**Normalization**

**Composite Key:** Made up of more than one column.

A composite key is a primary key made up of more than one column.

**Atomic Value:** An atomic value is a single, indivisible unit of data - it cannot or should not be splint further from a database design perspective.

**First Normal Form (1NF)**

* It should contain atomic or indivisible values.
* Each column should contain only one value.
* No repeating groups or arrays.

| student\_id | student\_name | course\_name | instructor\_name | instructor \_phone |
| --- | --- | --- | --- | --- |
| 1 | Alice | DBMS | Prof. Rao | 1324567890 |
| 1 | Alice | Networking | Prof. Sen | 9876543210 |

**Second Normal Form (2NF)**

* It is in 1NF.
* Every non-key column is fully functionally dependent on the whole primary key(not part of it).

Problem → **Partial Dependency**

If a non-key column depends on only part of a composite key, it’s called a partial dependency - and that violates 2NF.

Example:

Table → Enrollment

[student\_id, course\_id, student\_name, course\_name] are the columns

Here student\_id, course\_id are both primary keys or a composite key.

But student\_name is dependent on student\_id.

And course\_name is dependent on course\_name.

Fix: **Break the table**

Table\_1 → Student

student\_id, student\_name

Table\_2 → course

course\_id, course\_name

Table\_3 → Enrollment

student\_id, course\_id, pk(student\_id, course\_id), fk(student\_id), fk(course\_id)

Now all non-key columns in each table are fully dependent on their primary key.

**Third Normal Form (3NF)**

* It is in 2NF.
* No non-key column depends on another non-key column(no transitive dependency).

Problem → **Transitive Dependency**

If A → B and A → C, then C is transitively dependent on A.

Example of violation:

Table → course

course\_id PK, course\_name, instructor\_name, instructor\_phone

Instructor\_name is dependent on course\_id but instructor\_phone is dependent on instructor\_name instead of course\_id.

This is a transitive dependency and violates 3NF.

Fix: **Break it further**

Table → Instructor

instructor\_name PK, instructor\_phone

Table → course

course\_id PK, course\_name, instructor\_name FK

Now every non-key column is dependent only on the PK and not any other non-key column.

**CAPSTONE PROJECT**

**DATABASE →** cab\_booking\_system

**TABLE** → customers, drivers, cabs, bookings, trip\_details, feedback