88000.00	80000.00	3
5	Shruthi Deshmukh	Female	2017-03-01	shruthi@gmail.com	7864678950	98.67	87000.00	87000.00	2
6	Vaishnavi Kulkarni	Female	2019-06-01	vaishnavi@gmail.com	9090789534	80.67	88000.00	85000.00	4

- ① Can you please provide students names who scored more than 90 percentage
- ② Can you please give me only male candidate data.

① Select → Specific Column to Retrieve/Fetch

Syntax :- Select col1, col2 From tablename;

Select * from tablename;

↳ Retrive all Rows x Columns

↙ Select a table

② From → specifies the table(s) to Retrive the data From.

Syntax :- Select * from tablename;

③ Where :- Filter the Rows Based on Condition.

Syntax :- Select * from tablename

Where Condition ;

Types of Operations



Arithmetics
Operators

+,-,*,
/,%

Comparison/Relational

=, !=, <, >
>=, <=

Logical

Operator
And or
NOT

Special

IN, Like
ISNULL/ISNOTNULL
Between, Exists

Set

Operators
Union, Union All
Intersect
Except / Minus

④ Order By :- Sort results set by one or more columns.

Syntax :- Select * from tablename

Order By Col1 [ASC, DSC];

Where clause conditions

Select * from Students

Gender = "Male"

And percentage >= 85

And department_id != 3

And dob >= '2018-01-01'

And full-name like 'VY.'

And email like '%.gmail.com'

And department_id in (1,2,4)

And department_id not in (5,6)

And percentage Between 90 And 100

And phone number is not NULL ;

Group By → It is powerful function used to group rows from a table based on values of one or more columns. It is often used in conjunction with Aggregate functions.

student_id	full_name	gender	dob	email	phone_number	percentage	total_fees	fees_paid	department_id
1	Deepraj Patil	Male	1998-09-07	deepraj@gmail.com	7689065437	90.78	100000.00	95000.00	1
2	Vivek Patil	Male	2019-09-09	vivek@gmail.com	8756789534	90.67	90000.00	85000.00	2
3	Rahul Sunchu	Male	2018-06-04	rahul@gmail.com	7856789504	98.67	95000.00	95000.00	1
4	Shivraj Patil	Male	2017-05-01	shivraj@gmail.com	9076789534	80.67	88000.00	80000.00	3
5	Shruthi Deshmukh	Female	2017-03-01	shruthi@gmail.com	7864678950	98.67	87000.00	87000.00	2
6	Vaishnavi Kulkarni	Female	2019-06-01	vaishnavi@gmail.com	9090789534	80.67	88000.00	85000.00	4

Execution of GroupBy

Agg

→ sum

→ count

→ Avg

→ max

→ min

① SPLIT → M & F

② Apply → count

③ Combine

↳ Categorical / distinct

Select Gender, Count(Gender)

From Students

Group by Gender;

↳ Aggregation fu

ASians



Select Gender, max(percentage) as maxpercentage
From Students

Group by Gender;

min, mean, count,
sum.

Select department_id, Gender, max(percent) as max_per

From Students

Where Gender = 'male' and FeesPaid > 90,000

GroupBy department_id, Gender

Having :- It will Help us to filter a Data based on GroupBy ;

Select Gender, count(Gender) as GenderCount
from Students

GroupBy Gender

Having Count(Gender) > 4;

Where

- Fiter a Data based on column
- Be fiter Before GROUPBY

Having

Fitered Data based on agg fun
After GROUPBY

Limit

SQL Limit is a SQL clause used to restrict the No of Rows returning by query.

It is particularly useful when you want to control the size of your result set to avoid excessive data retrieval.

When to use Limit ?

You would use the SQL Limit Clause when you need to :

- ① Retrieve only specific No of Result Set.
- ② Implement pagination for displaying data in chunks.
- ③ Optimize query performance by reducing the amount of Data transferred.

Syntax:-

Select column1, column2, ...

From table

Limit numbers_of_rows;

Select * from Students

Limit 5;

Select * from Students

Order by percentage

Limit 5;

Order of writing SQL Query

Select
Distinct
From
Join
Where
Group by
Having
Order by
Limit / offset

Order of Execution SQL Query

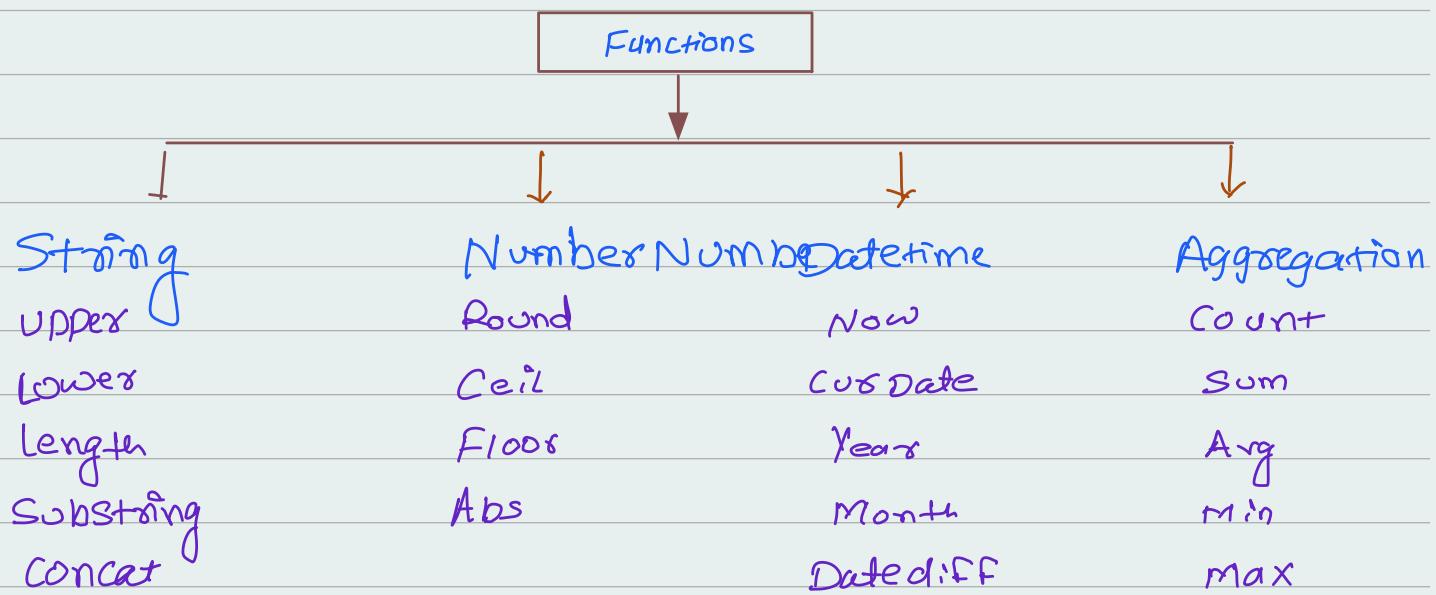
From
Join
Where
Group By
Having
Select
Distinct
Order By
Limit / offset

SQL Functions

SQL functions are Built in operations in SQL that takes input, perform f actions & return a value

Two main types:

- ① Single row (scalar) function → work on each individually
- ② Group (Aggregation) function → work on set of rows & Return a single value



Revisit

Constraints → Apply a Rules → Database / Table
↓

- ① unique → No duplicate
- ② NOT NULL → Nonnull (missing values)
- ③ Primary Key → Unique + NOT NULL
- ④ Foreign Key → Unique + Duplicate values
 - ↳ Connect with another table
 - ↳ Reference of primary key.
- ⑤ Composite → Two or more columns ↴
unique column

Clauses → Step by step instructions to add a table
to get output

- ① select ② from
↳
↳

- ② where

Select fullname from Students

where Marks > 10;

↳

&, >=, <=, =, !=
.1.

Between, IN, not in, like

→ and or not

(W) Group

Gender
Male
Male
Male
Female
Female

- ① split $\rightarrow \{M, F\}$
 - ② Apply \rightarrow count
 - ③ Combine
- IN 3
F 2

Male $\rightarrow 3 \{M_1, M_2, M_3\}$

Female $\rightarrow 2 \{F_1, F_2\}$

Male 3

Female 2

student

Gender	Marks	Dept
M	5	CSG
M	4	CIVIC
M	5	CSG
F	6	CIVIC
F	6	CSG

Select Gender, max(Marks) as Max_Marks
From Student

Groupby Gender ;

.
 ↳ SPLIT M F
 APPPLY M [5, 5, 4] }
 F [6, 6] } Max

Combine { M 5
 F 6 }

Mode 3

Example

student =

Gender	Marks	Dept
M	5	CSE
M	4	CIVIC
M	5	CSE
F	6	CIVIC
F	6	CSE

Dept , Gender max(Marks)

Select Dept , Gender , max(Marks)

from student

group Dept , Gender ;

Select Dept , Gender , max(Marks)

from student

where Gender = 'M'

group Dept , Gender

(having Max(Marks) ≥ 5)

Relationship

When we store Data in single table

- Data Duplication → Names were Repeated
- Data Inconsistency
- Data updation
- Handling missing values

we have split the Data into

- ① Students
- ② Teacher
- ③ Subject
- ④ Reference Table

-

What is Relational Database?

- Row columns
- ↳ Tables

Relationship

→ Connecting one two or tables together

Types of Relationship

- ① One to one
- ② One to many
- ③ Many to Many

① One to one Relationship

When Table A record is connect with Record in table B is called one to one.

① User → Account SBI

② Student → Id

③ Kukatpally → Pin code

One to Many

Where one Record in table A is connecting with multiple Records in Table B-

One teacher → DA
DS

Deepak → SQL
PBD
Excel
GNA } DA

Student → DA
→ DS

Many to One

student → one teacher
student2 →
student3 →

4139 → Deepoy
410 →
421 →

Many to Many

- When a many Records in Table A connect with many Records in Table B

Students ↔ Courses

Students ↔ Subjects

Joins

What is Joins?

A Joins is used to combine data from two or more tables based on a Related column Between them

Why we need Joins?

- ① Data Duplication | Redundancy.
- ② Data Updation
- ③ Storage
- ④ Data consistency.

Types of Joins

- ① Inner Join | Join
- ② Left + Join
- ③ Right Join
- ④ Cross Join
- ⑤ Self Join

Apply a Rule.

Primary → Unique + Not Null

Foreign key → Unique

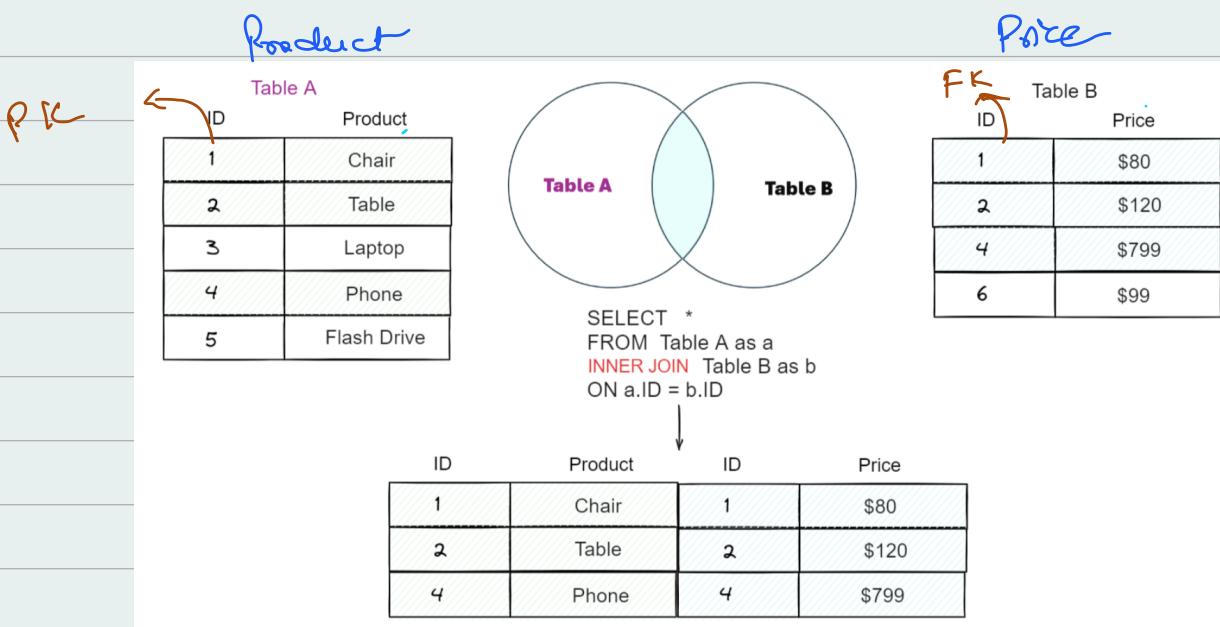


Connect with Second table / another table.

Inner Join

Return only Rows/Records with matching values in Both table.
or

The Result of the Inner join is only the Common
Values between 2 tables



→ The Inner join is fetching data
using Primary Key & Foreign Key

which are Common Records

Query:-

Select * from Product as p

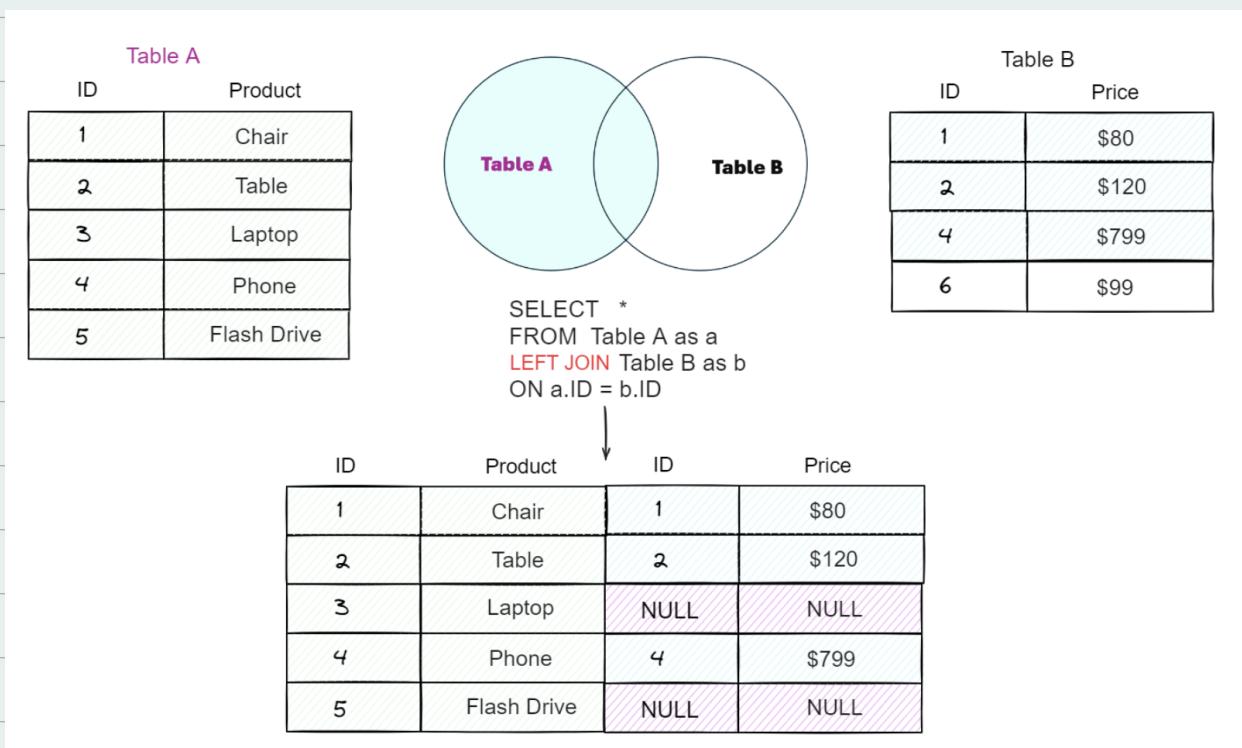
Join / innerjoin Price as pr

on p.id = pr.id ;

- Select p.product, pr.price from Product P
Join Price as pr
On p.id = pr.id

Left Join

Return all the rows from the table, and matched rows from the Right table. Unmatched rows from table shows as Null.



Select * from Product as P

Left Join price as P0

On p.id = p0.id ;

Select P.id, P.Product, P0.Price
from Product as P

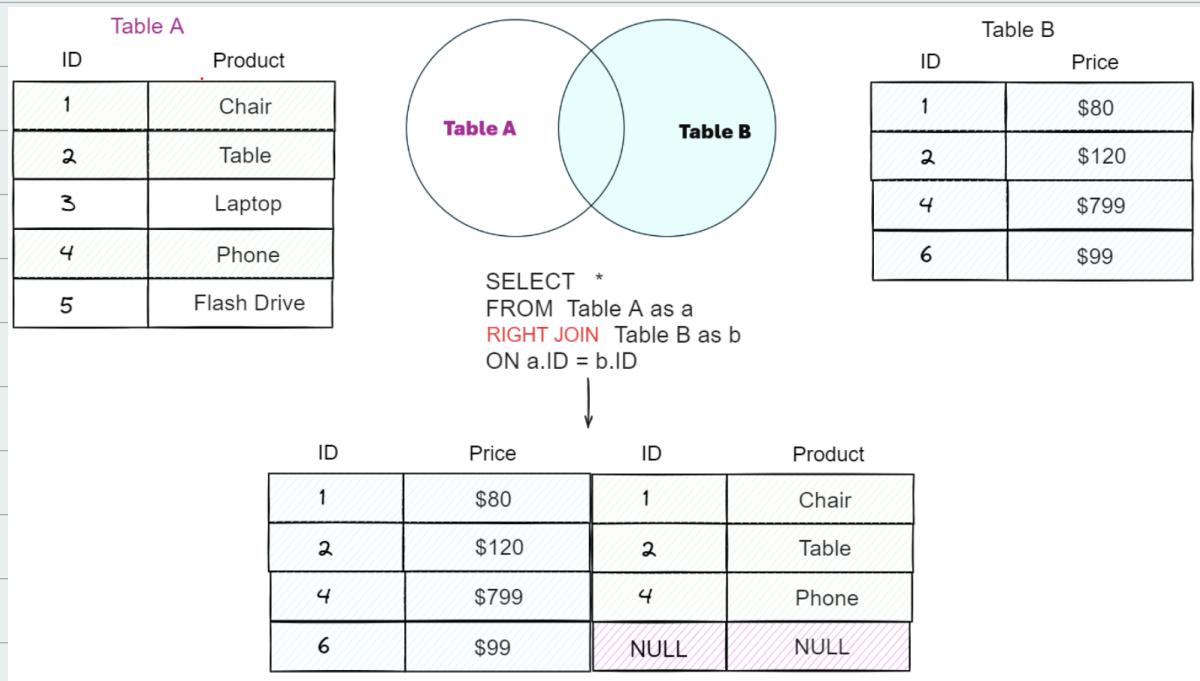
Left Join price as P0

On P.id = P0.id ;

Right Join

Return all Rows from Right table , and matched Rows from Left table

unmatched rows from the left show as NULL.



Select * from product as P

Right Join price as P_o

on P.id = P_o.id ;

Select P.id, P.Product, P_o.price

from product as P

Right Join price as P_o

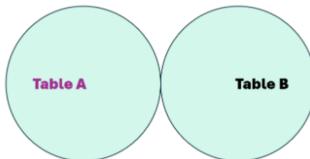
on P.id = P_o.id ;

Cross Join :-

Return a Cartesian product - every combination of rows from both table.

Cross tab

ID	Product
1	Chair
2	Table
3	Laptop
4	Phone
5	Flash Drive



Supplier
A
B
C
D

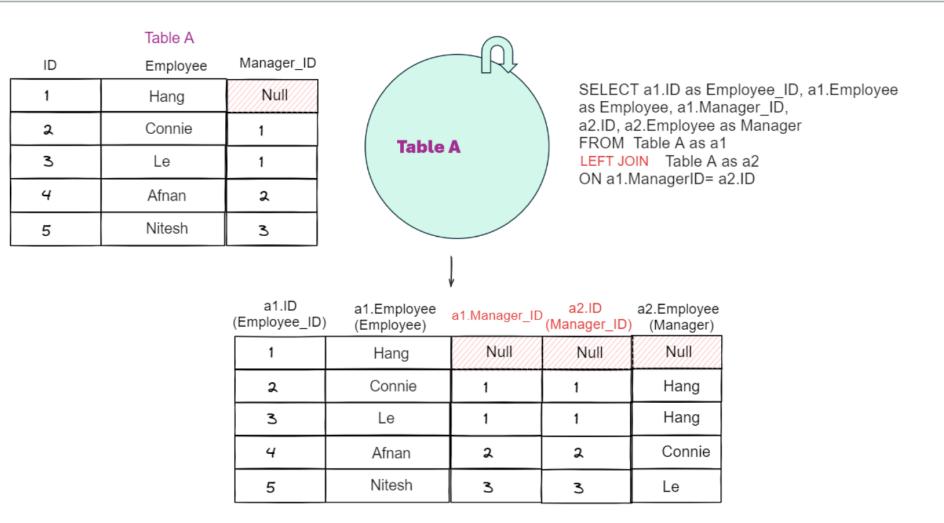
SELECT *
FROM Table A as a
CROSS JOIN Table B as b

ID	Product	Supplier
1	Chair	A
1	Chair	B
1	Chair	C
1	Chair	D
2	Table	A
2	Table	B
2	Table	C
2	Table	D
⋮	⋮	⋮

Self Join

A Self Join is a regular Join where a table is joined with itself.

It is useful for comparing rows within the same table - especially relational structure like employees & managers, products & categories or friends & followers.



Set Operations in SQL

Set operations are used to combine the results of two or more Select queries.

This works similarly to set operations in mathematics (like Union, Intersection, Difference).

Types of Set Operators.

- ① Union
- ② Unionall

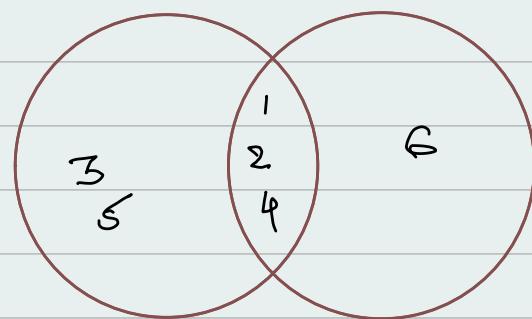
① Union:-

Union in SQL combines the results of two or more Select statements into a single result set, removing duplicate rows to ensure that each row is unique.

Products

Table A

ID	Product
1	Chair
2	Table
3	Laptop
4	Phone
5	Flash Drive



Price

Table B

ID	Price
1	\$80
2	\$120
4	\$799
6	\$99

Select id
From Products
union
select id from prices.

1
2
3
4
5
6

① Unionall

unionall in SQL Combines the results of two or more Select Statements into a single Result Set with duplicate values.

Products

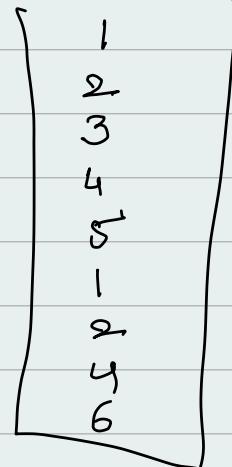
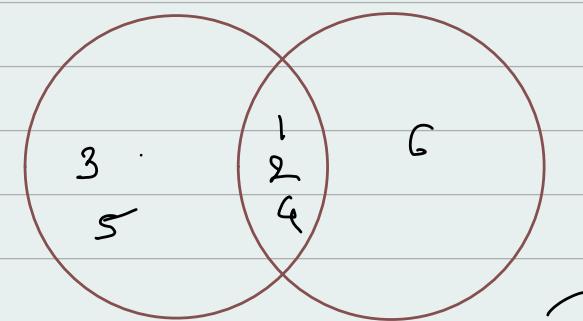
Table A

ID	Product
1	Chair
2	Table
3	Laptop
4	Phone
5	Flash Drive

Price

Table B

ID	Price
1	\$80
2	\$120
4	\$799
6	\$99



Union

Remove the duplicates

(only unique rows are returned)

Slower Because SQL must check
& remove duplicates

We use when we want unique
Rows

{ 1, 2, 3, 4 }

Union all

keep duplicates

(all rows from both queries)

Faster, since no duplicates
check is done

We use when we want all
Records.

{ 1, 2, 4, 1, 3, 4 }

①

Joins

②

Group by

③

Subquery

④

Execution / writing

⑤

CTE

⑥

window func

⑦

Commands

⑧

Data types

Subquery

- A Subquery, also known as inner query, it's a query within another SQL statement
- It allows us to use the result of one query input in another query.
- Subquery will be enclosed in parentheses "()" & can be used in various parts of SQL statement including select, from, where.
- For Subquery we use operators
 - ↳ Comparative
 - ↳ In, not in

Why to use Subquery?

- Retrieved a data based on a results of another query!
 - use the output of one query as a filter or criteria of another query -
- Breaking down complex problem into smaller
 - more readable & manage

Syntax

outer query

Select Col1, Col2, Col3
From table

inner query

Where Col Operator (Select Column From
another_table Where Coln);

Col1, Col2, Col3 → The columns which we want to select
table → Main table / outer table

Col → The column you want to filter or compare
operator → >, <, >=, !=, In, Not In etc

name	Marks
A	10
B	20
C	10
I	15

What is the maximum marks of a student.

Select marks(marks) from Student)

L, maximum marks of a student.

Select name

From student

→ first query will run

where marks = (Select marks(marks) from Student) ;

↓
20

name marks

A, 10 = 20 X

B, 20 = 20 ✓

C, 10 = 20, X

Or 15 = 20 X

B

Outer query will iterate will we get a result/
filter

Types of Subquery

- (1) Single Subquery
- (2) Multi Subquery (in, all, any)
- (3) Correlated Subquery

(1) Single query

A query inside another query that returns one result set (single column or single row)

(2) Multi-Row Subquery (in, Any, All)

(1) Subquery with IN

Check if a value matches any value in a list

(2) Subquery with Any

Condition is true if it matches any value returned by subquery

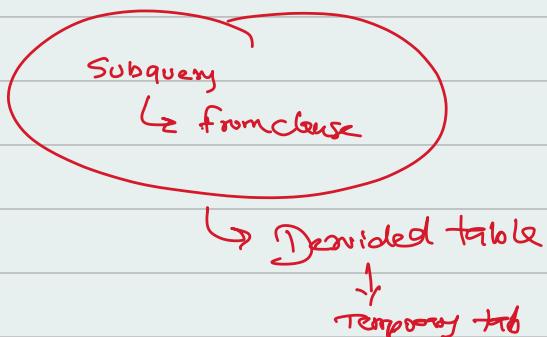
(3) Subquery in ALL

Condition must be true for all values in Subquery.

(3) Correlated Subquery

A correlated subquery depends on the outer query.

It runs Row by Row.



Desired Table.

A derived table is just a subquery inside the from clause.
It behaves like a temporary table that only exists while
the query runs.
→ It must have alias (name).

Syntax:-

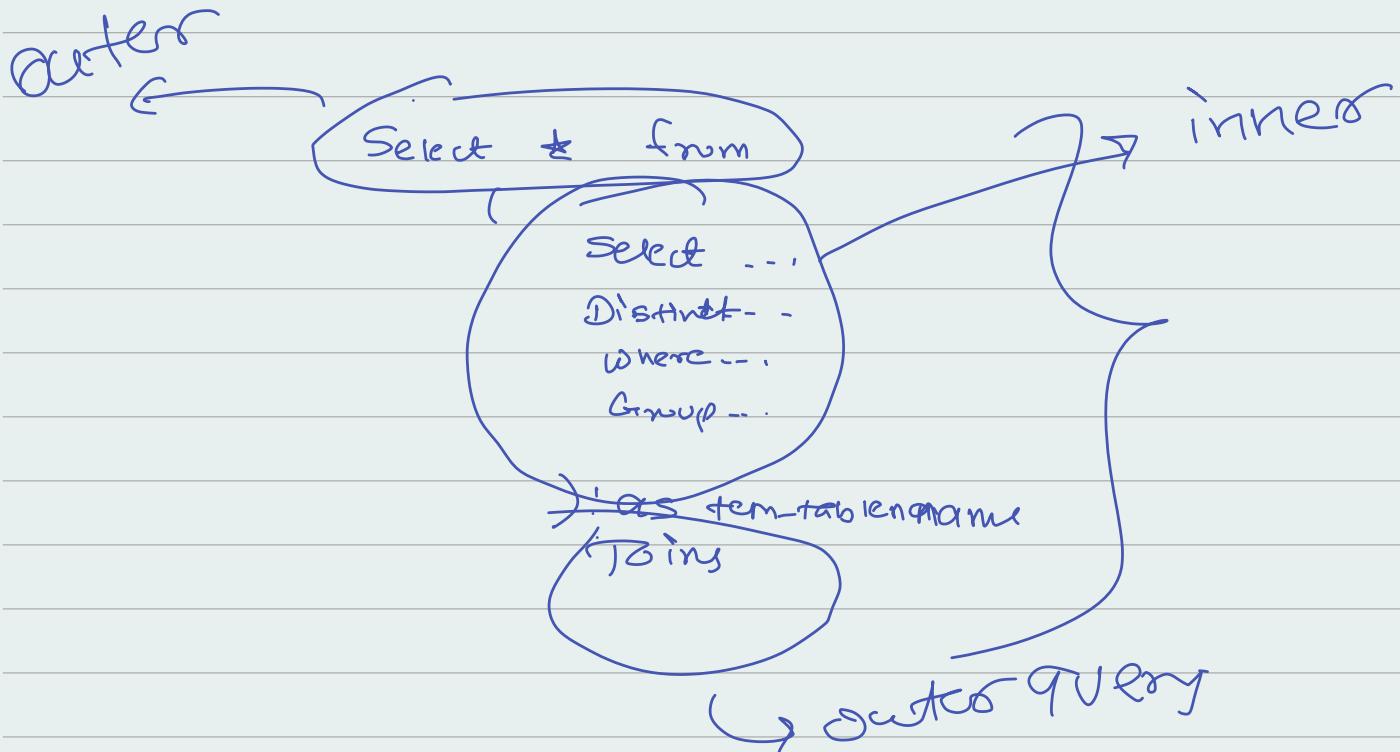
Select Col1, Col2

From (

Select ... - Subquery

From table name

) as temp table; → alias is requir



CTE

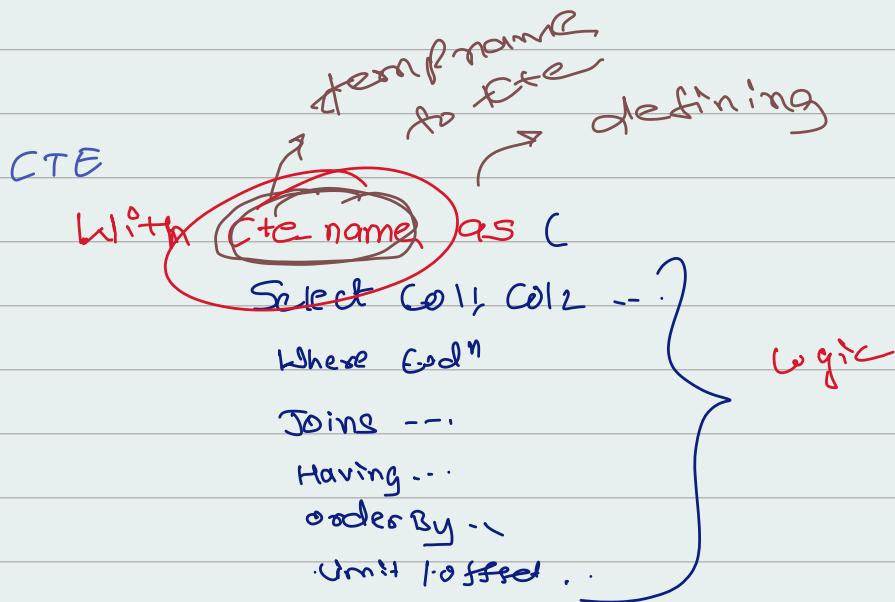
Common Table Expression -

A Common Table Expression (CTE) in SQL is a temporary result set that can be referenced within a Select, Insert, Update, Delete Statement.

CTE are defined using **WITH** keyword & allows you to create a named, reusable Subquery within SQL Statement.

Why to use CTE ?

- ① Simplifying complex queries by breaking them into smaller reusable parts.
- ② Reusable Subqueries within a single SQL Statement to avoid duplicates.
- ③ Organizing SQL statements better Readability & maintainability.



)

Select

where , joins

GroupBy

having

With Customer_CTE AS
 (Select customer-id, first-name
 last-name →
 From customers)
 Select * from Customer_CTE
 →

Views

A view is a virtual table based on Select query.
It does not store any physical Data.
You can select, filter, aggregate and join tables
inside a view

Use case :

1. Simplify complex queries
2. Enhance Security
3. Maintain consistency.

Syntax

Create view View-name as

Select Column1, Column2,

From table-name

Where Condition ;

