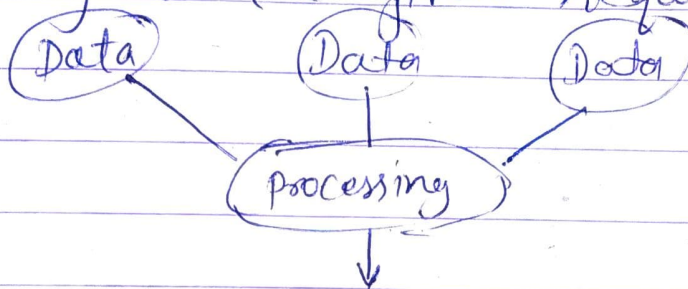




* Data - is a collection of facts about the object of interest.

→ Data is raw and unorganised fact that required to be processed to make it meaningful.

* Information - Information is a set of data which is processed in a meaningful way according to the given requirement.



Database - is a organized collection of data, which is stored and accessed from computer system.

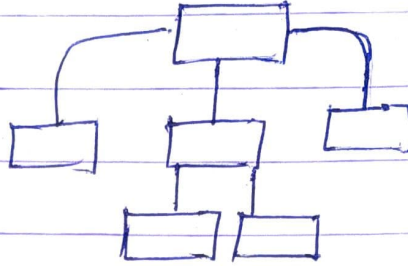
DBMS - is a software which is used to manage the database.

4 types of Database

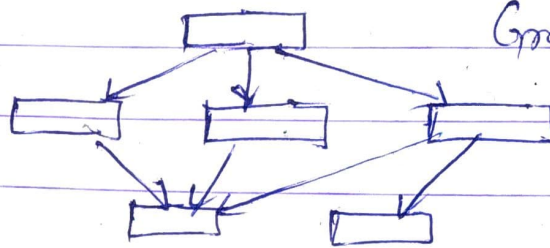
- Network
- Relational
- NoSQL
- Hierarchical



1) Hierarchical - e.g. - tree structure



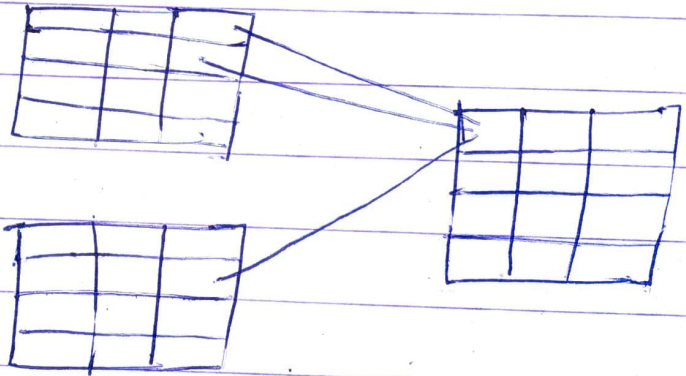
2) Network -



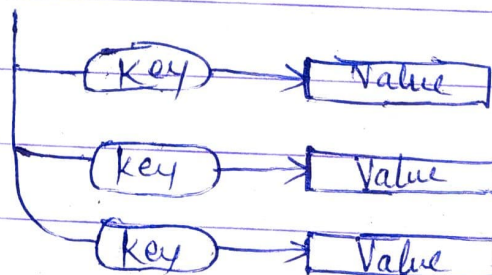
Graph structure

3) Relational.

Tabular structure



4) NoSQL -



key-value
pairs Graph
Document
structure

$\langle \rangle \rightarrow$ denotes not equal to $\neq$

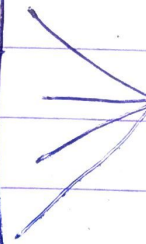


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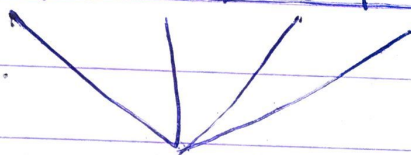
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Relational - Relational Database store data in relations i.e, tables. Each relation have a name.

ID	NAME	MOB	DEPT
1	Rishikesh	OPPO	CSE
2	Abhishek	Redmi	EE
3	— —	— —	— —
4	— —	— —	— —



Tuples/records/
Rows



Attributes/columns/fields

→ Column name → attribute

→ Row name → Tuple

→ No. of Rows/records/tuples → Cardinality of the relation

→ No. of columns/fields/attributes → Degree of the relation.

→ A collection of relations with distinct relation names is called as Relational model.

primary key - A column whose values uniquely identify every row in a table.



Page No.

Date

more → Turn page →

Facts.

- 1) A relational database consists of a collection of Tables.
- 2) A relationship among a set of values in a table is represented by a Row.
- 3) The set of permitted values of an attribute is called Domain.
- 4) The attribute value that is currently unknown is NULL.

Candidate Key - A Candidate key is a minimal set of columns/attributes that can be used to uniquely identify a single row/tuple in a relation.

→ Candidate keys are determined during database design.

A primary key is the Candidate key that is selected to uniquely identify a tuple in a relation.

→ It must uniquely identify a tuple

→ must not allow NULL values.

When 2 or more columns together identify the unique row then it is referred to as Composite Primary Key.

*



Page No

Date

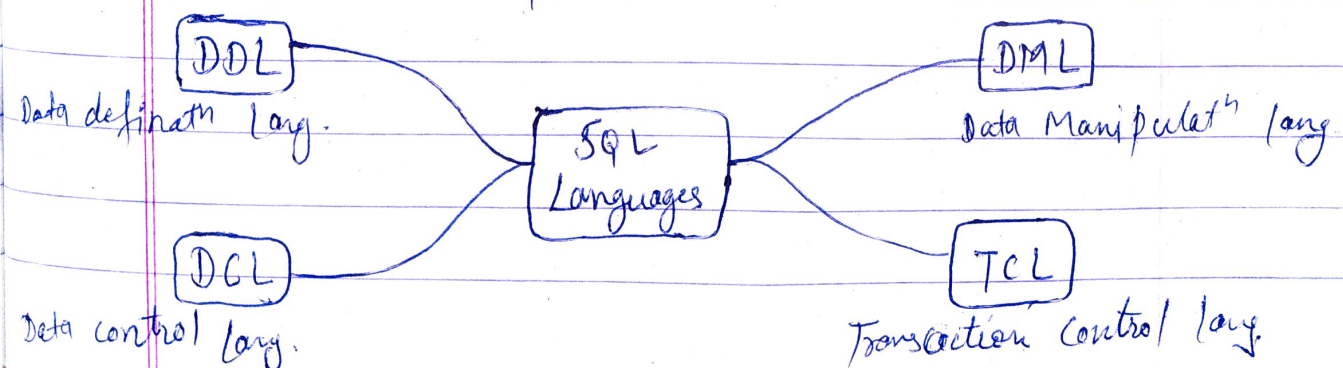
Foreign key - A foreign key is a set of one or more columns in the child table whose values are required to match with corresponding columns in the parent table.

ER model is a graphical representation of entities and their relationship which helps in understanding data independent.

Crow foot notation is one of the ways to represent cardinality of relationship in an ER model.
4 symbol -

- 1)  Exactly one
- 2)  Zero or one
- 3)  Zero, one or more
- 4)  one or more

⇒ SQL - Structured Query Language is used to manage data in all relational databases like DB2, Oracle, SQL Server etc.



→ ALTER → DDL (TRUNCATE)

→ REVOKE → DCL

→ INSERT → DML



Page No

Date.....

NUMBER (3,1)

precision scale

1) NUMBER(3) $\rightarrow$ e.g. $\rightarrow$ 999.0 $\rightarrow$ scale

2) $\text{NUMBER}(3,2) \rightarrow$

The diagram shows the number 9.99. Above the first 9 is a 'P' with an arrow pointing down to it. Below the decimal point is a 'scale' label with an arrow pointing up to it.

3) $\text{NUMBER}(2,3) \rightarrow 0.999$
 (The first 0 is circled, and the three 9s are grouped under a bracket labeled "scale")

Scale is the number of digits allowed after the decimal point.

precision is the total number of significant digits.

Column - A single field in a table, A column contains a particular piece of information within a table.

Row - A record in a table.

Schema → Information about database and table
Layout and properties.
Keyword - Reserve word



Page No

Date

Any column in a table can be defined as the primary key, as long as it meets the following conditions:

- No two rows can have same value.
- No NULL value.
- Values in primary key columns should never be modified or updated.

Why MySQL? → 1) Easy to use
2) free 3) supported on every OS
4) Most popular DBMS.

>> SELECT → use to retrieve data

Normalization - means the process of efficiently organizing data in a database.

Range → BETWEEN 2 AND 5

List → IN ('Rishi', 'Abhi', 'Shakti')

LIKE → string pattern match → LIKE "S%"

→ DROP Table statement is used to drop an existing table from the database.

⇒ DROP TABLE <table name>;

→ first drop the child table then parent table
~~direct~~ direct dropping parent table is not allowed



Page No.

Date.

Reason → due to foreign / primary key.

→ CREATE → used to create a table / database.

Syntax - CREATE TABLE students (
STIDID INTEGER PRIMARY KEY,
Sname VARCHAR(20),
Contactno. NUMBER(10));

→ REFERENCES - It is used to declare foreign key or get reference from parent table.

→ by using CASCADE CONSTRAINTS we drop parent table first.

↳ DROP TABLE students CASCADE CONSTRAINTS

Reason → The clause CASCADE CONSTRAINTS will remove all referential integrity constraints that refer to the primary or unique keys in the tables.

→ NOT NULL is only applied on column

→ A column can be given the default value by using DEFAULT option.

ORACLE doesn't support Default value.
(database)



Page No

Date.....

Data type of column and default expression must be the same.

→ CHECK constraint is used to limit the values that can be specified for a column.

→ Gender CHAR(1) CHECK (Gender IN ('M', 'F'))

Normalisation - Normalisation is the process of reorganizing data in a database to ensure that there is no data redundancy and no data dependencies.

Update -

update student set ~~SID~~MOB = 9876543210
Where SID = 'S04';

Alter -

→ Alter table student drop column Sname;
(Sname → name column delete)

→ Alter table student rename column SID to StudId;

→ Alter table student modify Sname VARCHAR(50);

→ Limit $3/2$ → limit value
offset value



Page No.

Date

→ Limit → It instruct return ^{how many} ~~B~~ how
e.g:- Limit 5.

→ OFFSET - It instruct return from where to
e.g:- limit 5 offset 5.

SQL - SQL is structured query language
Which is a computer language for
storing, manipulating & retrieving data in relational database.

→ When we have fix no. of data store use
CHAR

→ otherwise VARCHAR

→ desc / describe Students;

↳ used to know the table structure
↳ To see structure of table

Integer allowed 38 digit (default)

→ if 100.5 is store in integer then it round
and store 101 in database.

To store decimal value.
Expenses Number (5,2)

Select → Length(name), Length(Address) from Students;
returns length of name(int) and address length



Page No

Date

Expense Number;

→ Then it store any value like 1.23, 234.28, 22.2228 etc.

TIMESTAMP -

Time TIMESTAMP;

→ datatype

→ It is gives (SYSTEM STAMP) system instance time.

CLOB → character data > 4000 bytes.

BLOB → Binary data like image, video etc.

DATE → Syntax → it always store
→ DD - ^(Dstr)MM - YY (2-2 digit each)

DEFAULT - It is used to set default value.

e.g - DOJ Date default SYSDATE;

→ if user doesn't provide date (DOJ) then it get default value as system ~~date~~ date.

check - Check constraint is used for where we know value is only from these li
e.g. → Gender is always M or F.

* Check constraints allow NULL value



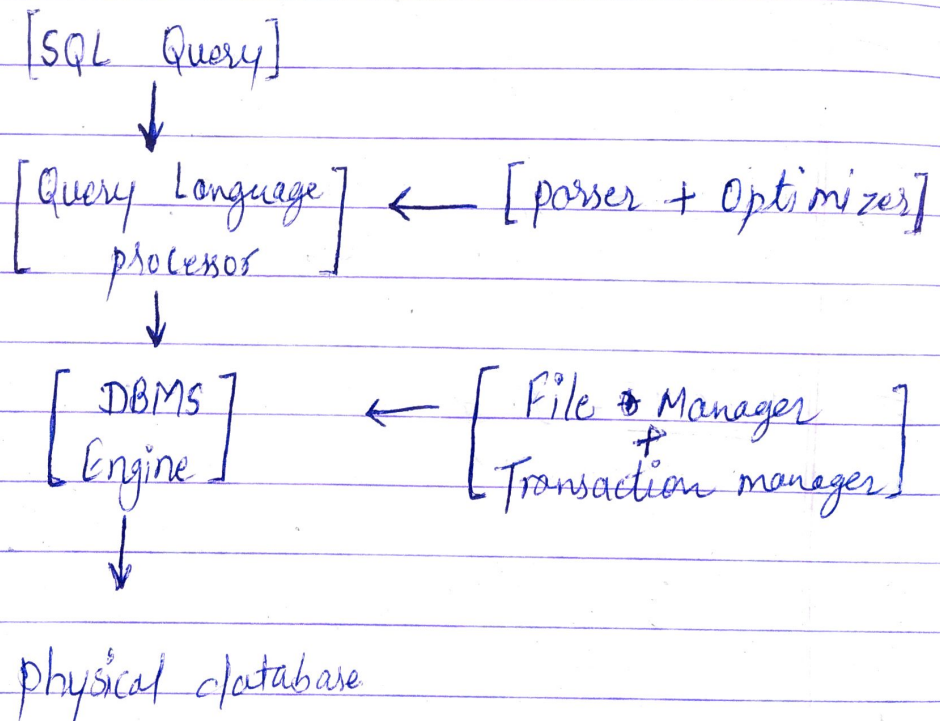
Page No
Date

Syntax - check.

→ Gender (has (1) constraint st-gender check
Gender IN("M", "F"));
or → Age Number constraint st-age check (age > 18);

- Q- Why SQL - 1) Allow user to access data in the relational database management system.
2) easy to learn
3) Widely used in world.

SQL Architecture





Command is classified into the following groups based on their nature -

1) DDL - Data definition Language.

commands → CREATE (to create a new table)
ALTER (modify the table)
DROP (delete whole table)

2) DML - Data manipulation language.

commands - SELECT
INSERT
DELETE
UPDATE

3) DCL - Data control language.

commands - GRANT → gives a privilege to user.
REVOKE → Takes back the privilege.



RDBMS - Relational database management system is a database management system that is based on the relational model introduced by E.F. Codd.

Table - The data in an RDBMS is stored in database objects which are called as tables.

Record or row - A record is also called a row of data is each individual entry that exists in a table. (Horizontal entity)

Column - A column is a vertical entity in a table that contains all information associated with a specific field in a table.

NULL value - A NULL value in a table is a value in a field that appears to be blank, which means a field with a NULL value is a field with no value.

Constraints - Constraints are the rules enforced on data columns on a table.



These are used to limit the type of data that can go into a table.



#

Database Normalisation - DB Normalisation is the process of efficiently organizing data in a database.

There are 2 reasons of this normalisation process:

- Eliminating redundant data.
 - ↳ Storing same data more than one table.
- Ensuring data dependencies make sense.

* First normal form (1NF) - First normal form (1NF) sets basic rules for an organized database:

- Define the data items required, because they become the columns in a table.
 - Place the related data items in a table.
 - Ensure that there are no repeating groups of data.
 - Ensure that there is a primary key.
- * It contains an atomic value.
- * It states that an attribute of table cannot hold multiple values.

Syntax → set of rules & guidelines for writing code/anything.



Page No.

Date

* Second normal form (2NF) - 2NF states that a table should meet all the rules for 1NF and there must be no ~~partial~~ ^{fully functional} dependencies of any of the columns on the primary key.

* Third normal form (3NF) - A table is in a third normal form when the following conditions are met:

- It is in the second normal form.
- All non-primary fields are dependent on the primary key.

* Reduce the data duplication. / also used to achieve the data integrity.



Various SQL Command Syntax -

→ Select statement → select / fetch value
SELECT col1, col2, from table-name;

→ DISTINCT clause → used to find single values.
SELECT DISTINCT col1, col2 FROM table-name

→ WHERE clause → check condition.
SELECT col1, col2 FROM tb-name
WHERE condition;

* BCNF $\rightarrow$ Boyce Codd * Table should be in 3NF
 $\rightarrow$ for every FD, LHS is Super Key.

* 4NF $\rightarrow$ A relation will be in 4NF

if it is in Boyce Codd normal form and has no multi-valued dependency.

$\rightarrow$ AND/OR clause -

```
SELECT C1, C2 FROM tname  
WHERE Cond1 AND/OR Cond2;
```

$\rightarrow$ (exactly)

$\rightarrow$ IN clause - check IN list and fetch match values.

```
SELECT C1, C2 FROM tname  
WHERE colname IN (values);
```

$\rightarrow$ exactly value

$\rightarrow$ BETWEEN clause - check from 2.

```
SELECT C1, C2 FROM tname  
WHERE colname BETWEEN val-1 AND val-2;
```

$\rightarrow$ LIKE clause - check pattern. 'y.a'/'a_'

```
SELECT C1 FROM TName  
WHERE colname LIKE (pattern);
```

$\rightarrow$ ORDER BY clause -

```
SELECT C1 from tname  
WHERE Condition.  
ORDER BY Colname ASC/DESC;
```

$\rightarrow$ GROUP BY clause -

```
SELECT C1 FROM tname  
WHERE Condition  
GROUP BY Colname;
```

* Having clause use with group by clause.



Page No
Date.....

→ COUNT clause - count no. of ~~row~~ row.
SELECT COUNT(colname) FROM tname
WHERE condition;

→ HAVING clause -
SELECT SUM(col) FROM tname
WHERE condition.
GROUP BY colname
HAVING arithmetic condition;

SQL operators - Aggregations -

Avg() → return average of selected column.

Count() → no. of row

Max() → maximum value in a row

Min() → minimum value in a row

Sum() → Sum of row.



→ CREATE TABLE -

```
CREATE TABLE table_name (  
    col1 datatype,  
    col2 datatype,  
    col3 datatype,  
    :  
    :  
    PRIMARY KEY (colname)  
);
```

→ DROP TABLE -

```
DROP TABLE table_name;
```

→ CREATE INDEX -

```
CREATE UNIQUE INDEX index_name  
ON table_name (col1, col2, ... colN);
```

→ DROP INDEX -

```
ALTER TABLE table_name  
DROP INDEX index_name;
```

→ DESCRIBE table -

```
DESC table_name;
```



→ TRUNCATE TABLE -

TRUNCATE TABLE table-name;

→ ALTER TABLE - (update use)

ALTER TABLE table-name {ADD/DROP/MODIFY}
column-name {data-type};

→ Rename to new table name -

ALTER TABLE table-name RENAME TO new_name;

→ INSERT INTO -

INSERT INTO table-name (col1, col2, ..., colN)
VALUES (val1, val2, ..., valN);

→ UPDATE statement

UPDATE table-name SET col1 = val1, col2 =
val2, ...
[Where condition];

→ DELETE statement

DELETE FROM table-name
WHERE {condition};



→ CREATE DATABASE -

CREATE DATABASE dbname;

→ DROP database -

DROP DATABASE dbname;

→ USE Statement -

USE dbname;

→ COMMIT -

COMMIT;

→ ROLLBACK -

ROLLBACK;

Data type - It is an attributes that specifies the type of data of any object.

##) Exact Numeric data types -

bigint, int, smallint, tinyint, bit, decimal, numeric, money, smallmoney.

#) Approx. Numeric data type -

float, real, datetime, smalldatetime, date, time.

A datetime data type as 3.33 milliseconds accuracy
And smalldatetime has —
1 minute accuracy.



Page No.

Date

#) Character string data types.

Char. → max. length of 8000 character
varchar → max. of 8000 character (non-Unicode)
Text → Max. 2,147,483,647 characters.

Operators in SQL -

An operator is a reserved word or a character used in SQL statement WHERE clause to perform operations. Such as comparison and arithmetic operators.

- Arithmetic operators
 - Comparison operators
 - Logical operators.
 - Operators used to negate conditions.
- Arithmetic operator → +, -, *, /, %
 - Comparison operator → =, !=, <> (not equal), <, >, <=, >=, !<, !>
 - Logical operators → ALL, AND, ANY, BETWEEN, LIKE, NOT, IS NULL, EXISTS, IN, OR, UNIQUE

* Where age IN (25, 30) → it gives all value from age 25 to 30.
OR Where age BETWEEN 25 AND 27.



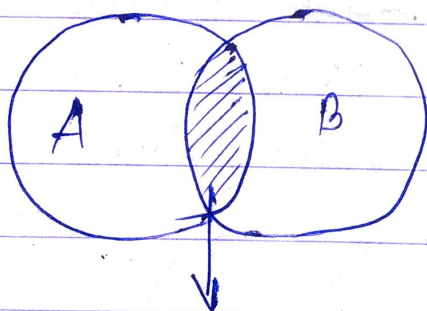
Union - union return all the value of 2 table except duplicate value

UNION ALL - It return all value of 2 table also duplicate value.

→ `SELECT Sname, Sbranch from student1
UNION ALL
SELECT Sname, Sbranch from student2`

SQL Join - Combine rows/columns from two or more tables, based on a related column between them in a database.

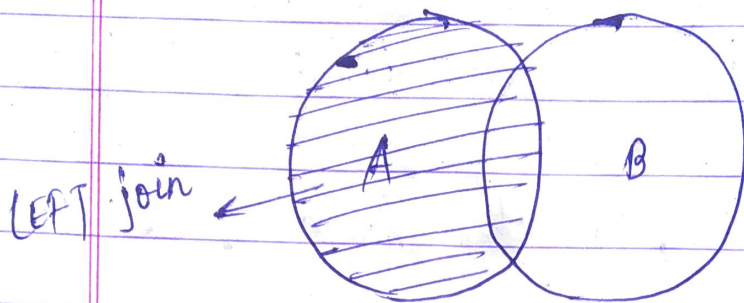
* INNER JOIN - Return rows when there is a match in both tables.



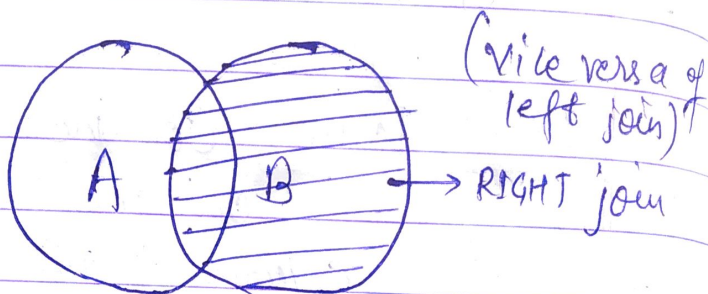
INNER



* LEFT JOIN - Return all rows from the left table, even if there are no matches in the right tables.

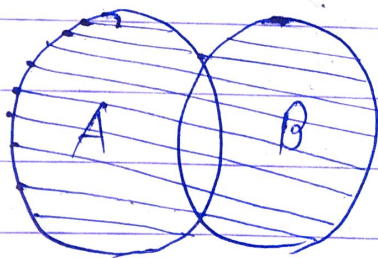


* RIGHT JOIN -



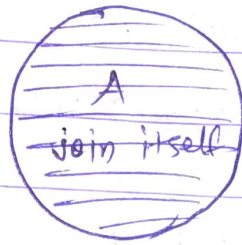
* FULL OUTER JOIN - Return rows when there is a match in one of the tables. अगर ~~match~~ condition match नहीं होता है तो वहाँ NULL value आता है।

* Return all value from both table.

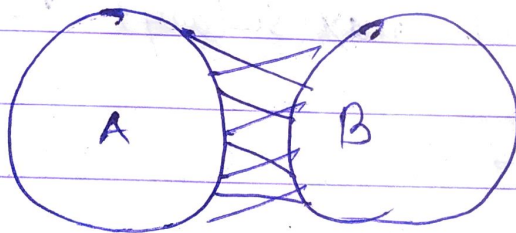




* SELF JOIN - Used to join a table to itself as if the table were two tables, temporarily renaming at least one table in the SQL statement.



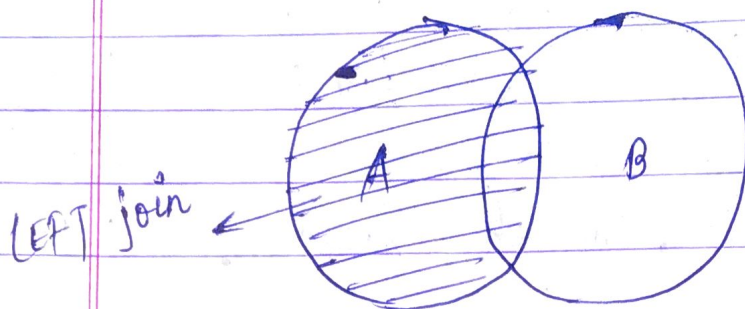
* CARTESIAN JOIN (CROSS JOIN) :- Return the Cartesian product of the sets of records from the two or more joined tables.



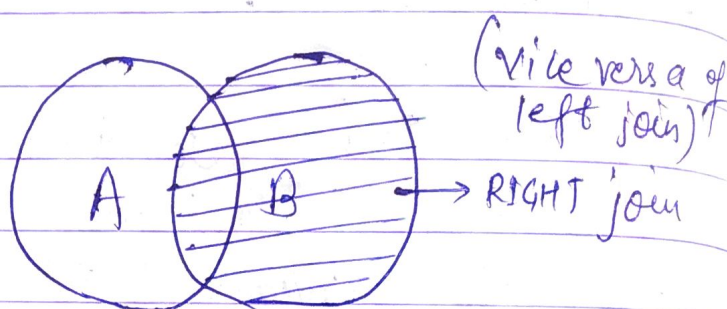
if A table has 3 record
~~table~~ and B table has 4 record
then final table get $3 \times 4 = 12$
record.



* LEFT JOIN - Return all rows from the left table, even if there are no matches in the right tables.

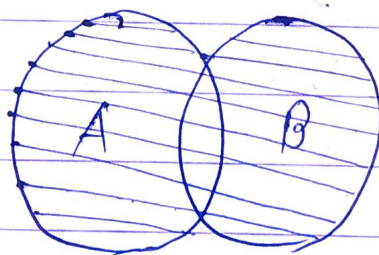


* RIGHT JOIN -



* FULL OUTER JOIN - Return rows when there is a match in one of the tables. अगर ~~कोई~~ condition match नहीं होती है तो वह NULL value आती है।

* Return all value from both table

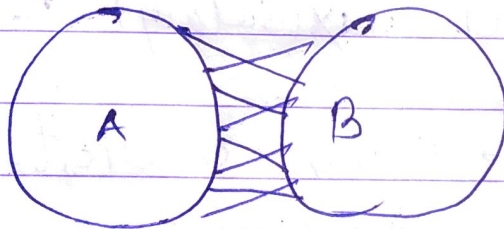




* SELF JOIN - Used to join a table to itself as if the table were two tables, temporarily renaming at least one table in the SQL statement.



* CARTESIAN JOIN (CROSS JOIN) :- Return the Cartesian product of the sets of records from the two or more joined tables.



if A table has 3 record
~~table~~ and B table has 4 record
then final table get $3 \times 4 = 12$
record.



SQL Operators - Aggregation function

1) Avg() → Return the average value from specified columns.

~~SELECT avg(salary) FROM employees;~~

→ SELECT avg(salary) FROM employees;

2) Count() → Return number of table rows.
→ SELECT Count(*) FROM employees;

3) Max() → Return largest value among the records.

→ SELECT ~~max~~(salary) FROM employees;

4) Min() → Return smallest value among the records.

→ SELECT ~~max~~ min(salary) FROM employees;

5) Sum() → Return the sum of specified column values.

→ SELECT Sum(salary) FROM employees;

→ SHOW DATABASES;
→ USE students;



Page No

Date

Expression - An expression is a combination of one or more values, operators and SQL function that evaluate to a value. These SQL expressions are like formulae and they are written in query language.

There are different types of SQL expressions, which are mentioned below:

✗ Boolean



Select * from
customer where
salary = 10000;

✗ Numeric



Select (15+6).

✗ Date



Select current_timestamp
Select GETDATE();

CREATE table infoStudent As
Select Firstname, class from student.

↳ It makes another table name infoStudent having all value of student table (firstname, class).

Where clause - Where clause is used to specify a condition while fetching the data from a single table or by joining the multiple table.



SQL- AND & OR Conjunctive Operators

The SQL AND & OR operators are used to combine multiple conditions to narrow down in SQL statement.

→ N numbers of conditions using the AND operator (AND)

~~DELETE~~ - UPDATE - UPDATE query is used to modify the existing records in a table.

→ Where ~~where~~ clause with the UPDATE query to update the selected row, otherwise all rows would be affected.

e.g. UPDATE Sname SET ADDRESS = 'PUNE'
WHERE ID = 6; / otherwise all Sname have Pune.

DELETE - It is used to delete the existing records from a table.

→ WHERE clause is used to delete the selected rows, otherwise all the records would be deleted.

e.g. → DELETE FROM table-name
WHERE condition;

All database do not support Top clause
LIMIT → support MySQL
ROWNUM → ORACLE



Page No

Date

LIKE clause - It is used to compare a value to similar values using wildcard operators (% & -)

1) %- percent sign 2) - → underscore sign

→ The % sign represent 0, 1 or multiple character.

→ The (-) sign represent a single char or number.

e.g. - SELECT FROM table

WHERE name LIKE 'RA%.'

← %

OR (%A%)

SELECT FROM table

WHERE name LIKE 'RAHU_'

← _

OR (-AHU-)

★ # TOP - This clause is used to fetch a TOP N number or X percent records from a table

TOP e.g. = SELECT TOP 3* FROM table;

LIMIT e.g. = SELECT * FROM table → MySQL
LIMIT 3;

ROWNUM e.g. → SELECT * FROM table → Oracle
WHERE ROWNUM ≤ 3;

* Some database sort the query results in an ascending order by default.



Page No.

Date

ORDER BY clause - used to sort the data in ascending or descending order, based on one or more columns.

eg. SELECT col1 FROM table
WHERE condition
ORDER BY DESC/ASC;

GROUP BY - used in collaboration with the SELECT statements to arrange identical data into groups

→ This GROUP BY clause follows the WHERE clause in a SELECT statements and precedes the ORDER BY clause.

eg. - table →

1- Ramesh	4000/-
2- Sahil	2000/-
3- Ramesh	4500/-

SELECT name, sum(salary) table
~~WHERE~~ GROUP BY name;

⇒ o/p →

Ramesh	9500
Sahil	2000



DISTINCT Keyword - used in conjunction with the SELECT statement to eliminate all the duplicate records and fetching only unique records.

e.g:- SELECT DISTINCT col1 FROM table
WHERE condition.

~~Clause~~ - ~~Key~~ - A DBMS

Normalisation - ACID properties -

- * Atomicity - The entire transaction take place at once or doesn't happen at all
- * Consistency - The database must be consistent before and after the transaction.
- * Isolation - Multiple Transactions occur independently without interference.
- * Durability - The changes of a successful transaction occurs even if the system failure occurs.