

GRADED HOMEWORK 3 (Maximum Points: 100 points = 10% of the course grade)

Assigned: 11/15/2023 at 1:30 PM (CST); Due: 11/29/2023 at 11:59 PM (CST) on Canvas

- **Late submissions will be accepted until 11:59 PM on the date following the due date with 5% penalty. Any late submission after this time will not be graded.**
- **ACADEMIC INTEGRITY:** The graded homework must be done by you only; no collaboration with anyone is allowed. The use of generative AI tools (including ChatGPT, Bard, Bing Chat, and other AI writing and coding assistants) is not allowed in all homework questions, except for those questions where the use of these tools is explicitly required. Violations of any of these rules will be considered academic misconduct and will result in action as specified in the Academic Integrity Code at The University of Oklahoma: <http://www.ou.edu/integrity>. Consult also the following web page for a Student's Guide to Academic Integrity at The University of Oklahoma: <http://www.ou.edu/integrity/students>.

PROBLEM 1 (28 points):

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 (60 points):

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)}

- Find ALL candidate keys for the schema EMPLOYEE; show your work.
- 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.
- 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. If you only state that your decomposition in part (c) is/is not loss-less join without detailed explanations, you will get a zero score for this question.
- e) **Explain in detail** why your decomposition obtained in part (c) is/is not dependency-preserving. If you only state that your decomposition in part (c) is/is not dependency-preserving without detailed explanations, you will get a zero score for this question.

PROBLEM 3 (12 points):

Using ChatGPT, generate prompts to ask it to explain how functional dependencies are utilized in practical database management systems and how functional dependencies can be used together with the Entity Relationship Model. Using the answers given by ChatGPT, provide detailed explanations of whether you agree or disagree with the answers (if you only state that you agree or disagree with the answers without providing detailed explanations, you will get a zero score for this question). If you disagree, include modifications to the answers. Present your prompts, ChatGPT's answers, your detailed explanations, and any modifications made.

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 (Your Last Name_Your First Name_HW4) to the class website on Canvas.
- Attach to the PDF file containing your answers for Problem 1 a cover page that contains the following information:

NAME: <Write your name here>

STUDENT ID: <Write your student ID here>

GRADED HOMEWORK NUMBER: 4

COURSE: CS/DSA 4513 - DATABASE MANAGEMENT

SECTION: ONLINE 995-999

SEMESTER: FALL 2023

INSTRUCTOR: DR. LE GRUENWALD

SCORE: <we will record your total score for Problems 1, 2, and 3 here>