

Assignment 4 – Week 5

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], [B, 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:

There is a transitive dependency between $A \rightarrow C \rightarrow D$. We can get rid of it by:

$AC \rightarrow D$

- (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:

Relations that have redundant information have the problem of update anomalies. We can classify update anomalies as insertion, deletion, or modification anomalies.

Insertion anomaly – the inability to add new data to the database because another data is not available in the dependent linked tables.

Deletion anomaly – occurs when deleting unwanted information in one table creates an orphan data in another linked tables.

Modification anomalies – exists when an update to one entry must be copied to potentially many fields due to the presence of duplicate data in a given table.

- (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:

A full functional dependency means that it meets the requirements of First Normal Form (1NF), and all non-key attributes are fully functionally dependent on the primary key. This meets the normalization requirements of a 2NF. In 2NF, a relation that is in first normal form and every non-primary-key attributes are fully functionally dependent on any candidate key.

- (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:

It is a functional dependency that is indirectly formed by two functional dependencies. A table is in 3NF if it is in 2NF and has no indirect relationship that causes the functional dependency, i.e. it contains no transitive dependencies.

- (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:

patientNo: fullName

wardNo: wardName

wardName: wardNo

drugNo: name, description, dosage, methodOfAdmin

patientNo, drugNo, startDate: unitsPerDay, finishDate

(b) ANS:

1st Normal Form (1NF)

(patientNo, drugNo, startDate, fullName, wardNo, wardName, bedNo, name, description, dosage, methodOfAdmin, unitsPerDay, finishDate)

2nd Normal Form

(patientNo, drugNo, startDate, wardNo, wardName, bedNo, unitsPerDay, finishDate)

(drugNo, name, description, dosage, methodOfAdmin)

(patientNo, fullName)

3rd Normal Form

(patientNo, drugNo, startDate, wardNo, bedNo, unitsPerDay, finishDate)

(drugNo, name, description, dosage, methodOfAdmin)

(patientNo, fullName)

(wardNo, wardName)

(c) ANS:

(patientNo, drugNo, startDate, wardNo, bedNo, unitsPerDay, finishDate)

(drugNo, name, description, dosage, methodOfAdmin)

(patientNo, fullName)

(wardNo, wardName)

(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:

Example of insertion anomaly:

The primary key of the given relation could be (staffNo, apptDate, apptTime). One way the insertion anomalies can occur is when we try to insert a new dentist record while there is no patient allocated to this new dentist. In this case, we need to insert null into apptDate and apptTime which violates entity integrity rule.

Example of deletion anomaly:

When we delete the details of a patient, we will lose all the dentist information and vice versa. As an example, if we delete the dentist Tony Smith, we will lose patients Gillian White and Jill Bell.

Example of update anomaly:

Assume we want to update the patient information with the patNo P110, then we will update all the records in the relation which has a patient number P110. Failing to updating this information will leave the database into inconsistent state.

(b) ANS:

Relation in 1NF

(staffNo, apptDate, apptTime, dentistName, patNo, patName, surgeryNo)

FD1: (staffNo, apptDate, apptTime) \rightarrow patNo, patName

FD2: staffNo \rightarrow dentistName

FD3: patNo \rightarrow patName, surgeryNo

FD4: (staffNo, apptDate) \rightarrow surgeryNo

FD5: (apptDate, apptTime, patNo) \rightarrow staffNo, dentistName

Assumptions:

- A patient is registered at only one surgery
- A patient may have more than one appointment on a given day

(c) **ANS:**

FD2 and FD4 violate 2NF, and we need to eliminate these partial dependencies. Finally, we get:

(staffNo, apptDate, apptTime, patNo, patName)

(staffNo, dentistName)

(staffNo, apptDate, surgeryNo)

FD3 violates 3NF, and we need to eliminate this transitive dependency.

(staffNo, apptDate, apptTime, patNo)

FK = patNo and staffNo

AK = (apptDate, apptTime, patNo)

FD1: (staffNo, apptDate, apptTime) \rightarrow patNo

FD5: patNo \rightarrow staffNo

(patNo, patName)

FD3: patNo \rightarrow patName

(staffNo, dentistName)

FD2 : staffNo \rightarrow dentistName

(staffNo, apptDate, surgeryNo)

FK = staffNo

FD4: (staffNo, apptDate) \rightarrow surgeryNo