

Comprehensive Exam

Databases

Spring 2007

1) (30 points) 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#

2) Consider the following set F of functional dependencies for the relational scheme $R=(A,B,C,D,E,F)$.

$A \Rightarrow B$

$A \Rightarrow D$

$C \Rightarrow EA$

(a) (10 points) Now consider the decomposition of R into $R_1=(A,B,F)$ and $R_2=(A,C,D,E)$. Is this decomposition dependency preserving (yes or no)? If so, then explain why, and if not, then explain why not.

(b) (10 points) Now suppose that the set of functional dependencies, for the same relational scheme, is:

$A \Rightarrow B$

$A \Rightarrow D$

$C \Rightarrow EA$

$C \Rightarrow B$

Is the decomposition of R into $R_1=(A,B,F)$ and $R_2=(A,C,D,E)$ still dependency preserving (yes or no)? If so, then explain why, and if not, then explain why not.

3) (30 points) Consider the following collection of relation schemes.

employee(employee-name, street, city)

works(employee-name, company-name, salary)

company(company-name, city)

manages(employee-name, manager-name)

Give an SQL statement for each of the following.

(a) A list of manager names, and for each manager a count of the number of employees that they manage.

(b) As declared above, each employee works for exactly one company (This is indicated by the fact that *employeenname* is a candidate key for *works*). Give an SQL statement that lists all employee who do not work for First Bank Corporation.

(c) Now suppose that each employee can work for more than one company. Furthermore, suppose that in order to support this the schema for *works* is changed so that *employee-name* and *company-name* both collectively form the primary key. Does your answer to part (b) apply in this case as well (yes or no)? If not, then give an SQL query that does.

4) (20 points)

a) Define first normal form (1NF).

b) Define second normal form (2NF).

c) Define third normal form (3NF).

d) Define BCNF.