EASTERN UNIVERSITY, SRILANKA
DEPARTMENT OF MATHEMATICS

EXTERNAL DEGREE EXAMINATION IN SCIENCE - 2008/2009
SECOND YEAR, SECOND SEMESTER (Jan. /Feb., 2011)

EXTCS203 - Database Design
(Proper/Repeat)

Answer all questions **Time: 2 Hours**

1.

a. With respect to database design, define the following terms:
   i. Logical database design;
   ii. Physical database design.

b. List the merits and demerits of a database system.

c. Describe briefly the use of Data Manipulation Language (DML) and Data Definition Language (DDL).

d. Why is data modeling is important?

e. Briefly describe the following **data models** with suitable diagram;
   i. relational data model;
   ii. hierarchical data model.

2.

a. define the following terms:
   i. entity;
   ii. entity type;
   iii. attribute;
   iv. relationship;
   v. Relationship type.

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.

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

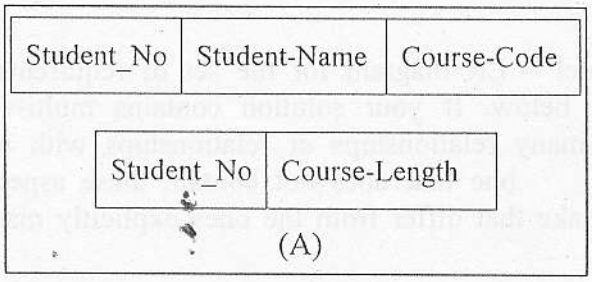
3.

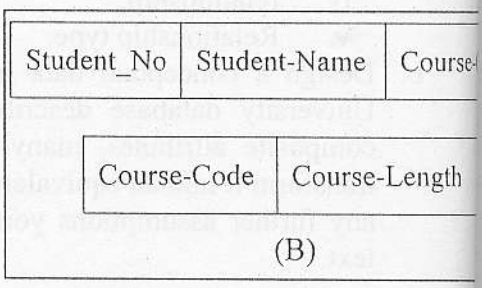
a. Define each of the following with regard to database design;
   i. functional dependency;
   ii. full functional dependency;
   iii. transitive dependency.

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

Student_No	Student-Name	Course-Code	Course-Length

'Student_No' is the only candidate key of the relation. Each Course-Code has a unique Course-Length associated with it.





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

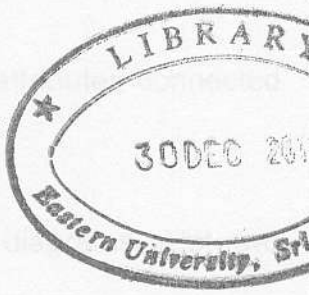
c. Using Normalization technique Normalize the following table up to 3rd NF.

Student ID	Name	Campus	Major	Course ID	Course Title	Ins Nam	Ins Location	Marks
125	Silva	Colombo	Pro	CA	Com Architecture	C	B104	74
125	Silva	Colombo	Pro	PP	Prolog	A	B105	60
127	Perera	Kandy	Acct	CA	Com Architecture	C	B104	50
127	Perera	Kandy	Acct	AA	Accounting	Z	X103	60
127	Perera	Kandy	Acct	EC	Economics	E	E102	65

4.

a. List and describe **Relational Algebra Operators** with suitable syntax for every eight operators.

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



c. Consider the following relations containing airline flight information:
Flights(*flno:* integer, *from:* string, *to:* string,
distance: integer, *departs:* time, *arrives:* time)
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 (otherwise, he or she would not qualify as a pilot), and only pilots are certified to fly. Write the following queries in relational algebra.

i. to find the *eid*s of pilots certified for some Boeing aircraft
ii. to find the *name*s of pilots certified for some Boeing aircraft.
iii. to find the *aid*s of all aircraft that can be used on non-stop flights from Bonn to Madras.
iv. Identify the flights that can be piloted by every pilot whose salary is more than $100,000.
v. To find the names of pilots who can operate planes with a range greater than 3,000 miles but are not certified on any Boeing aircraft.
vi. to find the *eid*s of employees who make the highest salary.
vii. to find the *eid*s of employees who make the second highest salary.
viii. to find the *eid*s of employees who are certified for exactly three aircraft.