Fundamental Concepts of Database

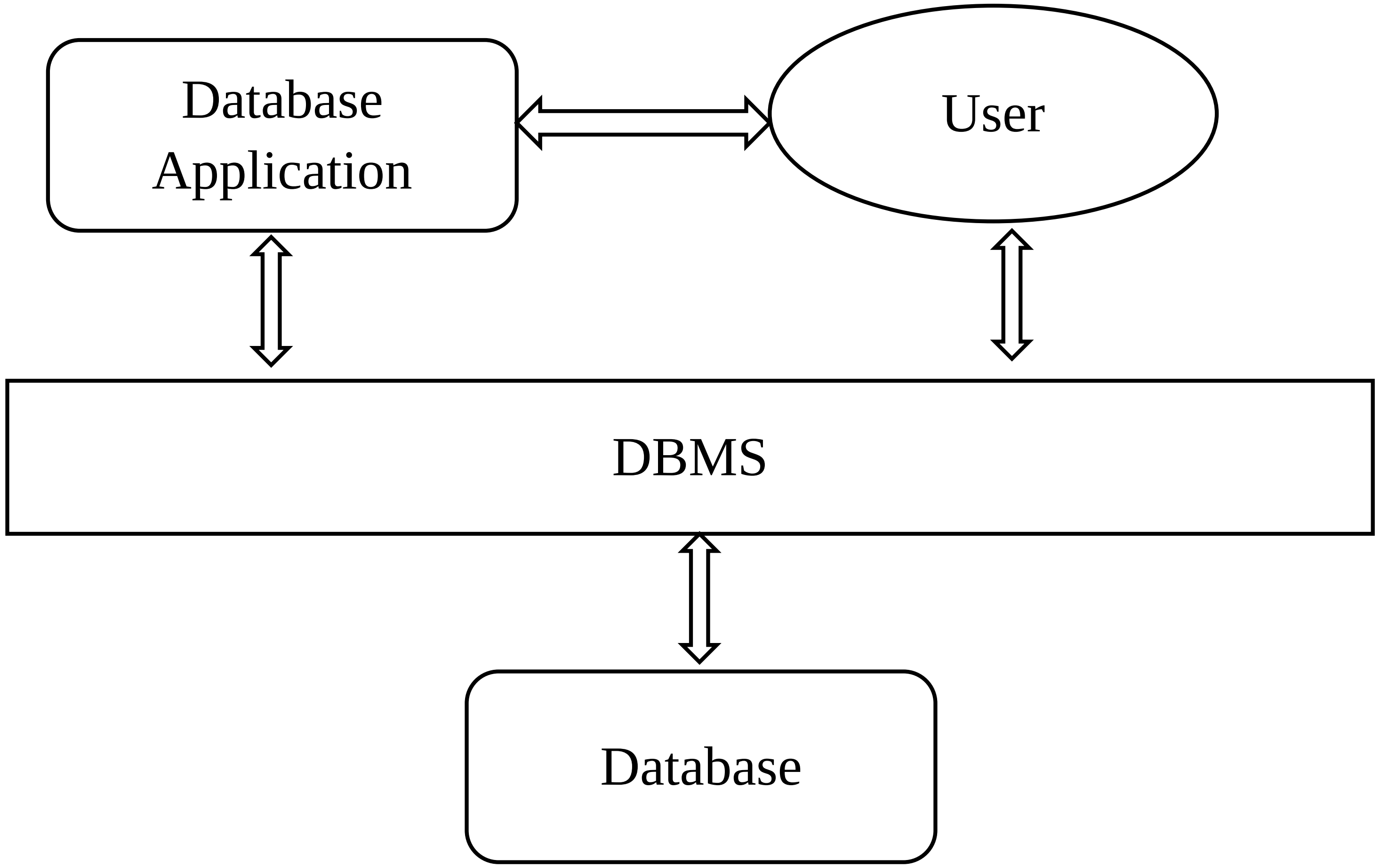
Contents(1)

- What is Data?
  - a collection of facts about something.
- Let’s take an example. For the DVD collection, what information would we hold about each DVD?
  - Title, Year, Director, Runtime, Principal actors etc.
- In electronic machine, data is represented in the form of text , numbers or media files.

Contents(2)

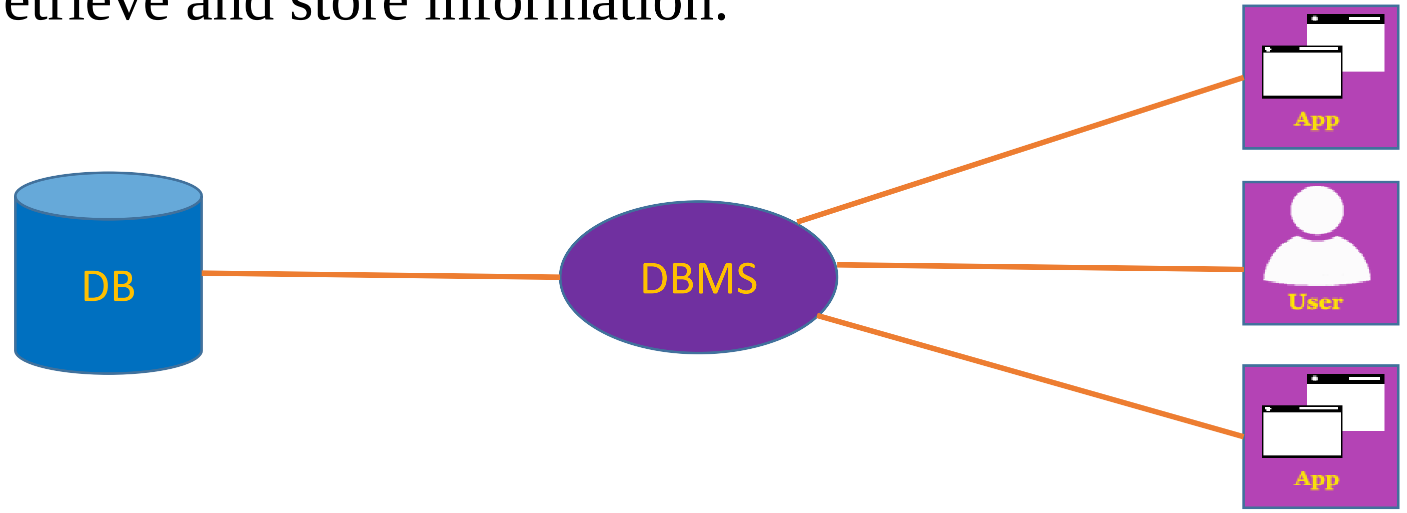
- What is Database?
  - ➢ A collection of interrelated data organized to meet users' needs.
  - ➢ Is also a repository of data that is defined once and then is accessed by various users.
  - ➢ Contains information about a particular enterprise.
- Database Examples
  - ➢ Sales – customers, products, sale-records
  - ➢ Banking – transactions, account
  - ➢ Hotel reservation – room, customers, services

Components of Database



Contents(3)

- Database Management System(DBMS)
  - Is a group of programs that manipulate the database and provide an interface between the database and the user of the database or other application programs.
  - An environment that is both convenient and efficient for users to retrieve and store information.



Database Keys

Types of Database Key

- Primary Key
- Secondary Key
- Foreign Key
- Simple Key
- Compound Key

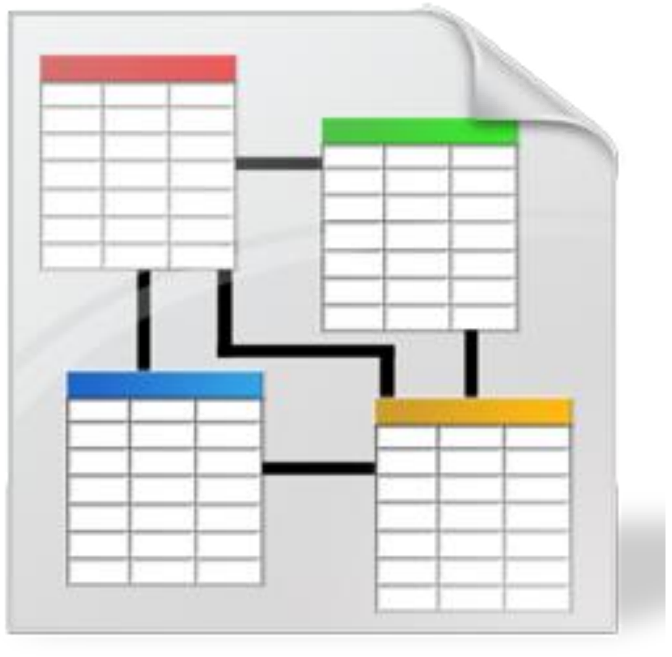
1. Primary Key

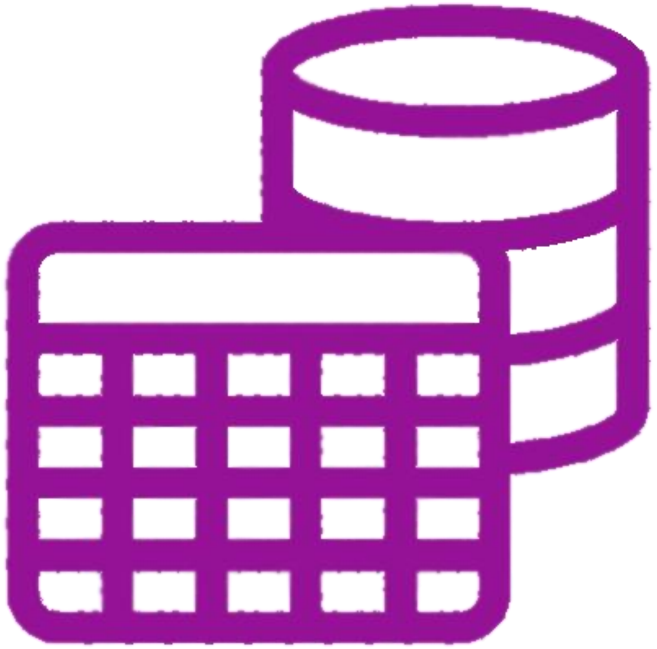
- A column or group of columns uniquely identifies every record in the table.
- A primary key is mandatory and it cannot be null.
- For example, student ID is a primary key as this uniquely identifies within the student records system.

2. Secondary Key

- An entity may have one or more choices for the primary key. These are also known as candidate keys.
- One is selected as the primary key. Those not selected are known as secondary keys.
- For example Stud ID, Roll No, and email are candidate keys which help to uniquely identify the student record.

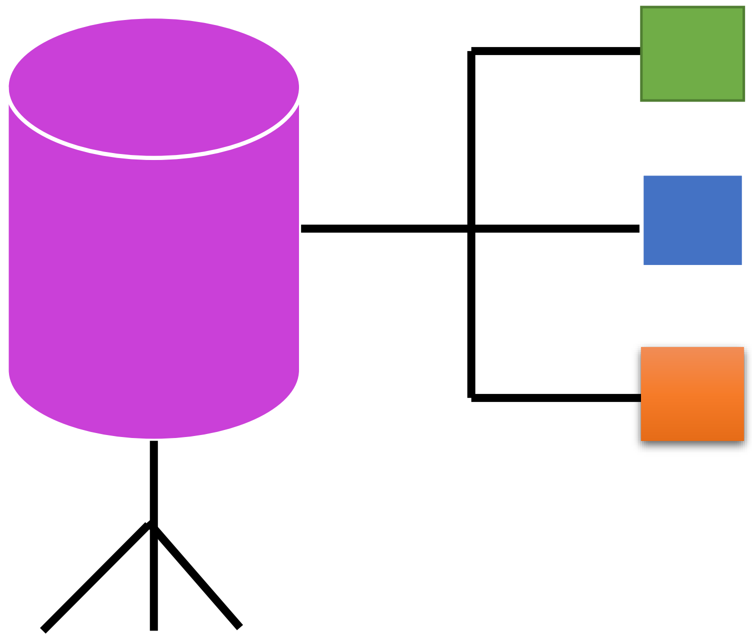
Relational Data Model





Contents(1)

- What is Relational Data Model (RDM)
  - It represents the database as a collection of relations, i.e., tables.
  - Eg. Oracle, MSSQL Server, MySQL etc.
- Components of RDM
  1. Table
  2. Columns
  3. Row
  4. Primary key
  5. Relationship



Contents(2)

- What is MySQL?
- MySQL Data Type
  1. Numeric
  2. Text
  3. Date/time etc.

String Data Type

Data Type Syntax	Maximum Size	Description
CHAR(size)	255 characters	**size** is the number of characters. Fixed-length strings.
VARCHAR(size)	255 characters	**size** is the number of characters. Variable-length strings.
TEXT(size)	65,535 characters	
BINARY(size)	255 bytes	**size** is the number of binary characters. Fixed-length strings.
VARBINARY(size)	255 bytes	**size** is the number of binary characters. Variable-length strings.
BLOB	65,535 bytes	

Integer Data Type

Data Type Syntax	Description
SMALLINT	▪ Signed values range is from -32768 to 32767. Unsigned values range is from 0 to 65535.
INT	▪ Standard integer value. ▪ Signed values range from -2147483648 to 2147483647. ▪ Unsigned values range from 0 to 4294967295.
BOOL	▪ Treated as a Boolean data type ▪ Zero is considered as false, nonzero values are considered as true.

Floating Data Type

Data Type Syntax	Description
FLOAT(m,d)	**m** is total digits **d** is number of digit after the decimal FLOAT is accurate to approximately 7 decimal places
DOUBLE(m,d)	Double is accurate to approximately 14 decimal places
DECIMAL	DECIMAL can store 30 digits after decimal point. For Business Oriented Math, always use Decimal.

Date Data Type

Data Type Syntax	Format
DATE	YYYY-MM-DD
DATETIME	YYYY-MM-DD hh:mm:ss
TIME	hh:mm:ss
YEAR	YYYY

Structure Query Language (SQL)

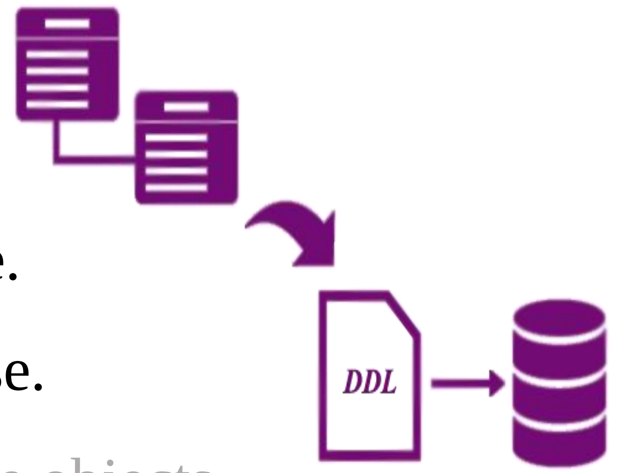
SQL

- What is SQL?
- Every software developer should have a really good grasp of SQL knowledge(DDL and DML).
- DDL: It covers items such as CREATE TABLE and ALTER TABLE.
- DML: It covers items such as Select, Update, Insert and Delete.
- You should also understand all the major clauses such as WHERE, GROUP BY, HAVING, and ORDER BY.
- In addition you should be comfortable with sub queries and joins.

Data Definition Language - DDL

- What is DDL?
- Four main DDL commands

1. CREATE – to create objects in the database.
2. DROP– to remove objects from the database.
3. ALTER– to modify the structure of database objects.
4. RENAME – to change database object names.



DDL – CREATE Command

- “CREATE” command is used to create new objects such as database, table etc.
- Creating Database

Syntax:

```
CREATE DATABASE [IF NOT EXIST] db_name;
```

- Creating Table

General Syntax:

```
CREATE  TABLE [IF NOT EXISTS] tblname (col-name dataType);
```

Database Constraints

- Before studying DDL & DML statements, you should learn database keys and constraints.
- Database Constraints are rules and restrictions applied on the columns of the table to meet data integrity.
- Types of Constraints:

1. Data Type
2. Nullability
3. Unique Key
4. Primary Key
5. Foreign Key
6. Default
7. Checked

1. Nullability Constraint

- It defines the column value accepts empty value or not.

General Syntax:

```
CREATE TABLE table-name
(
Column-name data-type NOT NULL,
Column-name datatype NULL,
…
);
```

2. UNIQUE Constraint

- It ensures the column will have unique value for each row.

General Syntax -1:

```
CREATE TABLE table_name
(
   col-name  data_type UNIQUE,
);
```

General Syntax - 2:

```
CREATE TABLE table_name(
   col-name data_type,
   …
UNIQUE(column_name)
);
```

3. PRIMARY KEY Constraint

- It forces the column to have unique value.
- This constraint is another type of UNIQUE constraint.

General Syntax -1:

```
CREATE TABLE table_name
(
col-name  data_type PRIMARY KEY,
);
```

General Syntax - 2:

```
CREATE TABLE table_name(
   col-name data_type,
   ...
PRIMARY KEY(column_name)
);
```

DML Contents

- DML
- Storing New Data
- Modifying Existing Data
- Removing Unused Data
- Data Retrieval

Data Manipulation Language - DML

- What is DML?
- Four main DML commands

1. INSERT to insert data into a table
2. UPDATE to update existing data within a table
3. DELETE to remove existing data from a table
4. SELECT to retrieve data from a table

Storing New Data

- INSERT INTO command is used to insert new records into the table.
- **Syntax 1:**

```
INSERT INTO table_name VALUES (value1,value2,value3,..., value_n);
```

- **Syntax 2:**

```
INSERT INTO table_name (col1,col2,col3,...) VALUES (val1, val2, val3,
...);
```

Example

User table				
id	name	email	township	city
1	Mg Mg	mgmg@gmail.com	Bahan	Yangon
2	Aung Aung	aung@gmail.com	Hlaing	Yangon
3	Kyaw Kyaw	kyaw@gmail.com	Mahar Myaing	Mandalay

```
INSERT INTO users (id,name,email,township,city)
VALUES (4, ‘Yuri’, ‘yuri@gmail.com’, ‘Chan Aye Thar San’, ‘Mandalay’)
```

Result				
id	name	email	township	city
1	Mg Mg	mgmg@gmail.com	Bahan	Yangon
2	Aung Aung	aung@gmail.com	Hlaing	Yangon
3	Kyaw Kyaw	kyaw@gmail.com	Mahar Myaing	Mandalay
4	Yuri	yuri@gmail.com	Chan Aye Thar San	Mandalay

Modifying Existing Data

- UPDATE command is used to update any record of data in a table.
- One or more fields can be updated together.
- **General Syntax:**

```
UPDATE table_name SET field1=new-value1, field2=new-value2
[WHERE Clause]
```

Example - 1

employee table			
id	name	age	salary
1	Yuki	22	3000
2	Mr. Jeon	23	5000
3	Kyaw Kyaw	20	2600

```
UPDATE employee SET salary = salary + (salary * 0.2) ;
```

Result			
id	name	age	salary
1	Yuki	22	3600
2	Mr. Jeon	23	6000
3	Kyaw Kyaw	20	3120

Example - 2

employee table			
id	name	age	salary
1	Yuki	22	3000
2	Mr. Jeon	23	5000
3	Kyaw Kyaw	20	2600

```
UPDATE employee SET name = ‘JK’ WHERE id= 3 ;
```

Result			
id	name	age	salary
1	Yuki	22	3000
2	Mr. Jeon	23	5000
3	JK	20	2600

Example - 3

employee table			
id	name	age	salary
1	Yuki	22	3000
2	Mr. Jeon	23	5000
3	Kyaw Kyaw	20	2600

```
UPDATE employee SET name = ‘JK’, salary = 6000 WHERE id= 3 ;
```

Result			
id	name	age	salary
1	Yuki	22	3000
2	Mr. Jeon	23	5000
3	JK	20	6000

Removing Unused Data

- DELETE command is used to delete data from a table.
- **Syntax:**

```
DELETE FROM table_name [WHERE condition];
```

- Drop command is used to permanently delete database objects. It is rarely used.
- **Syntax:**

```
DROP TABLE table_name;
```

Example

User table				
id	name	email	township	city
1	Mg Mg	mgmg@gmail.com	Bahan	Yangon
2	Aung Aung	aung@gmail.com	Hlaing	Yangon
3	Kyaw Kyaw	kyaw@gmail.com	Mahar Myaing	Mandalay
4	Yuri	yuri@gmail.com	Chan Aye Thar San	Mandalay

```
DELETE FROM users WHERE city = ‘Yangon’;
```

Result				
id	name	email	township	city
3	Kyaw Kyaw	kyaw@gmail.com	Mahar Myaing	Mandalay
4	Yuri	yuri@gmail.com	Chan Aye Thar San	Mandalay

Data Retrieval

- SELECT command is used to retrieve data from database.
- ***Syntax***

```
SELECT column1, column2,… FROM table_name;
```

```
SELECT * FROM table_name;
```

```
SELECT * FROM table_name LIMIT number;
```

Example - 1

User table				
id	name	email	township	city
1	Mg Mg	mgmg@gmail.com	Bahan	Yangon
2	Aung Aung	aung@gmail.com	Hlaing	Yangon
3	Kyaw Kyaw	kyaw@gmail.com	Mahar Myaing	Mandalay
4	Yuri	yuri@gmail.com	Chan Aye Thar San	Mandalay
5	Jeon	jeon@gmail.com	Pale	Monywa

```
SELECT name, city FROM users;
```

Result	
name	city
Mg Mg	Yangon
Aung Aung	Yangon
Kyaw Kyaw	Mandalay
Yuri	Mandalay
Jeon	Monywa

Example - 2

User table				
id	name	email	township	city
1	Mg Mg	mgmg@gmail.com	Bahan	Yangon
2	Aung Aung	aung@gmail.com	Hlaing	Yangon
3	Kyaw Kyaw	kyaw@gmail.com	Mahar Myaing	Mandalay
4	Yuri	yuri@gmail.com	Chan Aye Thar San	Mandalay
5	Jeon	jeon@gmail.com	Pale	Monywa

```
SELECT * FROM users LIMIT 3;
```

Result				
id	name	email	township	city
1	Mg Mg	mgmg@gmail.com	Bahan	Yangon
2	Aung Aung	aung@gmail.com	Hlaing	Yangon
3	Kyaw Kyaw	kyaw@gmail.com	Mahar Myaing	Mandalay

SELECT DISTINCT statement

- SELECT DISTINCT command is used to retrieve unique values from table.
- ***Syntax***

```
SELECT DISTINCT column-name FROM table_name;
```

Example

User table				
id	name	email	township	city
1	Mg Mg	mgmg@gmail.com	Bahan	Yangon
2	Aung Aung	aung@gmail.com	Hlaing	Yangon
3	Kyaw Kyaw	kyaw@gmail.com	Mahar Myaing	Mandalay
4	Yuri	yuri@gmail.com	Chan Aye Thar San	Mandalay
5	Jeon	jeon@gmail.com	Pale	Monywa

```
SELECT DISTINCT city FROM users;
```

Result
city
Yangon
Mandalay
Monywa

WHERE Clause

- WHERE clause is used to retrieve only user wanted data from database.
- ***Syntax***

```
SELECT column(s)
FROM table-name
WHERE col-name operator value;
```

Example

User table				
id	name	email	township	city
1	Mg Mg	mgmg@gmail.com	Bahan	Yangon
2	Aung Aung	aung@gmail.com	Hlaing	Yangon
3	Kyaw Kyaw	kyaw@gmail.com	Mahar Myaing	Mandalay
4	Yuri	yuri@gmail.com	Chan Aye Thar San	Mandalay
5	Jeon	jeon@gmail.com	Pale	Monywa

```
SELECT * FROM users WHERE city = ‘Mandalay’;
```

Result				
id	name	email	township	city
3	Kyaw Kyaw	kyaw@gmail.com	Mahar Myaing	Mandalay
4	Yuri	yuri@gmail.com	Chan Aye Thar San	Mandalay

List of Operators

Operator	**Meaning**
=	Equal
!=	Not equal
<>	
<	Less than
>	Greater than
<=	Less than or equal
>=	Greater than or equal
BETWEEN val1 IN val2	BETWEEN inclusive range
LIKE	Search for pattern matching
IN	To specify multiple possible values for a column

Example - 1

employee table			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT * FROM employee WHERE salary <= 6000;
```

Result			
id	name	city	salary
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

Example - 2

employee table			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT * FROM employee WHERE salary BETWEEN 9000 AND 6000;
```

Result			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000

Example - 3

employee table			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT * FROM employee WHERE salary IN (1000,4000,7800);
```

Result			
id	name	city	salary
2	Aung Aung	Yangon	7800
5	Jeon	Monywa	4000

LIKE Operator

- LIKE operator is used to perform pattern matching to find the correct result.
- ***Syntax*** :

```
--Starting pattern—
SELECT|UPDATE|DELETE
statements...
WHERE fieldname LIKE 'xx%';
```

```
--Ending pattern—
SELECT|UPDATE|DELETE statements...
WHERE fieldname LIKE '%xx ';
```

```
--Containing pattern--
SELECT|UPDATE|DELETE statements...
WHERE fieldname LIKE '%xx %';
```

Example - 1

employee table			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT * FROM employee WHERE name LIKE ‘a%’;
```

Result			
id	name	city	salary
2	Aung Aung	Yangon	7800

Example - 2

employee table			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT * FROM employee WHERE name LIKE ‘%g’;
```

Result			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800

Example - 3

employee table			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT * FROM employee WHERE name LIKE ‘%n%’;
```

Result			
id	name	city	salary
2	Aung Aung	Yangon	7800
5	Jeon	Monywa	4000

Logical Operator

- Logical operators are used with SELECT, INSERT, UPDATE or DELETE statements to test two or more conditions in an individual query.
- Three types of logical operators : AND, OR, NOT
- NOT operator can be used with a comparison operator to negate the result of the comparison.
  - NOT BETWEEN...AND...
  - NOT IN (value1, value2, value3 ...)
  - NOT LIKE

AND Operator

- AND Operator displays a record if all specified conditions are true.
- ***Syntax***

```
SELECT column(s)

FROM table-name

WHERE condition1 AND condition2 …….. AND condition-n;
```

Example

employee table			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT * FROM employee WHERE city = ‘Mandalay’ AND salary > 4000
```

Result			
id	name	city	salary
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200

OR Operator

- OR Operator displays a record if at least one condition is true.
- ***Syntax***

```
SELECT column(s)
FROM table-name
WHERE condition1 OR condition2 …….. OR condition-n;
```

Example

employee table

id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT * FROM employee WHERE city = ‘Mandalay’ OR salary > 4000
```

Result

id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200

Sorting Data

- ORDER BY clause is used to sort the query result sets by a specified column in descending or ascending order (default).
- ***Syntax***

```
SELECT column(s)
FROM table-name
[WHERE conditions]
ORDER BY column-name [ASC|DESC];
```

Example

employee table			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT * FROM employee ORDER BY salary ASC
```

id	name	city	salary
5	Jeon	Monywa	4000
4	Yuri	Mandalay	4200
3	Kyaw Kyaw	Mandalay	6000
2	Aung Aung	Yangon	7800
1	Mg Mg	Yangon	9000

Built-in Functions

- MySQL provides many built-in functions to perform operations on data.
- Aggregate : return a single value after performing calculations on a group of values. E.g. AVG, COUNT, MAX, MIN, SUM etc.
- Scalar : returns a single value from an input value. E.g. UCASE, LCASE, ROUND etc.

COUNT() Function

- COUNT function returns the number of records (NULL value will not be counted) of the specified columns.
- ***Syntax***

```
SELECT COUNT(columns)
FROM table-name
[WHERE conditions];
```

Example

employee table			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT COUNT(*)  ‘Total’ FROM employee WHERE city = ‘Yangon’;
```

Result
Total
2

```
SELECT COUNT(*)  ‘Total’ FROM employee
```

Result
Total
5

MAX(), MIN() Function

- MAX function returns the largest value of the selected column.
- ***Syntax***

```
SELECT MAX(column-name)
FROM table-name [WHERE conditions];
```

- MIN function returns the smallest value of the selected column.
- ***Syntax***

```
SELECT MIN(column-name)
FROM table-name [WHERE conditions];
```

Example

employee table			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT MIN(salary)  'Min Salary' FROM employee;
```

Result
Min Salary
4000

```
SELECT MAX(salary)  'Max Salary' FROM employee;
```

Result
Max Salary
9000

```
SELECT MAX(salary)  'Max Salary' FROM employee
WHERE city = 'Mandalay';
```

Result
Max Salary
6000

SUM(), AVG() Function

- SUM function returns the total sum of selected columns in numeric values.
- ***Syntax***

```
SELECT SUM(column-name)
FROM table-name [WHERE conditions];
```

- AVG function returns average value selected columns in numeric values.
- ***Syntax***

```
SELECT AVG(column-name)
FROM table-name [WHERE conditions];
```

Example

employee table			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT SUM(salary)  'Total Salary' FROM employee;
```

Result
Total Salary
31000

```
SELECT AVG(salary)  'Average Salary' FROM employee;
```

Result
Average Salary
6200

UCASE(), LCASE() Function

- UCASE function used to convert value of string column to uppercase characters.
- ***Syntax***

```
SELECT UCASE(column-name
FROM table-name [WHERE conditions];
```

- LCASE function used to convert value of string column to lowercase characters.
- ***Syntax***

```
SELECT LCASE(column-name)
FROM table-name [WHERE conditions];
```

Example

employee table			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT id, UCASE(name), LCASE(city) FROM employee;
```

id	name	city
1	MG MG	yangon
2	AUNG AUNG	yangon
3	KYAW KYAW	mandalay
4	YURI	mandalay
5	JEON	monywa

GROUP BY Clause

- GROUP BY clause is used to group the results of a SELECT query.
- It returns one row for each group.
- It is used with aggregate functions such as SUM, AVG, MAX, MIN, and COUNT.
- ***Syntax***

```
SELECT col-name, aggregate_function(ci)

FROM table-names

[WHERE clause]

GROUP BY col-name;
```

Example - 1

employee table			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT city, MAX(salary) ‘Maximum Salary’ FROM employee GROUP BY city;
```

Result	
city	Maximum Salary
Yangon	9000
Mandalay	6000
Monywa	4000

Example - 2

employee table			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT city, COUNT(*) ‘Total Employee’ FROM employee GROUP BY city;
```

Result	
city	Total Employee
Yangon	2
Mandalay	2
Monywa	1

HAVING Clause

- HAVING clause is used to restrict the results returned by the GROUP BY clause.
- It is used together with aggregate functions.
- HAVING clause must be placed immediately after GROUP BY clause.
- ***Syntax***

```
SELECT column-name, aggregate_function (ci)
FROM table-name
[WHERE conditions]
GROUP BY column-name
HAVING aggregate_function (ci) operator value;
```

Example

employee table			
id	name	city	salary
1	Mg Mg	Yangon	9000
2	Aung Aung	Yangon	7800
3	Kyaw Kyaw	Mandalay	6000
4	Yuri	Mandalay	4200
5	Jeon	Monywa	4000

```
SELECT city, COUNT(*) ‘Total Employee’ FROM employee
GROUP BY city HAVING COUNT(*) > 1;
```

Result	
city	Total Employee
Yangon	2
Mandalay	2

Q & A