UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2003/2004

September/October 2003

CIT503 - Databases and E-Commerce Rapid Application Development

Duration : 3 hours

INSTRUCTION TO CANDIDATES:

- Please ensure that this examination paper contains **FIVE** questions in **FIVE** printed pages before you start the examination.
- Answer **ALL** questions.
- You can choose to answer either in Bahasa Malaysia or English.

ENGLISH VERSION OF THE QUESTION PAPER

1. Answer the following questions in the context of the database system given below:

USM maintains a database system which is shared by many categories of users. It offers different **external views** for lecturers, students and administrators. The vice chancellor is given a **community view** of the data. The database system is put under the responsibility of a **DBA**. Among the relations contained in the database are shown below:

Student(StudentID, Name, Addr, TelNo)
Course(CourseCode, Name, Unit, LecturerID)
Register(StudentId, CourseCode)
Lecturer(StaffNo, Name, OfficeNo)

(a) Explain the difference between external view and community view and why they need to be separated.

(5 marks)

(b) What is metadata and briefly explain its significance? Give an example of a relation stored in the metadata of the above database.

(5 marks)

(c) Who is a DBA? Briefly explain **four (4)** roles and responsibilities of the DBA.

(5 marks)

(d) Explain and give an example for each of the following:

(i) Homonym and synonym

(ii) Referential integrity

(5 marks)

2. (a) The original E-R model introduced by Chen in 1976 has a few shortcomings which has been overcome by the extended E-R model. List and explain the **four (4)** new modelling capabilities introduced in the extended E-R model.

(6 marks)

(b) Explain the concept of inheritance in the extended E-R model. Give an example.

(2 marks)

(c) The following is a scenario of some processes involved in a departmental store:

An order placed by a customer for a product contains order no, order date and order type (urgent or ordinary). An order is made for products and the product information like prod_code, name, price, manufactured date and expiry date are to be recorded. A customer can make one or more orders but every order is meant for one customer only. An order contains many products and one product has many orders ordered for it. The company also stores identification number, name, sex, address and telephone number of the customers. The products are supplied by the suppliers and the information about supplier like supplier name, address and telephone number are stored. One supplier may supply a maximum of 20 products. One product can be purchased from many suppliers. There are two types of suppliers, registered and unregistered. Registered supplier will be awarded some points upon delivery of products on time. Accumulated rewards points will be stored. The company also saves information about the payments to the supplier. The payment details include payment number, date, amount and type of payment (cheque or cash).

(i) Model the above scenario using E-R or EER diagram.

(8 marks)

(ii) Map the diagram obtained in 2(c)(i) above to a relational schema.

(4 marks)

3. (a) The following is a sample instance of the relation used to store the extra curricular activities of students in USM. This relation may contain some anomalies.

Sno	Name	Sex	Age	City	Activity	In-charge	Fees
101	Ganesh	M	25	Mantin	Swimming	Mr. James	100
102	Ram	M	19	KL	Sports	Mr. Jones	150
103	Raga	F	21	Klang	Drawing	Ms. Jane	75
104	Vignesh	M	20	Penang	Games	Mr. Smith	200
105	Norhaisa	F	22	Alor Setar	Drawing	Ms. Jane	75
101	Ganesh	M	25	Mantin	Sports	Mr. Jones	150
103	Raga	F	21	Klang	Swimming	Mr. James	100

(i) Explain and show an example of every type of anomalies that occur in the above instance.

(ii) What is the highest normal form of the above relation? Explain your answer.

(8 marks)

(b) The attributes that are involved in the grade report issued by Universiti Sains Malaysia are given in a relational model as below.

Grade_report (StudNo, StudName, Major, Advisor,
CourseNo, CourseTitle, InstructName, InstructOffice, Grade)

Assume that a student can take many courses and the same course can be taken under different majors. A student may have many advisors but can have only one advisor under a particular major. An advisor may advise in one major only. An instructor may teach many courses and has only one office but no team teaching is allowed.

Normalize this relation up to BCNF, clearly indicating the functional dependencies.

(Note: you may assume that *InstructName* is unique.)

(8 marks)

(c) Explain multivalued dependency. Why is the existence of multivalued dependency not good for a relation?

(4 marks)

4. (a) The following relations form part of a database held in a Relational Database Management System:

Staff (**staff_no**, name, dept, skill_code)
Skill (**skill_code**, description, charge_out_rate)
Project (**project_no**, start_date, end_date, budget, project_manager_staff_no)
Booking (**staff_no**, **project_no**, date_worked_on, time_worked_on)

where

- Staff contains staff details and **staff_no** is the key.
- Skill contains descriptions of skill codes (e.g. Programmer, Analyst, Manager, etc.) and the charge out rate per hour for that skill; the key is **skill_code**.
- Project contains project details and **project_no** is the key.
- Booking contains details of the date and the number of hours that a member of staff worked on a project and the key is **staff_no**, **project_no**.

Formulate the following queries using SQL:

(i) List all skills with a charge out rate greater than RM60 per hour, in alphabetical order of description.

(ii) How many staff have the skill "Programmer"?

(iii) List all staff with a charge out rate greater than the average charge out rate.

(10 marks)

Answer the questions in the following sections: 4(b) and 4(c) based on the database schema given below:

STUDENT (**StudentId**, BDate, Major, Name, TelNo)
SCHOOL (**DeptCode**, DeptName)
LECTURER (**LecturerName**, TelNo, Post)
OFFER (**CourseCode**, DeptCode, Semester, LecturerName)
BOOK (**ISBN**, Author, Title, Publisher, Year, Price)
TEXT (**CourseCode**, **ISBN**)
REGISTER (**StudentId**, **CourseCode**)

(Note: Attributes printed in bold is the primary key.)

(b) Write QBE statements for the following queries:

(i) List the name and telephone number for all lecturers who are an 'Assoc. Prof.' and teaching a course at the 'Department of Computer Sciences' in semester 'Sem2 2003'.

(ii) List all course codes and the book title that the courses use for all books published by 'Addison Wesley'.

(5 marks)

(c) Write rational Algebra expressions for the following queries:

(i) Get a list of course codes which use the books published by 'Addison Wesley' in '2002'.

(ii) List all students who register for all the courses taught by lecturer 'Ali Talib'.

(5 marks)

5. (a) What do you understand by Rapid Application Development (RAD)? Describe **four (4)** advantages of RAD for development of e-commerce applications and **one (1)** disadvantage of RAD.

(8 marks)

(b) Explain why a web-based database is important for e-Commerce. Differentiate a traditional two-tier and three-tier client-server architecture. Explain why a three-tier architecture is more suitable for of a web-based database.

(7 marks)

(c) What is meant by database threat? List **four (4)** different types of threat that could affect a database system and for each, describe the measures that you would take.

(5 marks)