Information and Database Management Systems I (CIS 4301)
(Fall 2016)

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TA: Yang Peng

Homework 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></th>
<th>Maximum</th>
<th>Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise 1</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Exercise 2</td>
<td>30</td>
<td></td>
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<tr>
<td>Exercise 3</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
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</tbody>
</table>
Exercise 1 (Knowledge Questions) [30 points]

Provide precise and concise replies for the following statements and questions.

1. What is a DBMS? What are the advantages of using DBMS (list at least four)? [4 points]
   Solution:
   A DBMS is a collection of programs that enables users to create and maintain a database. Advantages: data consistency, data integrity, data security, backup and recovery, flexibility, and so on.

2. Define the term “database system”. [2 points]
   Solution:
   DBMS along with database is called Database system.

3. What is a data model? [2 points]
   Solution:
   A data model is a mathematical formalism consisting of a notation for describing the data of interest and of a set of operations for manipulating these data. It describes the structure of a database (data types, relationships, conditions).

4. Explain the difference between physical data models and logical data models [4 points].
   Solution:
   Physical data models: the storage-oriented representation of data
   Logical data models: the user-oriented representation of data

5. Describe the difference between key and primary key [4 points].
   Solution:
   A minimal set of attributes whose values uniquely characterize the associated entity among all entities of its type is called key. One of the possible keys is selected as the primary key.

6. Explain the difference between physical data independence and logical data independence [4 points].
   Solution:
   Physical data independence: changes of the physical schema do not have impact on the conceptual schema (and thus also not on the external schemas);
   Logical data independence: changes of the conceptual schema do not have impact on external schemas

7. Describe the difference between data definition language and data manipulation language [4 points].
   Solution:
   DDL: the languages to manipulate a database schema; it permits the specification of the structure of databases
   DML: query language for the retrieval of data objects in a database; it does not permit users
to specify how data can be found

8. Describe the levels of abstraction in a database. [3 points]
   Solution:
   • External/view level describe the part of the DB, which is relevant for the user
   • Conceptual/logical level gives information about existing data and relationships in the DB
   • Physical/internal level describes how data are physically stored

9. What are the different kinds of components in an E-R diagram? Explain them. [3 points]
   Solution:
   • Entities are distinguishable, independent, self-contained, physically or intellectually existing concepts of the mini-world to be modeled.
   • A relationship describes a connection between several entities.
   • Attributes describe characteristic properties of an entity or a relationship.

Exercise 2 (Oracle) [30 points]

Consider the following ‘World’ table.

<table>
<thead>
<tr>
<th>name</th>
<th>continent</th>
<th>area</th>
<th>population</th>
<th>gdp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan</td>
<td>Asia</td>
<td>652230</td>
<td>25500100</td>
<td>20343</td>
</tr>
<tr>
<td>Albania</td>
<td>Europe</td>
<td>28748</td>
<td>2831741</td>
<td>12960</td>
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<td>Algeria</td>
<td>Africa</td>
<td>2381741</td>
<td>37100000</td>
<td>188681</td>
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<tr>
<td>Andorra</td>
<td>Europe</td>
<td>468</td>
<td>78115</td>
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</tr>
<tr>
<td>Angola</td>
<td>Africa</td>
<td>1246700</td>
<td>20609294</td>
<td>100990</td>
</tr>
</tbody>
</table>

(“name” is the primary key)

Use your CISE Oracle account to create this table and perform the operations below. Provide SQL statements for all operations. Show the **screenshots of query results** from Oracle. [5 points each]

(1) Create the World table.
   Solution:
   CREATE TABLE World ( 
     name VARCHAR(255) PRIMARY KEY, 
     continent VARCHAR(255), 
     area INTEGER, 
     population INTEGER, 
     gdp INTEGER 
   );
(2) Insert the data into the table.
Solution:
INSERT INTO World VALUES ('Afghanistan', 'Asia', 652230, 25500100, 20343);
INSERT INTO World VALUES ('Albania', 'Europe', 28748, 2831741, 12960);
INSERT INTO World VALUES ('Algeria', 'Africa', 2381741, 37100000, 188681);
INSERT INTO World VALUES ('Andorra', 'Europe', 468, 78115, 3712);
INSERT INTO World VALUES ('Angola', 'Africa', 1246700, 20609294, 100990);

(3) Express the following colloquial queries in SQL.
(a) List the names of countries from Africa.
Solution:
SELECT name FROM World WHERE continent = 'Africa'
– Return –
Algeria
Angola

(b) List the names and gdps of countries whose area is smaller than 50,000.
Solution:
SELECT name, gdp FROM World WHERE area < 50000;
– Return –
Albania 12960
Andorra 3712

(c) For countries in Europe, add 1000 to their gdp.
Solution
UPDATE World SET gdp = gdp + 1000 WHERE continent = 'Europe';

(4) Calculate the sum gdp of countries from Asia and Africa. Hint: Use the aggregation function “sum” in the same manner as the aggregation function “count” in class.
Solution:
SELECT SUM(gdp) FROM World WHERE continent = 'Asia' OR continent = 'Africa';
– Return –
310014
Exercise 3 (ER Model) [40 points]

This problem is concerned with modeling of a database that stores information about properties managed by AMC, which has been in the business of property management for over a decade. AMC has many properties across states in USA, including Tivoli, Stoneridge, etc. Suppose you are hired by the AMC to design a database to manage the properties. Below we describe the entities and the relations that needed to be captured by your design.

- Each property has a name, street number, street name, zip code and one phone number. The property names are unique. Example: (‘Tivoli’, ‘2841’, ‘SW 13th ST’, ‘32608’, ‘FL’, ‘3522265021’)

- Each property has a number of apartments and each apartment is associated with an apartment number. Each apartment has one or more residents. The information stored for a resident includes his/her name and sex. Assuming names are unique among the residents in an apartment.

- An employee of AMC is uniquely identified by his/her SSN. Moreover, we store his/her name.

- An employee may work at several properties of AMC. For instance, Smith is working at “Tivoli” on Tuesday and Friday and at “Stoneridge” on Monday, Wednesday and Thursday. For every employee we record the percentage of time he or she works at each property. Thus, employee ‘Smith’ would be recorded as working at 40% at Tivoli and 60% at “Stoneridge”.

- Each property has one property manager and one leasing manager. Each property/leasing manager may manage zero, one or multiple properties. For each leasing manager, we need to record his/her highest education degree and for each property manager, we need to record his/her number of years working in this area.

Design the E.R. diagram for the small database described above. Make sure to indicate the primary and partial keys, cardinality constraints, weak entities (if applicable).
Solution: