Exam 1 Part 1 Solutions

Name: __________________________
UFID: __________________________
Email Address: ____________________

Pledge (Must be signed according to UF Honor Code)

On my honor, I have neither given nor received unauthorized aid in doing this assignment.

_____________________________________________
Signature

For scoring use only:

<table>
<thead>
<tr>
<th>Question</th>
<th>Maximum</th>
<th>Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Question 2</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>
**Question 1 (Knowledge Questions)  [20 points]**

1. What is a DBMS? What are the processes that a DBMS facilitates? [4 points]
   A DBMS is a collection of programs that enables users to create and maintain a database. The DBMS is a general-purpose software system that facilitates the processes of defining, constructing, manipulating, and sharing databases among various users and applications.

2. Briefly list the four stages of database design (only list their keywords). [4 points]
   - Requirements Analysis
   - Conceptual Design
   - Logical Design
   - Physical Design

3. Consider a database of employees in which we need to record information about employees’ addresses. Name at least two conditions that would cause you to make “address” an entity set of its own rather than an attribute of the employee entity set. [4 points]
   - An employee may have more than one address and all of them are supposed to be stored in the database.
   - Attribute address is composed of street, city, state, etc. Components of an address may also be interesting to some queries.
   - Address of an employee may be shared by another entity.

4. What is the difference of generalization and aggregation? [4 points]
   Generalization defines an is-a-kind of relationship in which one class shares its structure and/or behavior with one or more other classes. Aggregation is a special relationship set which associates each superior entity set with several subordinate entity sets.

5. What is the difference of an inner join and outer join? [4 points]
   Inner join: the result does not contain those tuples that did not find a partner.
   Outer join: the result contains those tuples that did not find a partner. The result tuples are “filled” with null values.
Question 2 (ER Model)   [30 points]

1. Suppose you and your friends are starting an e-commerce company to sell various kinds of products in daily life like perfume and toys online. Now you are trying to design the company’s website. Based on the following requirements, design an ER diagram for the database of the website. For each binary relationship you identified, state the cardinalities (1:1, 1:m or m:n) on the entities participating in this relationship. [25 points]

- The database maintains the information of customers, including the customer’s name, email address, shipping address, billing address, credit card number, and phone number. In order to arrange the shipment efficiently and reduce the cost, the shipping address is composed by street, state and zip code.
- There are two kinds of customers, registered customer and non-registered customer. Registered customers are identified by their registered ids, and for each non-registered customer, a temporary id is used.
- A product has a product id, a name, its price, a supplier (from where this product is purchased) and a description. Each product is identified by the product id.
- Each product has a number of items. All the items from a same product are identical in looking, however, they are different in their item ids (imagine when you go to the supermarket, although you buy two same things, they have different barcodes). In addition, each item has a producing date. The item id alone is not enough to distinguish different items from all kinds of products; instead, it must be associated with its corresponding product id.
- Each customer can order many items at a time. When he/she is making an order, the date, time, and total amount of that order will be recorded. The total amount is not stored information but calculated each time when a customer makes an order, by adding all the prices of items together.
- Each product belongs to one or more categories. For example, a photographer’s book can belong to both “book” and “photography.” Each category includes many kinds of products. A category has its category number, category name, and is identified by the category number.
- For each registered customer, you will keep track of his/her favorite categories. This will be useful when you suggest products for him/her in his/her future purchase. One customer can favorite in one or more categories, and for each of his/her favorite, you will keep record of the number of purchases he/she made in this category.
Solution:

[Each entity set needs to have a primary/partial key. Grading criteria:
* Missing keys/attributes: -1 each, -5 max
* Bad design: -1~10, depending on how bad it is.
* Missing relationship/entity: -2 each.
* Missing/incorrect cardinalities: -1 each, -5 max.]

2. Suppose that every category must have at least one product but is restricted to at most 100 products, and a product must belong to some category. Further we require that a product cannot have more than 1000 items (otherwise we may have a very high cost of inventory!). How does this show up on the (min, max) constraints? Write the answer in this form: [Relationship: Entity1 (min, max), Entity2 (min, max)] [5 points]

Solution:
belongsto: Product (1, *), Category (1, 100)
has: item(1,1), Product(0, 1000)