

# Database Management Systems

**(COP 5725)**

Fall 2019

Instructor: Dr. Markus Schneider

TAs: Kyuseo Park

## 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.