UNIVERSITÄT MANNHEIM

Data and Web Science Group
Prof. Dr. Heiko Paulheim
B6,26 – B1.16
68159 Mannheim

Database Technology– FSS 2018

Exercise 5: Normal Forms

5.1. Functional Dependencies

a. List all functional dependencies satisfied by the following relation:

A	B	C
A1	B1	C1
A1	B1	C2
A2	B1	C1
A2	B1	C3

b. Check if the following FDs hold for the following table:
   a. A->B
   b. B->C
   c. C->A
   d. AB -> C
   e. AC->B
   f. BC->A

A	B	C
10	B1	C1
10	B2	C2
11	B4	C1
12	B3	C4
13	B1	C1
14	B3	C1

c. Given the database schema R(a, b, c), and a relation r on the schema R,
write an SQL query to test whether the functional dependency b → c holds on relation r .
Also write an SQL assertion that enforces the functional dependency.
Assume that no null values are present.

5.2. Multiple Choise

When is a relation in 1NF?

- A relation is always in 1NF
- A relation is in 1 NF if every attribute of the relation has atomic content
- A relation is not always in 1NF

When is a relation in 2NF (assuming it is already in 1NF)?

- If the primary key of a relation consist of exactly one attribute and all other attributes depend on it
- If all non-prime attributes depend fully on the primary key
- If a relation has at most as many attributes as keys

When is a relation in 3NF (assuming it is already in 1NF)?

- If a relation has only one non-prime attribute and it is fully dependend on the primary key
- No non-prime attribute transitively dependent on the primary key
- If the primary key of a relation consists of exactly one attribute and all other attributes depend on it

In which relations are the normalforms?

- Is a relation in 3NF, it is also in 2NF
- Is a relation in 2NF, it is also in 3NF
- 2NF and 3NF do not depend on each other

5.3. Anomalies

StudentID	Name	SectionID	CourseID	CourseTitle	Room	Day
512874	Coen Piper	1	CS 460	Database Technology	115	Monday
554867	Reilly Harvey	2	IE661	Text Analytics	104	Tuesday
512874	Coen Piper	2	IE661	Text Analytics	104	Tuesday
457214	Elina Burn	3	IE661	Text Analytics	219	Friday

a. Given the following relation there are three types of anomalies (insert/delete/update). Find an example for each of these anomalies.
b. Normalise the relation to 1NF and write it down in relational form
c. Write down all functional dependencies
d. Normalise the relation to 2NF
e. Normalise the relation to 3NF

5.4. Supermarket

We have a database for supermarkets and their stores together with the city and the average income per person for each city.

Store_ID	Street	City	Income
4711	Schuchardstraße 1	64283 Darmstadt	40440
4712	An der Hauptwache 5	60313 Frankfurt	24984
4713	D3 3	68159 Mannheim	22970
4714	E2 16	68159 Mannheim	22970

a. Normalise the relation to 1NF
b. Write down all functional dependencies
c. Normalise the relation to 2NF
d. Normalise the relation to 3NF