CSC 355 Database Systems 501
Assignment 6 (2/26)

Due 11:59:00pm, Wednesday 3/4.

Reading: The posted Lecture 13-14 Slides, and Sections 3.1-3.5 of Ullman/Widom. Next week: Sections 7.1-7.5 of Ullman/Widom (some of this will be review).

Problems:

1. Perform the general matrix test for the lossless join property for the relation $R(A_1, A_2, A_3, A_4)$, and the decomposition D and set of functional dependencies F given below:

$D = \{ R_1(A_1, A_3) , R_2(A_1, A_4) , R_3(A_2, A_4) \}$

$F = \{ A_1 \rightarrow A_3 , A_2 \rightarrow A_3 , A_4 \rightarrow A_1 \}$

a. Show the initial state of the matrix S, and then show each step of your work as you modify the matrix using the functional dependencies. (That is, each time you change the matrix, state which functional dependency you are applying, and show the change to the state of the matrix. Answers that show only the final matrix without showing the steps taken to obtain it will receive little to no credit.)

b. Does the decomposition D have the lossless join property? Explain why or why not in terms of the final state of the matrix S.

2. Find a minimal basis for the following set F of functional dependencies. Show your work. (That is, each time your replace one functional dependency with another or remove a functional dependency, show the change that you are making to the minimal basis. Answers that show only the final result without showing the steps taken to obtain it will receive little to no credit.)

a → b
a,d → c
b → d,c
c → d

3. Consider the universal relation

STUDENT(SID, SSN, First, Last, Major, Dept, Class)

with the following set F of functional dependencies:

SID → SSN, Major
SSN → First, Last, SID
SID → Dept
Major → Dept
First → Class

a. Identify all of the candidate keys of *F*.

b. Explain why STUDENT is not in 3NF. (Be specific – don't just restate the definition of 3NF, but rather explain how STUDENT does not satisfy the definition.)

c. Construct a decomposition of STUDENT into relations in 3NF that has both the dependency preservation property and the lossless join property. Use the algorithm discussed in class, and show your work. (Answers that show only the final result without showing the steps taken to obtain it will receive no credit.)

(Hint: I will tell you that if you split SID → SSN, Major into two functional dependencies, split SSN → First, Last, SID into three functional dependencies, and remove SID → Dept, then the resulting set is a minimal basis of *F*.)

Submit a .doc, .docx, .txt or other electronic document with your answers and your name at the top to the "Assignment 6" dropbox.

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 submission must be your own individual work.

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