

CSCI 4333 Design of Database Systems
Summer 2020
Homework #8

Functional Dependency and Normalization Analysis

(1) (25%) Conduct normalization analysis on OWOS by listing the FDs and the highest normal form of each relation. You must use [h8q1_template.docx](#) (which is based on the suggested solution of HW #4). Complete the task by filling in the rows "Normalization Analysis."

(2) (25%) List the candidate keys and the highest normal forms for the following relations.

- [a] $R(A,B,C,D)$ $\{A \rightarrow BC, B \rightarrow A\}$
- [b] $R(A,B,C,D)$ $\{A \rightarrow B, BC \rightarrow D\}$
- [c] $R(A,B,C,D)$ $\{AB \rightarrow CD, D \rightarrow C\}$
- [d] $R(A,B,C,D)$ $\{AB \rightarrow C, BC \rightarrow D\}$
- [e] $R(A,B,C,D)$ $\{A \rightarrow B, B \rightarrow C, C \rightarrow D, D \rightarrow C\}$

[3] (20%) Consider the relation Student(StudentId, LastName, FirstName, Email, FacultyId) with obvious meanings of the columns. StudentId and FacultyId are the unique identifier for a student and a faculty respectively.

Provide two sets of FDs and assumptions such that:

1. the first set of assumptions make the relation in BCNF.
2. the second set of assumptions make the relation violating 3NF.

List also the candidate keys in both cases. There can be many acceptable answers.

[4] (20%) Consider the following relation

$R(A,B,C,D)$ $\{AC \rightarrow B, C \rightarrow D\}$

(a) Show all candidate keys.

(b) What is the highest normal form (up to BCNF)? Why?

(c) If it is not in BCNF, can you losslessly decompose R into component relations in BCNF while preserving functional dependencies?

(5) (10%)

(a) Consider $R(A,B,C,D)$. It is known that R has exactly two candidate keys and one of them is AB. How many superkeys can R have?

(b) Prove or disprove: If $R(A,B,C)$ has exactly two prime attributes, the R is in BCNF.

Your solution filename should be h8_<<Your name>>_<<Your Student ID>>.docx.
Submit your homework through Blackboard.