CSC 355 Database Systems 501
Assignment 5 (2/19)

Due 11:59:00pm, Wednesday 2/26.

Reading: The posted Lecture 10-13 Slides, and Sections 3.1-3.5 of Ullman/Widom.

Problems:

1. Consider the relation *R* with schema *R*(a, b, c, d), and the following set of functional dependencies: *F* = { a → c,d ; b,d → a ; b → c }.

a. For each of the fifteen non-empty subsets *S* of the set of attributes {a, b, c, d}, find the closure of *S* using the set of functional dependencies *F*.

b. List all of the superkeys of *R*.

c. List all of the candidate keys of *R*.

2. Consider the following relational schema with seven attributes, which stores information on contacts between lawyers at a law firm and their clients:

CONTACT(LawyerID, ClientID, ClientName, Company, City, Date, Hours)

The functional dependencies in CONTACT are:

ClientID → ClientName, Company, City
LawyerID, ClientID, Date → Hours
Company → City

a. CONTACT has only one candidate key. What is it?

b. Two of the three functional dependencies in CONTACT violate the condition for CONTACT to be in BCNF. Identify which two they are, and explain how they violate the BCNF condition.

c. Construct a decomposition of CONTACT into a collection of relations that are all in BCNF. Use the algorithm given in class, and show your work. (That is, at each step, state which functional dependency you are removing from which relation, and what the resulting decomposition is after you remove it. Answers that show only the final result without showing the steps taken to obtain it will receive little to no credit.)

3. For the universal relation *R*(A, B, C, D), consider the decomposition *D* consisting of R_1(A, B, C) and R_2(C, D), and the set *F* of functional dependencies { A → B ; C → B,D ; D → A }.

a. Compute the projection of *F* on R_1.

b. Compute the projection of *F* on R_2.

c. Does the decomposition *D* preserve the set of dependencies *F*? Give a detailed explanation why or why not. (Don't just repeat back the definition of the dependency preservation property, but rather show why the decomposition *D* either has or does not have this property by showing whether or not each functional dependency in *F* can be derived from the union of the projections.)

Remarks:

1. For all assignments, it is your responsibility to make sure that the files you have uploaded are readable and in the correct locations. You should always check that you can successfully download your submitted files back from the course web site to be sure that they have been uploaded correctly.

2. As is the case for every assignment, all work must be completed individually – no collaboration between students or sharing of answers between students is permitted. Do not post this assignment to any website in search of answers, and do not consult posted answers to this assignment on any website while completing the assignment. Your assignment must be your own individual work.

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