Phase 2 (20 pts)

- Given your requirements document from Phase 1, your task is to leverage the Entity Relationship (ER) Model that we learned in class to model your application database. You should identify the important entity sets, relationship sets (cardinalities!), and attributes that are relevant and have later to be stored in the database in an ER diagram. Only use the ER notation found in the “Database System: The Complete Book” 2nd edition sections 4.1 – 4.6, other formats will not be accepted. Please explain the purpose of each important concepts of your diagram in detail.

Your ER diagram should have a minimum of 5 entity sets and 5 relations.

- Write out the schema for all relations and entity sets from your ER diagram. Specify the key attributes for each relation.

- The sketch out the (data definition language) DDL representation for each relation in part 2. Please use valid SQL and specify all key and constraints relationships. Your schema should be completely compilable with PostgreSQL 9.2. It would behoove you to test the create statements on the department servers or using SQLFiddle.

Problems (30 pts)

0.1 Exercise 2.3.1

In this exercise we introduce one of our running examples of a relational database schema. The database schema consists of four relations, whose schemas are:

\[
\text{Product}(\text{maker}, \text{model}, \text{type})
\]
\[
\text{PC}(\text{model}, \text{speed}, \text{ram}, \text{hd}, \text{price})
\]
The Product relation gives the manufacturer, model number and type (PC, laptop, or printer) of various products. We assume for convenience that model numbers are unique over all manufacturers and product types; that assumption is not realistic, and a real database would include a code for the manufacturer as part of the model number. The PC relation gives for each model number that is a PC the speed (of the processor, in gigahertz), the amount of RAM (in megabytes), the size of the hard disk (in gigabytes), and the price. The Laptop relation is similar, except that the screen size (in inches) is also included. The Printer relation records for each printer model whether the printer produces color output (true, if so), the process type (laser or ink-jet, typically), and the price.

Write the following declarations:

a) A suitable schema for relation Product.
b) A suitable schema for relation PC.
c) A suitable schema for relation Laptop.
d) A suitable schema for relation Printer.
e) An alteration to your Printer schema from (d) to delete the attribute color.
f) An alteration to your Laptop schema from (c) to add the attribute od (optical-disk type, e.g., cd or dvd). Let the default value for this attribute be none if the laptop does not have an optical disk.

0.2 Truth tables

Fill in the truth table for PostgreSQL 9.2.4.

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>=</th>
<th>≠</th>
<th>AND</th>
<th>OR</th>
<th>NOT (X)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRUE</td>
<td>TRUE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRUE</td>
<td>FALSE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRUE</td>
<td>NULL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FALSE</td>
<td>TRUE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FALSE</td>
<td>FALSE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FALSE</td>
<td>NULL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NULL</td>
<td>TRUE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NULL</td>
<td>FALSE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NULL</td>
<td>NULL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
0.3 Relational Algebra

1. Consider the following schema:

Sale (cust_name, item_name, when)
Cust (cust_name, industry)
Item (item_name, category, price)

Write relational algebra expressions that will answer the following questions.

a) Which customers bought something on Jan 1, 2010?

b) Which customers from the medicine industry bought something on Jan 1, 2010?

2. Consider the following schema:

Suppliers(sid, sname, address)
Parts (pid, pname, color)
Catalog (sid, pid, cost)

Write the following queries in relational algebra.

a) Find the sids of suppliers who supply some red or green part.

b) Find the sids of suppliers who supply every red part.

0.4 SQL

1. Given following relations:

Customers (cid, cname, city, discnt)
Agents (aid, aname, city, percent)
Products (pid, pname, city, quantity, price)
Orders (ordno, month, cid, aid, pid, qty, dollars)

Write the following query in SQL:

a) Get pid values of products ordered by at least one customer who lives in the same city as the agent taking the order.

2. Consider the following table managed by a garden database.

<table>
<thead>
<tr>
<th>PlandID</th>
<th>Name</th>
<th>Sunlight</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Carrot</td>
<td>0.26</td>
</tr>
<tr>
<td>1</td>
<td>Beet</td>
<td>0.42</td>
</tr>
<tr>
<td>2</td>
<td>Corn</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Write the following query in SQL:

a) Determine the plant name and sunlight with the sunlight higher than 0.4.