Java module 4

Exercises Day 4

<table>
<tr><td>1 - 1NF</td><td>Convert to 1NF</td></tr>
<tr><td>Instructions</td><td>Given the following table that stores information about customers and the products they have purchased.

Identify the violation(s) of 1NF in this table and normalize it to 1NF.

<table>
<tr><th>Customer_ID</th><th>Customer_Name</th><th>Product_List</th></tr>
<tr><td>101</td><td>Alice</td><td>iPhone, MacBook, iPad</td></tr>
<tr><td>102</td><td>Bob</td><td>Samsung TV, PlayStation</td></tr>
<tr><td>103</td><td>Charlie</td><td>Xbox, PlayStation, Nintendo</td></tr>
</table>
</td></tr>
<tr><td>Solution</td><td>The violation to 1NF comes from the Product_List column because it contains an array of values. We should modify that column to contain just one product and create multiple rows for each customer, one for each product the customer bought.

<table>
<tr><th>Customer_ID</th><th>Customer_Name</th><th>Product</th></tr>
<tr><td>101</td><td>Alice</td><td>iPhone</td></tr>
<tr><td>101</td><td>Alice</td><td>MacBook</td></tr>
<tr><td>101</td><td>Alice</td><td>iPad</td></tr>
<tr><td>102</td><td>Bob</td><td>Samsung TV</td></tr>
<tr><td>102</td><td>Bob</td><td>PlayStation</td></tr>
<tr><td>103</td><td>Charlie</td><td>Xbox</td></tr>
<tr><td>103</td><td>Charlie</td><td>PlayStation</td></tr>
<tr><td>103</td><td>Charlie</td><td>Nintendo</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>2 - 2NF</td><td>Convert to 2NF</td></tr>
<tr><td>Instructions</td><td>Consider the following Table about Students.

Identify the violation(s) of 2NF in this table and normalize it to 2NF.

<table>
<tr><th>Student_ID</th><th>Student_Name</th><th>Course_ID</th><th>Course_Name</th><th>Instructor_ID</th><th>Instructor_Name</th></tr>
<tr><td>1</td><td>Alice</td><td>101</td><td>Math</td><td>201</td><td>Mr. Smith</td></tr>
<tr><td>1</td><td>Alice</td><td>102</td><td>Physics</td><td>202</td><td>Ms. Johns</td></tr>
<tr><td>2</td><td>Bob</td><td>101</td><td>Math</td><td>201</td><td>Mr. Smith</td></tr>
<tr><td>2</td><td>Bob</td><td>103</td><td>Chemistry</td><td>203</td><td>Dr. Brown</td></tr>
<tr><td>3</td><td>Charlie</td><td>102</td><td>Physics</td><td>202</td><td>Ms. Johns</td></tr>
<tr><td>3</td><td>Charlie</td><td>104</td><td>Biology</td><td>204</td><td>Dr. Lee</td></tr>
</table>
</td></tr>
<tr><td>Solution</td><td>The primary key of this table is a combination of Student_ID and Course_ID columns. The other 4 columns should be moved to separate tables because they are not related to both columns of the primary key. Student_Name is related only to Student_ID, the other three columns are related to Course_ID.

Students table:

Primary Key: Student_ID

Foreign Key: None

<table>
<tr><th>Student_ID</th><th>Student_Name</th></tr>
<tr><td>1</td><td>Alice</td></tr>
<tr><td>2</td><td>Bob</td></tr>
<tr><td>3</td><td>Charlie</td></tr>
</table>

Courses table:

Primary Key: Course_ID</td></tr>
</table>

Foreign Key: None

Course_ID	Course_Name	Instructor_ID	Instructor_Name
101	Math	201	Mr. Smith
102	Physics	202	Ms. Johns
103	Chemistry	203	Dr. Brown
104	Biology	204	Dr. Lee

Student_Courses table:

Primary Key: None

Foreign Keys: **Student_ID** (references **Students** table), **Course_ID** (references **Courses** table)

Student_ID	Course_ID
1	101
1	102
2	101
2	103
3	102
3	104

<table>
<tr><td>3 - 3NF</td><td>Convert to 3NF</td></tr>
<tr><td>Instructions</td><td>Consider a table that stores information about customers, their orders, and the products ordered.

Identify the violation(s) of 3NF in this table and normalize it to 3NF.

<table>
<tr><th>Customer_ID</th><th>Customer_Name</th><th>Order_ID</th><th>Product_Name</th><th>Product_Price</th></tr>
<tr><td>101</td><td>Alice</td><td>201</td><td>iPhone</td><td>999</td></tr>
<tr><td>101</td><td>Alice</td><td>202</td><td>MacBook</td><td>1299</td></tr>
<tr><td>102</td><td>Bob</td><td>203</td><td>Samsung TV</td><td>1499</td></tr>
<tr><td>103</td><td>Charlie</td><td>204</td><td>Xbox</td><td>499</td></tr>
<tr><td>103</td><td>Charlie</td><td>205</td><td>PlayStation</td><td>399</td></tr>
</table>
</td></tr>
<tr><td>Solution</td><td>The primary key of this table is the column Order_ID. There are two transitive relationships in this table.

Order_ID -> Customer ID -> Customer Name

Order ID -> Product Name -> Product Price

Customers table:

Primary Key: Customer_ID

<table>
<tr><th>Customer_ID</th><th>Customer_Name</th></tr>
<tr><td>101</td><td>Alice</td></tr>
<tr><td>102</td><td>Bob</td></tr>
<tr><td>103</td><td>Charlie</td></tr>
</table>

Orders table:

Primary Key: Order_ID</td></tr>
</table>

Foreign Key: **Customer_ID** (references **Customers** table)

Foreign Key: **Product_Name** (references **Products** table)

Order_ID	Customer_ID	Product_Name
201	101	iPhone
202	101	MacBook
203	102	Samsung TV
204	103	Xbox
205	103	PlayStation

Products table:

Primary Key: **Product_Name**

Product_Name	Product_Price
iPhone	999
MacBook	1299
Samsung TV	1499
Xbox	499
PlayStation	399