

B.Tech. Computer Science & Engineering

Semester : 3rd

Introduction To Database Management System

Course Code: 71203002003

Unit – 3 : STRUCTURED QUERY LANGUAGE - SQL AND PL/SQL

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Transaction Control Commands in SQL



What is a Transaction?

A Transaction is a group of SQL statements executed as a single unit.

It ensures data consistency — meaning either all operations succeed or none do. This prevents partial updates that

could corrupt your data. If one operation fails, the entire transaction can be rolled back to maintain database integrity.

Example Transaction

```
BEGIN;UPDATE accounts SET  
balance = balance - 500 WHERE  
id = 1;UPDATE accounts SET  
balance = balance + 500 WHERE  
id = 2;COMMIT;
```

Transaction

Control

Commands (TCC)

There are 3 main commands used to manage transactions effectively:

COMMIT



Save all changes permanently to the database.

ROLLBACK

1. COMMIT

Definition

COMMIT permanently saves all the changes made during the transaction to the database.

Syntax

```
COMMIT;
```

After COMMIT, all changes are

Undo (cancel) all changes made since the last COMMIT or SAVEPOINT.

SAVEPOINT

permanent and cannot be undone.

Example

```
BEGIN;UPDATE Students SET  
department_id = 102 WHERE student_id  
= 1;INSERT INTO Students VALUES (4,  
'Priya',  
103);COMMIT;
```

2. ROLLBACK



Definition

ROLLBACK cancels all changes made in the current transaction and restores the database to the last committed state.

Syntax

```
ROLLBACK;
```

After ROLLBACK, changes are **undone** — as if they never happened.

Example

```
BEGIN;UPDATE Students SET
```

```
department_id = 105 WHERE student_id  
= 2;DELETE FROM Students WHERE  
student_id = 3;-- Oops! Wrong data  
deletedROLLBACK;
```

Both the UPDATE and DELETE are completely undone.

3. SAVEPOINT

SAVEPOINT sets a checkpoint inside a transaction. You can roll back to that specific point without undoing the entire transaction.



Syntax

```
SAVEPOINT  
savepoint_name;ROLLBACK TO savepoint_name;
```

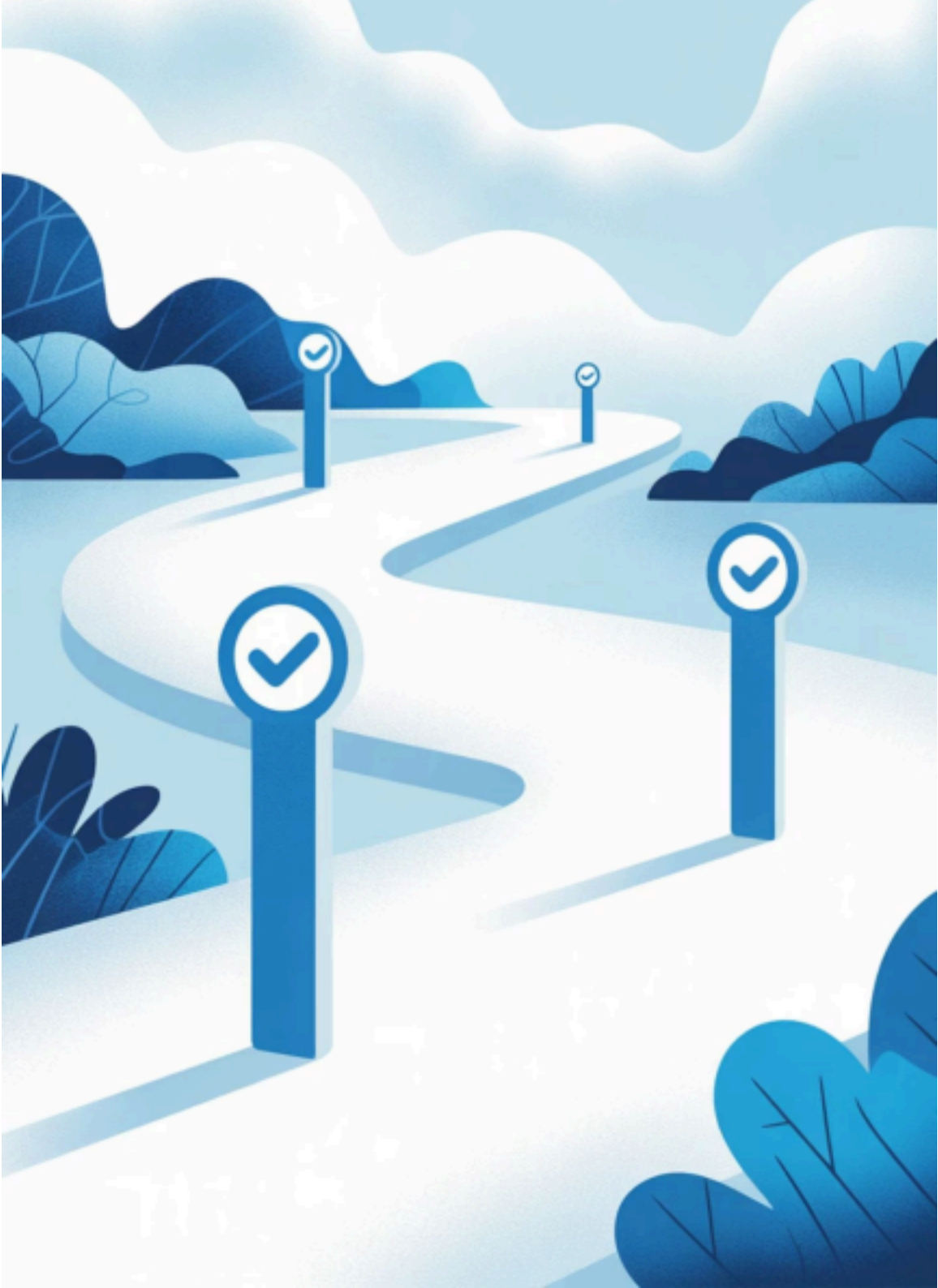
Example

```
BEGIN;UPDATE Students SET department_id = 102  
WHERE student_id = 1;SAVEPOINT A;UPDATE  
Students SET department_id = 103 WHERE
```

Changes before SAVEPOINT B are kept. The DELETE is undone. Then COMMIT saves everything else.

Summary Table

```
student_id =  
2;SAVEPOINT B;DELETE  
FROM Students WHERE  
student_id = 3;-- Only  
undo the  
deleteROLLBACK TO  
B;COMMIT;
```



COMMIT Ends a transaction and saves changes permanently Changes cannot be undone

ROLLBACK Cancels all uncommitted changes Restores database to last COMMIT **SAVEPOINT** Creates a temporary rollback point

Allows partial rollback within transaction

Analogy: Easy to Remember

Imagine you're editing a document:

SAVE (COMMIT)

You save your work permanently to disk.

UNDO (ROLLBACK)

You undo everything since your last save.

BOOKMARK (SAVEPOINT) You

mark a place, so you can undo changes only after that point.

ACID Properties in SQL

ACID ensures database transactions are reliable and consistent.



1. Atomicity – All or Nothing

Definition

A transaction is treated as one single unit — either every step succeeds or

none do.

Real-life analogy

When sending a parcel, if you can't hand over the parcel and collect the payment together, the deal is canceled — not half done.

Example code

```
BEGIN;UPDATE accounts SET  
balance = balance - 500 WHERE  
id = 1;UPDATE accounts SET  
balance = balance + 500 WHERE  
id = 2;COMMIT;
```

If the second UPDATE fails, the first one will also be rolled back automatically.



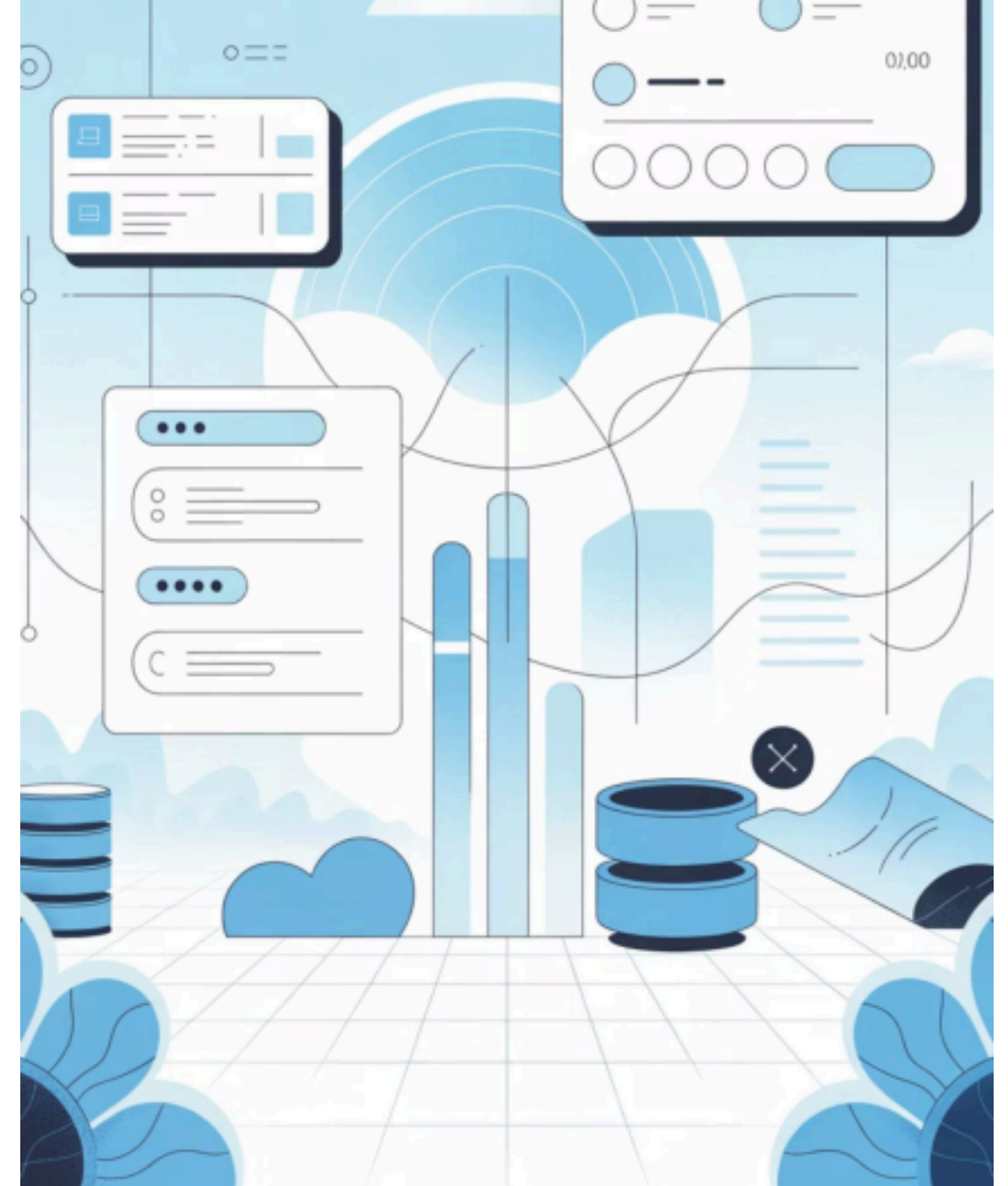
2. Consistency – Database Stays Valid

A transaction must keep the database in a valid state , means data rules, constraints, and relationships remain correct.

Example: If Account A had ₹2000 and Account B had ₹1000, after transferring ₹500, total money = ₹3000 should still remain.

The transaction must not violate constraints like:

- Foreign key relationships
- Data types
- Check constraints
- Balance totals



3. Isolation – Transactions Don't Disturb Each Other

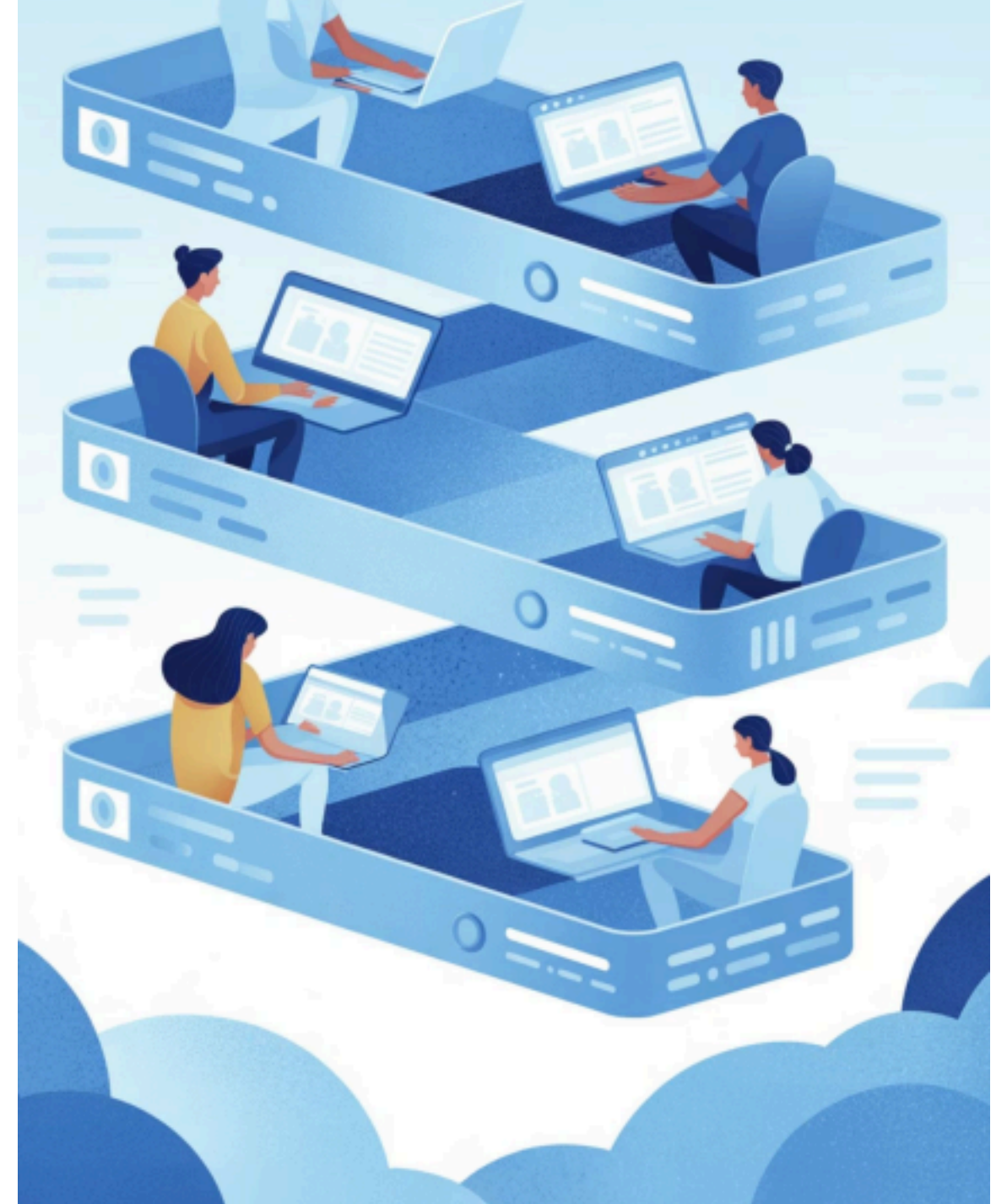
Definition: Each transaction works independently. Even if 10 users are updating the database at once, it should feel like each one is running alone.

Example: If two users try to buy the last ticket at the same time:

- Isolation ensures only one of them gets it
- The other will see the updated data after the first transaction commits

Prevents problems like:

- Dirty reads
- Lost updates
- Inconsistent data





4. Durability – Once Saved, Always Saved

Definition: After a transaction is committed, the changes are permanent, even if there's a power failure or crash.

Example: If you COMMIT a transaction that adds ₹500 to your account, even if the database server restarts, your ₹500 will still be there.

Databases achieve durability using:

- Transaction logs
- Backups
 - Write-ahead logging mechanisms



ACID Properties Summary

All or Nothing

ISOLATION

Transactions Don't Disturb Each Other

ATOMICITY

ACID properties ensure reliable database transactions.

Database Stays Valid

DURABILITY

Once Saved, Always Saved

CONSISTENCY



Wrap-up:

Real-Life Example

Bank money transfers use COMMIT, ROLLBACK, and SAVEPOINT to ensure both debit and credit operations succeed together — or neither happens at all.

Key Takeaway

Transaction control commands are essential for maintaining data integrity and consistency in any database application.

Practice these commands in phpMyAdmin or your SQL terminal to master transaction control and ace your interviews!



Thank You!