CS482 – Test 1

1:10pm – 2:25 pm

September 29, 2004

Note:

- Names appearing in the text are fictiuous.
- There are 3 questions (100 points: 100 points for 25% of the total grade).
- Be short and precise in your answers. (Remember: Time is precious and writting takes time.)
- Helpful notes: *It is always good to read the questions before starting to answer. It is also always good to start with something easy.*

Name:

Signature:

1. (a) Design a schema for a part of a package delivery company, which contains information about packages (PkgId, AddresseeId), addressees (Id, Name, StreetNumber, StreetName, City), and streets (StreetName, City, MinHouseNumber, MaxHouseNumber). Show the primary and foreign keys. Indicate the NOT NULL constraint wherever applicable. Use INTEGER for number and CHAR(n) for domains of strings with length less than or equal n. Invent your own domain if necessary.

(b) Express the constraint that the street number in the addressee's address must be within the range valid for the corresponding street. **Hint:** An assertion can be helpful.

2. The ACMCS organizes "Movie Night" every week. It has a huge collection of movies and so students are interested in borrowing the movies as well. To help the organizers in managing the movies collection and the students in selecting the movie, the ACMCS asks students for help.
Best from CS482 — a group of students — volunteer to help ACMCS in developing a movie recommendation system. In the first phase, the group decides to develop a movie database.
The group decides that the database should contain information about movies, actors, and studios that produce movies. Actors are people with attributes such as Id (which is unique), name, date of birth, etc. Actors play in movies. A movie has the usual attributes such as title (which is unique), release date, director, rate, length, and type. Studios are companies. A company has an address, phone numbers (typically more than one), name. Company names are trade mark and are unique. Studios have additional attributes, such as the artistic director.
The group also decides that the following constraints are sensible:

- A movie has at least one actor
- Exactly one studio makes each particular movie.
- Every actor played in at least one movie.
- Some studios may be brand new and had no time to make any movies yet.

Complete the following to help *Best of CS482*

(a) Represent the above as an E-R diagram. Do not forget to include all relevant constraints. List all the constraints that you cannot represent in the E-R diagram.

(b) Translate *your diagram* into a relational database schema. You do not need to specify the domain of attributes. Do not forget the constraints.

3. Consider the following schema:

```
Manufacturer(MName,HQAddress,Country)
Car(Make,ModelNum,MName,Kind)
Dealership(DName,DAddress)
Sell(DName,Make,ModelNum)
```

The relations record information about the manufactures, cars, dealerships, and the sale. (The name of the attributes are self-explained; please ask questions if it is not clear!) Write relational algebra expressions for the following queries:

(a) Find the makes of all cars manufactured by “Mercedes/Chrysler”

(b) Find the names and addresses of all dealers who sell Plymouths (i.e., cars with make ’Plymouth’.)

(c) Find the addresses of dealers that sell at least one make of car manufactured by a company incorporated in Japan.

(d) Find all dealers who don’t sell any car manufactured by “Mercedes/Chrysler”.

4. Consider the SQL query:

```
SELECT P.Name, C.Name
FROM Professor P, Course C, Taught T
WHERE P.Id = T.ProfId AND T.Semester = 'S2002'
      AND T.CrsCode = C.CrsCode
```

(a) Write down an equivalent expression in relational algebra.

(b) Describe in English (at most two sentences) the result of the query.

5. Consider the following schema:

```
Employee (ID,Name,Address)
Supplier (ID,Name)
PurchaseOrder (OrderID,EmpIssuerID,SupplierID,Date)
PurchaseItem (ItemID,OrderID,ItemName,ItemCost)
```

The first two schemas are self-explanatory. Each tuple in PurchaseOrder describes a purchase order issued by a particular employee to a particular supplier. The last relation, PurchaseItem, describes each ordered item and its relationship to the corresponding order.

Write the following queries using the SQL language:

(a) Names of employees who have made a purchase order that contains an item costing more than $150.

(b) For each supplier, list the name and the total cost of all items ever ordered from this supplier.

(c) Number of orders such that the total cost of items in each of those orders is over $200.

(d) Names of employees who have issued a purchase order to every supplier.