



Date 26.06.2009

Time: 1.30 pm – 4.00 pm

Answer **Four** Questions **Only**.

1.

- i. In the context of relational databases, define the following terms;
- |                  |                |
|------------------|----------------|
| a. Candidate key | c. Primary key |
| b. Super key     | d. Foreign key |

- ii. What is meant by,
- Entity integrity?
  - Referential Integrity?

Give an example each, that violates these rules.

iii. What is conceptual design?

iv. By means of an example describe what do you mean by the term existence dependent.

v. Suppose you have been asked to design a “Tourist information System” to help tourists find their way around an unfamiliar city. What would you need to find out in order to develop a conceptual model?

2.

i. United Broke Artists (UBA) is a broker for not-so-famous painters. UBA maintains a small network database to track painters, paintings, and galleries. Using PAINTER, PAINTING, and GALLERY, write the network structure and identify appropriate sets within the UBA database.

(Hint 1: A painting is painted by a particular artist, and that painting is exhibited in a particular gallery.)

(Hint 2: A gallery can exhibit many paintings, but each painting can be exhibited in only one gallery. Similarly, a painting is painted by a single painter, but each painter can paint several paintings.)

If you decide to convert the network database above, to a relational database:

What tables would you create, and what would be the table attributes?

ii. A small company specializes in custom-made electronic products. The rules below describe its information needs with respect to people, jobs, and materials:

- Each employee of the company has at least one of a certain set of skills the company needs. Each employee has an identifying number and name. Each skill has an identifying number and description. Employees are numerically rated for their proficiency at each of the skills they possess.
- Each employee (except those on holidays) is assigned to work on one or more jobs, with a predetermined number of hours per week for each such job. Most jobs require several employees. Each job has an identifying number, definition, and time estimate.

a. Create an E-R diagram that models the data described above.

b. Convert the above E-R diagram into a complete set of tables (relations) and their attributes. For each table, underline the attributes that make up its primary key, and use a dotted line to indicate any foreign keys.

3.

i. The following rules describe the health care services provided by a hospital.

- There are only two kinds of health care employees: nurses and clinicians. A nurse may be assigned to one or more hospital wards in each of which the nurse has a certain role. A clinician (who may be a staff doctor or technologist) works in one of the hospital's clinics (e.g. gerontology, radiology, physiotherapy).
- Each employee has an identifying number, name, and title. Also, each nurse has a seniority level and each clinician has a hospital phone number.
- A hospital patient (actually a future patient, in most cases, but this need not concern you) may be scheduled for one or more operations or may have one or more appointments with the hospital's clinics.
- Each scheduled operation has an identifying number, date, time, type, and location. No operation at this hospital is performed on more than one patient (e.g. the separation of siamese twins is not done at this hospital). Each clinic appointment has a date, time, and purpose.
- An in-patient is a special kind of patient who stays in the hospital for one or more days (e.g. while recovering from an operation).
- Each patient has a provincial health care number, name, and physician. At the time of hospital admittance, the date and reason for admittance are recorded for each in-patient.
- A nurse may work on one or more shifts (some shifts are part-time). Each shift has an identifying number and work-time (e.g. Sat&Sun, 00:00-08:00).
- A nurse may care for one or more in-patients. For each such in-patient, the nurse may have several duties (e.g. intravenous feeding) to perform.
- Each ward has a code (e.g. M=maternity), name, and phone number. Each clinic has a code and name. Furthermore, a clinician heads each clinic.

- Each ward has a number of rooms in which in-patients may stay. Each room has an identifying number (the ward-code, room-number combination is unique) and capacity (i.e. number of beds for in-patients).

Obtain the generalization hierarchy for the above scenario.

- ii. Indicate whether the entities are overlapping or non-overlapping?
- iii. By using the generalization hierarchy in part i), obtain an ERD in the relational model.

4.

- i. When will a relation be a normalized relation?
- ii. What do you mean by the term denormalization?
- iii. Consider the list of individually 3NF relations below. These relations were developed from several separate normalization activities.

PATIENT (Patient\_ID, Room\_Number, Admit, Date, Address)

ROOM (Room\_Number, Phone, Daily\_Rate)

PATIENT(Fatient Number, Treatment\_Description,Address)

TREATMENT(Treatment\_ID,Description,Cost)

PHYSICIAN(Physician\_ID,Name,Department)

PHYSICIAN(Physician\_ID,Name,Supervisor\_ID)

- a. Merge these relations into a consolidated set of 3NF relations. Make and take whatever assumptions you consider necessary to resolve any potential problems you identify in the merging process.
- b. Draw an E-R diagram for your answer to part (a).

5.

- i. The STAFF relation in a software company has the following structure:

#### STAFF

Programmer	Programmer Number	Workstation	Make	Program Number	Language
Smith	0016	X194	IBM	CS01	Java
Smith	0016	X194	IBM	CS43	Java
Smith	0016	X194	IBM	CS213	V Basic
Patel	1005	L29	Siemens	HS57	V Basic
Patel	1005	L29	Siemens	HS82	Java

Each programmer works at his own workstation computer on a number of software programs. Each particular program is written in one language.

- a. What are the problems likely to arise in this structure?
  - b. Indicate the functional dependencies in the STAFF relation. If you need to make further assumptions you should state them clearly.
  - c. Obtain a set of Second Normal Form relations from STAFF
  - d. What problems remain with these Second Normal Form relations?
- ii. Using the following INVOICE table structure, draw its dependency diagram and identify all dependencies (including all partial and transitive dependencies). You can assume that the table does not contain repeating groups and that any invoice number may reference more than one product. (*Hint: This table uses a composite primary key.*)

Attribute name	Sample value
INV_NUM	211347
PROD_NUM	AA_E3422QW
SALE_DATE	06/25/1999
PROD_DESCRIPTION	B&D rotary sander, 6 in. disk
VEND_CODE	211
VEND_NAME	Never Fail, Inc.
NUMBER_SOLD	2
PROD_PRICE	\$49.95

6. Consider the following relations:

Student (snum, sname, major, level, age)  
 Class (name, meets at, room, fid)  
 Enrolled (snum, cname)  
 Faculty (fid, fname, depid)

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 down MySQL queries to retrieve the following information. No duplicates should be retrieved in any of the answers.

- i. Find the names of all Juniors (level = JR) who are enrolled in the Literature class.

- ii. Find the age of students who are either a History major or are enrolled in Literature class.
- iii. Find the names of all classes that either meet in room R128 or have five or more students enrolled.
- iv. Find all students who are enrolled in two classes that meet at the same time.
- v. Find the level and the average of students for that level, for each level.
- vi. Find the level and the average of students for all level except JR.
- vii. Find the Find the students who are not enrolled in any class.

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