

**Database Systems**

**Lab No.10**

**Submitted By**

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**Submitted To:**

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**Tasks:**

**Consider the following table “StudentCourses”**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| StudentID | StudentName | CourseID | CourseName | InstructorID | InstructorName | InstructorPhone | Grade |
| 101 | John Doe | CSE101 | Data Structures | I01 | Dr. Smith | 555-1234 | A |
| 101 | John Doe | CSE102 | Databases | I02 | Dr. Allen | 555-5678 | B+ |
| 102 | Jane Roe | CSE101 | Data Structures | I01 | Dr. Smith | 555-1234 | B |
| 103 | Mark Smith | CSE103 | Networking | I03 | Dr. White | 555-4321 | A- |
| 103 | Mark Smith | CSE101 | Data Structures | I01 | Dr. Smith | 555-1234 | B |

**Submission:**

* Submit a report containing the original table, and the tables in 1NF, 2NF, and 3NF.
* Provide explanations for each step of the normalization process.

**Solution:**

**Original Table:**

Here is the original table:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| StudentID | StudentName | CourseID | CourseName | InstructorID | InstructorName | InstructorPhone | Grade |
| 101 | John Doe | CSE101 | Data Structures | I01 | Dr. Smith | 555-1234 | A |
| 101 | John Doe | CSE102 | Databases | I02 | Dr. Allen | 555-5678 | B+ |
| 102 | Jane Roe | CSE101 | Data Structures | I01 | Dr. Smith | 555-1234 | B |
| 103 | Mark Smith | CSE103 | Networking | I03 | Dr. White | 555-4321 | A- |
| 103 | Mark Smith | CSE101 | Data Structures | I01 | Dr. Smith | 555-1234 | B |

**1NF:**

**Explanation:**

The original table is already in 1NF because all the entries are single, every column contains one value for each row and there are primary keys for Student, Course and Instructor.

Here is the table in 1NF:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| StudentID | StudentName | CourseID | CourseName | InstructorID | InstructorName | InstructorPhone | Grade |
| 101 | John Doe | CSE101 | Data Structures | I01 | Dr. Smith | 555-1234 | A |
| 101 | John Doe | CSE102 | Databases | I02 | Dr. Allen | 555-5678 | B+ |
| 102 | Jane Roe | CSE101 | Data Structures | I01 | Dr. Smith | 555-1234 | B |
| 103 | Mark Smith | CSE103 | Networking | I03 | Dr. White | 555-4321 | A- |
| 103 | Mark Smith | CSE101 | Data Structures | I01 | Dr. Smith | 555-1234 | B |

**2NF:**

**Explanation:**

In order to achieve 2NF, we must eliminate redundancy and we must have non-key columns depend only on primary key columns. That is why we will separate the columns for Student, Course and Instructor. We will also create a grade table for students, their grades and course as well as a course assignment table for instructor and course.

Student\_Table:

|  |  |
| --- | --- |
| StudentID | StudentName |
| 101 | John Doe |
| 102 | Jane Roe |
| 103 | Mark Smith |

Course\_Table:

|  |  |
| --- | --- |
| CourseID | CourseName |
| CSE101 | Data Structures |
| CSE102 | Databases |
| CSE103 | Networking |

Instructor\_Table:

|  |  |  |
| --- | --- | --- |
| InstructorID | InstructorName | InstructorPhone |
| I01 | Dr. Smith | 555-1234 |
| I02 | Dr. Allen | 555-5678 |
| I03 | Dr. White | 555-4321 |

Grade\_Table:

|  |  |  |
| --- | --- | --- |
| StudentID | CourseID | Grade |
| 101 | CSE101 | A |
| 101 | CSE102 | B+ |
| 102 | CSE101 | B |
| 103 | CSE103 | A- |
| 103 | CSE101 | B |

CourseAssignment\_Table:

|  |  |  |
| --- | --- | --- |
| CourseID | CourseName | InstructorID |
| CSE101 | Data Structures | I01 |
| CSE102 | Databases | I02 |
| CSE103 | Networking | I03 |

Hence, we have achieved 2NF.

**3NF:**

**Explanation:**

As we can see from the tables we made in 2NF, there are no dependencies between non-key columns. All the non-key columns are now depending on the primary key. There are not depending upon each other. So,we don’t need to further normalize the tables as they have already achieved 3NF.

Here are the tables for 3NF.

Student\_Table:

|  |  |
| --- | --- |
| StudentID | StudentName |
| 101 | John Doe |
| 102 | Jane Roe |
| 103 | Mark Smith |

Course\_Table:

|  |  |
| --- | --- |
| CourseID | CourseName |
| CSE101 | Data Structures |
| CSE102 | Databases |
| CSE103 | Networking |

Instructor\_Table:

|  |  |  |
| --- | --- | --- |
| InstructorID | InstructorName | InstructorPhone |
| I01 | Dr. Smith | 555-1234 |
| I02 | Dr. Allen | 555-5678 |
| I03 | Dr. White | 555-4321 |

Grade\_Table:

|  |  |  |
| --- | --- | --- |
| StudentID | CourseID | Grade |
| 101 | CSE101 | A |
| 101 | CSE102 | B+ |
| 102 | CSE101 | B |
| 103 | CSE103 | A- |
| 103 | CSE101 | B |

CourseAssignment\_Table:

|  |  |  |
| --- | --- | --- |
| CourseID | CourseName | InstructorID |
| CSE101 | Data Structures | I01 |
| CSE102 | Databases | I02 |
| CSE103 | Networking | I03 |