

Assignment 4 – Week 5

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**This assignment is based on lecture 5 (chapter 14).**

- Submit your *own work* on time. No credit will be given if the assignment is submitted after the due date.
  - Note that the completed assignment should be submitted in .doc, .docx, .rtf or .pdf format only.
  - In MCQs, if you think that your answer needs more explanation to get credit then please write it down.
  - You are encouraged to discuss these questions in the Sakai forum.
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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.  $A \rightarrow B$
  - B.  $A \rightarrow C$
  - C.  $A \rightarrow (B, C)$
  - D.  $(B, C) \rightarrow A$

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:  
 $AB \rightarrow C$ ,  $C \rightarrow D$ , and  $D \rightarrow A$   
(a) List all candidate keys of R.

ANS: (A, B), (B, C), (C, D)

(b) Is R in 3NF?

ANS: Yes

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

ANS: Yes,  $A \rightarrow C$  and  $C \rightarrow D$  To get rid of transitive dependency we have to create two new tables.

- (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:

There are 3 types of update anomalies that may occur in a relation that has redundant data i.e. data inconsistency occurs due to the data redundancy and partial update.

**Insertion Anomalies:** When inserting data to the database, some attribute can't be inserted without the presence of other attributes. So we have to take care of other constraints while inserting the data attributes.

**Update Anomalies:** It occurs when we update the data in a relation only and not update the data across all instances.

**Deletion Anomalies:** This occurs when data is deleted from one relation. That data deletion of that relation also delete the data of other relation.

- (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:

Full functional dependency helps to ensure the data integrity and it also avoid the data anomalies in the database. Full functional dependency is a relationship that exists between the two attributes i.e. between the primary key and non-key attribute within the table.

$A \rightarrow B$ , here full functional dependency indicates that A is fully functionally dependent on B and B is fully dependent on A. Here B should not be the subset of A otherwise  $A \rightarrow B$  has trivial functional dependency. Fully functional dependency relates to the 2NF in a such way that all dependencies should be fully functional i.e., it should be in First Normal Form (1NF), all non-key attributes are fully functionally dependent on the primary key and no partial dependency.

Student:

StdId	StdName	CourseId	CourseName
1	Saraha	1	Maths
2	John	2	Computer
3	Rusell	3	Arts

Here in the above Student table, StdId, CourseId both are candidates keys. Here StdId is the primary key and CourseId is the foreign key. All the other attributes StdName and CourseName must depend on the primary key. But the table is not fully dependent because StdName only depends on StdId while other CourseName depends on CourseId. This is the partial dependency. To remove this we must separate the the above table into two tables.

Student:

StdId	StdName	CourseId
1	Saraha	1
2	John	2
3	Rusell	3

Course:

1	Maths
2	Computer
3	Arts

We removed the CourseId from the Student table and created the new Course table. Now the relation between these tables are fully dependent and are in 2NF.

- (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:

Transitive dependency normally occurs in a relation of three or more attributes. It also helps to normalize the database in Third Normal Form (3NF). Functional dependency becomes the transitive dependency when two functional dependencies indirectly formed. For example,  $X \rightarrow Z$  is the transitive dependency when  $X \rightarrow Y$  and  $Y \rightarrow Z$  that results  $X \rightarrow Z$ . So to make 3NF, tables are in 2NF and there is no transitive dependency. We do that by creating the separate table.

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

(a) ANS:

Assumption: Drug Description and Drug name are unique

(PatientNo, WardNo)  $\rightarrow$  BedNo, FullName, WardName

(DrugNumber, UnitPerDay, StartDate, FinishDate)  $\rightarrow$  Name, Description, Dosage, MethodOfAdmin

(Name, UnitPerDay, StartDate, FinishDate)  $\rightarrow$  DrugNumber, Description, Dosage, MethodOfAdmin

(Description, UnitPerDay, StartDate, FinishDate)  $\rightarrow$  DrugNumber, Name, Dosage, MethodOfAdmin

(b) ANS:

1NF: eliminate all the repeated data.

2NF: We have to create a new table based on the partial dependency.

**Partial dependency:**

PatientNumber  $\rightarrow$  FullName

WardNumber  $\rightarrow$  WardName

DrugNumber  $\rightarrow$  Name, Description, Dosage, MethodOfAdmin

Name  $\rightarrow$  DrugNumber, Description, Dosage, MethodOfAdmin

Description  $\rightarrow$  DrugNumber, Name, Dosage, MethodOfAdmin

**Patient :**

PatientNumber	FullName
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Ward:

WardNumber	WardName
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Patient\_Ward:

PatientNumber	WardNumber	BedNumber
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Drug:

DrugNumber	Name	Description	Dosage
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Drug\_Use:

DrugNumber	UnitPerDay	StartDate	FinishDate
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3NF: We have remove transitive dependency. Here we don't have any transitive dependency so this is already in the 3NF.

(c) ANS:

Primary Key:

Patient: PatientNumber

Ward: WardNumber

Patient\_Ward: PatientNumber, WardNumber

Drug\_Use: DrugNumber, UnitsPerDay, StartDate, FinishDate

Alternate Key:

DrugTable: Name, Description

Foreign Key: There are no foreign keys in this database

(10) Solve exercise 14.15 (a, b, c) on page 391 from the course text book (5<sup>th</sup> edition).

For the 4<sup>th</sup> edition users, the question is 13.15 (a,b,c)

(a) ANS:

Insert Anomalies: when we insert a new patient patNo P100 there should the patName Gillian White in order to make data consistent. Here we can insert patNo with a null staffNo also.

Update Anomalies: If we update by setting the staffNo=s3000 where patNo=P100. Here we have 2 staffNo for the same dentistName which is not correct.

Delete Anomalies: If we delete the patNo: P110 from the table, we will lose the corresponding dentistName: Robin Plevin.

(b) ANS:

Functional Dependencies:

staffNo-> dentistName

patNo->patName, surgeryNo

StaffNo, aDate, aTime,->patNo,, patName

aDate, aTime, patNo->staffNo, dentistName

(c) ANS:

The database is already in 1NF.

This relation has partial dependency:

patNo->patName

Now, We have to create a new table: Patient

This relation also has a partial dependency

staffNo->dentistName

Now, again we have to create a new table: Staff

Now the 2NF is as below:

Patient:

patNo	patName
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Staff:

staffNo	dentistName

Patient\_Appointment\_Table:

staffNo	patNo	Appointment Date          Time	surgeryNo
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Here we don't have any transitive dependency so this 2NF is already in 3NF.