

**GRADED HOMEWORK 4 (Maximum Points: 100 points)**

**Assigned: Monday, 11/22/2021**

**Group Portion Due: Thursday, 12/2/2021 at 1:30 PM on Canvas**

**Individual Portion Due: Friday, 12/3/2021 at 11:59 PM on Canvas**

**No late submission of either the group portion or the individual portion will be accepted.  
See the submission instructions at the end of the document. Read the "Group Graded Homework  
Grading Policy" posted on Canvas**

**PROBLEM 1 (Group Question; No Individual Question):**

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:**

**Group Question:**

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) -> (salary, manager),  
name -> (age, id),  
id -> name,  
manager -> (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.**

**Individual Question:**

Each group member will be assigned one of the following questions randomly after the group portion of the homework is due (see the submission instructions at the end of the document). You must be ready to answer any of these questions on your own to submit the individual portion of the homework:

- 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 (Group Question; No Individual Question):**

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 4 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 INSTRUCTIONS:****Group Portion:**

- The homework answers (one submission per group) for all the three problems must be submitted in ONE PDF file to Canvas by 1:30 PM, 12/2/2021. Use the file name convention HW4\_Group X where X is your group number.
- Attach to your PDF for Problem 1 a cover page that contains the following information:  
COURSE: CS/DSA-4513 - DATABASE MANAGEMENT  
SECTION: 001  
SEMESTER: FALL 2021  
INSTRUCTOR:  
GRADED HOMEWORK NUMBER: 4  
GROUP NUMBER: <write your group number here>  
GROUP MEMBERS: <list the names of all members here>  
SCORE: <<we will record the total score of your group for the three problems here>>

**Individual Portion:**

After the submission deadline of the group portion of this graded homework, and before the submission deadline of the individual portion of this graded homework, you will have to take a quiz on Canvas. The quiz will be open from 2:46 PM, Thursday, December 2, 2021 to 11:59 PM, Friday, December 3, 2021. The quiz will contain one of the versions of the Individual Question for Problem 2. Once you open the quiz, you will have 60 minutes to submit your answer. You will have to upload one PDF document as your answer. The quiz will also ask you for your feedback on your group members (i.e. the scores you give to each of your group members on the group portion of this graded homework) as outlined in the "Group Graded Homework Grading Policy" document available on Canvas. If you do not provide the scores for your group members, then we assume that you give the same points (10 points) to each of your group members.