

**GRADED HOMEWORK 4**

**Assigned: 11/22/2021 at 1:30 PM (CST); Due: Thursday, 12/2/2021 at 11:59 PM (CST) on Canvas**

**Late submissions will be accepted until 11:59 PM (CST) on the date following the due date with 5% penalty. Any late submission after this time will not be graded.**

**Problem 1 (28%):**

Do exercise 2.14 (a, b, c, d) on Page 62 in Chapter 2 in the textbook, but ignore the ID attribute in the queries as the given employee database in Figure 2.17 does not have this attribute.

**Problem 2 (47%):**

Given the following relational schema where each attribute is atomic:

EMPLOYEE (id, name, age, classid, gender, manager, salary)

and a set of functional dependencies:

SetOfFDs = {(classid, id, gender)  $\rightarrow$  (salary, manager),  
name  $\rightarrow$  (age, id),  
id  $\rightarrow$  name,  
manager  $\rightarrow$  (gender, age, classid, id)}

- a) Find ALL candidate keys for the schema EMPLOYEE; show your work.
- b) For each of the normal forms (1NF, 2NF, 3NF, BCNF), **explain in detail** why EMPLOYEE satisfies/does not satisfy with respect to the set of functional dependencies SetOfFDs.
- c) Use the decomposition algorithm to obtain the lowest normal form that the schema EMPLOYEE does not satisfy with respect to SetOfFDs (for example, if your answer for question (b) is that EMPLOYEE satisfies 1NF and 2NF, but does not satisfy 3NF and BCNF, then use the decomposition algorithm to decompose EMPLOYEE into the schemas each of which satisfies 3NF); **show your work**. For each resulting schema, give its **complete** set of functional dependencies and candidate keys. You must explain why each of your resulting schemas is in the desired normal form.
- d) **Explain in detail** why your decomposition obtained in part (c) is/is not loss-less join.
- e) **Explain in detail** why your decomposition obtained in part (c) is/is not dependency-preserving.

**Problem 3 (25%):**

Select a database application of your choice, describe the application in details, list all functional dependencies that should hold among the attributes, and then design relational schemas for your database so that every schema must be in 3NF or BCNF. Your relational database must contain at least 2 relational schemas. You must justify that each of your relational schemas is in 3NF or BCNF. The application must not come from the textbooks/ lecture notes / homework assignments / class projects / exams / examples / qualifying exams used for CS/DSA 4513 at the University of Oklahoma. If you have copied the application from some other sources, you must provide the references of the sources in your answers. If you designed an ER diagram for this problem, do not turn it in; we will not grade your ER diagram.

**Notes for Problem 3: you need to justify the functional dependencies you provide by explaining which functional dependency represents which requirement(s) in your application. Without the justifications, your solution for Problem 3 will not be graded and a zero score will be given for your Problem 3.**

**SUBMISSION:**

- Your solutions must be typed; no hand-written solutions will be graded.
- Submit your solutions for all three problems in one single PDF file with the file name convention (HW4\_Your Last Name\_Your First Name) to the class website on Canvas.