THE OPEN UNIVERSITY OF SRI LANKA
Bachelor of Software Engineering-Level 4
Department of Electrical & Computer Engineering
ECI4166 – Data Modelling and Database Systems
Final Examination 2011/2012

Date: March 21, 2012 **Time: 0930-1230 hrs**

This question paper consists of **six** questions.

Answer **FIVE** questions **ONLY.**

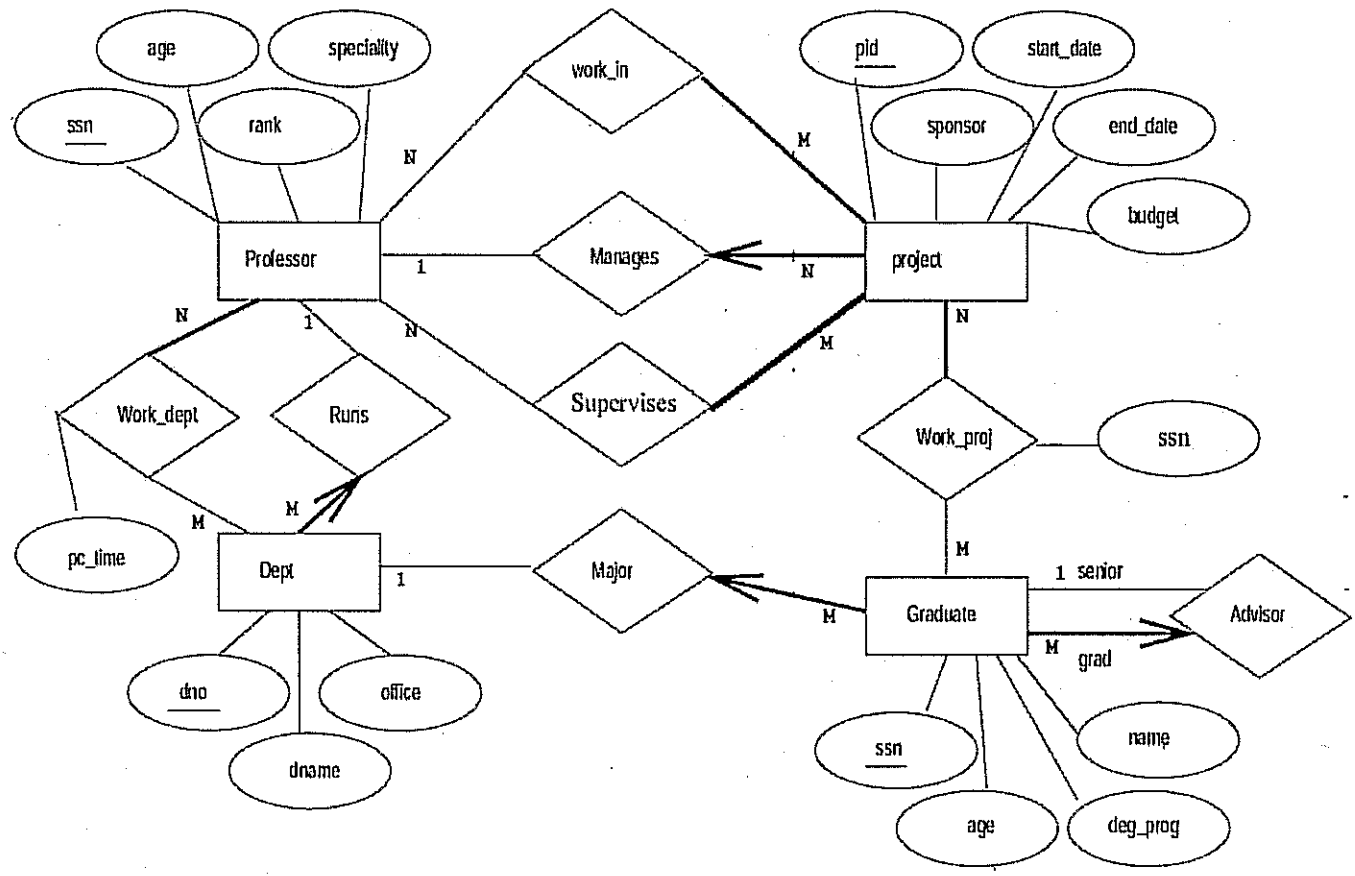
Question 1: ER Diagram
Marks: 20 marks

A University database is required to store current information about students (student number, name, phone number), units (unit number, title, credit points), rooms (room number, type, capacity), and buildings (building number, name). Each student is identified by a unique student number, each unit by its unique unit number, each room in a building by a unique room number (but a given room number can be present in many buildings), and each building by a unique building number. A student may take a number of unites and each unit will have many students. Each unit meets only once a week and in only one room. The day of the week and the time for the meeting are to be recorded.

Draw an E-ER diagram for the university database. Be sure to indicate the various attributes of each entity and relationship set. Specify the keys.

Question 2: ER to Relational Mapping
Marks: 20 marks

Convert the following ER diagram to the relational model. You do not need to specify the domains of attributes.



Question 3: SQL
Marks: 20 marks

(a.) What is the difference between a relational schema and a relational instance?

(2 marks)

(b.) What can a *null* value for an attribute in a tuple represent?

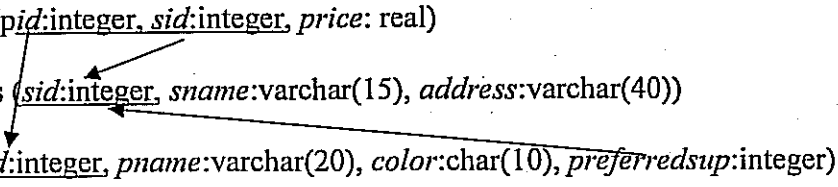
(2 marks)

(c.) Consider the following relational schema:

Catalog (*pid*:integer, *sid*:integer, *price*: real)

Suppliers (*sid*:integer, *sname*:varchar(15), *address*:varchar(40))

Parts (*pid*:integer, *pname*:varchar(20), *color*:char(10), *preferredsup*:integer)



The key attributes are underlined, and the domain of each attribute is listed after the attribute name. Thus, *sid* is the key for Suppliers, *pid* is the key for Parts, and *sid* and *pid* together form the key for Catalog. If there is a preferred supplier for a part, the *preferredsup* column of Parts will contain that supplier's *sid*, otherwise the column will contain a *null*. The Catalog relation lists the prices charged for parts by Suppliers.

(1) Create the above relational schema using SQL statements. Make sure to add all primary key, foreign key constraints. Indicate possible actions to be taken with the ON DELETE clause for each foreign key when creating the relation.

(10 marks)

(2) Assume that all three relations have been created with appropriate foreign keys. If a tuple is deleted from the Suppliers table, explain what will be the effect on other tables?

(3 marks)

(3) Write SQL statement(s) to insert the following information to the relational schema given above. Mention the order of execution of insert statements.

Supplier information

Sid	Sname	color	address	Part	Price
123	Mr. Nuwan	Blue	Colombo 5	1002	15.00

Part information

pid	pname	color
1002	Pen	Blue

(3 marks)

Question 4: SQL Queries
Marks: 20 marks

Consider the following relations in a movie database.

Movie (title:char(25), year:int, length:float, language:char(15), filmtype:char(1))
MovieStar (name: char(15), address:varchar(40), gender:char(1), birthdate: date)
StarsIn (movieTitle:char(25), movieYear:int, starname:char(15), role:varchar(15))

The attributes of the *Movie* relation are *title* of the movie, *year* it was made, *length* of the movie, *language*, and *filmtype* which may be 'F' or 'D' for feature or documentary respectively. The *MovieStar* relation has attributes to record the *name, address, gender* ('M' or 'F'), and *birthday* of stars. *StarsIn* relation associates the movie with stars that acted in them and contains the *role* ('lead', 'support', or 'other') they played. The primary keys of all relations are underlined.

Write SQL statements for the followings.

(a.) Print the star name and address of all movie stars if they have bone after "1980/3/31".
(2 marks)

(b.) Print the star name, address, and movie title for all movie stars if they have birth day after "1980/3/31" and played the role "lead".
(4 marks)

(c.) Print the star name, address, movie title and film type for all movie stars if they have birth day after "1980/3/31" and played the role "lead".
(4 marks)

(d.) For each English language feature movie, get the title, year, and the number of stars who acted in the movie.
(5 marks)

(e.) Display the names of stars who have acted in 5 or more movies in any year between 2006 and 2011. Display the names without duplicates.
(5 marks)

Question 5: Normalization
Marks: 20 marks

(a.) Briefly explain what the Loss-less join property is.
(4 marks)

(b.) Briefly explain the following using suitable examples.
i. Insert anomaly
ii. Update anomaly
iii. Delete anomaly (6 marks)

(c.) Consider the following relation,

```
Project(projName, payID, payAmount, payDate, projMgr, teamLead, city)
```

And assume the following set of functional dependencies,

```
F = {  (projName → projMgr,teamLead,city),
       (payID → payAmount, payDate),
       (projMgr → city)      }
```

The key of the relation is `(projName, payID)`.

If the relation is **not in** Third Normal Form (3NF), provide a loss-less join decomposition to 3NF.

Normalized step by step by removing functional dependencies and explain which Normal Form it is.

(10 marks)

Question 6: XML and Relational Algebra
Marks: 20 marks

(a.) Consider the following *bib.xml* file which has stored in MS Server 2008. Translate the following queries into FLWOR expressions and integrate those with the functions available in DBMS.

Note: answers should contain FLWOR expression and expected output of it.

```
- <bib>
  - <book year="1994" type="paper">
      <title>TCP/IP Illustrated</title>
      <author>Stevens, W.</author>
      <publisher>Addison-Wesley</publisher>
      <price>965.95</price>
    </book>
  - <book year="1992" type="paper">
      <title>Advanced Programming in the Unix environment</title>
      <author>Stevens, W.</author>
      <publisher>Addison-Wesley</publisher>
      <price>1165.95</price>
    </book>
  - <book year="2000" type="paper">
      <title>Data on the Web</title>
      <author>Abiteboul, Serge</author>
      <author>Buneman, Peter</author>
      <author>Suciu, Dan</author>
      <publisher>Morgan Kaufmann Publishers</publisher>
      <price>39.95</price>
    </book>
  - <book year="1999" type="journal">
      <title>The Digital TV</title>
      <editor>Gerbarg, Darcy</editor>
      <publisher>Kluwer Academic Publishers</publisher>
      <price>129.95</price>
    </book>
</bib>
```

i. Return the author and title elements of all books.

(2 marks)

ii. Consider the *second* book information from all *paper* publications and return title, author and price.

(3 marks)

iii. Return all title of books published after 1995. Format output as followed. If it is a paper tag as *researchPaper* else check for journal and tag as *journalPape.* Otherwise tag as an *article.*

(3 marks)

(b.) Consider the following relational database schema of a university marks database:

Student (<u>studentNo</u>, studentName, gpa, level)

Marks (<u>studentNo, subjectNo</u>, grade)

Subject (<u>subjectNo</u>, subjectName, credits)

Student relation contains information of students. *Subject* relation contains information of subjects offered in the university. *Marks* relation contains the grades obtained by students for different subjects. A student who has completed a subject will have a tuple in the Marks relation stating the *studentNo* of the student and *subjectNo* of completed subjects.

Write the **relational algebra** expressions for the following queries:

i. Print the student number (i.e. *studentNo*), name (i.e. *studentName*) and gpa.

(2 marks)

ii. Print the names of students (i.e. *studentName*) who have earned a "B" grade for "Software Engineering" (i.e. *subjectName*).

(3 marks)

iii. Print name and number of students who have not completed at least one subject.

(3 marks)

iv. Print the student numbers (i.e. *studentNo*) who have already completed 6 subjects.

(4 marks)

--- End of the Question Paper ---