



Chandigarh Engineering College Jhanjeri

Mohali-140307

Department of Artificial Intelligence (AI) and Data Sciences

Experiment-2

Experiment Name:

Data Definition & Manipulation (DDL & DML)

Objective:

To create tables using DDL commands and perform data insertion, updation, and deletion using DML commands

Prerequisites:

- Basic knowledge of SQL syntax.
- Understanding of database concepts (tables, rows, columns).

Key Terms: SQL Data types

System requirements:

- 4-8 GB RAM, 10-15 disk space, Windows OS
- MySQL Workbench 8.0 CE

Theory and Application:

SQL Database Data Types

DATA TYPES represents the type of data an object is holding. Data Types are defined for columns of a table, local/global variables, input/output arguments of procedures etc..

Each database system (MS SQL Server, MYSQL, DB2, Oracle etc.) have its own long list of data types but several data types are common in most of them. This article will list down common data types across various database systems.

Number Data Type

Few numeric data type has syntax of data_type(x). Here x is meant for precision value.

Date Time Data Type

- **datetime:** This data type stores both date and time values together. It supports dates ranging from **01/01/1753** to **12/31/9999** and requires **8 bytes** of storage. In some database systems, this data type is also referred to as a **timestamp**.
- **date:** This data type is used to store only the date component, without any time information.



- **time:** This data type stores only time-related information, without including the date.
- Some numeric data types follow the syntax **data_type(x)**, where x specifies the precision or size of the value.

String Data Type

- **char(x):** This data type stores fixed-length character data and is padded with spaces to match the specified length. Here, x defines the exact number of characters to be stored.
- **varchar(x):** Short for *variable characters*, this data type stores character data of variable length and does not add extra spaces. The value of x specifies the maximum number of characters allowed.
- **text:** This data type is used to store large or lengthy textual data.
- Some numeric data types use the syntax **data_type(x)**, where x represents the precision of the value.

Other Data Type

- **blob:** Binary Large Object. This type is used to store large amount of binary date such as images or other type of files.
- **money:** In few databases also termed as currency. The type is used to storage money/currency information
- **binary:** The data type is used to store information in binary string format.



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1. CREATE & USE DATABASE

Syntax

```
CREATE DATABASE Db3;  
USE Db3;
```

The screenshot shows the MySQL Workbench interface. In the SQL editor tab, two statements are visible:

```
1 • CREATE DATABASE Db3;  
2 • USE Db3;
```

The output pane shows the results of these statements:

#	Time	Action	Message	Duration / Fetch
1	17:51:52	CREATE DATABASE Db3	1 row(s) affected	0.016 sec
2	17:51:52	USE Db3	0 row(s) affected	0.000 sec

Figure 1: CREATE & USE Database



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2. CREATE TABLE

Syntax

```
CREATE TABLE building (
    building_id INT AUTO_INCREMENT PRIMARY KEY,
    name VARCHAR(50) NOT NULL UNIQUE,
    location VARCHAR(100) DEFAULT 'Unknown'
);
```

The screenshot shows the MySQL Workbench interface. In the SQL editor tab, the following SQL code is written:

```
CREATE DATABASE Db3;
USE Db3;
CREATE TABLE building (
    building_id INT AUTO_INCREMENT PRIMARY KEY,
    name VARCHAR(50) NOT NULL UNIQUE,
    location VARCHAR(100) DEFAULT 'Unknown'
);
```

The Output tab displays the execution results:

#	Action	Time	Message	Duration / Fetch
1	CREATE DATABASE Db3	17:51:52	1 row(s) affected	0.016 sec
2	USE Db3	17:51:52	0 row(s) affected	0.000 sec
3	CREATE TABLE building (building_id INT AUTO_INCREMENT PRIMARY KEY, name VARCHAR(50) NOT N...	17:53:49	0 row(s) affected	0.094 sec

Figure 2: CREATE TABLE

Creates building table with PRIMARY KEY, AUTO_INCREMENT, NOT NULL, UNIQUE, DEFAULT value.



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```
CREATE TABLE room1 (
room_id INT AUTO_INCREMENT PRIMARY KEY,
chair INT NOT NULL,
bench INT NOT NULL,
is_active BOOLEAN DEFAULT TRUE,
building_id INT,
FOREIGN KEY (building_id) REFERENCES building(building_id)
);
```

The screenshot shows the MySQL Workbench interface with the following details:

- Navigator:** Shows the database schema with tables: db1, db2, dbms, office, officel, restaurant, sakila, samples, sys, world, xy.
- SQL Editor:** The SQL editor tab is active, displaying the CREATE TABLE statement for room1.
- Output:** The Action Output pane shows the execution log with the following entries:

#	Time	Action	Message	Duration / Fetch
1	17:51:52	CREATE DATABASE Db3	1 row(s) affected	0.016 sec
2	17:51:52	USE Db3	0 row(s) affected	0.000 sec
3	17:53:49	CREATE TABLE building (building_id INT AUTO_INCREMENT PRIMARY KEY, name VARCHAR(50) NOT NULL UNIQUE, location VARCHAR(100) DEFAULT 'Unknown');	0 row(s) affected	0.094 sec
4	17:59:14	CREATE TABLE room1 (room_id INT AUTO_INCREMENT PRIMARY KEY, chair INT NOT NULL, bench INT NOT NULL, is_active BOOLEAN DEFAULT TRUE, building_id INT, FOREIGN KEY (building_id) REFERENCES building(building_id));	0 row(s) affected	0.063 sec
5	17:59:14	INSERT INTO building (name, location) VALUES ('Main Block', 'Campus A'), ('Science Block', 'Campus B');	2 row(s) affected Records: 2 Duplicates: 0 Warnings: 0	0.016 sec

Figure 3: CREATE room1 TABLE

Creates room1 with NOT NULL, DEFAULT and a FOREIGN KEY referencing building.



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3. INSERT

Syntax

```
INSERT INTO building (name, location) VALUES
```

```
('Main Block', 'Campus A'),
```

```
('Science Block', 'Campus B');
```

```
INSERT INTO room1 (chair, bench, is_active, building_id) VALUES
```

```
(20, 10, TRUE, 1),
```

```
(15, 7, FALSE, 2);
```

The screenshot shows the MySQL Workbench interface. In the SQL editor tab, there are two queries:

```
CREATE DATABASE Db3;
USE Db3;
CREATE TABLE building (
    building_id INT AUTO_INCREMENT PRIMARY KEY, name VARCHAR(50) NOT NULL UNIQUE,
    location VARCHAR(100) DEFAULT 'Unknown');
CREATE TABLE room1 (
    room_id INT AUTO_INCREMENT PRIMARY KEY, chair INT NOT NULL, bench INT NOT NULL,
    is_active BOOLEAN DEFAULT TRUE, building_id INT, FOREIGN KEY (building_id) REFERENCES building(building_id));
INSERT INTO building (name, location) VALUES ('Main Block', 'Campus A'),('Science Block', 'Campus B');
INSERT INTO room1 (chair, bench, is_active, building_id) VALUES (20, 10, TRUE, 1),(15, 7, FALSE, 2);
```

In the Output pane, the results of the execution are shown:

#	Time	Action	Message	Duration / Fetch
1	17:51:52	CREATE DATABASE Db3	1 row(s) affected	0.016 sec
2	17:51:52	USE Db3	0 row(s) affected	0.000 sec
3	17:53:49	CREATE TABLE building (building_id INT AUTO_INCREMENT PRIMARY KEY, name VARCHAR(50) NOT N...	0 row(s) affected	0.094 sec
4	17:59:14	CREATE TABLE room1 (room_id INT AUTO_INCREMENT PRIMARY KEY, chair INT NOT NULL, bench INT...	0 row(s) affected	0.063 sec
5	17:59:14	INSERT INTO building (name, location) VALUES ('Main Block', 'Campus A'),('Science Block', 'Campus B')	2 row(s) affected Records: 2 Duplicates: 0 Warnings: 0	0.016 sec
6	18:03:08	INSERT INTO room1 (chair, bench, is_active, building_id) VALUES (20, 10, TRUE, 1),(15, 7, FALSE, 2)	2 row(s) affected Records: 2 Duplicates: 0 Warnings: 0	0.046 sec

Figure 4: INSERT



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4. SELECT

Syntax

SELECT * FROM building;

SELECT * FROM room1;

The screenshot shows the MySQL Workbench interface with the following details:

- File Bar:** MySQL Workbench, Local instance MySQL80.
- Toolbar:** Standard MySQL Workbench toolbar.
- Navigator:** Schemas (db1, db2, db3, db4, db5, db6, db7, db8, db9, db10, db11, db12, db13, db14, db15, db16, db17, db18, db19, db20, db21, db22, db23, db24, db25, db26, db27, db28, db29, db30, db31, db32, db33, db34, db35, db36, db37, db38, db39, db40, db41, db42, db43, db44, db45, db46, db47, db48, db49, db50, db51, db52, db53, db54, db55, db56, db57, db58, db59, db60, db61, db62, db63, db64, db65, db66, db67, db68, db69, db70, db71, db72, db73, db74, db75, db76, db77, db78, db79, db80, db81, db82, db83, db84, db85, db86, db87, db88, db89, db90, db91, db92, db93, db94, db95, db96, db97, db98, db99, db100).
- SQL Editor:** Contains the following SQL code:

```
4   building_id INT AUTO_INCREMENT PRIMARY KEY, name VARCHAR(50) NOT NULL UNIQUE,
5   location VARCHAR(100) DEFAULT 'Unknown';
6 • CREATE TABLE room1 (
7   room_id INT AUTO_INCREMENT PRIMARY KEY, chair INT NOT NULL, bench INT NOT NULL,
8   is_active BOOLEAN DEFAULT TRUE, building_id INT, FOREIGN KEY (building_id) REFERENCES building(building_id));
9 • INSERT INTO building (name, location) VALUES ('Main Block', 'Campus A'), ('Science Block', 'Campus B');
10 • INSERT INTO room1 (chair, bench, is_active, building_id) VALUES (20, 10, TRUE, 1), (15, 7, FALSE, 2);
11 • SELECT * FROM building;
12 • SELECT * FROM room1;
```
- Result Grid:** Shows the results of the SELECT query on the room1 table.

room_id	chair	bench	is_active	building_id
1	20	10	1	1
2	15	7	0	2
•	NULL	NULL	NULL	NULL
- Action Output:** Shows the log of actions taken during the session, including table creation and data insertion.

#	Time	Action	Message	Duration / Fetch
3	17:53:49	CREATE TABLE building (building_id INT AUTO_INCREMENT PRIMARY KEY, name VARCHAR(50) NOT...)	0 row(s) affected	0.094 sec
4	17:59:14	CREATE TABLE room1 (room_id INT AUTO_INCREMENT PRIMARY KEY, chair INT NOT NULL, bench ...)	0 row(s) affected	0.063 sec
5	17:59:14	INSERT INTO building (name, location) VALUES ('Main Block', 'Campus A'), ('Science Block', 'Campus B')	2 row(s) affected Records: 2 Duplicates: 0 Warnings: 0	0.016 sec
6	18:03:08	INSERT INTO room1 (chair, bench, is_active, building_id) VALUES (20, 10, TRUE, 1), (15, 7, FALSE, 2)	2 row(s) affected Records: 2 Duplicates: 0 Warnings: 0	0.046 sec
7	18:06:10	SELECT * FROM building LIMIT 0, 1000	2 row(s) returned	0.000 sec / 0.000 sec
8	18:06:10	SELECT * FROM room1 LIMIT 0, 1000	2 row(s) returned	0.000 sec / 0.000 sec

Figure 5: SELECT



5. UPDATE

Syntax

```
UPDATE room1 SET chair = 25 WHERE room_id = 1;
```

The screenshot shows the MySQL Workbench interface. In the SQL editor tab, the following SQL code is displayed:

```
CREATE TABLE room1 (
    location VARCHAR(100) DEFAULT 'Unknown';
)
CREATE TABLE building (
    name VARCHAR(100),
    location VARCHAR(100) DEFAULT 'Unknown'
)
CREATE TABLE room1 (
    room_id INT AUTO_INCREMENT PRIMARY KEY,
    chair INT NOT NULL,
    bench INT NOT NULL,
    is_active BOOLEAN DEFAULT TRUE,
    building_id INT,
    FOREIGN KEY (building_id) REFERENCES building(building_id)
)
INSERT INTO building (name, location) VALUES ('Main Block', 'Campus A'), ('Science Block', 'Campus B');
INSERT INTO room1 (chair, bench, is_active, building_id) VALUES (20, 10, TRUE, 1), (15, 7, FALSE, 2);
SELECT * FROM building;
SELECT * FROM room1;
UPDATE room1 SET chair = 25 WHERE room_id = 1;
```

The Result Grid shows the following data:

room_id	chair	bench	is_active	building_id
1	25	10	1	1
2	15	7	0	2

The Action Output pane shows the execution log:

#	Time	Action	Message	Duration / Fetch
5	17:59:14	INSERT INTO building (name, location) VALUES ('Main Block', 'Campus A'), ('Science Block', 'Campus B')	2 row(s) affected Records: 2 Duplicates: 0 Warnings: 0	0.016 sec
6	18:03:08	INSERT INTO room1 (chair, bench, is_active, building_id) VALUES (20, 10, TRUE, 1), (15, 7, FALSE, 2)	2 row(s) affected Records: 2 Duplicates: 0 Warnings: 0	0.046 sec
7	18:06:10	SELECT * FROM building LIMIT 0, 1000	2 row(s) returned	0.000 sec / 0.000 sec
8	18:06:10	SELECT * FROM room1 LIMIT 0, 1000	2 row(s) returned	0.000 sec / 0.000 sec
9	18:07:26	UPDATE room1 SET chair = 25 WHERE room_id = 1	1 row(s) affected Rows matched: 1 Changed: 1 Warnings: 0	0.016 sec
10	18:07:36	SELECT * FROM room1 LIMIT 0, 1000	2 row(s) returned	0.000 sec / 0.000 sec

Figure 6: UPDATE



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6. DELETE

Syntax:

DELETE FROM room1 WHERE room_id = 2;

The screenshot shows the MySQL Workbench interface with the following details:

- Navigator:** Shows available databases: db1, db2, dbms, office, office1, restaurant, sakila, samples, sys, world, xy.
- SQL Editor:** Displays the SQL code:

```
CREATE TABLE room1 (
    room_id INT AUTO_INCREMENT PRIMARY KEY,
    chair INT NOT NULL,
    bench INT NOT NULL,
    is_active BOOLEAN DEFAULT TRUE,
    building_id INT,
    FOREIGN KEY (building_id) REFERENCES building(building_id));
INSERT INTO building (name, location) VALUES ('Main Block', 'Campus A'), ('Science Block', 'Campus B');
INSERT INTO room1 (chair, bench, is_active, building_id) VALUES (20, 10, TRUE, 1), (15, 7, FALSE, 2);
SELECT * FROM building;
SELECT * FROM room1;
UPDATE room1 SET chair = 25 WHERE room_id = 1;
DELETE FROM room1 WHERE room_id = 2;
```
- Result Grid:** Shows the initial state of the room1 table:

room_id	chair	bench	is_active	building_id
1	25	10	1	1
2	15	7	0	2
- Action Output:** Shows the log of executed statements:

#	Time	Action	Message	Duration / Fetch
7	18:06:10	SELECT * FROM building LIMIT 0, 1000	2 row(s) returned	0.000 sec / 0.000 sec
8	18:06:10	SELECT * FROM room1 LIMIT 0, 1000	2 row(s) returned	0.000 sec / 0.000 sec
9	18:07:26	UPDATE room1 SET chair = 25 WHERE room_id = 1	1 row(s) affected Rows matched: 1 Changed: 1 Warnings: 0	0.016 sec
10	18:07:36	SELECT * FROM room1 LIMIT 0, 1000	2 row(s) returned	0.000 sec / 0.000 sec
11	18:10:09	DELETE FROM room1 WHERE room_id = 2	1 row(s) affected	0.016 sec
12	18:10:15	SELECT * FROM room1 LIMIT 0, 1000	1 row(s) returned	0.000 sec / 0.000 sec

Figure 7: DELETE



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7. ALTER

Syntax:

ALTER TABLE room1 ADD COLUMN projector BOOLEAN DEFAULT FALSE;

ALTER TABLE room1 MODIFY COLUMN bench INT NOT NULL;

ALTER TABLE room1 ADD CONSTRAINT unique_room UNIQUE (chair, bench);

The screenshot shows the MySQL Workbench interface with the following details:

- Navigator:** Shows the Schemas: db1, db2, dbms, office, office1, restaurant, sakila, samples, sys, world, xy.
- SQL Editor:** Contains the following SQL code:

```
9 • INSERT INTO building (name, location) VALUES ('Main Block', 'Campus A'), ('Science Block', 'Campus B');
10 • INSERT INTO room1 (chair, bench, is_active, building_id) VALUES (20, 10, TRUE, 1), (15, 7, FALSE, 2);
11 • SELECT * FROM building;
12 • SELECT * FROM room1;
13 • UPDATE room1 SET chair = 25 WHERE room_id = 1;
14 • DELETE FROM room1 WHERE room_id = 2;
15 • ALTER TABLE room1 ADD COLUMN projector BOOLEAN DEFAULT FALSE;
16 • ALTER TABLE room1 MODIFY COLUMN bench INT NOT NULL;
17 • ALTER TABLE room1 ADD CONSTRAINT unique_room UNIQUE (chair, bench);
```
- Result Grid:** Displays the data from the room1 table:

room_id	chair	bench	is_active	building_id	projector
1	25	10	1	1	0
2	15	7	0	2	0
- Output:** Shows the history of actions taken on the table:

#	Time	Action	Message	Duration / Fetch
11	18:10:09	DELETE FROM room1 WHERE room_id > 2	1 row(s) affected	0.016 sec
12	18:10:15	SELECT * FROM room1 LIMIT 0, 1000	1 row(s) returned	0.000 sec / 0.000 sec
13	18:12:43	ALTER TABLE room1 ADD COLUMN projector BOOLEAN DEFAULT FALSE	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.031 sec
14	18:12:43	ALTER TABLE room1 MODIFY COLUMN bench INT NOT NULL	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.016 sec
15	18:12:43	ALTER TABLE room1 ADD CONSTRAINT unique_room UNIQUE (chair, bench)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.062 sec
16	18:12:52	SELECT * FROM room1 LIMIT 0, 1000	1 row(s) returned	0.000 sec / 0.000 sec

Figure 8: ALTER

8. RENAME

Syntax:

RENAME TABLE room1 TO classroom;



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The screenshot shows the MySQL Workbench interface with the SQL editor tab selected. The code pane contains the following SQL script:

```

CREATE DATABASE Db3;
USE Db3;
CREATE TABLE building (
    building_id INT AUTO_INCREMENT PRIMARY KEY, name VARCHAR(50) NOT NULL UNIQUE,
    location VARCHAR(100) DEFAULT 'Unknown');
CREATE TABLE room1 (
    room_id INT AUTO_INCREMENT PRIMARY KEY, chair INT NOT NULL, bench INT NOT NULL,
    is_active BOOLEAN DEFAULT TRUE, building_id INT, FOREIGN KEY (building_id) REFERENCES building(building_id));
INSERT INTO building (name, location) VALUES ('Main Block', 'Campus A'), ('Science Block', 'Campus B');
INSERT INTO room1 (chair, bench, is_active, building_id) VALUES (20, 10, TRUE, 1), (15, 7, FALSE, 2);
SELECT * FROM building;
SELECT * FROM room1;
UPDATE room1 SET chair = 25 WHERE room_id = 1;
DELETE FROM room1 WHERE room_id = 2;
ALTER TABLE room1 ADD COLUMN projector BOOLEAN DEFAULT FALSE;
ALTER TABLE room1 MODIFY COLUMN bench INT NOT NULL;
ALTER TABLE room1 ADD CONSTRAINT unique_room UNIQUE (chair, bench);
RENAME TABLE room1 TO classroom;

```

The output pane shows the results of the commands:

#	Time	Action	Message	Duration / Fetch
12	18:10:15	SELECT * FROM room1 LIMIT 0, 1000	1 row(s) returned	0.000 sec / 0.000 sec
13	18:12:43	ALTER TABLE room1 ADD COLUMN projector BOOLEAN DEFAULT FALSE	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.031 sec
14	18:12:43	ALTER TABLE room1 MODIFY COLUMN bench INT NOT NULL	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.016 sec
15	18:12:43	ALTER TABLE room1 ADD CONSTRAINT unique_room UNIQUE (chair, bench)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.062 sec
16	18:12:52	SELECT * FROM room1 LIMIT 0, 1000	1 row(s) returned	0.000 sec / 0.000 sec
17	18:14:34	RENAME TABLE room1 TO classroom	0 row(s) affected	0.047 sec

Figure 9: RENAME

9. TRUNCATE

Syntax:

TRUNCATE TABLE classroom;

The screenshot shows the MySQL Workbench interface with the SQL editor tab selected. The code pane contains the following SQL script, identical to Figure 9:

```

CREATE DATABASE Db3;
USE Db3;
CREATE TABLE building (
    building_id INT AUTO_INCREMENT PRIMARY KEY, name VARCHAR(50) NOT NULL UNIQUE,
    location VARCHAR(100) DEFAULT 'Unknown');
CREATE TABLE room1 (
    room_id INT AUTO_INCREMENT PRIMARY KEY, chair INT NOT NULL, bench INT NOT NULL,
    is_active BOOLEAN DEFAULT TRUE, building_id INT, FOREIGN KEY (building_id) REFERENCES building(building_id));
INSERT INTO building (name, location) VALUES ('Main Block', 'Campus A'), ('Science Block', 'Campus B');
INSERT INTO room1 (chair, bench, is_active, building_id) VALUES (20, 10, TRUE, 1), (15, 7, FALSE, 2);
SELECT * FROM building;
SELECT * FROM room1;
UPDATE room1 SET chair = 25 WHERE room_id = 1;
DELETE FROM room1 WHERE room_id = 2;
ALTER TABLE room1 ADD COLUMN projector BOOLEAN DEFAULT FALSE;
ALTER TABLE room1 MODIFY COLUMN bench INT NOT NULL;
ALTER TABLE room1 ADD CONSTRAINT unique_room UNIQUE (chair, bench);
RENAME TABLE room1 TO classroom;
TRUNCATE TABLE classroom;

```

The output pane shows the results of the commands:

#	Time	Action	Message	Duration / Fetch
13	18:12:43	ALTER TABLE room1 ADD COLUMN projector BOOLEAN DEFAULT FALSE	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.031 sec
14	18:12:43	ALTER TABLE room1 MODIFY COLUMN bench INT NOT NULL	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.016 sec
15	18:12:43	ALTER TABLE room1 ADD CONSTRAINT unique_room UNIQUE (chair, bench)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.062 sec
16	18:12:52	SELECT * FROM room1 LIMIT 0, 1000	1 row(s) returned	0.000 sec / 0.000 sec
17	18:14:34	RENAME TABLE room1 TO classroom	0 row(s) affected	0.047 sec
18	18:16:22	TRUNCATE TABLE classroom	0 row(s) affected	0.078 sec

Figure 10: TRUNCATE