

KENYA METHODIST UNIVERSITY

END OF TRIMESTER EXAM APRIL 2009

FACULTY : SCIENCES
DEPARTMENT : COMPUTER INFORMATION SYSTEMS
COURSE CODE : CISY 221
COURSE TITLE : DATABASE MANAGEMENT SYSTEMS

Total Marks (60)

TIME: 2 HOURS

Instructions

Answer all questions in SECTION A and ANY TWO questions in SECTION B

SECTION A – Answer all questions

Question 1 – 30 marks

1. Define the following terms:
 - a. Weak entity set (3 marks)
 - b. Covering constraint
 - c. Relation schema

2. Suppose that we have a ternary relationship R between entity sets A, B, and C such that A has a key constraint and total participation and B has a key constraint; these are the only constraints. A has attributes a_1 and a_2 , with a_1 being the key; B and C are similar. R has no descriptive attributes. Write SQL statements that create tables corresponding to this information so as to capture as many of the constraints as possible. If you cannot capture some constraint, explain why. (8 marks)

3. Consider the following schema:

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

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

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

The key fields are underlined, and the domain of each field is listed after the field name. The Catalog relation lists the prices charged for parts by Suppliers.

Write the following queries in relational algebra:

- a. Find the *sids* of suppliers who supply some red part and some green part.
 - b. Find pairs of *sids* such that the supplier with the first *sid* charges more for some part than the supplier with the second *sid*.
 - c. Find the *pids* of parts supplied by at least two different suppliers. (9 marks)
4. Explain the statement that relational algebra operators can be *composed*.

i. Why is the ability to compose operators important? (2 marks)

5. Making a data structured relational is achieved by the process of normalization. Normalise the following data structure in its First Normal Form (1NF) to the 3NF.

(8Mks)

studentID	name	advisor	dept	deptName	courseName	grade
123	Jones	Brooks	CS	CompSci	CS451	A
123	Jones	Brooks	CS	CompSci	CS450	B
123	Jones	Brooks	CS	CompSci	CS551	B
321	Smith	Hansen	CS	CompSci	CS451	C
321	Smith	Hansen	CS	CompSci	CS450	B
999	Abel	Thomas	EE	ElectEng	EE450	B

SECTION B – Answer ANY TWO question

Question 2 – 15 marks

The Prescriptions-R-X chain of pharmacies has offered to give you a free lifetime supply of medicine if you design its database. Given the rising cost of health care, you agree. Here's the information that you gather:

- Patients are identified by an SSN, and their names, addresses, and ages must be recorded.
- Doctors are identified by an SSN. For each doctor, the name, specialty, and years of experience must be recorded.
- Each pharmaceutical company is identified by name and has a phone number.
- For each drug, the trade name and formula must be recorded. Each drug is sold by a given pharmaceutical company, and the trade name identifies a drug uniquely from among the products of that company. If a pharmaceutical company is deleted, you need not keep track of its products any longer.
- Each pharmacy has a name, address, and phone number.
- Every patient has a primary physician. Every doctor has at least one patient.
- Each pharmacy sells several drugs and has a price for each. A drug could be sold at several pharmacies, and the price could vary from one pharmacy to another.
- Doctors prescribe drugs for patients. A doctor could prescribe one or more drugs
- for several patients, and a patient could obtain prescriptions from several doctors.
- Each prescription has a date and a quantity associated with it. You can assume that, if a doctor prescribes the same drug for the same patient more than once, only the last such prescription needs to be stored.
- Pharmaceutical companies have long-term contracts with pharmacies. A pharmaceutical company can contract with several pharmacies, and a pharmacy can contract with several pharmaceutical companies. For each

contract, you have to store a start date, an end date, and the text of the contract.

- Pharmacies appoint a supervisor for each contract. There must always be a supervisor for each contract, but the contract supervisor can change over the lifetime of the contract.

Draw an ER diagram that captures the preceding information.

Question 3 – 15 marks

- a. Why does a DBMS interleave the actions of different transactions instead of executing transactions one after the other? (5 marks)

- b. The following relations keep track of airline flight information:

Flights(*flno*: integer, *from*: string, *to*: string, *distance*: integer, *departs*: time, *arrives*: time, *price*: real)

Aircraft(*aid*: integer, *aname*: string, *cruisingrange*: integer)

Certified(*eid*: integer, *aid*: integer)

Employees(*eid*: integer, *ename*: string, *salary*: integer)

Note that the Employees relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft, and only pilots are certified to fly.

Write each of the following queries in SQL.

- i. For all aircraft with *cruisingrange* over 1000 miles, find the name of the aircraft and the average salary of all pilots certified for this aircraft.
- ii. Print the names of employees who are certified only on aircrafts with cruising range longer than 1000 miles and who are certified on some Boeing aircraft.

(10 marks)

Question 4 – 15 marks

- a. Describe Strict 2PL. (2 marks)

- b. What is the minimum space utilization for a B+ tree index? (3 marks)

- c. You are a painter and have an Internet store where you sell your paintings directly to the public. You would like customers to pay for their purchases with credit cards, and wish to ensure that these electronic transactions are secure. Assume that Mary wants to purchase your recent painting of the Cornell Uris Library.

Answer the following questions.

- ii. Explain how SSL ensures that the communication of the credit card number is secure. What is the role of a certification authority in this case? (5 marks)

- iii. Assume that you would like Mary to be able to verify that all your email messages are really sent from you. How can you authenticate your messages without encrypting the actual text? (5 marks)