

Database Normalization: 1NF, 2NF, 3NF (Detailed Explanation)

1) First Normal Form (1NF)

- All values must be atomic.
- No repeating groups or arrays.
- Each record must be unique.

Example (Not in 1NF):

Students(StudentID, Name, Courses=[Math, English, Science])

Corrected (1NF Applied):

Students(StudentID, Name)

StudentCourses(StudentID, Course)

2) Second Normal Form (2NF)

- Must be in 1NF.
- No partial dependency on a composite primary key.

Example (Not in 2NF):

Enrollment(StudentID, CourseID, StudentName)

StudentName depends only on StudentID.

Corrected (2NF Applied):

Students(StudentID, Name)

Enrollment(StudentID, CourseID)

3) Third Normal Form (3NF)

- Must be in 2NF.
- No transitive dependencies (non-key attributes must not depend on other non-key attributes).

Example (Not in 3NF):

Orders(OrderID, CustomerID, CustomerCity)

Corrected (3NF Applied):

Customers(CustomerID, CustomerName, City)

Orders(OrderID, CustomerID)