Database Management System – cs422 DE

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 → 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(<u>empcode</u>, 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:
- (A, C)
- (B, C)
- (B, D)
- (A, B)

(b) Is R in 3NF?
ANS: Yes

(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?
ANS: Yes. To get rid of it, we need to decompose the relation R into two relations, each satisfying a specific functional dependency

- R1 (A, C, D)
- R2 (A, B)

(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 three main types of update anomalies

- Insertion anomalies: occur when it is not possible to add certain data to the database without adding other unrelated data.
- Deletion anomalies: occur when deleting certain data leads to unintentional loss of other related data that should have been retained.
- Update anomalies: occur when updating data in a relation leads to inconsistencies because the data is stored redundantly in multiple places.

(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 occurs when an attribute B is entirely dependent on attribute A within a relation. In this scenario, B is functionally dependent on A but not on any proper subset of A. In essence, if the functional dependency A -> B holds, it constitutes a full functional dependency. Removing any attribute from A would cause the dependency to cease to exist.
The Second Normal Form (2NF) is a state of relation achieved after ensuring it meets the criteria of the first normal form. Additionally, in 2NF, every non-primary-key attribute is fully functionally dependent on the primary key.

Example:
Table Student (StudentId, StudentName, Address, CourseId, CourseName, StartDate, EndDate)
We can decompose the relation to 2NF

- Table Student (StudentId, StudentName, Address)
- Table Course (CourseId, CourseName)
- Table StudentCourses (StudentId, CourseId, StartDate, EndDate)

(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: A transitive dependency occurs when there are attributes A, B, and C in a relation, and if A -> B and B -> C, then C is transitively dependent on A through B. This is true as long as A is not functionally dependent on B or C.
The Third Normal Form (3NF) refers to a relation that has achieved the second normal form and where no non-primary-key attribute is transitively dependent on the primary key.

Example:
Table Student (StudentId, StudentName, Address, CourseId, CourseName, StartDate, EndDate)
We can decompose the relation to 3NF

- Table Student (StudentId, StudentName, Address)
- Table Course (CourseId, CourseName)
- Table StudentCourses (StudentId, CourseId)

- Table Calendar (CourseId, StartDate, EndDate)

(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: Table Patien (PatienNo, FullName, BedNo, WardNo, WardName, DrugNo, DrugName, Description, Dosage, MethodOfAdmin, UnitsPerDay, StartDate, FinishDate)
Functional dependencies:
- PationNo -> FullName
- (PartionNo, WardNo) -> FullName, WardName, BedNo
- WardNo -> WardName
- DrugNo -> DrugName, Description, Dosage, MethodOfAdmin, UnitsPerDay, StartDate, FinishDate

(b) ANS:
- Table Patient (PatientNo, FullName)
- Table Ward (WardNo, WardName)
- Table PationDrug (PatientNo, DrugNo, UnitsPerDay, StartDate, FinishDate,)
- Table Drug (DrugNo, DrugName, Description, Dosage, MethodOFAdmin)

(c) ANS:
- Table Pation:
  - PrimaryKey: PationNo
- Table Ward:
  - PrimaryKey: WardNo
- Table PationDrug:
  - PrimaryKey: PatientNo-DrugNo
  - ForeignKey: PatientNo, DrugNo
- Table Drug:
  - PrimaryKey: DrugNo

(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:
- Update: Update appointment set surgeryNo = 'S11' where staffNo = 'S1011'
- Insertion: Insert into appointment (staffNo, dentistName, patNo, patName, appointmentDatetime, surgeryNo) value ('S1055', 'John Doe', 'P108', 'Jill Bell', 16-Sep-13 15.00, 'S15')
- Deletion: Delete appointment where staffNo = 'S1011'

(b) ANS:
- (surgeryNo, patNo, appointmentDateTime) -> staffNo, dentistName, patName, surgeryNo
- (staffno) -> dentistName
- (surgeryNo, appointmentDateTime) -> staffNo, dentistName
- (patNo) -> patName

(c) ANS:
- Table Patient (patientNo, patientName)
- Table Staff (staffNo, dentistName)
- Table appointment (surgeryNo, patNo, appointmentDateTime, staffNo)