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COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Govt. of Maharashtra)

Comp/IT

End-Semester Examination- Nov 2012

CT 303: DATABASE MANAGEMENT SYSTEM

Class: - T.Y. B.Tech (Computer Engineering. & Information Technology)

Year: - 2012-13 **Semester: - V**

Duration: - 3 hrs. **Max. Marks: - 50**

Instructions:

a) Attempt any Five (5) Questions.
b) Assume suitable data whenever necessary.
c) Draw neat figures wherever required
d) Figures to right indicate full marks

Q.1 **A)** Consider the following information about a university database: **[6]**

- Professors have an SSN, a name, an age, a rank, and a research specialty.
- Projects have a project number, a sponsor name (e.g., NSF), a starting date, an ending date, and a budget.
- Graduate students have an SSN, a name, an age, and a degree program (e.g., M.S. Or Ph.D.).
- Each project is managed by one professor (known as the project's principal investigator).
- Each project is worked on by one or more professors (known as the project's co-investigators).
- Professors can manage and/or work on multiple projects.
- Each project is worked on by one or more graduate students (known as the project's research assistants).
- When graduate students work on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have a (potentially different) supervisor for each one.
- Departments have a department number, a department name, and a main office.
- Departments have a professor (known as the chairman) who runs the department.

- Professors work in one or more departments, and for each department that they work in, a time percentage is associated with their job.
- Graduate students have one major department in which they are working on their degree.
- Each graduate student has another, more senior graduate student (known as a student advisor) who advises him or her on what courses to take.

Design and draw an ER diagram that captures the information about the university. Use only the basic ER model here, that is, entities, relationships, and attributes. Be sure to indicate any key and participation constraints.

B) Does the relational model, as seen by an SQL query writer, provide physical and logical data independence? Explain. **[4]**

Q.2. A) Consider the following schema: **[5]**

Suppliers(sid: integer, sname: string, address: string)

Parts(pid: integer, pname: string, color: string)

Catalog(sid: integer, pid: integer, cost: real)

State what the following queries compute:

1. $\Pi_{sname}(\Pi_{sid}(\sigma_{color='red'}$ Parts) **NATURAL JOIN**$(\sigma_{cost<100}$ Catalog) **NATURAL JOIN** Suppliers)

2. Π_{sname} $(\Pi_{sid}$ $((\sigma_{color='red'}$Parts) **NATURAL JOIN** $(\sigma_{cost<100}$ Catalog) **NATURAL JOIN** Suppliers))

3. $(\Pi_{sname}$ $((\sigma_{color='red'}$ Parts) **NATURAL JOIN** $(\sigma_{cost<100}$ Catalog) **NATURAL JOIN** Suppliers)) $\cap$ $(\Pi_{sname}$ $((\sigma_{color='green'}$ Parts) **NATURAL JOIN** $(\sigma_{cost<100}$ Catalog) **NATURAL JOIN** Suppliers))

4. $(\Pi_{sid}$ $((\sigma_{color='red'}$Parts) **NATURAL JOIN** $(\sigma_{cost<100}$ Catalog) **NATURAL JOIN** Suppliers)) $\cap$ $(\Pi_{sid}$ $((\sigma_{color='green'}$ Parts) **NATURAL JOIN** $(\sigma_{cost<100}$ Catalog) **NATURAL JOIN** Suppliers))

5. Π_{sname} $((\Pi_{sid,sname}$ $((\sigma_{color='red'}$ Parts) **NATURAL JOIN** $(\sigma_{cost<100}$ Catalog) **NATURAL JOIN** Suppliers)) $\cap$ $(\Pi_{sid,sname}$ $((\sigma_{color='green'}$ Parts) **NATURAL JOIN** $(\sigma_{cost<100}$ Catalog) **NATURAL JOIN** Suppliers)))

B) Consider the following relations: **[5]**

Student(snum: integer, sname: string, major: string, level: string, age: integer)

Class(name: string, meets at: time, room: string, fid: integer)

Enrolled(snum: integer, cname: string)

Faculty(fid: integer, fname: string, deptid: integer)

The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class.

Write the following queries in SQL. No duplicates should be printed in any of the answers.

1. Find the names of faculty members for whom the combined enrollment of the courses that they teach is less than five.
2. Print the Level and the average age of students for that Level, for each Level.
3. Print the Level and the average age of students for that Level, for all Levels except JR.
4. Find the names of students who are enrolled in the maximum number of classes.
5. Find the names of students who are not enrolled in any class.

Q.3. **A)** Compute the closure of the following set F of functional dependencies for relation schema R = (A, B, C, D, E). **[6]**

$A \rightarrow BC$

$CD \rightarrow E$

$B \rightarrow D$

$E \rightarrow A$

List the candidate keys for R.

B) Suppose that we decompose the schema R = (A, B, C, D, E) into **[4]**

(A, B, C)

(A, D, E).

Show that this decomposition is a lossless-join decomposition if the following set F of functional dependencies holds:

$A \rightarrow BC$

$CD \rightarrow E$

$B \rightarrow D$

$E \rightarrow A$

Q.4. **A)** Explain Dense Index and Sparse Index. When is it preferable to use a dense index rather than a sparse index? Explain your answer. **[6]**