Assignment 6, CSCI-C442

Drew Caldwell 4/21/2025

---

1. Redefine in your own words:

    1. 1st normal form

In 1NF, a table is organized so that each column has only one value, each row is unique, and all entries in a column are the same data type.

    2. 2nd normal form

In 2NF, the table is already in 1NF and additionally every non-key column depends on the entire primary key.

    3. 3rd normal form

In 3NF , the table is already in 2NF and additionally every non-key column depends only on the primary key.

2. 14.26, given the table, answer parts A and B to find the functional dependencies.

A	B	C	TUPLE#
10	b1	c1	1
10	b2	c2	2
11	b4	c1	3
12	b3	c4	4
13	b1	c1	5
14	b3	c4	6

a. Given the previous extension state, which of the following dependencies may hold in the above relation? If the dependency cannot hold, explain why specifying the tuples that cause the violation.

i. A → B does not hold. A=10 → b_1 and b_2. Thus this is a violation.
ii. B→C does hold.
iii. C→B does not hold. c_1 → b_4 and b_1. Thus a violation.
iv. B→A does not hold. b_1 → 10 and 13. Thus a violation.
v. C→A does not hold. c_1 → 10, 11, and 13. Thus a violation.

b. Does the above relation have a potential candidate key? If it does not, why not?

The only way we could get a key here is if we combine two of the columns. Individually, A, B, and C are not unique. But we do have unique pairs of (A,B). So the only potential candidate key is the combination of (A,B).

3. 14.35, given the relation given, answer A, and B and then give the schema and data as 3NF.

Book_Name	Author	Edition	Copyright_Year
DB_fundamentals	Navathe	4	2004
DB_fundamentals	Elmasri	4	2004
DB_fundamentals	Elmasri	5	2007
DB_fundamentals	Navathe	5	2007

   a. Based on a common sense understanding of the above date what are the possible candidate keys of this relation?

Just looking at the tables we could simply combine all values to make a key. That is (Book_Name, Author, Edition, Copyright_Year). Or we could get rid of the Book_Name since they're always the same. Then it would be (Author, Edition, Copyrgiht_Year). Lastly, we could use only (Edition, Copyright_Year) or (Author, Copyright_Year) if we wanted.

   b. Justify that this relation has the MVD {book} →→ {Author}|{Edition, Year}.

This relation means that for any book, there exists multiple authors. For any book, there are multiple editions with corresponding years.

So if we consider DB_Fundamentals book, we see there are 2 authors, and 2 editions with years corresponding to the editions as the relation states.

   c. What would be the decomposition of this relation based on the above MVD? Evaluate each resulting relation for the highest normal form it possesses.

We could decompose the relation to be,

BookAuthor → {Book_Name, Author}, and

BookDetails → {Book_Name, Edition, Copyright_Year}

This gives us 4NF since we eliminate the non trivial MVD's, and there is no redundancy between the cross product of the sets.