EASTERN UNIVERSITY, SRILANKA

DEPARTMENT OF MATHEMATICS

SECOND EXAMINATION IN SCIENCE - 2008/2009

SECOND SEMESTER (Oct. /Nov., 2010)

CS203 - Database Design

Answer all questions **Time: 2 Hours**

1.

a. Define the following terms:
   i. data;
   ii. information;
   iii. database;
   iv. database Management System . (4*2=8 marks)

b. Data can be stored in files and application programs can share this data by having a direct access to the respective files (refer to Diagram 1, below). However, data-centered applications normally employ a database management system (refer to Diagram 2, below).

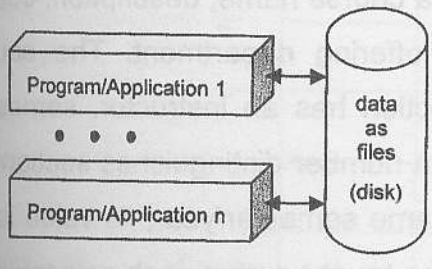

Diagram 1

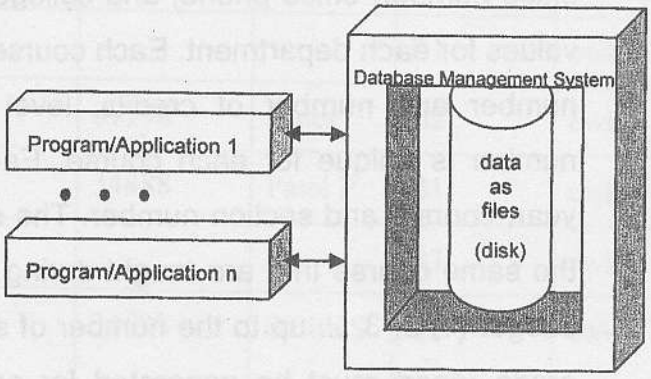

Diagram 2

State why the latter approach (Diagram 2) is preferred for data-centered applications (refer to at least four features of a DBMS). (4 marks)

c. Define the concept of database schema. Describe the types of schemas that exist in a database complying with the three levels ANSI/SPARC architecture. (4 marks)

d. Why is data modeling is important? (5 marks)

e. Briefly describe the following **data models** with suitable diagram;

i. relational data model;
ii. hierarchical data model. (2*2=4 marks)

2.

a. Describe the three basic components of an entity - relationship diagram, and state clearly the usefulness of E-R diagrams in designing a database. (4 marks)

b. Design a conceptual data model – ER diagram for the set of requirements of a University database described below. If your solution contains multi-valued or composite attributes, many-to-many relationships or relationships with attributes, transform it into an equivalent one that does not contain these aspects. State any further assumptions you make that differ from the ones explicitly made in the text.

The university keeps track of each student's name, student number, social security number, current address and phone number, permanent address and phone number, date of birth, sex, class (freshman, graduate), major department, minor department (if any), degree program (B.A., B.Sc., ..., Ph.D.). Some user applications need to refer to the city, state, and zip code of the student's permanent address and to the student's last name. Both social security number and student number are unique for each student. All students will have at least a major department. Each department is described by a name, department code, office number, office phone, and college. Both the name and code have unique values for each department. Each course has a course name, description, course number and number of credits, level and offering department. The course number is unique for each course. Each section has an instructor, semester, year, course, and section number. The section number distinguishes sections of the same course that are taught during the same semester/year; its value is an integer (1, 2, 3, ... up to the number of sections taught during each semester). A grade report must be generated for each student that lists the section, letter grade, and numeric grade (0, 1, 2, 3, or 4) for each student and calculates his or her average GPA. (16 marks)

c. Transform the ER diagram into a relational model, specifying the primary, alternate (if any) and foreign keys. (5 marks)

3.

a. Define each of the following with regard to database design;
   i. functional dependency;
   ii. full functional dependency;
   iii. transitive dependency.

(3*2=6 marks)

b. Consider the following relation, referring to the final year projects of students:

student	project	prototype	result

'student' is the only candidate key of the relation. Each project has a unique prototype associated with it.

student	project	result

student	prototype

(A)

student	project	result

project	prototype

(B)

Which of the above decomposition is the best? Explain your answer.

(4 marks)

c. Using Normalization technique Normalize the following table up to 3rd NF.

Modules						
moduleName	**staffNo**	**staffName**	**studentNo**	**student**	**assGrade**	**assType**
Relational Database System	234	Davies T	34698	Smith S	B3	cwk1
					B1	cwk2
			37798	Jones	B2	cwk1
			34888	Patel P	B1	cwk1
					B3	cwk2
Relational Database Design	234	Davies T	34698	Smith S	B2	cwk1
					B3	cwk2
Deductive Database	345	Evans R	34668	Smith J	A1	exam

(15 marks)

4.

a. What are the important features of relational algebra operators?

(4 marks)

b. Consider the relation schemas as follows.

works(person name, company name, salary);
lives(person name, street, city);
located_in(company name, city);
managers(person name, manager name);

The key fields are underlined. Therefore *parson name is* the key for lives, *company name* is the key for located_in, and *parson name* and *company name* together form the key for works. The manager name refers to person name. Write the following queries in relational algebra;

i. to find the names of all employees who work for 'EUSL'.
ii. to find the names and cities of residence of all employees who work for 'EUSL'.
iii. to find the names, street address, and cities of residence of all employees who work for 'EUSL' and earn more than $10,000 per annum.
iv. to find the names of all employees who live in the same city and on the same street as do their managers.
v. to find the names of all employees in this database who do not work for 'EUSL'.
vi. to find the names of all employees who earn more than every employee of 'OUSL'.
vii. to find all companies located in every city in which 'OUSL' is located, assuming that the companies may be located in several cities

(7*3=21 marks)