

Database Systems Homework 3

"I have done this assignment completely on my own. I have not copied it, nor have I given my solution to anyone else. I understand that if I am involved in plagiarism or cheating, I will have to sign an official form that I have cheated and that this form will be stored in my official university record. I also understand that I will receive a grade of 0 for the involved assignment and my grade will be reduced by one level (e.g., from A to A- or from B+ to B) for my first offense, and that I will receive a grade of "F" for the course for any additional offense of any kind."

Sincerely,

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CS532: Homework 3 B

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1. **Continue from Question 1 of Homework 3 Part 1 and use the instructor's solution to Part 1 for this question (as well as for the next question in Homework 3 Part 2). Specifically, for each schema, use functional dependencies identified in the instructor's solution to**
- a. **compute all candidate keys for each relation using the dependency graph approach (although you are not required to show the dependency graph), and**

Candidate Keys:

Students: B# and email

Courses: (course# dept_code)

Classes: classid and (dept_code course# sect# year semester)

Faculty: B# and email

G_Enrollment: (G_B# classid)

- b. **determine whether or not the schema is in 3NF or in BCNF. Need to provide justification for your answer, e.g., if you say a schema is not in 3NF/BCNF, you need to identify the FD that makes the schema not in 3NF/BCNF.**
- **Students**
Students is in BCNF as for every non-trivial FDs, the left side is a superkey. Since Students is in BCNF, it is in 3NF as well.
 - **Courses**
Courses is not in BCNF as for every non-trivial FDs, the left side is not a superkey. Courses is not in 3NF as the non-prime attribute credits non-trivially depends on a non-superkey course#.
 - **Classes**
Classes is in BCNF as for every non-trivial FDs, the left side is a superkey. Since Classes is in BCNF, it is in 3NF as well.
 - **Faculty**
Faculty is not in BCNF as for every non-trivial FDs, the left side is not a superkey. Faculty is not in 3NF as the non-prime attributes (phone# deptname) and (office deptname) non-trivially depends on non-superkeys office and phone# respectively.
 - **G_Enrollment**
G_Enrollment is not in BCNF as for every non-trivial FDs, the left side is not a superkey
G_Enrollment is not in 3NF as the non-prime attribute lgrade non-trivially depends on non-superkey score.

2. For each schema that is not in 3NF (from Question 1 above), decompose it into 3NF schemas using Algorithm LLJD-DPD-3NF. Show the result after each step of the algorithm, i.e., show the candidate keys (from Question 1), show the minimal cover (Step 2; if the FDs of a schema has multiple minimal covers, show all of them), show the decomposition based on functional dependencies in the minimal cover (Step 3; if a schema has multiple minimal covers, show the decomposition that can produced by each minimal cover), and mention whether an additional schema needs to be added to the decomposition (Step 4). Don't forget to underscore the primary key of each new relation.

Answer -

Please find below decomposition of relational schemas to 3NF which were not in 3NF -

- **Courses -**

- Candidate Keys - dept_code course#
- Fmin - { dept_code course# → title,
course# → credits,
dept_code → deptname }
- D - { D1 (dept_code, course#, title)
D2 (course#, credits)
D3 (dept_code, deptname) }

- **G_Enrollments -**

- Candidate Keys - sid classid
- Fmin - { sid classid → lgrade,
lgrade → ngrade }
- D - { D1 (sid, classid, ngrade),
D2 (lgrade, ngrade) }

- **Faculty -**

- Candidate Keys - : B# and email
- Fmin - { B# → first_name last_name title email office;

email → B#; office → phone# deptname; phone# → office deptname }
- D - { D1 { B# first_name last_name title email office; }
D2 (office phone# deptname;}