UNIVERSITY OF COLOMBO, SRI LANKA

FACULTY OF SCIENCE

THIRD YEAR EXAMINATION IN SCIENCE - 2001 (Held in 2002)

CS 3123 – Designing, Managing and Administrating Database Systems

Three Hours
Answer ALL FOUR questions

No of Pages = 4   No of Questions = 4

1. (a) Briefly describe the following terms, using a suitable example.
    (i)   Domain
    (ii) Degree
    (iii) Cardinality
    (iv) Candidate Key
    (v)   Practitioner

    (9 marks)

    (b) A manufacturer buys components at a fixed price per component from suppliers and assembles several different models of motor from them. These motors are then sold to distributors at a fixed price per model. In order not to become dependent on any one supplier, the manufacturer always makes sure that any given component-type is supplied by at least two separate suppliers. A component-type can be used in making several different models. A motor is made of many different types of components. A given distributor can receive and re-sell many different models of motor. No motor distributor has a monopoly on re-selling any given motor type.

    (i) Determine the potential entities, their attributes and other relevant information for this manufacturing system.

    (5 marks)

    (ii) Draw a detailed E-R diagram for the above system. Indicate clearly the entities and relationship types and cardinality constraints.

    (8 marks)

    (iii)Using the E-R diagram, explain how the system could determine the suppliers who have supplied components to make a given model.

    (3 marks)

2. (a) A student society holds annual contests in some selected hobbies to determine the champion student for each hobby. The society creates a table to record information about the contestants for that year. The information includes the hobby, location of the competition, names of the contestants, and their birthday.

Contestants should not be over 21 years old (born on or after 1.1.1981). A contestant may compete in more than one hobby. You may assume that contestant's name is unique. A given hobby competition is always held only in one location. The following is this hobby relation with some sample data.

Hobby	Location	Contestant	Birthdate
Astronomy	Planetarium	Gihan Dias	01.01.1982
Astronomy	Planetarium	Sunil Mendis	12.04.1984
Astronomy	Planetarium	Ajith Silva	05.06.1981
Model Aircraft	KG Hall	Sam Alwis	25.08.1983
Model Aircraft	KG Hall	Sunil Mendis	12.04.1984
Stamp	ICT	Ajith Silva	05.06.1981

(i) In which normal form is the above hobby table? Justify your answer.

(3 marks)

(ii) Assuming no additional data is required, design a set of third normal form (3NF) relations for the above information. Explain clearly each stage in deriving the 3NF relations, by defining the normal forms used at each of these stages.

(9 marks)

(iii) Identify the data redundancy in each stage of the transformation process.

(3 marks)

(iv) Using an example describe briefly how Entity, Referential and Attribute integrity constraints can be applied on the above 3NF relations.

(6 marks)

(b) The society wants to record for each hobby, which books and videotapes would be useful for students of that hobby to have. A given hobby may have several useful books and videotapes, and a given book or videotape may be useful in learning more than one hobby. The following relation has been proposed, shown here are some sample entries.

Hobby	Book	Videotape
Astronomy	Technical Maths	Astronomy Journal
Astronomy	Astronomy Basics	
Model Aircraft	Technical Maths	Aircraft Monthly
Model Aircraft		Flying on the Air
Stamp	Stamp Collection Handbook	Philatelic Monthly

Is this relation fully normalised? Justify your answer. If it is not so, propose an alternate schema, which can hold the same information but which is fully normalised.
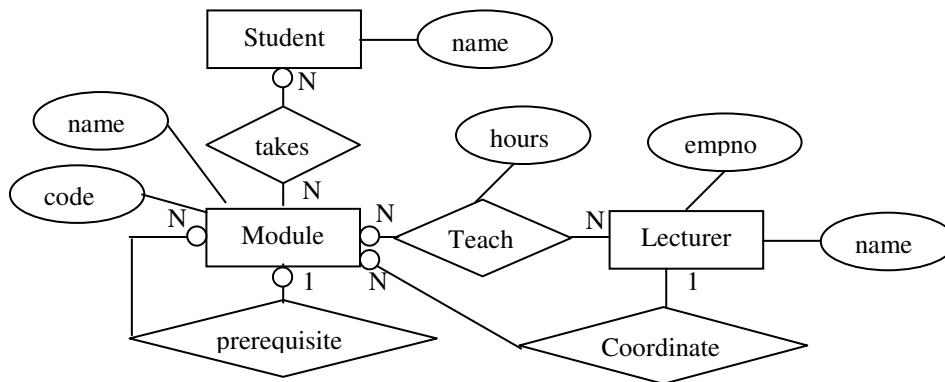
(4 marks)

3. (a) Relational objects, relational operators and integrity constraints are the three main components of a relational data model. Using examples briefly explain them.

(9 marks)

(b) A Craft Centre's database includes a relation, called *Teach*, which holds information about instructors qualification to teach Craft. A Craft can be taught by more than one instructor, and an instructor can be qualified to teach more than one Craft. Database also includes relations *Instructor* and *Craft* to hold information about instructors and Craft courses offered. The information for instructors include name, contact address, telephone number and qualifications, and for craft courses includes name, duration and maximum number of students. Depending on the instructor a course will be offered during one of the three timeslots, namely: the weekday, evening or weekends. An instructor will teach a given Craft only on one of these slots.

(i) Write SQL statements to create the three relations with appropriate constraints for this Craft Centre database.

(5 marks)

(ii) Write an SQL statement to list the names of all instructors with their telephone number (if any).

(2 marks)

(iii) Write an SQL statement to list the names of all instructors who are available to teach the Craft watercolours during evenings.

(2 marks)

(iv) Write an SQL statement to list the names of all instructors who are available to teach during evenings or weekends the craft courses watercolours or still life.

(3 marks)

(v) Write an SQL statement to list the Craft courses offered at each timeslot (weekday, evening, weekend) with the maximum number of students.

(4 marks)

4. (a) Using examples, explain the following terms and their benefits.
    (i) data independence
    (ii) data security
    (iii)data views

(7 marks)

(b) The following is part of an Entity-Relationship diagram of an information system. The identifiers are underlined.

(i) Convert the information of the above diagram into a set of relations of a relational data model. Clearly indicate the rules you have applied.

(8 marks)

(ii) Explain the existence conditions represented in the diagram. Discuss how you would implement them in an information system.

(5 marks)

(iii)Write an SQL statement to identify students and the prerequisite not taken for students who may have taken a module without taking its prerequisite.

(5 marks)

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