Lab 2
Functional dependencies and Normal forms

EXERCISES

1. Consider the relation scheme with attributes S (store), D (department), I (item), and M (manager), with functional dependencies SI -> D and SD -> M.

a) Find all keys for SDIM.

Key is IS

b) Show that SDIM is in second normal form but not third normal form.

SDIM not depend on 3NF, but depend on 2NF, because of SD→M violation 3NF,

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2. Consider the relation scheme with attributes CITY, ST, and ZIP, which we here abbreviate C, S, and Z. We observed the dependencies CS -> Z and Z -> C. The decomposition of the relation scheme CSZ into SZ and CZ has a lossless join. Does this decomposition preserve dependencies?

F = {CS -> Z, Z -> C}

R1 = {SZ}, F1 = Ø

R2 = {CZ}, F2 = {Z -> C}

⇨ No preserve dependencies

3. Let F = {AB → C, A → D, BD → C}.

a) Find a minimal cover for F.

F = {A→ D, BD→ C} because AD and

BD→C should be AB→C redundant

b) Give a 3NF, dependency-preserving decomposition of ABCD into only two schemes (with respect to the set of functional depend-

R1 (AD), F1 = {A→ D} and

R2 (BCD), F2 = {BD→ C}encies F).

c) What are the projected dependencies for each of your schemes?

Reference of F to F1 is: A→ D

The reference for F on F2 is: BD→ C.

d) Does your answer to (a) have a lossless join? If not, how could you modify the database scheme to have a lossless join and still preserve dependencies?

Keys of F are: AB and no properties of F1 and F2 are super keys.

→T add dependencies R3 (AB) => R (AD, BCD, AB).

4. Let F = {AB → C, A →B}.

a) Find a minimal cover for F.

Minimum function dependency of F = {A→BC} because A→B so AB→C is extra attribute B

b) When (a) was given on an exam at a large western university, more than half the class answered G = {A →B, B → C}. Show that answer is wrong by giving a relation that satisfies F but violates G

because in dependency of F function, we can not determine B→C dependency, but in G there is B→C dependence, this is a violation.

5. Suppose we are given relation scheme ABCD with functional dependencies

(A → B, B → C, A → D, D → C}. Let p be the decomposition (AB,AC,BD).

a) Find the projected dependencies for each of the relation schemes of p.

the reference of F on dependency (AB) is: A→B

the reference for F on dependencies (AC) is: A→C

the reference for F on dependencies (BD) is: Ø

b) Does p preserve the given dependencies?.

Because we cannot deduce B→C and D→C from the reference of F on

decomposition dependencies, there is no functional dependency guaranteed.

6. Consider the relation scheme ABCD with dependencies

F = {A → B, B → C, D → B]

We wish to find a lossless-join decomposition into BCNF.

a) Suppose we choose, as our first step, to decompose ABCD into ACD and BD. What are the projected dependencies in these two schemes?

AB→C;C→AD.

C is key of second, but C->A violates BCNF condition in ABC as C is not a key. We cannot decompose ABC further as AB->C dependency would be lost.

b) Are these schemes in BNCF? If not, what further decomposition is necessary?

It is a violate BCNF.