(1)

You are given the following set of functional dependencies for a relation R (A, B, C, D, E, F),

F = {AB -> C, DC -> AE, E -> F}.

{A, B, D} and {B, C, D} are the only keys for the relation R.

Is the decomposition (A, B, C, D) (B, C, D, E, F) a dependency preserving decomposition? Explain briefly.

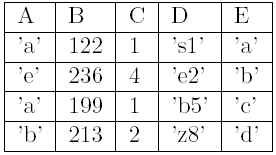
Diagram

Description automatically generated

(2)

You are given the table below for a relation R (A, B, C, D, E). You do not know the

functional dependencies for this relation.



Suppose this relation is decomposed into the following two tables: R1(A, B, C, D) and R2(A,C,E).

Is this decomposition lossless? Explain your reasoning. Diagram, schematic

Description automatically generated

(3)

Suppose you are given a relation R = (A, B, C, D, E) with the following functional

dependencies:

{CE ->D, D ->B, C ->A}

The only key for the relation R is {C, E}

1. Identify the best normal form that R satisfies (1NF, 2NF, 3NF, or BCNF).

2NF

1. If the relation is not in BCNF, decompose it until it becomes BCNF. At each step, identify a new relation, decompose and re-compute the keys and the normal forms they satisfy.

Diagram, schematic

Description automatically generated

(4)

A relation *R* is defined as follows.

*R* = (*name, street, city, state, postal\_code*) where only *name* is unique, and for any given postal code, there is just one city and state.

1. Give a set of FDs for this relation.
2. What are the candidate keys?
3. Is the relation *R* in3NF? Explain why?
4. If *R* is not in 3NF, normalize it into 3NF relations.

(5)

Consider the following relation:

CAR\_SALE (Car#, Date\_sold, Salesman#, Commission%, Discount\_amt)

Assume that a car may be sold by multiple salesmen and hence {Car#, Salesman#}

is the primary key.

Additional dependencies are:

Date\_sold → Discount\_amt

Salesman# → Commission%

Car# → Date\_sold

1. Draw a dependency diagram.
2. What normal form is the above relation is and why?
3. Show by successive decomposition based on keys, how you transform it into BCNF relations. At each step, show what test is applied and what unwanted dependencies are removed.

Diagram

Description automatically generated with low confidence

(6)

Consider the relation for published books:

Book (Book\_title, Authorname, Book\_type, Listprice, Author\_affil, Publisher)

Author\_affil refers to the affiliation of author.

Suppose the following dependencies exist:

Book\_title →Publisher, Book\_type

Book\_type →Listprice

Authorname →Author\_affil

The key for this relation is {Book\_title, Authorname}.

a. Draw the dependency diagram.

b. Which normal form is it in? State reasons.

c. Normalize this relation into BCNF.

Diagram, text

Description automatically generated