Database Management Systems (COP 5725)

Spring 2016

Instructor:
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TAs:
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Exam 3

Name:	
UFID:	
Email Address:	

Pledge (Must be signed according to UF Honor Code)

On my honor, I have neither given nor received unauthorized aid in doing this assignment.

_____
Signature

For scoring use only:

	Maximum	Received
Question 1	30	
Question 2	25	
Question 3	25	
Question 4	20	
Total	100	

Question 1 (Functional Dependencies) [30 points]

Consider the following set S of functional dependencies:

$$A \rightarrow B \qquad (1)$$

$$AB \rightarrow C \qquad (2)$$

$$AC \rightarrow B \qquad (3)$$

$$B \rightarrow C \qquad (4)$$

1. [2 points] Given (1) and (4), prove (2) using Armstrong axioms. Please indicate the rules that have used in each step.

2. [2 points] Given (1) and (4), prove (3) using Armstrong axioms. Please indicate the rules that have used in each step.

3. [3 points] Give all candidate keys of relation $R(ABC)$ that satisfies (1-4). Explain your answer.

4. [3 points] Give a minimal cover for the set S.

For the following questions, suppose you are given the functional dependencies set $S = \{AB \rightarrow C, C \rightarrow B, C \rightarrow D\}$.

5. [5 points] Given S, is the relation $R_1(A,B,C)$ in 3NF? If yes, justify. If no, specify at least one FD which violates the definition.

6. [5 points] Given S, which normal form(s) (BCNF, 3NF) does relation $R_2(C,D)$ obey?

7. [5 points] Is it correct to say that any relation with two attributes is in BCNF? If yes, please prove it. If not, please give a counter-example.

8. [5 points] Usually, a decomposition of a database schema in Boyce-Codd normal form (BCNF) relation schemas is regarded as the "ultimate" decomposition in order to eliminate redundancy and potential update anomalies. Why is the third normal form (3NF) still of interest?

Question 2 (Normalization) [25 points]

StaffNo	DentistName	PatientNo	PatientName	Appointment date	time	SurgeryNo
S001	Michael Pearson	P1005	Jake Mill	23-Sep-13	10:00	SU05X
S001	Michael Pearson	P1129	Nicolas Reese	24-Sep-13	11:00	SU08X
S402	Zheng Lei	P1130	Noah Fuller	10- Aug -13	09:30	SU19Z
S402	Zheng Lei	P1130	Noah Fuller	17-Aug-13	09:30	SU19Z
S303	Joanna Lawson	P0020	Paul Bates	05-Jun-13	14:00	SU03X
S303	Joanna Lawson	P1005	Jake Mill	08-Oct-13	11:00	SU20P

1. [12 points] The table shown above provides some details of patient dental appointments. It is susceptible to update anomalies. Provide examples of insertion, deletion, and modification anomalies. Please describe the examples concisely.

2. [13 points] Describe and illustrate the process of normalizing the table above to 3NF. State any assumptions you make about the data shown in this table.

Question 3 (Data Integrity) [25 points]

Consider the following database concerning World War II ships:

Classes (class, type, country, numGuns, weight)
Ships (name, class, launched)
Battles (name, date)
Outcomes (ship, battle, result)

Ships are built in "classes" of the same design, and a class is usually named after the first ship of that class. The relation Classes records the name of the class, the type ('bb' for battleship, 'bc' for battlecruiser), the country that built the ship, the number of main guns, and the weight (in tons). Relation Ships records the name of the ship, the name of its class, and the year in which the ship was launched. Relation Battles gives the name and date of battles involving these ships, and relation Outcomes gives the result (sunk, damaged, or ok) for each ship in each battle.

1. Write **assertions** for each of the following conditions.
(a) [6 points] No class may have more than 3 ships.
(b) [6 points] No ship may be launched before the ship that bears the name of this class.

2. Write the following triggers. In each case, disallow or undo the modification if it does not satisfy the stated constraints.
(a) [6 points] When a new class is inserted into "Classes", also insert a ship with the name of that class and a NULL launch data.
(b) [7 points] If a tuple is inserted into "Outcomes", check that the battle is listed in "Battles", and if not, insert tuples into one or both of these relations, with NULL components where necessary.

Question 4 (Data Integrity) [20 points]

Consider the following relational schema:

Emp(eid: integer, ename: string, age: integer, salary: real)
Works(eid: integer, did: integer, pct time: integer)
Dept(did: integer, budget: real, managerid: integer)

1. [5 points] Define a table constraint on Emp that will ensure that every employee makes at least $10,000. You should include the SQL statements of creation of the table.

2. [5 points] Define a table constraint on Dept that will ensure that all managers have age > 30.

3. [5 points] Define an assertion on Dept that will ensure that all managers have age > 30. Compare this assertion with the equivalent table constraint. Explain which is better.

4. [5 points] Write SQL statements to delete all information about employees whose salaries exceed that of the manager of one or more departments that they work in. Be sure to ensure that all the relevant integrity constraints are satisfied after your updates.

(Overflow page if the space for an answer is insufficient. Please mark precisely the question you continue below.)