The Entity-Relationship (ER) Model

1) Describes/Model
   a. Entities - real world objects, described using a set of attributes
   b. Relationships - associations among two or more entities

2) Features
   a. Integrity constraints
      i. Key constraint - must be unique
      ii. Participation constraint (on a relationship) - entity must have at least one relationship with other entity
   b. Weak Entities - entity requires another entity to be uniquely identified
   c. N-way relationship - relates more than two entities
   d. ISA Hierarchies - allows for specific sub-types of entities

3) Basic E-R notation
   Attribute Type:               Entity Type:               Relationship Type:
   name                          normal                       normal
   key                          Entity name                  relationship
   partial key

   Line Type:
   Any number (partial participation)
   At most one (partial participation)
   At least one (total participation)
   Exactly one (total participation)

4) Example Diagram

5) Some Rules in general
   a. All normal entities must have at least a key
   b. All weak entities must have a partial key
   c. All weak entities must be connected via a relationship to a normal entity with total participation
Exercise (modified from Ramakrishnan/Gehrke chapter 3)

Part 1 (40 minutes)
A company database needs to store information about employees (identified by ssn, name, parking lot as attributes); departments (identified by did, dname, and budget as attributes); and dependents (identified by pname and age as attributes). Employees work in departments; each department is managed by at most one employee; a child must be identified uniquely by pname when the parent (who is an employee; assume that only one parent works for the company) is known; and each dependent is required to have a covering policy. We are not interested in information about a child once the parent leaves the company.

Other key attributes to consider include:
- The date an employee started working
- The date an employee started managing a department
- Policy cost

Draw an ER diagram that captures this information. Use the ER model here, that is, entities, relationships, and attributes. Be sure to indicate any key and participation constraints.

If you have time add the following to the model: Some employees are Hourly_Emps and some are Contract_Emps. The relation for Hourly_Emps includes the hourly_wages and hours_worked attributes of Hourly_Emps. Similarly, the relation for Contract_Emps includes contractid as attributes.

Part 2 (20 minutes)
Based on the sample solution for the ER model from part 1, translate the Employees, Departments, and Dependents entities along with the manages and works_in relationships, into a relational tables using SQL commands. Specification of the data types is given below:

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Data Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>ssn</td>
<td>CHAR(11)</td>
</tr>
<tr>
<td>name</td>
<td>CHAR(30)</td>
</tr>
<tr>
<td>lot</td>
<td>INTEGER</td>
</tr>
<tr>
<td>pname</td>
<td>CHAR(20)</td>
</tr>
<tr>
<td>age</td>
<td>INTEGER</td>
</tr>
<tr>
<td>cost</td>
<td>REAL</td>
</tr>
<tr>
<td>did</td>
<td>INTEGER</td>
</tr>
<tr>
<td>dname</td>
<td>CHAR(20)</td>
</tr>
<tr>
<td>budget</td>
<td>REAL</td>
</tr>
<tr>
<td>since</td>
<td>DATE</td>
</tr>
</tbody>
</table>

General Syntax of the CREATE TABLE statement used in data definition language

```
CREATE TABLE tablename ( column_declare1,
                          column_declare2,
                          constraint_declare1, ... )
```