Lab8-Normalization-2NF and 3NF

**Purpose:** To continue the **normalization** of user views from **1NF** to **2NF and 3NF**

How to identify and remove **partial dependencies**

How to identify and remove **transitive dependencies**

**Part A: Second Normal Form (2NF)**

**Definition:** A table is in 1NF if it contains no repeating groups.

**Definition:** A table is in 2NF it is in 1NF and it contains no **Partial Dependencies**.

**Definition:** A Partial Dependency occurs when a non-key attribute(s) is dependent on (or is determined by) a part of a composite primary key.

Note: A table that has only a simple primary key cannot have any partial dependencies.

A table that has no non-key attributes is already in 2NF as there are no partial dependencies

1. Examine the following report:

**Premiere Corporation**

**Customer Orders**

**Customer Name Order Order Sales Rep**

**Number Number Date Rep Last Name**

**No**

124 Sally Adams 12489 2001-09-02 03 Jones

12500 2001-09-05

256 Ann Samuels 12495 2001-09-04 06 Smith

311 Don Charles 12491 2001-09-02 12 Diaz

315 Tom Daniels 12494 2001-09-04 06 Smith

522 Mary Nelson 12498 2001-09-05 12 Diaz

12504 2001-09-05

\*\*\*\*\*\*\*\* End of report \*\*\*\*\*\*\*\*

**Step 1**: Create the **UNF** table by creating a table composed of all the attributes found in the User View. Don’t forget to underline the primary key and place brackets around any repeating groups you may find.

**UNF:**

**Step 2: Create the 1NF tables by removing the repeating groups:**

**1NF:**

Now you are ready to create the 2NF tables by removing the partial dependencies from the 1NF tables.

Your 1NF solution should contain 2 tables and look something like this:

**1NF: Customer [CustNo, CustName, RepNo, RepName]**

**CustOrder [ CustNo, OrderNo, OrderDate ]**

**If you look at the table called CustOrder you can see that a primary Key of OrderNo is sufficient. The customer number would be a foreign key**

Note: if you did not get a similar solution, please talk to your instructor about it now! It is very important to get the correct UNF and 1NF tables.

**Step 3**: The process for taking a table from 1NF to 2NF involves removing the partial dependencies. We see that from our definition of 2NF (page 1) a partial dependency is when a non-key attribute is determined by a part of the primary key. We also read in the note (page 1) that we cannot have partial dependencies when there is a simple primary key (only 1 field makes up the primary key).

Therefore in looking at our 1NF solution, we can see that by definition, the customer table is already in 2NF. It is in 1NF and contains no partial dependencies. In fact it cannot contain partial dependencies because it has a simple primary key (Custno). So we will **start** our **2NF solution** by simply copying the customer table from 1NF to 2NF.

**2NF**: **Customer [CustNo, CustName, RepNo, RepName]**

Now examine the CustOrder table. Does it have a composite primary key (a key made up of more than 1 field) ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(Not if you could see the red note above)

Identify the key attributes.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Identify the non-key attributes. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Are any of the non-key attributes determined by ONE of the key attributes? \_\_\_\_

Which non-key attribute is determined by one of the key attributes? \_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Which key field is determining it? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**We must create a new table for the partial dependency**. We do this by moving the non-key attributes involved in the partial dependency to the new table and assign the key attribute that was involved in the partial dependency as the primary key of the new table. Do NOT remove any key fields from the CustOrder table! **Complete the 2NF solution:**

**2NF: Customer [CustNo, CustName, RepNo, RepName]**

**CustOrder [ CustNo, OrderNo ]**

**Order [ ]**

**Part C: Third Normal Form (3NF)**

We now have a set of 2NF tables from our User View. Your 2NF solution should look something like this:

**2NF: Customer [CustNo, CustName, RepNo, RepName]**

**CustOrder [ CustNo, OrderNo ]**

**Order [ OrderNo, Orderdate ]**

**(The above solution “might” imply that the relationship between customer and order was many-to-many, when it is really 1-to-many. The solution in the end will still be the same, but how you get there depends upon your skill level and what you can see now, versus following a fixed set of rules. Both ways work as long as the design is correct)**

If you did not correctly identify the order table, please ask your instructor about this process now!

We are now ready to identify any transitive dependencies we may have.

**Definition:** A table is in 3NF if it is in 2NF and it contains no **Transitive Dependencies.**

**Definition:** A Transitive Dependency occurs when a non-key attribute (s) is dependent on (or is determined by) another non-key attribute.

ASIDE:

**PROBLEM 1:** What you must not forget is that what appears to be a non-key attribute, may have been an alternate key. Alternate keys determine non-key attributes just like primary keys do. Alternate keys are not considered in the analysis of transitive dependencies.

EXAMPLE:

COURSE [**COURSE\_ID**, COURSE\_NAME, Professor ID, Professor Name, YEAR\_DEVELOPED}

It appears that the course name determines the year the course was developed. This occurs because course name is unique and therefore could have been used as the primary key.

Notice the transitive dependency in the example. Given a Professor ID we can determine the Professor name. We can’t the other way around if there were 2 people with the same name.

PROBLEM 2:

STUDENT [SID, SNAME, SADDRESS, PROGRAMNAME)

This is a hard one to see, but *if* the attribute PROGRAMNAME was split into PROGID and PROGNAME, it would be easier to see that program id determines the program name

Note: A table that has no transitive dependencies is already in 3NF!

1. Examine each of the 2NF tables and determine the following:

**Customer table**: Key attributes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Non-key attributes: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**CustOrder table** Key attributes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Non-key attributes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Order table** Key attributes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Non-key attributes: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Note**: if a table contains less than 2 non-key attributes, there cannot be any transitive dependencies. Therefore the CustOrder and Order tables cannot contain any transitive dependencies! **Simply copy those tables to the 3NF solution.**

Examine non-key attributes of the Customer table. Do any of the non-key attributes determine any of the other non-key attributes? \_\_\_\_\_\_\_\_\_\_

If you answered yes, you are right. Fill in the blanks:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is (are) determined by \_\_\_\_\_\_\_\_\_\_\_\_

2. **We must create a new table for the transitive dependency**. We do this by moving the non-key attributes involved in the transitive dependency to a new table. The primary key of the new table will be the non-key attribute that determines the other non-key attributes involved in the transitive dependency.

Write the DBDL for the new table:

**Rep [ ]**

3. The last step in removing the transitive dependency is to maintain the link (or relationship) between the table that contained the transitive dependency (Customer) and the new table (Rep). We do this by placing a foreign key to the new table (Rep) into the table that contained the transitive dependency (Customer). The foreign key will be the primary key of the new table. Don’t forget to identify it with **(FK)**

**Complete the 3NF solution:**

**3NF:**

**CustOrder [ CustNo, OrderNo ]**

**Order [ OrderNo, Orderdate ]**

**Customer [CustNo, CustName, ]** (fill in the foreign key)

**Rep [ ]**

**Submission:**

**Write the answer of following questions and show it personally next week to get marks during lab period.**

**1. For the following User View, determine the 1, 2 and 3NF and hand in this page to your instructor. The UNF table has been provided.**

**Premiere Corporation**

**Order Detail Report**

**Order Order Cust Cust Part Part Qty Quoted**

**Number Date Number Last Number Desc Ordered Price**

**Name**

12489 2001-09-02 124 Adams AX12 Iron 11 14.95

12491 2001-09-02 311 Charles BT04 GasGrill 1 149.99

BZ66 Washer 1 399.99

12494 2001-09-04 315 Daniels CB03 Bike 4 279.99

12495 2001-09-04 256 Samuels CX11 Blender 2 22.95

12498 2001-09-05 522 Nelson AZ52 Dartboard 2 12.95

BA74 Basketbal 4 24.95

12500 2001-09-05 124 Adams BT04 GasGrill 1 149.99

12504 2001-09-05 522 Nelson CZ81 Treadmill 2 325.99

\*\*\*\*\*\* \*\*\*\*\*\*\*\* End of report \*\*\*\*\*\*\*\*

**UNF:**

Order [OrderNo, Orderdate, CustNo, CustLname, (PartNo, PartDesc, QtyOrd, Price)]

**1NF:**

**2NF:**

**3NF:**