# TCL & DCL Commands

🎯 Session Objectives

- ☑ Understand what TCL (Transaction Control Language) is.

- ☑ Learn how to use COMMIT, ROLLBACK, and SAVEPOINT.

- ☑ Explore how TCL enforces ACID properties (Atomicity, Consistency, Isolation, Durability).

- ☑ Understand practical usage with real SQL examples

SYNTAX:

```
GRANT privilege_name
ON object_name
TO {user_name | PUBLIC | role_name}
[WITH GRANT OPTION];
```

```
TRANSACTION CONTROL LANGUAGE

   COMMIT        ROLLBACK        SAVEPOINT


        DATA CONTROL LANGUAGE

   GRANT                        REVOKE
```
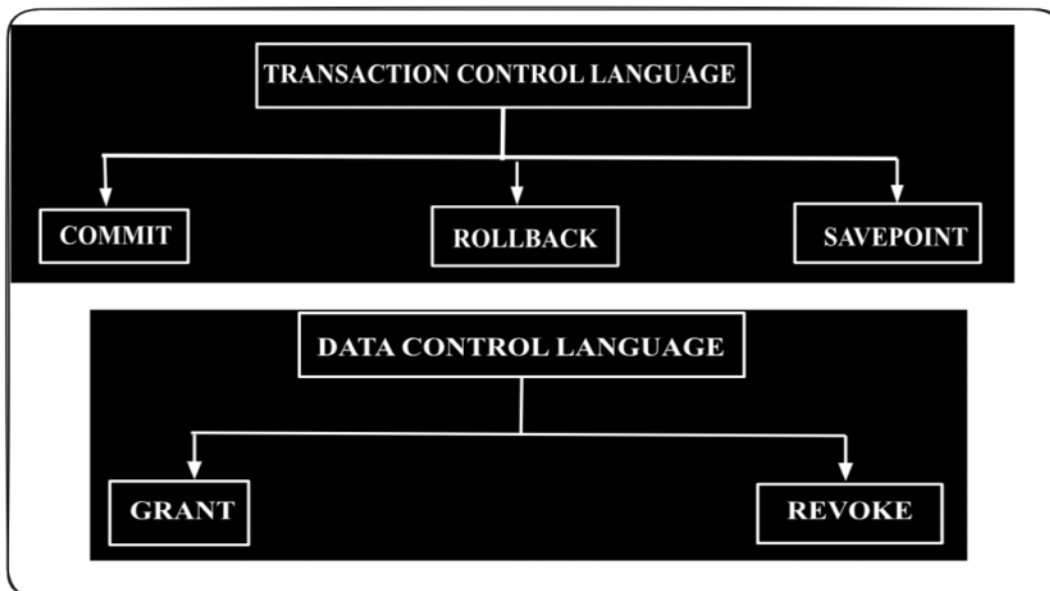
```
-- TCL [Transaction Control Language]
START TRANSACTION;
USE bike_analysis;
DESC Products;
SELECT * FROM Products;

INSERT INTO Products(ProductKey, ProductName, ProductPrice)
VALUES(607,"Tesla ModelX", 9999.99);

INSERT INTO Products(ProductKey, ProductName, ProductPrice)
VALUES(608,"Tesla ModelY", 9999.99);

INSERT INTO Products(ProductKey, ProductName, ProductPrice)
VALUES(609,"Tesla ModelZ", 9999.99);
COMMIT;
ROLLBACK;
```

```sql
SET SQL_SAFE_UPDATES = 0;
DELETE FROM Products WHERE ProductKey = 607;
DELETE FROM Products WHERE ProductKey = 608;
DELETE FROM Products WHERE ProductKey = 609;
```

```sql
-- AUTOCOMMIT = 0;
SET AUTOCOMMIT = 0; -- AutoCommit OFF
SET AUTOCOMMIT = 1; -- AutoCommit ON [BY DEFAULT]
```

```sql
-- SAVEPOINT
SELECT * FROM Products;
START TRANSACTION;

INSERT INTO Products(ProductKey, ProductName, ProductPrice)
VALUES(607,"Tesla ModelX", 9999.99);

SAVEPOINT modelX;

INSERT INTO Products(ProductKey, ProductName, ProductPrice)
VALUES(608,"Tesla ModelY", 9999.99);

SAVEPOINT modelY;

INSERT INTO Products(ProductKey, ProductName, ProductPrice)
VALUES(609,"Tesla ModelZ", 9999.99);

COMMIT;
ROLLBACK TO SAVEPOINT modelX; -- it removes ModelY,ModelZ
ROLLBACK TO SAVEPOINT modelY; -- it removes ModelZ
ROLLBACK;
```

ACID Properties in TCL

A - Atomicity
C - Consistency
I - Isolation
D - Durability.

```sql
CREATE TABLE bank_transactions(
    txn_id INT AUTO_INCREMENT PRIMARY KEY,
    account_id INT,
    balance DECIMAL(10,2),
    remarks VARCHAR(100),
    txn_time TIMESTAMP DEFAULT CURRENT_TIMESTAMP
);
DESC bank_transactions;
```

Field	Type	Null	Key	Default	Extra
txn_id	int	NO	PRI	NULL	auto_increment
account_id	int	YES		NULL	
balance	decimal(...	YES		NULL	
remarks	varchar...	YES		NULL	
txn_time	timestamp	YES		CURRENT_TIMESTAMP	DEFAULT_GENERATED

```sql
INSERT INTO bank_transactions(account_id, balance, remarks) VALUES
(1, 1000.00 , 'Opening Balance'),
(2, 2000.00 , 'Opening Balance');

SELECT * FROM bank_transactions;
```

txn_id	account_id	balance	remarks	txn_time
1	1	1000.00	Opening Balance	2025-07-17 22:17:01
2	2	2000.00	Opening Balance	2025-07-17 22:17:01
NULL	NULL	NULL	NULL	NULL

```sql
-- ATOMICITY - ALL OR NOTHING Execution
START TRANSACTION;

INSERT INTO bank_transactions(account_id, balance, remarks) VALUES
(1, -500.00 , 'Debit For Transfer');
SELECT * FROM bank_transactions;

INSERT INTO bank_transactions(account_id, balance, remarks) VALUES
("INVALID" , 500.00 , 'Credit For Transfer');
-- Error Code: 1366. Incorrect integer value: 'INVALID'
for column 'account_id' at row 1

ROLLBACK;


-- ATOMICITY - ALL OR NOTHING Execution
START TRANSACTION;

INSERT INTO bank_transactions(account_id, balance, remarks) VALUES
(1, -500.00 , 'Debit For Transfer');
SELECT * FROM bank_transactions;

INSERT INTO bank_transactions(account_id, balance, remarks) VALUES
(2, 500.00 , 'Debit For Transfer');

-- ROLLBACK;
COMMIT;
```

txn_id	account_id	balance	remarks	txn_time
1	1	1000.00	Opening Balance	2025-07-17 22:17:01
2	2	2000.00	Opening Balance	2025-07-17 22:17:01
4	1	-500.00	Debit For Transfer	2025-07-17 22:23:44
5	2	500.00	Debit For Transfer	2025-07-17 22:24:03

```
-- To find the current balance
SELECT
    account_id,
    SUM(balance) AS remaining_balance
FROM bank_transactions
GROUP BY account_id;
```

account_id	remaining_balance
1	500.00
2	2500.00

Consistency

```
-- Consistency -- total amount still be same
START TRANSACTION;

INSERT INTO bank_transactions(account_id, balance, remarks) VALUES
(2, -1500.00 , 'Debit For Transfer');
SELECT * FROM bank_transactions;

INSERT INTO bank_transactions(account_id, balance, remarks) VALUES
(1, 1500.00 , 'Credit For Transfer');

-- ROLLBACK;
COMMIT;
```

account_id	remaining_balance
1	2000.00
2	1000.00

ISOLATION

```
327 •  START TRANSACTION;
328 •  SELECT
329        SUM(balance) AS remaining_balance
330    FROM bank_transactions
331    WHERE account_id = 1;
332
333 •  COMMIT; -- (Don't commit yet)
334
```

Result Grid	Filter Rows:	Export:	Wrap Cell Content:

remaining_balance
2000.00

```
-- ISOLATION  -- Transaction They Don't interfere
START TRANSACTION;
SELECT
    SUM(balance) AS remaining_balance
FROM bank_transactions
WHERE account_id = 1;

COMMIT; -- (Don't commit yet)

START TRANSACTION; -- [Parallel Transactions]

INSERT INTO bank_transactions(account_id, balance, remarks) VALUES
(1, +200.00 , 'Deposit');

COMMIT;
```

	remaining_balance
▶	2200.00

Durability

```
-- DURABILITY -- Changes Persists after commit
START TRANSACTION;

INSERT INTO bank_transactions(account_id, balance, remarks) VALUES
(1, -100.00 , 'ATM Withdrawl');

COMMIT;

-- After commit, even your system crashed, once commit can't rollback.
```

```
353     -- Final Stage
354 •   SELECT * FROM bank_transactions
355     ORDER BY txn_time;
```

txn_id	account_id	balance	remarks	txn_time
1	1	1000.00	Opening Balance	2025-07-17 22:17:01
2	2	2000.00	Opening Balance	2025-07-17 22:17:01
4	1	-500.00	Debit For Transfer	2025-07-17 22:23:44
5	2	500.00	Debit For Transfer	2025-07-17 22:24:03
6	2	-1500.00	Debit For Transfer	2025-07-17 22:33:12
7	1	1500.00	Credit For Transfer	2025-07-17 22:33:20
8	1	200.00	Deposit	2025-07-17 22:39:59
9	1	-100.00	ATM Withdrawl	2025-07-17 22:43:35
NULL	NULL	NULL	NULL	NULL

```
307 •  SELECT
308        account_id,
309        SUM(balance) AS remaining_balance
310    FROM bank_transactions
311    GROUP BY account_id;
```

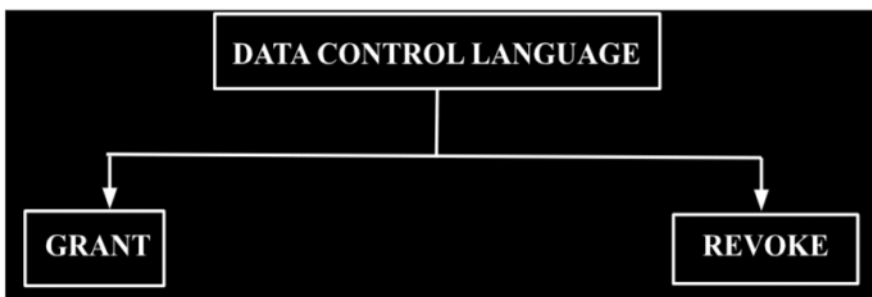|	account_id	remaining_balance
▶	1	2100.00
	2	1000.00

DCL - Data Control language

SYNTAX:

```
GRANT privilege_name
ON object_name
TO {user_name | PUBLIC | role_name}
[WITH GRANT OPTION];
```

DBA - Database Admin


```
-- DCL [Data Control Language]
CREATE DATABASE dcl_demo;
USE dcl_demo;

CREATE TABLE employee_data(
        emp_id INT PRIMARY KEY,
    emp_name VARCHAR(100),
    salary DECIMAL(10,2)
);

DESC employee_data;

# Let's create users
CREATE USER 'report'@'localhost' IDENTIFIED BY 'report123';
CREATE USER 'ops'@'localhost' IDENTIFIED BY 'ops123';

# Grant Some Access to the users
GRANT SELECT ON dcl_demo.employee_data TO 'report'@'localhost';
GRANT INSERT ON dcl_demo.employee_data TO 'ops'@'localhost';
```

```
C:\Users\krish>mysql -u report -p
'mysql' is not recognized as an internal or external command,
operable program or batch file.
```

```
C:\Users\krish>"C:\Program Files\MySQL\MySQL Server 8.0\bin\mysql.exe" -u report -p
Enter password: *********
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 30
Server version: 8.0.42 MySQL Community Server - GPL

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owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.
```

```
mysql> SHOW DATABASES;
+--------------------+
| Database           |
+--------------------+
| dcl_demo           |
| information_schema |
| performance_schema |
+--------------------+
3 rows in set (0.13 sec)

mysql> USE dcl_demo;
Database changed
mysql> SHOW TABLES;
+--------------------+
| Tables_in_dcl_demo |
+--------------------+
| employee_data      |
+--------------------+
1 row in set (0.04 sec)

mysql> DESC employee_data;
+----------+---------------+------+-----+---------+-------+
| Field    | Type          | Null | Key | Default | Extra |
+----------+---------------+------+-----+---------+-------+
| emp_id   | int           | NO   | PRI | NULL    |       |
| emp_name | varchar(100)  | YES  |     | NULL    |       |
| salary   | decimal(10,2) | YES  |     | NULL    |       |
+----------+---------------+------+-----+---------+-------+
```

```
mysql> INSERT INTO employee_data
    -> VALUES(1,"Kuldeep",100000.00);
ERROR 1142 (42000): INSERT command denied to user 'report'@'localhost' for table 'employee_data'
```

```
    -> ^Z
Bye
```

```
C:\Users\krish>"C:\Program Files\MySQL\MySQL Server 8.0\bin\mysql.exe" -u ops -p
Enter password: ******
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 31
Server version: 8.0.42 MySQL Community Server - GPL

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owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> SHOW DATABASES;
+--------------------+
| Database           |
+--------------------+
| dcl_demo           |
| information_schema |
| performance_schema |
+--------------------+
3 rows in set (0.06 sec)
```

```
mysql> DESC employee_data;
+----------+---------------+------+-----+---------+-------+
| Field    | Type          | Null | Key | Default | Extra |
+----------+---------------+------+-----+---------+-------+
| emp_id   | int           | NO   | PRI | NULL    |       |
| emp_name | varchar(100)  | YES  |     | NULL    |       |
| salary   | decimal(10,2) | YES  |     | NULL    |       |
+----------+---------------+------+-----+---------+-------+
3 rows in set (0.02 sec)

mysql> SELECT * FROM employee_data;
ERROR 1142 (42000): SELECT command denied to user 'ops'@'localhost' for table 'employee_data'
mysql> INSERT INTO employee_data
    -> VALUES(1,"Kuldeep",100000.00);
Query OK, 1 row affected (0.03 sec)

mysql> INSERT INTO employee_data VALUES
    -> (2,"Aman",100000.00),
    -> (3,"Utkarsh",100000.00 ),
    -> (101, 'Alice', 50000),
    -> (102, 'Bob', 60000),
    -> (103, 'Charlie', 55000);
Query OK, 5 rows affected (0.01 sec)
Records: 5  Duplicates: 0  Warnings: 0

mysql> SELECT * FROM employee_data;
ERROR 1142 (42000): SELECT command denied to user 'ops'@'localhost' for table 'employee_data'
mysql>
```

```
C:\Users\krish>"C:\Program Files\MySQL\MySQL Server 8.0\bin\mysql.exe" -u report -p
Enter password: *********
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 32
Server version: 8.0.42 MySQL Community Server - GPL

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owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> SHOW DATABASES;
+--------------------+
| Database           |
+--------------------+
| dcl_demo           |
| information_schema |
| performance_schema |
+--------------------+
3 rows in set (0.06 sec)
```

```
mysql> USE dcl_demo;
Database changed
mysql> SHOW TABLES;
+------------------+
| Tables_in_dcl_demo |
+------------------+
| employee_data    |
+------------------+
1 row in set (0.01 sec)

mysql> SELECT * FROM employee_data;
+--------+----------+-----------+
| emp_id | emp_name | salary    |
+--------+----------+-----------+
|      1 | Kuldeep  | 100000.00 |
|      2 | Aman     | 100000.00 |
|      3 | Utkarsh  | 100000.00 |
|    101 | Alice    |  50000.00 |
|    102 | Bob      |  60000.00 |
|    103 | Charlie  |  55000.00 |
+--------+----------+-----------+
6 rows in set (0.02 sec)
```

389 • SHOW GRANTS FOR 'report'@'localhost';

Result Grid | Filter Rows: | Export: | Wrap Cell Content: IA

Grants for report@localhost
GRANT USAGE ON *.* TO `report`@`localhost`
▶ GRANT SELECT ON `dcl_demo`.`employee_dat...

390 • SHOW GRANTS FOR 'ops'@'localhost';

Result Grid | Filter Rows: | Export: | Wrap Cell Content: IA

Grants for ops@localhost
▶ GRANT USAGE ON *.* TO `ops`@`localhost`
GRANT INSERT ON `dcl_demo`.`employee_dat...

392 • REVOKE SELECT ON dcl_demo.employee_data FROM 'report'@'localhost';

Result Grid | Filter Rows: | Export: | Wrap Cell Content: IA

Grants for report@localhost
▶ GRANT USAGE ON *.* TO `report`@`localhost`

393 • REVOKE INSERT ON dcl_demo.employee_data FROM 'ops'@'localhost';

Result Grid | Filter Rows: | Export: | Wrap Cell Content: IA

Grants for ops@localhost
▶ GRANT USAGE ON *.* TO `ops`@`localhost`

395 • GRANT SELECT , INSERT ON dcl_demo.employee_data TO 'ops'@'localhost';

Result Grid | Filter Rows: | Export: | Wrap Cell Content: IA

Grants for ops@localhost
GRANT USAGE ON *.* TO `ops`@`localhost`
▶ GRANT SELECT, INSERT ON `dcl_demo`.`empl...

```sql
SHOW GRANTS FOR 'report'@'localhost';
SHOW GRANTS FOR 'ops'@'localhost';

REVOKE SELECT ON dcl_demo.employee_data FROM 'report'@'localhost';
REVOKE INSERT ON dcl_demo.employee_data FROM 'ops'@'localhost';

GRANT SELECT , INSERT ON dcl_demo.employee_data TO 'ops'@'localhost';

CREATE USER 'engineer'@'localhost' IDENTIFIED BY 'engineer';
GRANT ALL PRIVILEGES ON dcl_demo.employee_data TO 'engineer'@'localhost' WITH GRANT OPTION;
```