Friday, May 2, 2008
2.30p.m. – 4.30p.m.
Duration: 2 hours

University of Glasgow

EXAMINATION FOR
MSC & POSTGRADUATE DIPLOMA IN INFORMATION TECHNOLOGY

INFORMATION SYSTEMS AND DATABASES (M)

(Answer Question 1 in Section A and Two Questions from Section B)

This examination paper is worth a total of 70 marks

Section A

1. Write a short description with examples of **two** of the following:

(i) Number formatting in spreadsheets

(ii) Formulae in spreadsheets

(iii) Cascading Style Sheets

(iv) Fonts

(v) Compression techniques for multimedia data

(vi) Uniform Resource Indicators

(vii) XML Schema and DTDs

(viii) Accessibility techniques for the web.

[10]

Section B

2. Given the following relational database which describes the data held by a company concerning the in-house training of their staff and which comprises details of courses, the individual running of these courses and the employees who take and give these courses:

```
Course( CourseID, Subject, Length)

Offering( CourseID, OfferingNbr, Date, Location)

Prequisites( CourseID, PreCourseID )

Employee( EmpID, Name, Dept, Salary )

Teaches( CourseID, OfferingNbr, EmpID )

Attends( CourseID, OfferingNBR, EmpID, Mark, Grade )
```

(a) What kind of element of an ER diagram gives rise to the tables `Offering` and `Teaches`?

[2]

Provide queries which return the following in SQL and the Relational Algebra:

(b) The subjects of courses which are longer than 3 sessions.

[2]

(c) The names of the courses attended by the teachers of Database courses.

[4]

(d) The grades of all employees who have attended courses but not taught any of them.

[4]

Give SQL for the following:

(e) A **query** which, for each location, returns the average salary of employees who have taught in that location.

[4]

(f) The **addition** of a new course on Nanotechnology which is three sessions long and requires course C123 as a pre-requisite.

[4]

(g) Describe three **user roles** for this database and indicate what kind of access each would be given to the data. In your answer, describe some useful views (but you need not give the SQL for these).

[6]

(h) Describe one technique with which a database system **recovers from a crash**.

[4]

3. **(a)** In the Entity Relationship Diagram below, explain what is meant by the following (i.e. explain the structure, don't just name it):

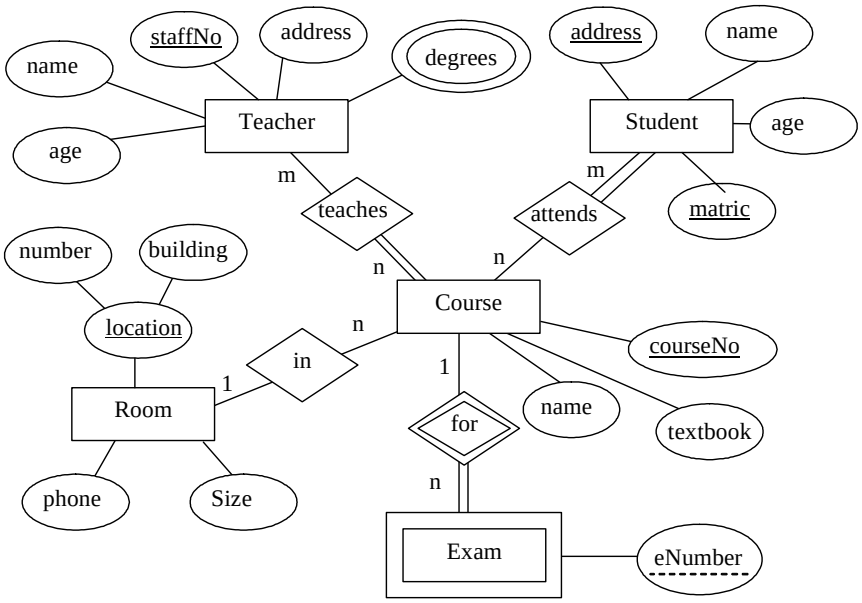
the double oval around "degrees";

the double box around "Exam"

the double line between "Course" and "Teaches"

the broken line under "Enumber"

[5]



(b) Turn this into a set of tables giving the domains of the columns and the foreign keys.

[10]

(c) A spreadsheet and a relational database system both manage rectangular data structures. List **five** main difference between them.

[5]

(d) In a banking system, three transactions start at the same time which are intended to:

Tx1: Move £20 from account 1234 to account 4321

Tx2: Move £40 from account 4321 to account 5678

Tx3: Move £60 from account 5678 to account 1234

Describe how a transaction system is used to:

preserve any **constraints** which are imposed on the database;

between the transactions

ensure that the transactions eventually **complete**

[10]

4. **(a)** Create an **ER diagram** which describes the schema of a database to hold data for the following application:

> *A chemist wishes to store the information about prescriptions and customers. The database must hold the names and contact information about the customers as well as which drugs they are allergic to and the name and phone number of their doctor. The part of the database dealing with drugs stores the manufacturer, the name of illnesses for which they are commonly prescribed and which other drugs they may not be taken with. Each prescription may be for more than one drug and includes the date and total price together with the individual prices and doses of each drug.*

[13]

(b) Given the following set of relations, indicate which are in third normal form, which only in second and which are only in first normal form:

```
Student( Matric, Name, HallName, HallAddress, Faculty )

Course( CourseID, CourseName )

EnrolledIn( StudentMatric, ClassName, ClassHeadStaffNumber )

Teaches( CourseID, TeacherStaffNumber )

Teacher( StaffNumber, Name, Department, Faculty )

StudiesOn( StudentMatric, CourseID, grade )
```

[5]

(c) What needs to be done to put the whole database into third normal form?

[6]

(d) There are eight courses in the database. Draw a B+ tree for an index created on the course name.

[6]