

# First Normal Form (1NF) Violations and Examples

## 1. Violation: Multi-Valued Attributes (Atomicity Violation)

Example: Student\_Courses Table

Student_ID	Student_Name	Courses
101	Alice	Math, Science
102	Bob	English
103	Charlie	History, Art

Why Does This Violate 1NF?

- The 'Courses' column contains multiple values within a single cell.
- 1NF requires atomic values (single values per column).

### Solution:

Transform the table so each course is in a separate row:

Student_ID	Student_Name	Course
101	Alice	Math
101	Alice	Science
102	Bob	English
103	Charlie	History
103	Charlie	Art

## 2. Violation: Lack of a Unique Identifier (Primary Key Violation)

Example: Employee\_Projects Table

Employee_ID	Employee_Name	Project_ID
201	John Doe	P1
201	John Doe	P1
202	Jane Smith	P2
203	Alice Brown	P3

Why Does This Violate 1NF?

- The table contains duplicate rows.
- A relation in 1NF must have a primary key that ensures uniqueness.

**Solution:**

Define a composite primary key (Employee\_ID, Project\_ID) and remove duplicates:

Employee_ID	Employee_Name	Project_ID
201	John Doe	P1
202	Jane Smith	P2
203	Alice Brown	P3

**3. Violation: Mixed Data Types in a Column**

Example: Orders Table

Order_ID	Customer_Name	Order_Date	Order_Amount
501	Alice	2024-02-20	\$100
502	Bob	2024-02-21	200 USD
503	Charlie	2024-02-22	One Fifty

Why Does This Violate 1NF?

- The 'Order\_Amount' column contains inconsistent data types:
  - \$100 (Currency format)
  - 200 USD (Different currency format)
  - One Fifty (Text instead of a number)

**Solution:**

Standardize data types to ensure consistency:

Order_ID	Customer_Name	Order_Date	Order_Amount
501	Alice	2024-02-20	100.00
502	Bob	2024-02-21	200.00
503	Charlie	2024-02-22	150.00

Summary of 1NF Violations and Solutions

Violation Type	Example Problem	Solution
Multi-valued attributes	Multiple values in a column	Normalize by creating separate rows
Lack of primary key (duplicates)	Duplicate rows exist	Define a unique identifier (Primary Key)
Mixed data types in a column	Inconsistent data formats	Enforce a single data type