Comp115 Spring 2017, HW2 - Due March 3rd, 2017

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Problem 1 - 20%

Suppose that we have the following three tuples in a legal instance of a relation schema S with four attributes $WXYZ$ (listed in order): (1, 2, 3, 4), (5, 2, 3, 4), (6, 4, 3, 5)

1. Which of the following dependencies can you infer does **not** hold over the schema S? State your reasoning.

   (a) $W \rightarrow Y$

   (b) $XZ \rightarrow W$

   (c) $Y \rightarrow Z$

   (d) $WX \rightarrow Z$

2. Can you identify any dependencies that **do** hold over S?

Problem 2 - 30%

Suppose you are given a relation R with four attributes $WXYZ$. For each of the following sets of FDs, assuming those are the only dependencies that hold for R, do the following:

(a) Identify the candidate key(s) for R

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

(c) If R is not in BCNF, decompose it into a set of BCNF relations that preserve the dependencies

1. $WX \rightarrow Y, WX \rightarrow Z, XY \rightarrow WX$

2. $X \rightarrow YZ, Y \rightarrow W, W \rightarrow X$

3. $XY \rightarrow WX, XY \rightarrow YZ, Z \rightarrow X$

4. $WX \rightarrow YZ, Y \rightarrow W$

5. $YZ \rightarrow X, X \rightarrow W, W \rightarrow Y$

Problem 3 - 50%

Consider the attribute set R = $ABCDEGH$ and the FD set

$$F = \{ AC \rightarrow E , AE \rightarrow C, BE \rightarrow D, CG \rightarrow A, G \rightarrow E, D \rightarrow G \}$$

(i) ACE (ii) $ABCDE$ (iii) ABC (iv) $ACDEG$

1. For each of the attribute sets above, do the following:

   (a) Compute which dependencies hold over the set.
   (b) Identify the candidate key(s).
   (c) Decompose it into a collection of BCNF relations if it is not in BCNF.

2. Which of the following decompositions of R = $ABCDEGH$ with the same set dependencies F, is (i) dependency-preserving? (ii) lossless-join?

   (a) $\{ ACE, BCED, ACDG \}$
   (b) $\{ AC, CG, ABCD, ED \}$