



THE UNIVERSITY OF THE WEST INDIES

EXAMINATION OF APRIL/MAY 2003

Code and Name of Course: CS35A Database Management Systems

Paper:

Date and Time: **Tuesday May 6, 2003 1:00 - 3:00 P.M.**

Duration: 2 HRS

INSTRUCTIONS TO CANDIDATES: This paper has 3 pages and 4 questions.

Do Question #1 and two (2) others.

Question 1 [30 Marks]

- a. The office of placement and career services has approached you to develop a database to help streamline their operations. The office is mainly responsible for arranging interviews for students, who are about to graduate, with organizations who are seeking graduates to fill job openings. The office keeps a list of all the students who sign up to participate. They must have a record of the students' id., name, contact number, the faculty they belong to and the degree they are expected to graduate with. All students who graduate with the same degree must belong to the same faculty.

The information that the office maintains about the companies seeking graduates is the company name, address and phone number. Each company has a number of available jobs they are trying to fill. For each of these jobs a record is kept of the job description, requirements and the salary. The section assigns students for interviews for the various jobs. The date and the time of each interview must be recorded. A student can be assigned to a number of interviews and the company can interview a number of students for the same job. Based on these interviews the employee then offers one of the students the job. Each job can be taken by only one student and each student can take only one job.

- i. Draw an E-R diagram for the application above. State any assumptions that were made. [9 Marks]
- ii. Convert the diagram into a set of tables normalized up to BCNF. Be sure to discuss why the tables are in BCNF. [6 Marks]

Question 1 (con't)

- b. Consider the following set of relations for the exams database. The database records the courses that need to be examined, the rooms where the examinations are held and the chief invigilator for each exam. Assume that there is only one exam per course and each exam is assigned only one chief invigilator.

Course(courseno, ctitle, csize)

Room(room#, rlocation, rcapacity)

Examinedin(courseno, roomno, iname, date, time)

Invigilator(iname, idept, icontract#)

Answer the following:

- i. Write a relational calculus expression for the following query "Find the date and time for the exam entitled Database Management Systems." [2 Marks]
- ii. Write a relational algebra expression for the following query "Find the name of those courses that have been assigned a room where the capacity of the room is smaller than the size of the class." [2 Marks]
- iii. Write an SQL query for the following "Find the contact number for the invigilator of the Artificial Intelligence exam." [2 Marks]
- iv. Write an SQL query for the following "Find the largest room". [2 Marks]
- v. Write an SQL query for the following "Find the name of those persons invigilating less than three exams". [2 Marks]
- vi. Write an SQL query to "change the date and time of the Database Management Systems exam to May 10th, 4 p.m." [2 Marks]
- vii. Identify the foreign keys in the schema above. What is the purpose of declaring these foreign keys when implementing a database? [3 Marks]

Question 2

[15 Marks]

- a. Two functions of a transaction management component are to ensure atomicity and concurrency control. Describe the purpose of each function. Use examples to support your answers. [10 Marks]
 - b. Distinguish between tables and views. What is the danger of allowing a view to be updateable? Use an example to emphasize your points. [5 Marks]
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Question 3 [15 Marks]

- a. Assume the following table and FD's.

VISITS(DOCID, DNAME, DSPEC, DSAL, PID, PNAME, PPHONE, VDATE)

DOCID -> DNAME, DSPEC, DSAL

DSPEC -> DSAL

PID -> PNAME, PPHONE

- i. What is the highest normal form that the table is in? Give reasons. [2 Marks]
 - ii. What is the problem(s) of leaving the table in this form? Use examples to emphasize your points. [3 marks]
 - iii. Decompose the tables into a set of BCNF tables. [2 Marks]
 - iv. Is the decomposition lossless? Justify your answer. [3 Marks]
- b. What is the purpose of a checkpoint? Describe how it is used. [3 Marks]
- c. How is the efficiency of a query measured in a centralized database system? [2 Marks]

Question 4 [15 Marks]

West Indies Airlines is investing in a database management system and they need your advice. They are planning to use this database to record information about their employees, customers, flights, etc. They are trying to decide between a centralized or distributed database and if they go with the distributed database how it should be designed. The decisions should be based on the following criteria:

West Indies Airlines is a relatively new airline and they are expected to grow quite considerably. They currently have offices in Barbados and Antigua, and the head office in Jamaica; however, they are planning on expanding into the rest of the Caribbean and North America. An employee works for a particular office and the office is responsible for hiring and firing its own employees. It is expected that a customer would visit most frequently the office in the country where he/she lives and that they would be mostly booking flights that originate and terminate in the country where they live. The head office needs information about how each office is doing as well as the organization as a whole.

- i. Would you recommend that the airlines go with a centralized or distributed database? Give reasons. [3 Marks]
- ii. Explain the purpose of fragmentation as it relates to a distributed database. Give an example of how the information could be fragmented. Justify your answer. [4 marks]
- iii. What are some of the issues that must be considered when fragmenting? [4 Marks]
- iv. Discuss transparency as it relates to distributed databases. Why is transparency such an important issue in distributed database systems? [4 Marks]