Assignment 4 – Week 5

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(1) Every time attribute A appears, it is matched with the same value of attribute B, but not the same value of attribute C. Therefore, it is true that:

    A. A → B
    B. A → C
    C. A → (B, C)
    D. (B,C) → A

ANS:

A

(2) A table is in 2NF if the table is in 1NF and what other condition is met?

    A. There are no functional dependencies.
    B. There are no null values in primary key fields.
    C. There are no repeating groups.
    D. There are no attributes that are not functionally dependent on the relation's primary key.

ANS:

D

(3) Consider a relation : EmpData(empcode, name, street, city, state, pincode)
For any pincode, there is only one city and state. Also, for given street, city and state, there is just one pincode. In normalization terms, EmpData is a relation in

    A. 1 NF only
    B. 2 NF and hence also in 1 NF
    C. 3NF and hence also in 2NF and 1NF
    D. None of the above

ANS:

B

(4) Consider a relation R = (A,B,C,D) with the following FDs:
AB → C, C → D, and D → A
(a) List all candidate keys of R.

ANS:

AB

BD

(b) Is R in 3NF?

ANS:

Yes, R is in 3NF

(5) Consider a relation R = (A,B,C,D) with the following FDs:
A → B, A → C, A → D, C → B and C → D
Is there any transitive dependency? If yes, then how to get rid of it?

Yes, there is a transitive dependency.
A->C->B, D
Splitting two relations can rid of it: A->C in one relation and C->B, D in one relation.

(6) Describe the types of update anomalies that may occur in a relation that has redundant data.
(Review question 14.3 from the book)
ANS:

The types of update anomalies
1. Insertion anomaly – it's not possible to add data without other additional data
2. Deletion anomaly –deletion only what we want to delete is not possible because it could also delete other additional data
3. Modification anomaly – updating data only what we want can cause inconsistencies at other redundant rows

(7) Describe the concept of full functional dependency and describe how this concept relates to 2NF. Provide an example to illustrate your answer. (Review question 14.10 from the book)
ANS:
If X and Y are attribute set of a relation, Y is fully functionally dependent on X if Y is functionally dependent on X but not on any other subset of X.

2NF -> 1NF + every non-primary key attribute is fully functionally dependent on primary key(No partial dependency)

e.g.,
Suppose we have a relation called ItemPrice
ItemPrice : SupplierId, SupplierName, SupplierZipCode, SupplierCity, ItemId, Price

SupplierId, ItemId -> Price is a full functional dependency.
But there are other partial dependencies
SupplierName -> SupplierId
SupplierAddress -> SupplierId

So, we can make that relation to be 2NF by removing partial dependency with two relations.
Supplier : SupplierId, SupplierName, SupplierZipCode, SupplierCity
ItemPrice : SupplierId, ItemId, Price

(8) Describe the concept of transitive dependency and describe how this concept relates to 3NF. Provide an example to illustrate your answer. (Review question 14.11 from the book)
ANS:
If X->Y and Y->Z in a relation, Z is transitively dependent on X via Y but X is not functionally dependent on Y or Z.

3NF -> 2NF + No transitive dependency
e.g.,

According to the answer7 example,

Supplier : SupplierId, SupplierName, SupplierZipCode, SupplierCity

SupplierId -> SupplierZipCode

SupplierZipCode -> SupplierCity

So, SupplierCity is transitively dependent on SupplierId. We can make it to be in 3NF with two relations.

Supplier : SupplierId, SupplierName, SupplierZipCode

Address : SupplierZipCode, SupplierCity

(9) Solve exercise 14.14 (a, b, c) on page 390 from the course text book (5th edition).
For the 4th edition users, the question is 13.14 (a,b,c)

(a) ANS:

Patient Number, Drug Number -> Units per Day, Start Date, Finish Date

Patient Number -> Full Name, Ward Number, Bed Number

Ward Number -> Ward Name

Drug Number -> Name, Description, Dosage, Method of Admin

Assumptions: Drug names are unique.

(b) ANS:
1NF
MedicationRecord:

Patient Number	Full Name	Ward Number	Ward Name	Bed Number	Drug Number	Name	Description	Dosage	Method of Admin	Units per Day	Start Date	Finish Date

2NF -> 1NF + No partial dependency
MedicationRecord:

Patient Number	Drug Number	Units per Day	Start Date	Finish Date

Patient:

Patient Number	Full Name	Ward Number	Ward Name	Bed Number

Drug:

Drug Number	Name	Description	Dosage	Method of Admin

3NF -> 2NF + No transitive dependency
MedicationRecord

Patient Number	Drug Number	Units per Day	Start Date	Finish Date

Patient

Patient Number	Full Name	Ward Number	Bed Number

Ward

Ward Number	Ward Name

Drug

Drug Number	Name	Description	Dosage	Method of Admin

(c) ANS:

Primary Keys

Patient Number and Drug Number as composite key in MedicationRecord relation

Patient Number in Patient relation

Ward Number in Ward relation

Drug Number in Drug relation

Alternate Keys

Drug Name is an alternate key in Drug relation because of my assumption

Foreign Keys

Patient Number and Drug Number in MedicationRecord relation

Ward Number and Bed Number in Patient relation

(10) Solve exercise 14.15 (a, b, c) on page 391 from the course text book (5th edition).
For the 4th edition users, the question is 13.15 (a,b,c)
(a) ANS:

Insertion anomaly:

To insert dentistName, I must include patName. In the same way, I must include dentistName to insert patName. If I insert either dentistName or patName, I must insert the same data which I use in other rows to avoid data inconsistency. If I want to insert only one of them, it's not possible because the other one will be null which can violate entity integrity.

e.g.,

S1011, Tony Smith

P108, Ian MacKay

Deletion anomaly:

When I delete a dentist data, patient data will be lost from the database vice versa.

e.g., deleting first row with the purpose of deleting S1011, Tony Smith can lose P100, Gillian White patient data.

Update anomaly:

If I update a dentistName or patientName, that fields from other rows will not be affected.

e.g., updating first row dentistName from Tony Smith to John Smith will not affect the second row.

(b) ANS:

staffNo -> dentistName

patNo -> patName

staffNo, patNo -> appointmentDatetime, surgeryNo

(c) ANS:

1NF
DentistPatientAppointment

staffNo	dentistName	patNo	patName	appointmentDatetime	surgeryNo

2NF
Dentist

staffNo	dentistName

Patient

patNo	patName

Appointment

staffNo	patNo	appointmentDatetime	surgeryNo

3NF
As there is no transitive dependency 2NF, it's the same with above 2NF.

Primary Keys

staffNo in Dentist relation

patNo in Patient relation

staffNo, patNo as composite key in Appointment relation

Alternate Keys

Foreign Keys

staffNo, patNo, surgeryNo in Appointment relation