

[illegible]

Normal Form	Definition / Condition	Goal / Purpose	Example (Violation)	Example (After Normalization)
1NF (First Normal Form)	A table is in 1NF if: • All attributes have atomic (indivisible) values • No repeating groups or arrays	Eliminate repeating data and ensure atomicity	Violation: Students(StudentID, Name, Subjects) where Subjects = "Math, Science"(multi-valued)	1NF: Students(StudentID, Name, Subject) with separate rows for each subject
2NF (Second Normal Form)	A table is in 2NF if: • It is in 1NF • No partial dependency exists (non-key attribute depends on part of a composite key)	Remove partial dependency	Violation: Orders(OrderID, ProductID, ProductName, Quantity) where (OrderID, ProductID) is the key but ProductName depends only on ProductID	2NF: Split into Orders(OrderID, ProductID, Quantity) and Products(ProductID, ProductName)
3NF (Third Normal Form)	A table is in 3NF if: • It is in 2NF • No transitive dependency exists (non-key attribute depends on another non-key attribute)	Remove transitive dependency	Violation: Employees(EmpID, Name, DeptID, DeptName) where DeptName depends on DeptID, not directly on EmpID	3NF: Employees(EmpID, Name, DeptID) and Departments(DeptID, DeptName)
BCNF (Boyce–Codd Normal Form)	A table is in BCNF if: • It is in 3NF • For every functional dependency $X \rightarrow Y$, X is a superkey	Handle anomalies not covered by 3NF	Violation: Courses(CourseID, Teacher, Dept) where Teacher \rightarrow Dept but Teacher is not a superkey	BCNF: Split into Teachers(Teacher, Dept) and Courses(CourseID, Teacher)
4NF (Fourth Normal Form)	A table is in 4NF if: • It is in BCNF • No multi-valued dependencies exist (one key relates to multiple independent attributes)	Remove multi-valued dependencies	Violation: Projects(EmpID, Skill, Project) where Skill and Project are independent	4NF: Split into EmpSkills(EmpID, Skill) and EmpProjects(EmpID, Project)
5NF (Fifth Normal Form)	A table is in 5NF if: • It is in 4NF • No join dependency exists (table can't be reconstructed from smaller tables without loss of data)	Remove join dependencies	Violation: Sales(Product, Store, Supplier) where data comes from multiple smaller relations	5NF: Split into ProductStore(Product, Store), StoreSupplier(Store, Supplier), ProductSupplier(Product, Supplier)
6NF (Sixth Normal Form)	A table is in 6NF if: • It is in 5NF • All attributes depend on the key, the whole key, and nothing but the key over time (temporal databases)	Handle time-variant data	Violation: Table with multiple time-dependent facts in one row	6NF: Separate each time-dependent fact into its own table