Exercise 3   Normalization   DBS

1. Consider a relation R(A, B, C, D) with the following FDs: B → C, D → B

(a) Find the key(s) of R.

(b) Is this relation in BCNF? Why or why not? If it is not, decompose R into a collection of relations that are in BCNF.

2. Prove that every two-attribute relation is in BCNF.

3. Consider the relation Courses(C, T, H, R, S, G) whose attributes may be thought informally as course, teacher, hour, room, student, and grade. Let the set of FD's of Courses be: C → T, HR → C, HT → R, HS → R, and CS → G.

(a) What are all the keys for Courses?

(b) Verify that the given FDs are their own minimal basis.

(c) Use the 3NF decomposition algorithm to find a lossless-join, dependency-preserving decomposition.

4. Consider a relation R(W, X, Y, Z) which satisfies the following set of FDs G ={Z→W, Y→X, Y→Z, XW→Y}, where G is a minimal basis.

(a) Decompose R into a set of relations in 3NF.

(b) Is the decomposition also in BCNF? Explain your answer.

5. Consider a relation R(A, B, C, D, E) and FD's A → BC, CD → E, E → A, and B→ D

(a) Is the decomposition R1(A,B,C) and R2(A,D,E) of R lossless or lossy? Justify your answer. Is this decomposition dependency preserving? If your answer is NO, then what is not preserved?

(b) Is the decomposition R3(A,B,C,D) and R4(C,D,E) of R lossless or lossy? Justify your answer. Is this decomposition dependency preserving? If your answer is NO, then what is not preserved?

6. We perform decomposition to normalize an original schema to be of certain normal forms. For such a decomposition to be "equivalent" to the original schema, it is desirable to be lossless. To study this concept, let's consider an original schema R(A, B, C). Suppose we decompose R into R1(A, B) and R2(A, C).

(a) Is this decomposition always lossless? Answer yes or no and briefly explain why.

(b) Give an example instance of R (i.e., an example table with several tuples) and demonstrate its decomposition, to support your answer in (a).