Homework (Database Design)

Due date: 6/5 23:55

1. Consider a relation schema R with attributes ABCDEF GH with functional dependencies F:

   F = {B → CD, BF → H, C → AG, CEH → F, CH → B} 1.

1) Which of these functional dependencies violate BCNF?
2) Employ the BCNF decomposition algorithm to obtain a lossless decomposition of R into a collection of relations that are in BCNF. Make sure it is clear which relations are in the final decomposition and project the dependencies onto each relation in that final decomposition.
3) Is your decomposition dependency-preserving?

2. Consider a relation R with attributes ABCDEF GH and functional dependencies F:

   F = {A → CD, ACF → G, AD → BEF, BCG → D, CF → AH, CH → G, D → B,
   H → DEG}

1) Compute all keys for R.
2) Compute a minimal basis (canonical cover) for F. In your final answer, put the FDs into alphabetical order.
3) Using the minimal basis from part (b), employ the 3NF synthesis algorithm to obtain a lossless and dependency-preserving decomposition of relation R into a collection of relations that are in 3NF.
4) Does your schema allow redundancy?

3. Questions about functional dependency:

1) Consider relation R(A,B,C,D,E) with functional dependencies:

AB→C, BC→D, CD→E, DE→A, AE→B

Which of the following FDs is guaranteed to be satisfied by R?

a) D→C b) CE→B c) AC→D d) ACD→B

2) Let relation R(A,B,C,D) satisfy the following functional dependencies:

A→B, B→C, C→A

Call this set S1. A different set S2 of functional dependencies is equivalent to S1 if exactly the same FDs follow from S1 and S2. Which of the following sets of FDs is equivalent to the set above?

a) B→A, B→C, C→B

b) C→B, B→A, A→C

c) A→B, B→A, B→C

d) A→BC, C→AB

3) Suppose relation R(A,B,C) currently has only the tuple (0,0,0), and it must always satisfy the functional dependencies A→B and B→C. Which of the following tuples may be inserted into R legally?

a) (1,0,2) b)(0,1,2) c) (2,0,1) d) (1,2,3)