

# Normal Forms Solution

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## 1NF

Table:

StudentID	StudentName	Subject	Grade
1	Alice	Math	A
1	Alice	Science	B
2	Bob	English	B
2	Bob	History	A
3	Charlie	Science	C
3	Charlie	Math	B

SQL Queries:

```
CREATE TABLE StudentSubjects (  
  StudentID INT,  
  StudentName VARCHAR(50),  
  Subject VARCHAR(50),  
  Grade CHAR(1),  
  PRIMARY KEY (StudentID, Subject)  
);  
  
INSERT INTO StudentSubjects (StudentID, StudentName, Subject, Grade) VALUES  
(1, 'Alice', 'Math', 'A'),  
(1, 'Alice', 'Science', 'B'),  
(2, 'Bob', 'English', 'B'),  
(2, 'Bob', 'History', 'A'),  
(3, 'Charlie', 'Science', 'C'),  
(3, 'Charlie', 'Math', 'B');
```

## 2NF

**Partial Dependency:** StudentName depends on StudentID, not on the full composite key (StudentID, CourseID).

Tables:

**Students:**

StudentID	StudentName
1	Alice
2	Bob

Courses:

CourseID	CourseName	Instructor
101	Math	Dr. Smith
102	Science	Dr. Brown
103	English	Dr. White

Enrollments:

EnrollmentID	StudentID	CourseID
1	1	101
2	1	102
3	2	103

SQL Queries:

```
CREATE TABLE Students (  
    StudentID INT PRIMARY KEY,  
    StudentName VARCHAR(50)  
);  
  
CREATE TABLE Courses (  
    CourseID INT PRIMARY KEY,  
    CourseName VARCHAR(50),  
    Instructor VARCHAR(50)  
);  
  
CREATE TABLE Enrollments (  
    EnrollmentID INT PRIMARY KEY,  
    StudentID INT,  
    CourseID INT,  
    FOREIGN KEY (StudentID) REFERENCES Students(StudentID),  
    FOREIGN KEY (CourseID) REFERENCES Courses(CourseID)  
);  
  
INSERT INTO Students (StudentID, StudentName) VALUES  
(1, 'Alice'),  
(2, 'Bob');  
  
INSERT INTO Courses (CourseID, CourseName, Instructor) VALUES
```

```
(101, 'Math', 'Dr. Smith'),
(102, 'Science', 'Dr. Brown'),
(103, 'English', 'Dr. White');

INSERT INTO Enrollments (EnrollmentID, StudentID, CourseID) VALUES
(1, 1, 101),
(2, 1, 102),
(3, 2, 103);
```

## 3NF

**Transitive Dependency:** InstructorEmail depends on Instructor.

Tables:

**Courses:**

CourseID	CourseName	Instructor
101	Math	Dr. Smith
102	Science	Dr. Brown
103	English	Dr. White

**Instructors:**

Instructor	InstructorEmail
Dr. Smith	smith@university.com
Dr. Brown	brown@university.com
Dr. White	white@university.com

**Enrollments:**

StudentID	CourseID
1	101
1	102
2	103

SQL Queries:

```
CREATE TABLE Courses (
  CourseID INT PRIMARY KEY,
  CourseName VARCHAR(50),
  Instructor VARCHAR(50)
);
```

```
CREATE TABLE Instructors (  
    Instructor VARCHAR(50) PRIMARY KEY,  
    InstructorEmail VARCHAR(50)  
);  
  
CREATE TABLE Enrollments (  
    StudentID INT,  
    CourseID INT,  
    PRIMARY KEY (StudentID, CourseID),  
    FOREIGN KEY (CourseID) REFERENCES Courses(CourseID)  
);  
  
INSERT INTO Courses (CourseID, CourseName, Instructor) VALUES  
(101, 'Math', 'Dr. Smith'),  
(102, 'Science', 'Dr. Brown'),  
(103, 'English', 'Dr. White');  
  
INSERT INTO Instructors (Instructor, InstructorEmail) VALUES  
( 'Dr. Smith', 'smith@university.com'),  
( 'Dr. Brown', 'brown@university.com'),  
( 'Dr. White', 'white@university.com');  
  
INSERT INTO Enrollments (StudentID, CourseID) VALUES  
(1, 101),  
(1, 102),  
(2, 103);
```