CSc 4710/6710
Spring 2003
Exam1

Name: _____

Problem	Max. Points	Points Earned
1	20	
2	20	
3	20	
4	25	
5	15	
TOTAL	100	

1. (20 Points) Consider the data requirements for an "eTailer," such as Amazon. Here are the kinds of information that the eTailer wishes to maintain:

   - Their suppliers, including supplier names, addresses, and a logo to display.
   - The items made by each supplier (e.g., HP), including the type of item (e.g., printer), the model number (e.g., 693C), and the retail price. Note that different suppliers may use the same model number for different items, even if those items are of the same type and price. However, one supplier will not use the same model number for two different items.
   - Customers, including their name, address, and email.
   - Credit cards, including the company (e.g., Visa), number, and expiration date. Each customer may have several credit cards on file, but each credit card belongs to only one customer.
   - Orders. Each order has a unique ID, has a single customer who placed the order. One of the customer's credit cards was used to pay for the order, and the order must tell which. A customer can place several orders and use different credit cards for each. An order is for some set of items, and there is an associated quantity for each. There are several ways to represent orders, but try to use a design that does not allow an order to be placed for a customer who does not own the credit card used to pay for the order.

   Give an E/R design for this database. Briefly explain your reasoning, including the intuitive meaning of any relationships you use and any entity sets you use other than suppliers, items, customers, and orders. Do not forget to indicate keys, many-one relationships, and weak entity sets in the appropriate ways.

2. (20 Points) Generate a relational schema for the following E-R schema. The relational schema should be drawn using the graphical notation of ElMasri-Navathe text (rectangles for relation schema with partitions for each attribute; underlining for primary keys and pointers for foreign keys).

3. (20 Points) Reverse engineer an E-R schema from the following relational schema shown in SQL:

```
create table zipcodes (
  zip      number(5),
  city     varchar2(30),
  primary key (zip));

create table employees (
  eno      number(4) not null primary key,
  ename    varchar2(30),
  zip      number(5) references zipcodes,
  hdate    date);

create table parts(
  pno      number(5) not null primary key,
  pname    varchar2(30),
  qoh      integer check(qoh >= 0),
  price    number(6,2) check(price >= 0.0),
  olevel   integer);

create table customers (
  cno      number(5) not null primary key,
  cname    varchar2(30),
  street   varchar2(30),
  zip      number(5) references zipcodes,
  phone    char(12));

create table orders (
  ono      number(5) not null primary key,
  cno      number(5) references customers,
  eno      number(4) references employees,
  received date,
  shipped  date);

create table odetails (
  ono      number(5) not null references orders,
  pno      number(5) not null references parts,
  qty      integer check(qty > 0),
  primary key (ono,pno));
```

4. (25 Points) Consider the following schema:

```
suppliers(SID,sname,address).
parts(PID,pname,color).
catalog(SID,PID,cost).
```

The primary keys are shown in uppercase. The `SID` column in `catalog` is a foreign key referring to `SID` in `suppliers` and the `PID` column in `catalog` is a foreign key referring to `PID` in `parts`. The `catalog` table lists the prices charged for parts by suppliers. Write the following queries in relational algebra.

(a) Get the names of suppliers who supply some red part or are at 221 Packer Ave.

(b) Get the names of suppliers who supply all red parts.

(c) Get the pnames of parts supplied by at least 3 different suppliers.

(d) Get the pnames of the most expensive parts supplied by suppliers named Yosemite Sham.

5. (15 Points) Consider two relations $r_1(R_1)$ and $r_2(R_2)$ where r_1 contains N_1 tuples and r_2 contains N_2 tuples with $N_2 > N_1 > 0$. For each of the following relational algebra expressions, give the MINIMUM and MAXIMUM possible sizes of the resulting relation produced by the expression. State any assumptions about the schemas that are necessary for the expressions to be meaningful.

   (a) $r_1 \cup r_2$.

   (b) $r_1 \cap r_2$.

   (c) $r_1 - r_2$.

   (d) $r_1 \times r_2$.

   (e) $r_1 \div r_2$.

   (f) $\Pi_A(r_1)$.

   (g) $\sigma_{A=5}(r_1)$.