Database Management Systems

(COP 5725)

Fall 2019

Instructor: Dr. Markus Schneider

TA: Kyuseo Park

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.

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Signature

For scoring use only:

	Maximum	Received
Exercise 1	30	
Exercise 2	40	
Exercise 3	30	
Total	100	

Exercise 1 (Knowledge Questions) [30 points]

Please provide concise but precise answers.

1. [5 points] Explain the terms “database” and “DBMS” and their relationship.

   - Database: It is an integrated and structured repository of large collections of persistent data, which serves for all users of an application area as a common and reliable basis of up-to-date information.
   - DBMS: It is an all-purpose software system, which supports the user in the definition, construction and manipulation of databases for different applications in an application-neutral and efficient manner.
   - Relationship between database and DBMS: The DBMS is a set of programs for the management of and access to the data in the database. It’s at software level between physical database and user.

2. [4 points] List and explain the main problems of file systems.

   1. Redundancy: repeated occurrence of the same data in different files.
   2. Inconsistency: Lacking logical concordance of file contents.
   3. Data-program dependence: Data are directly created and accessed by an application program, and changes of the file structure lead to changes of the application program.
   4. Inflexibility: Data from several files can only be combined with very high costs.

3. [5 points] What is the ER model? Explain its three components.

   The ER model is intended for conceptual database design. It helps the database designer model an interesting part of the “real world” by abstraction so that questions about its data and relationships between the data can be answered with the aid of the model.

   Components:
   1. Entity: Distinguishable, independent, self-contained, physically or intellectually existing concept of the mini-world to be modeled.
   2. Attribute: Property of an entity or a relationship.
   3. Relationship: It describes a logical connection between two or more entities.

4. [4 points] Explain the terms “DDL” and “DML”.

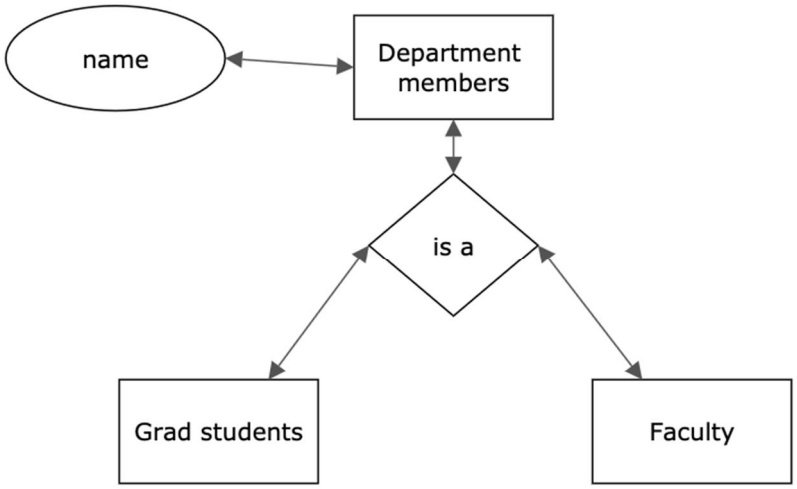
   - DDL is short for Data Definition Language or Data Description Language. It is the language to manipulate a database schema.
   - DML is short for Data Manipulation Language. It is the query language for inserting, deleting and updating data in a database.

5. [5 points] What are logical data independence and physical data independence?

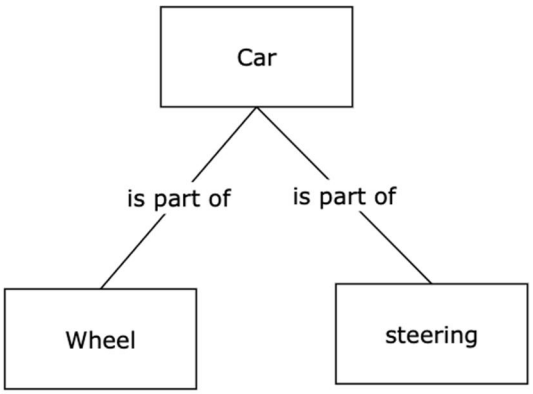
- Logical data independence: Changes of the conceptual schema (e.g., information about new types of entities, further information about existing entities) do not have impact on external schemas (e.g., existing application programs).
- Physical data independence: Changes of the physical schema (e.g., change of an access structure to a more efficient one, use of other data structures, exchange of algorithms) do not have impact on the conceptual schema and thus also not on external schemas.

6. [4 points] Explain the terms "generalization" and "aggregation", and provide an example for each term.

- Generalization: It is a is-a-kind of relationship in which one class shares its structure and/or behavior with one or more other classes.



- Aggregation: It is a special relationship set which associates each superior entity set with several subordinate entity sets.



7. [3 points] What are the advantages of Database Systems if you characterize them by concise phrases of at most three words each?

   1. Data independence
   2. Efficient data access
   3. common data basis
   4. concurrent data access
   5. lacking or controlled redundancy
   6. consistency of data
   7. data security

Exercise 2 (Oracle) [40 points]

Consider the following database table `Employees`.

EID	NAME	GENDER	JOB	HIRED_YEAR	SALARY	CITY
1001	Reilly Martins	F	salesman	2016	1500	Gainesville
1002	Amirah Zavala	M	clerk	2016	1300	Gainesville
1003	Sabrina Contreras	F	salesman	2017	1400	Ocalar
1004	Beulah Farley	M	clerk	2015	1000	Gainesville
1005	Griff Ashton	M	clerk	2013	1100	Jacksonville
1006	Amara Berg	F	analyst	2017	2500	Ocalar
1007	Mazie Herring	M	manager	2019	2000	Jacksonville
1008	Dana Ochoa	F	manager	2016	2200	Ocalar

Use your CISE Oracle account to create this table, and perform the operations below by formulating SQL queries. Provide **SQL statements** for all operations. Show the outputs of all results as **screen snapshots** in Oracle.

(1) [6 points] Create the `Employees` table and insert all the records into the table.

```
create table employees
  (eID integer,
   Name varchar(30),
   gender varchar(10),
   job varchar(30),
   hired_year integer,
   salary NUMBER(8),
   city varchar(30));

INSERT INTO employees
  VALUES(1001, 'Reilly Martins', 'F', 'salesman', 2016, 1500, 'Gainesville');
INSERT INTO employees
  VALUES(1002, 'Amirah Zavala', 'M', 'clerk', 2016, 1300, 'Gainesville');
INSERT INTO employees
  VALUES(1003, 'Sabrina Contreras', 'F', 'salesman', 2017, 1400, 'Ocalar');
INSERT INTO employees
  VALUES(1004, 'Beulah Farley', 'M', 'clerk', 2015, 1000, 'Gainesville');
INSERT INTO employees
  VALUES(1005, 'Griff Ashton', 'M', 'clerk', 2013, 1100, 'Jacksonville');
INSERT INTO employees
  VALUES(1006, 'Amara Berg', 'F', 'analyst', 2017, 2500, 'Ocalar');
INSERT INTO employees
  VALUES(1007, 'Mazie Herring', 'M', 'manager',  2019, 2000, 'Jacksonville');
INSERT INTO employees
  VALUES(1008, 'Dana Ochoa', 'F', 'manager', 2016, 2200, 'Ocalar');
```

(2) [6 points] Find the names of employees who were hired in 2016.

```
select name
from employees
where hired_year = 2016;
```

	NAME
1	Reilly Martins
2	Amirah Zavala
3	Dana Ochoa

(3) [5 points] Find the number of employees who live in Gainesville.

```
select count(*)
from employees
where city = 'Gainesville';
```

	COUNT(*)
1	3

(4) [6 points] Find the name of employees whose salary is less than 1300 and work as a clerk.

```
select name
from employees
where salary < 1300 and job = 'clerk';
```

	NAME
1	Beulah Farley
2	Griff Ashton

(5) [6 points] Find the name of employees who are female and work as manager.

```
select name
from employees
where gender = 'F' and job = 'manager';
```

	NAME
1	Dana Ochoa

(6) [5 points] Display the average salary of all employees. [Note: For answering this query, please look into Oracle SQL manuals how to compute the average of a set of values.]

```
select avg(salary)
from employees;
```

	AVG(SALARY)
1	1625

(7) [6 points] Find those students whose name has ‘re’ or ‘la’ in it. [Note: For answering this query, please look into Oracle SQL manuals how to formulate a substring search.]

```
select  name
from employees
where name like '%re%' or name like '%la%';
```

```
NAME
------------------------------
Amirah Zavala
Sabrina Contreras
Beulah Farley
```

Exercise 3 (ER Model) [30 points]

Consider the following requirements about a department management system:

- A user has an email address which is unique, name, date of birth, current address, and age. Age is a derived attribute.
- There are two types of users: students and professors.
- Graduate students are students and have an SSN.
- A professor has a title, tenure status, and an SSN.
- A hometown where users were born has a city name and a state name.
- Graduate students are advised by a professor.
- Students enroll in courses that have a title, a description, year, semester, and credits.
- A professor teaches courses, and an evaluation form is created.
- Students and professors belong to a department that has a unique department ID, name, and office address. The address includes street, city, state, and zip code.

Design an Entity-Relationship diagram that models this scenario and takes into account the requirements listed above. That means that you have to identify suitable entity sets, relationship sets, attributes, keys of entity sets (if not specified), and so on. Further add the cardinalities (1:1, 1:m, m:1, m:n) to the relationship sets.