EASTERN UNIVERSITY, SRILANKA

EXTERNAL DEGREE SECOND EXAMINATION IN

SCIENCE- 2002/2003 (Oct./Nov., 2007)

EXTCS 203 – Database Design

Answer all questions **Time: 2 hours**

Q1. a) State the available data models.
State clearly what an ***ER Model*** is and describe its role in designing a database.
[5 marks]

b) Consider the following information about a university database:

- Professors have an SSN, a name, an age, a rank, and a research specialty.
- Projects have a project number, a sponsor name (e.g., NSF), a starting date, an ending date, and a budget.
- Graduate students have an SSN, a name, an age, and a degree program (e.g., M.S. or Ph.D.).
- Each project is managed by one professor (known as the project's principal investigator).
- Each project is worked on by one or more professors (known as the project's co-investigators).
- Professors can manage and/or work on multiple projects.
- Each project is worked on by one or more graduate students (known as the project's research assistants).
- When graduate students work on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have a (potentially different) supervisor for each one.
- Departments have a department number, a department name, and a main office.
- Departments have a professor (known as the chairman) who runs the department.
- Professors work in one or more departments, and for each department that they work in, a time percentage is associated with their job.
- Graduate students have one major department in which they are working on their degree.

- Each graduate student has another, more senior graduate student (known as a studen advisor) who advises him or her on what courses to take.

Design and draw an ER diagram that captures the information about the university Use only the basic ER model here; that is, entities, relationships, and attributes. B sure to indicate any key and participation constraints.

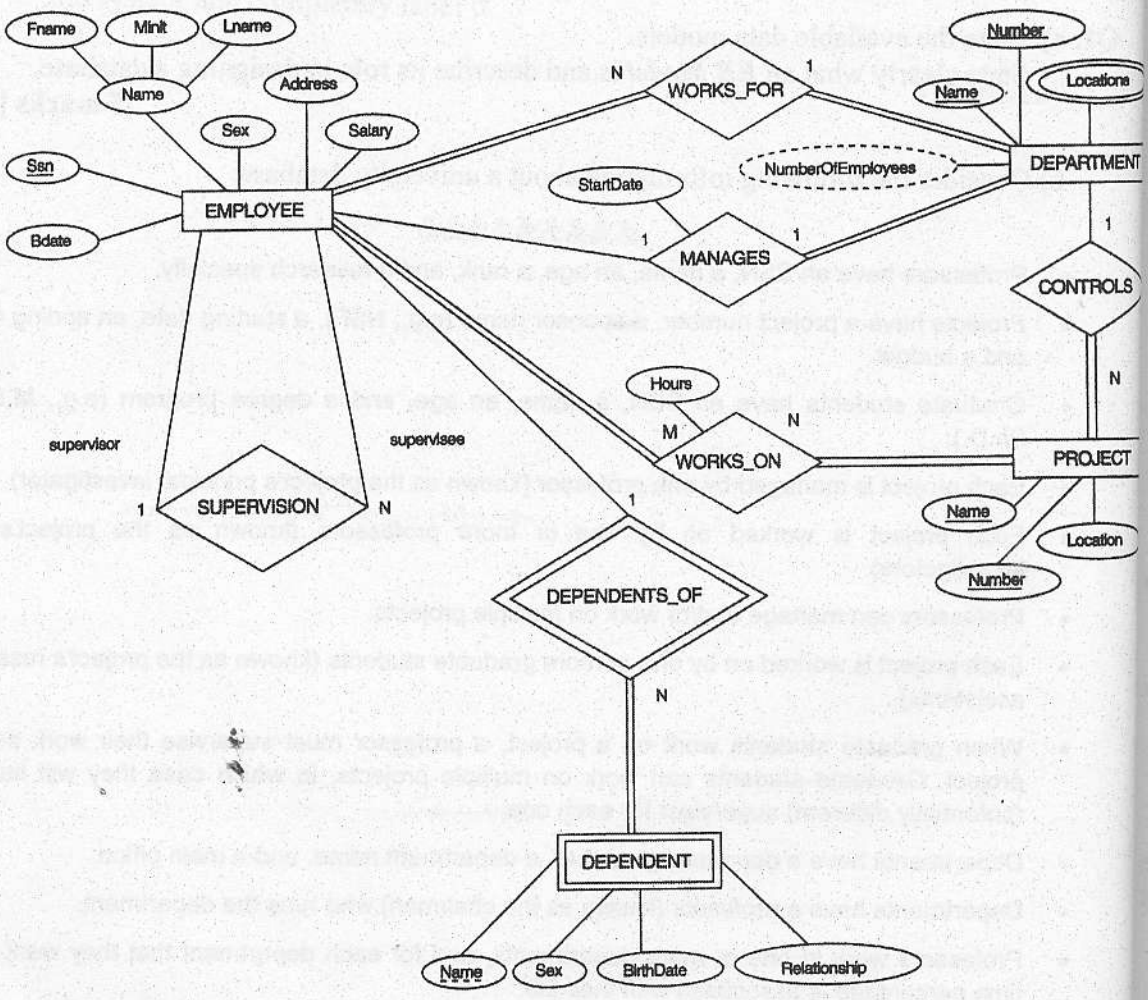
[20 marks]

Q2. a) Explain each of the following with regard to database design:

(i) Functional dependency ;
(ii) Anomalies ;
(iii) Normalization : first, second and third normal forms.

[6 marks]

b) Map the following COMPANY Entity Relationship schema into a relational schema



[9 marks]

c) Given the data below, what would the primary key be? Using that primary key, indicate the functional dependencies and their types. Then normalize the table to 3NF.

ItemID	ItemDesc	BldgRoom	Bldgcode	Bldgname	BldgManager
2111	HP Deskjet 660C	325	Eng	Engineering	Baker
2111	HP Deskjet 660C	333	BA	Business Admin	Smith
3222	Epson 440	122	BA	Business Admin	Smith

[10 marks]

Q3. a) Briefly describe the following relational algebra operations with suitable example:

(i) Projection ;
(ii) Selection ;
(iii)Union ;
(iv)Cartesian product ;
(v) Join.

[5 marks]

b) 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.

I Consider the Supplier-Parts-Catalog schema and state what the following queries compute:

(i) $\Pi_{sname}(\Pi_{sid}((\sigma_{colour='green'} Parts) \bowtie (\sigma_{cost<1000} Catalog) \bowtie Suppliers)$

(ii) $(\Pi_{sname}((\sigma_{colour='green'} Parts) \bowtie (\sigma_{cost<1000} Catalog) \bowtie Suppliers)) \cap (\Pi_{sname}((\sigma_{colour='blue'} Parts) \bowtie (\sigma_{cost<1000} Catalog) \bowtie Suppliers))$

(iii) $(\Pi_{sid}((\sigma_{colour='red'} Parts) \bowtie (\sigma_{cost<1000} Catalog) \bowtie Suppliers)) \cap (\Pi_{sid}((\sigma_{colour='green'} Parts) \bowtie (\sigma_{cost<1000} Catalog) \bowtie Suppliers))$

[6 marks]

II Write the following queries in relational algebra:

1. Find the *sids* and *names* of suppliers who supply some orange or purple part.
2. Find the *sids* of suppliers who supply some orange part or are at 3, Main Stre Batticaloa.
3. Find the *sids* of suppliers who supply every orange or green part.
4. Find pairs of *sids* such that the supplier with the first *sid* charges more for some pa than the supplier with the second *sid.*
5. Find the *pids* of parts supplied by at least two different suppliers.
6. Find the *pids* of the less expensive parts supplied by suppliers named "Manohari".
7. Find the *pids* of parts supplied by every supplier at less than Rs.2000.

[14 marks]

Q4. a) What is a foreign key constraint? Why are such constraints important? What i referential integrity?

[6 marks]

b) Answer each of the following questions briefly. The questions are based on the following relational schema:

Employee (*eid*: integer, *ename*: string, *age*: integer, *salary*: real)
Works (*eid*: integer, *did*: integer, *peL time*: integer)
Department (*did*: integer, *dname*: string, *budget*: real, *managerid*: integer)

(i) Give an example of a foreign key constraint that involves the **Departme** relation. What are the options for enforcing this constraint when a us attempts to delete a **Department** tuple?

[4 marks]

(ii) Write the SQL statements required to create the above mention relations, including appropriate versions of all primary and foreign k integrity constraints.

[5 marks]

(iii) Define the **Department** relation in SQL so that every department guaranteed to have a manager.

[2 marks

(iv) Write an SQL statement to add "Muththaiya Muralitharan" as employee with eid = 101, age = 32 and salary = 45,000.

[2 marks

(v) Write an SQL statement to give every employee a 10 percent raise.

[2 marks

(vi) Write an SQL statement to delete the Toy department. Given t referential integrity constraints you chose for this schema, explain wh happens when this statement is executed.

[4 marks