Information and Database Management Systems I

(CIS 4301 UF Online)

Fall 2019

Instructor: Dr. Markus Schneider

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:

	Maximum	Received
Exercise 1	35	
Exercise 2	20	
Exercise 3	35	
Exercise 4	10	
Total	100	

Exercise 1 [35 points]

1. [5 points] Consider the relation schema $R = (A, B, C, D, E, F)$ with the functional dependencies $FD = \{A{\rightarrow}B, D{\rightarrow}E, A{\rightarrow}C\}$. Which of the following sets of attributes functionally determine E and which sets are the candidate key? If no candidate key found, compute it. Show each step.
   - AD
   - BCD
   - AC
   - CD
   - AF

2. [5 points] Consider a relation schema R(X, Y, Z) with the functional dependencies $XY{\rightarrow}Z$ and $Z{\rightarrow}X$. Can we conclude that $Y{\rightarrow}XZ$ holds? If yes, please argue why. If no, please argue why not by giving a counter example.

3. [5 points] Consider the relation schema $R = (A, B, C, D, E, F, G, H)$ with functional dependencies $FD = \{A{\rightarrow}B, CH{\rightarrow}A, B{\rightarrow}E, BD{\rightarrow}C, EG{\rightarrow}H, DE{\rightarrow}F\}$. Which of the following FDs is also guaranteed to be satisfied by R? Show each step.
   - ADG$\rightarrow$CH
   - CGH$\rightarrow$BF
   - BFG$\rightarrow$AE
   - ADE$\rightarrow$CH

4. [5 points] Consider the relation schema $R = (A, B, C, D, E, F, G, H, I, J)$ with functional dependencies $FD = \{B{\rightarrow}E, E{\rightarrow}FH, BCD{\rightarrow}G, CD{\rightarrow}A, A{\rightarrow}J, I{\rightarrow}BCDE, H{\rightarrow}I\}$. Determine if B$\rightarrow$J holds and list every candidate key. Show each step.

5. [15 points] We have a set of functional dependencies given as $F = \{A{\rightarrow}B, B{\rightarrow}C\}$ for four attributes A, B, C, and D in a relation schema R. Write down all the functional dependencies in the closure F^+ of F and count them.

Exercise 2 [20 points]

1. [5 points] Consider the relation schema $R = (A, B, C, D, E, F, G, H)$ with functional dependencies $F = \{A \rightarrow C, AC \rightarrow E, D \rightarrow EH, F \rightarrow G\}$ and $G = \{A \rightarrow BCE, AD \rightarrow CFG, D \rightarrow A, DE \rightarrow GH, F \rightarrow D\}$. Are the two sets F and G **equivalent**? Show each step.

2. [2.5 points each] Use the Armstrong axioms to prove the following deductions.
   (1) $\{X \rightarrow Y, X \cup Y \rightarrow Z\} \Rightarrow \{X \rightarrow Z\}$
   (2) $\{X \rightarrow Z, Y \rightarrow W\} \Rightarrow \{X \cup Y \rightarrow Z \cup W\}$

3. [5 points] Consider the relation schema $R = (A, B, C, D, E)$ with the set of functional dependencies $F = \{A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}$. List all candidate keys of R by using the Armstrong's Axioms. Show each step.

4. [5 points] For a relation scheme $R = (A, B, C, D, E, F)$ and a set of functional dependencies given as $F = \{A \rightarrow B, A \rightarrow C, CD \rightarrow E, CD \rightarrow F, B \rightarrow E\}$, use Armstrong's Axioms rules to find one candidate key for R. Show each step.

Exercise 3 [35 points]

1. [15 points] Find a minimal cover for the relation $R = (A, B, C, D, E, F, G, H)$ with the set $F = \{A \rightarrow B, ABCD \rightarrow E, EF \rightarrow GH, ACDF \rightarrow EG\}$ of functional dependencies. Show each step.

2. [10 points] Find a minimal cover for the relation $R = (A, B, C, D, E)$ with the set $F = \{A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}$ of functional dependencies. Show each step.

3. [10 points] Find a minimal cover for the relation $R = (A, B, C, D, E, F)$ with the set $F = \{A \rightarrow D, AC \rightarrow DE, B \rightarrow F, D \rightarrow CE\}$ of functional dependencies. Show each step.

Exercise 4 [10 points]

1. [5 points] Consider the relation schema $R = (A, B, C, D, E, F)$ with a set of functional dependencies $F = \{CF \rightarrow D, AE \rightarrow F, D \rightarrow A, AB \rightarrow C\}$. List all candidate keys of R in a systematic manner (do not use the Armstrong's Axioms) and explain how you determine them. Show each step.

2. [5 points] Consider the relation schema $R(A, B, C, D, E, F)$ with the functional dependencies $FD = \{D \rightarrow C, CE \rightarrow A, D \rightarrow A, AE \rightarrow D\}$. Determine all candidate keys of R in a systematic manner (do not use the Armstrong's Axioms) and explain how you determine them.