Homework 4

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:

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Exercise 1 (Knowledge Questions) [40 points]

1. Is there any problem in the schema studentTranscript(sId, sname, sphone, saddr, courseId, courseGrade)? If yes, list two aspects of the problem. If no, argue why the schema is fine. [4 points]

2. Please define the term “functional dependency”. [4 points]

3. Please describe the 6 inference rules of the Armstrong axioms. What are the two criteria that we value these rules? [8 points]

4. Please give the algorithm of calculating the attribute closure A+ given a set F of FDs. [4 points]

5. What are the steps of computing the canonical cover. Given the set F={A->B, B->C, AC->D}, use the steps learned to compute the canonical cover. List each step in detail and explain it. [8 points]

6. Describe the two fundamental correctness criteria for the normalization. [4 points]

7. What kind of functional dependency does 2NF eliminate from 1NF? What kind of functional dependency does 3NF eliminate from 2NF? [4 points]

8. Describe the synthesis algorithm for computing the decomposition on the basis of F. [4 points]

Exercise 2 (Functional Dependencies and Normal Forms) [30 points]

1. [5 points] Consider a relation schema R(XYZ) with functional dependencies XY->Z and Z->X. Can we conclude that Y->XZ? If yes, please proof it. If no, please give a counter example.

2. [8 points] Given the relation schema R = (A, B, C, D, E) and the canonical cover of its set of functional dependencies Fc = { A -> BC CD E B -> D E -> A}. Compute a lossless join decomposition in Boyce-Codd Normal Form for R. Show your steps clearly.

3. [4 points] Is this decomposition dependency-preserving? Why or why not?

4. [6 points] Compute the Canonical Cover for F = {A -> B, ABCD -> E, EF -> GH, ACDF -> EG}. List the steps in detail.

5. [3 points] List all attribute sets from below that are candidate keys (if any) based on the above question.

   AB ACDE ACDF CDG

6. [4 points] Is the answer you computed from Question 4 in 3NF? Is it in 2NF? Why or why not?
Exercise 3 (Functional Dependencies and Normal Forms) [30 points]

Consider the relation schema $R(ABCDEF\overline{G})$ with the functional dependencies $A \rightarrow B$, $BD \rightarrow CG$ and $AFG \rightarrow E$.

1. [5 points] Using Armstrong’s axioms (6 inference rules), show that the given FD’s (functional dependencies) imply that $ADF \rightarrow E$. For each step, indicate which axiom and other FD’s you’re using.

2. [5 points] List all candidate keys of $R$. Show each step in detail.

3. [5 points] Suppose we project $R$ onto $S(ADF\overline{G})$. Give a minimal cover of FD’s that hold in $S$.

4. [10 points] Let $R = ABCDE$, $R1 = AD$, $R2 = AB$, $R3 = BE$, $R4 = CDE$, and $R5 = AE$. Let the functional dependencies be: $A \rightarrow C$, $B \rightarrow D$, $C \rightarrow D$, $DE \rightarrow C$, $CE \rightarrow A$. Use Chase Test to determine if this is Lossless Join Decomposition.

5. [5 points] Is the FDs of the previous question equivalent to FDs $\{A \rightarrow CD, DE \rightarrow A, BE \rightarrow C, B \rightarrow D\}$?