

4) Recall the following relational scheme, called FAC, for storing information associated with courses and faculty members at some university.

| | |
|------------|--|
| FACULTY# | A faculty identification number. |
| DEPARTMENT | A department name. |
| COURSE# | The identification number of a course. |
| SECTION# | The number of a course section, e.g., 01, 02, 03, etc. |
| BOOK | The ISBN number of a book. |

In addition, consider the following additional relational scheme, called STU, for representing student data.

| | |
|----------|--|
| STUDENT# | A student identification number. |
| COURSE# | The identification number of a course the student is currently taking. |
| SECTION# | The number of the section of the course that the student is in. |

Finally, consider the following relational scheme, called CRS, for representing course information.

| | |
|---------|--|
| COURSE# | A course identification number. |
| CREDITS | Total number of credit hours given for the course. |

Give an SQL query for each of the following.

(a) A list of those faculty identification numbers, without duplicates, for those faculty who teach a section of a course in which the student with identification number 013425387 is in.

(b) A listing of student identification numbers, showing the total number of credit hours currently being taken by each student.

(c) A listing of those faculty identification numbers for those faculty who have at least thirty (30) students in all of their courses combined.

(d) A listing of those faculty identification numbers, without duplicates, for those faculty members who teach a course using the book with ISBN number 1-13-435265 or who teach at least one course with four (4) or more credit hours.

3)

(a) Define the natural join relational operator.

(b) List and define four other fundamental relational-algebra operations.

2) For each of parts (a) and (b), give a decomposition of the given relational scheme into 3NF that is dependency preserving and has a lossless join.

(a) Relational scheme $R=(A,B,C,D,E,F)$ with functional dependencies $\{A \Rightarrow B, CD \Rightarrow A, BC \Rightarrow D, AE \Rightarrow F, CE \Rightarrow D\}$.

(b) Relational scheme $R=(A,B,C,D,E,F)$ with functional dependencies $\{A \Rightarrow D, B \Rightarrow E, C \Rightarrow F\}$.

Comprehensive Exam

Databases

Spring 1999

1) Consider the following relational scheme for storing information associated with courses and faculty members at some university, which is not necessarily Florida Tech.

| | |
|------------|--|
| FACULTY# | A unique faculty identification number. |
| DEPARTMENT | A department name. |
| COURSE# | The identification number of a course. |
| SECTION# | The number of a course section, e.g., 01, 02, 03, etc. |
| BOOK | The ISBN number of a book. |

Suppose that the following rules apply in the university.

1. Department names are math, computer science, biology, etc.
2. Course identification numbers are unique.
3. Every faculty member is assigned to exactly one department.
4. Each course that is taught in a given semester, has one or more sections.
5. Every faculty member teaches one or more course sections.
6. Different faculty members can teach different sections of the same course.
7. No more than one faculty member is assigned the same section of the same course.
8. Every faculty member selects one or more books for each course that they teach.
9. Different faculty members who teach the same course can use the same or different text books for their sections.
10. A faculty member uses the same books for every section of a specific course that they teach.
11. No other rules apply.

Based on the above rules, circle each of the following functional dependencies that hold.

FACULTY# => DEPARTMENT

SECTION# => COURSE#

BOOK => COURSE#,SECTION#

COURSE#,SECTION# => FACULTY#

FACULTY#,COURSE# => BOOK

FACULTY#,BOOK => COURSE#

COURSE#,SECTION# => BOOK

SECTION#,BOOK => COURSE#

FACULTY#,COURSE# => SECTION#

DEPARTMENT,COURSE#,SECTION#,BOOK => FACULTY#