Database Management Systems

(COP 5725)

Spring 2020

Instructor: Dr. Markus Schneider

TA: Kyuseo Park

Homework 1

Name:	Xiao Hu
UFID:	6936 3179
Email Address:	xiao.hu@ufl.edu

Pledge (Must be signed according to UF Honor Code)

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

Xiao Hu.

Signature

For scoring use only:

	Maximum	Received
Exercise 1	22	
Exercise 2	40	
Exercise 3	19	
Exercise 4	19	
Total	100	

Exercise 1 (Knowledge Questions) [22 points]

Please provide concise but precise answers.

- [4 points] Explain the following terms briefly and describe their relationship.
  - Database
  - DBMS
- [3 points] Briefly explain what a data model is and which kind of data models a DBS can have.
- [4 points] What is the ER model? Explain its three main components.
- [3 points] Describe the data abstraction levels that DBS can have.
- [4 points] What are the logical data independence and the physical data independence?
- [4 points] Explain the following terms (use the notions learnt in the lecture) and provide an example for each term.
  - [1 point] Generalization
  - [1 point] Aggregation
  - [2 points] What is a ‘table’, the purpose of it, and what language do we use to create it in database systems?

Exercise 1:

(1) Database: 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: 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.

the relation between DB and DBMS is DBMS is a set of programs for the management of and access to the data in the Database, a software level between physical database and user. and Database system is Database management system combined with Database.

(2). Data Model:
mathematical formalism consisting of a

notation for describing the data of interest.
and of a set of operations for manipulating
these data, description of the structure
of a database.
DBS can have physical data models and bgical
data models.

(3) E-R model for conceptual database design, has great importance in practice, modeling of an interesting part of the "real world" by abstraction so that questions about its data and the relationships between the data can be answered with the aid of the model.

entity: distinguishable, independent, self-contained, physically or intellectually existing concepts of the mini-world to be modeled

attributes: an entity is described by a set of pertaining properties.

relationship: describes a connection between several entities.

(4). external/view levels: 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

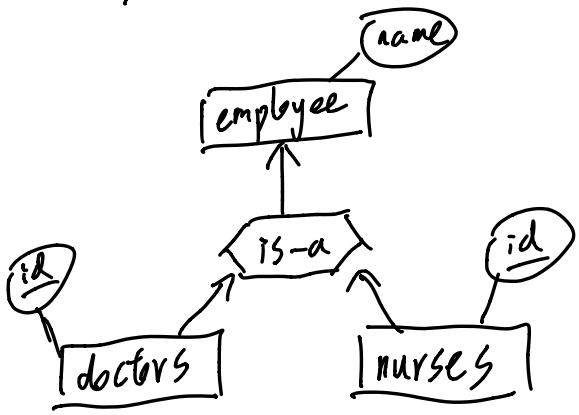
physical/internal level: describes how data are physically stored.

(5) logical data independence:
changes of the conceptual schema

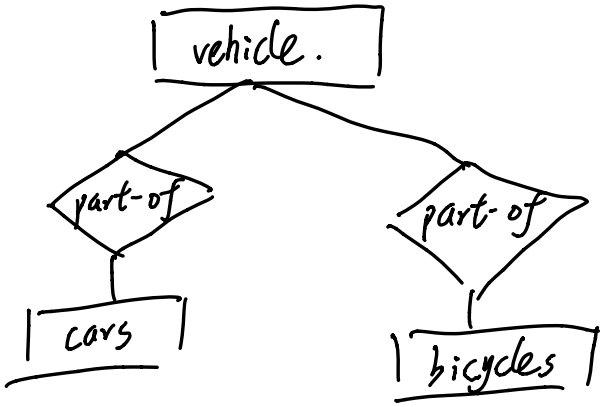
physical data independence:
changes of the physical schema.

(6). ① Generalization:

"Factoring" (extracting) properties (attributes, relationships) of similar entity sets (subclasses, subtypes, categories) to a common superclass (supertype).



② Aggregation:
is a special relationship set named part-of which associates a superior entity set with several subordinate entity sets based on structual composition.



. . .

③ tables as the simple underlying data structure
no nested complicated structures, that is, attribute fields may not contain values such as tables, arrays, lists, trees, etc. but only atomic values. representation of a relation as tables with rows and columns.

purpose: set oriented processing of data in contrast to record oriented processing prevailing until then (hierarchical model, network model)

simple comprehensibility also for the unskilled user
very good performance for standard, alphanumerical database applications.
Existence of a mature, formal theory.

SQL Language. ⇒ create table. table-name
(column1 data type,
⋮
);

professors			
pers-id	name	rank	room
2125	Sokrates	C4	226
2126	Russel	C4	232
2127	Kopernikus	C3	310
2133	Popper	C3	052
2134	Augustinus	C3	309
2136	Curie	C4	036
2137	Kant	C4	007

Exercise 2 (Oracle) [40 points]

Consider the following table '**Employees'**.

	EID	NAME	GENDER	JOB	HIRED_YEAR	SALARY	CITY
1	1001	Reilly Martins	F	salesman	2016	1500	Gainesville
2	1002	Amirah Zavala	M	clerk	2016	1300	Gainesville
3	1003	Sabrina Contreras	F	salesman	2017	1400	Ocala
4	1004	Beulah Farley	M	clerk	2015	1000	Gainesville
5	1005	Griff Ashton	M	clerk	2013	1100	Jacksonville
6	1006	Amara Berg	F	analyst	2017	2500	Ocala
7	1007	Mazie Herring	M	manager	2019	2000	Jacksonville
8	1008	Dana Ochoa	F	manager	2016	2200	Ocala

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

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

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

(3) [5 points] Find the number of employees who live in Gainesville and work as a salesman.

(4) [6 points] Find the names and salaries of all employees whose salary is between $1200 and $1500 and who work in Gainesville.

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

(6) [5 points] Display the names of all employees along with their salaries in descending salary order. (Hint: Find out in the Oracle manuals how to sort data in descending order.)

(7) [6 points] Find the names of employees whose name has more than two 'a' in it and ends with 's'. (Hint: Look up the command *like* in the Oracle manuals and apply it.)

Exercise 2:

(1)

```
create table Employees
  (EID integer,
   NAME varchar(30),
   GENDER varchar(20),
   JOB varchar(30),
   HIRED_YEAR integer,
   SALARY NUMBER(8),
   CITY varchar(30));
```

	COLUMN_NAME	DATA_TYPE	NULLABLE	DATA_DEFAULT	COLUMN_ID	COMMENTS
1	EID	NUMBER(38,0)	Yes	(null)	1	(null)
2	NAME	VARCHAR2(30 BYTE)	Yes	(null)	2	(null)
3	GENDER	VARCHAR2(20 BYTE)	Yes	(null)	3	(null)
4	JOB	VARCHAR2(30 BYTE)	Yes	(null)	4	(null)
5	HIRED_YEAR	NUMBER(38,0)	Yes	(null)	5	(null)
6	SALARY	NUMBER(8,0)	Yes	(null)	6	(null)
7	CITY	VARCHAR2(30 BYTE)	Yes	(null)	7	(null)

```
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, 'Ocala');
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, 'Ocala');
INSERT INTO Employees VALUES(1007, 'Mazie Herring', 'M', 'manager', 2019, 2000, 'Jacksonville');
INSERT INTO Employees VALUES(1008, 'Dana Ochoa', 'F', 'manager', 2016, 2200, 'Ocala');
```

	EID	NAME	GENDER	JOB	HIRED_YEAR	SALARY	CITY
1	1001	Reilly Martins	F	salesman	2016	1500	Gainesville
2	1002	Amirah Zavala	M	clerk	2016	1300	Gainesville
3	1003	Sabrina Contreras	F	salesman	2017	1400	Ocala
4	1004	Beulah Farley	M	clerk	2015	1000	Gainesville
5	1005	Griff Ashton	M	clerk	2013	1100	Jacksonville
6	1006	Amara Berg	F	analyst	2017	2500	Ocala
7	1007	Mazie Herring	M	manager	2019	2000	Jacksonville
8	1008	Dana Ochoa	F	manager	2016	2200	Ocala

(2)

```
SELECT NAME FROM Employees WHERE HIRED_YEAR < 2016
```

	NAME
1	Beulah Farley
2	Griff Ashton

(3)

```
SELECT COUNT(*) FROM Employees WHERE CITY = 'Gainesville' and JOB = 'salesman'
```

	COUNT(*)
1	1

(4.)

```
SELECT NAME,SALARY FROM Employees WHERE SALARY BETWEEN 1200 and 1500 and CITY = 'Gainesville'
```

	NAME	SALARY
1	Reilly Martins	1500
2	Amirah Zavala	1300

(5)

```
SELECT NAME FROM Employees WHERE GENDER = 'F' and JOB = 'manager'
```

	NAME
1	Dana Ochoa

(6)

```
SELECT NAME,SALARY FROM Employees order by SALARY DESC
```

	NAME	SALARY
1	Amara Berg	2500
2	Dana Ochoa	2200
3	Mazie Herring	2000
4	Reilly Martins	1500
5	Sabrina Contreras	1400
6	Amirah Zavala	1300
7	Griff Ashton	1100
8	Beulah Farley	1000

(7)

```
SELECT NAME FROM Employees WHERE name like '%a%a%a%s'
```

	NAME
1	Sabrina Contreras

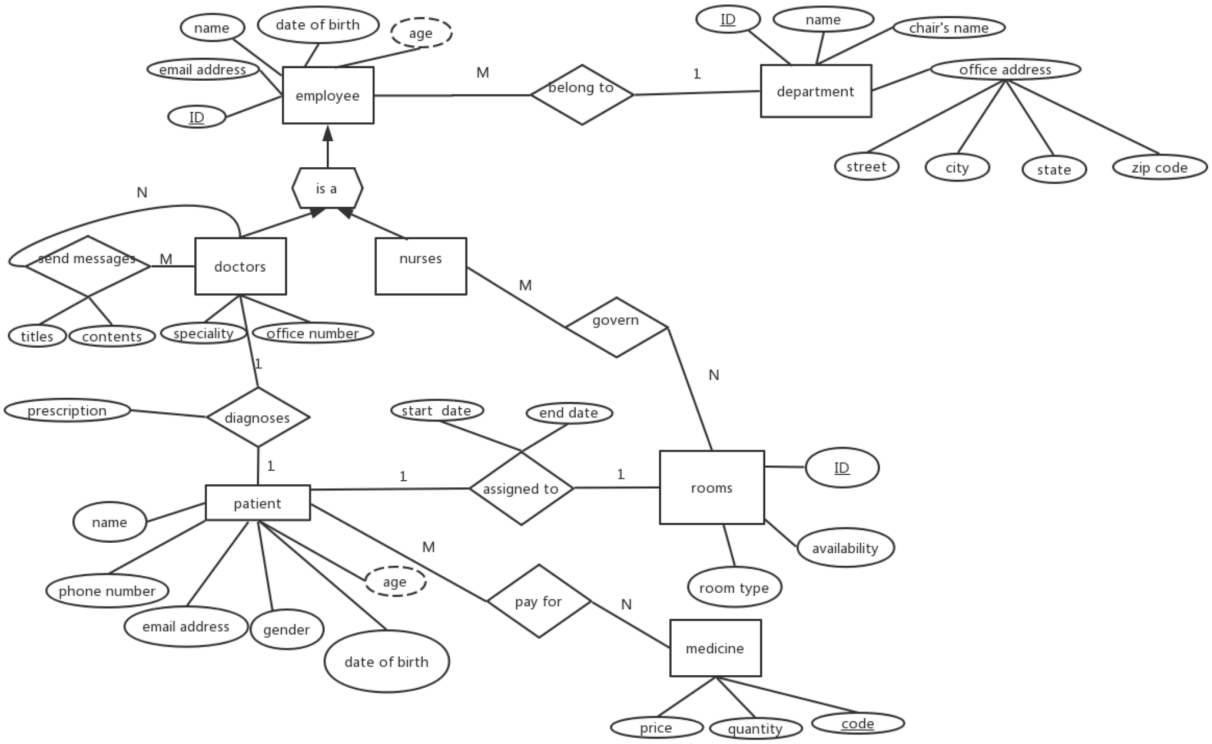
Exercise 3 (ER Model) [19 points]

Design an Entity-Relationship diagram that models a hospital management system and considers the requirements listed below. 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 and write down your assumptions regarding the cardinalities if there could be a doubt.

Consider the following requirements about a hospital management system:

- An employee has a unique ID, an email address, a name, a date of birth, and an age. Age is a derived attribute.
- There are two types of employees: Doctors and Nurses.
- Employees belong to a department that has a department ID, a name, its chair's name, and an office address. The address includes street, city, state, and zip code.
- Doctors have a specialty and an office number. They can send messages to other doctors.
- A message includes a title and contents.
- A patient information includes a name, an email address, a date of birth, an age, a phone number, and a gender. Age is a derived attribute.
- A doctor diagnoses a patient, and a prescription is written whenever a diagnosis is made.
- Nurses govern rooms that have room IDs, availability, and room type, and patients are assigned to a room.
- When a patient is assigned to a room, start and end date to the room will be recorded.
- Patients pay for prescribed medicine, and a medicine has a price, a quantity, and a code.

Exercise 3:


name
date of birth
age
email address
employee
ID
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belong to
1
ID
name
chair's name
department
office address
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zip code
is a
N
send messages
M
doctors
nurses
titles
contents
speciality
office number
1
M
govern
N
prescription
diagnoses
start date
end date
1
1
assigned to
1
rooms
ID
availability
room type
name
patient
M
age
phone number
email address
gender
date of birth
pay for
N
medicine
price
quantity
code

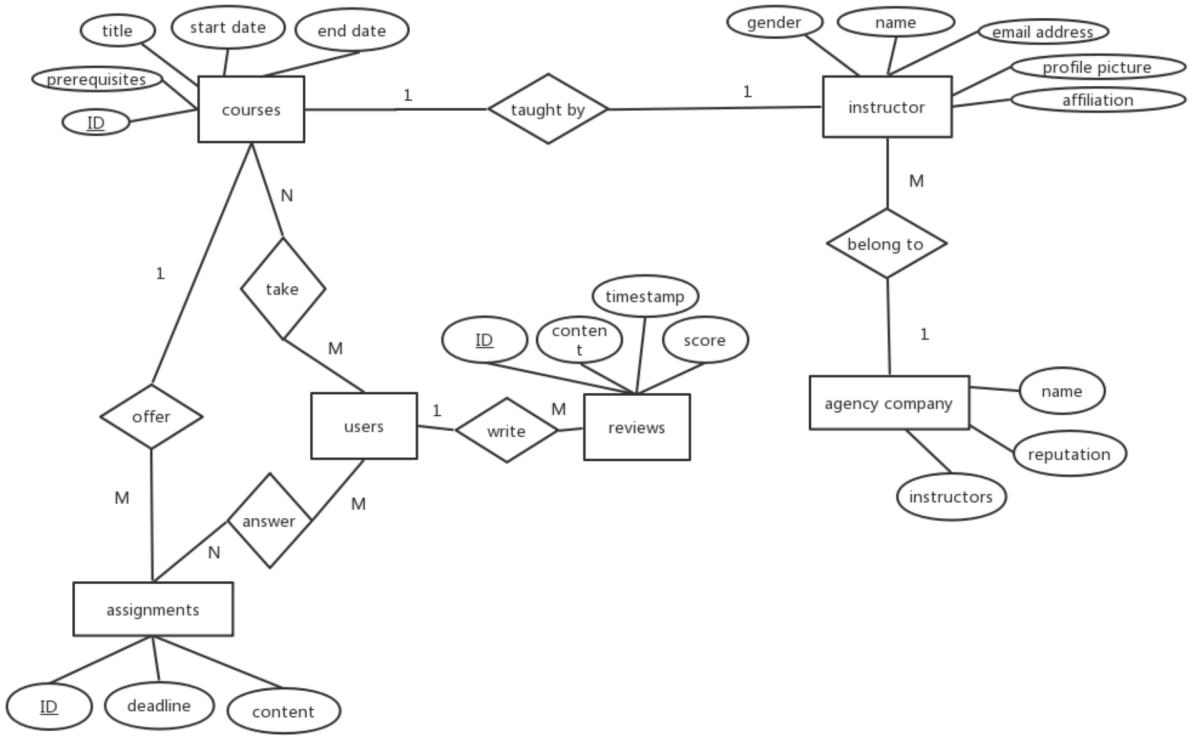
Exercise 4 (ER Model) [19 points]

Design an Entity-Relationship diagram that models an online course management system and considers the requirements listed below. 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 and write down your assumptions regarding the cardinalities if there could be a doubt.

Consider the following requirements about an online course management system:

- Every course has a unique ID, a title, and start and end dates.
- Each course might have prerequisites.
- Each course is taught by one instructor.
- Each instructor has a name, gender, email address, profile picture, and affiliation.
- Instructors can belong to an agency company that has a name, a reputation, and a number of instructors as attributes.
- Users can take multiple courses.
- Each user has a unique ID, a name, an email address, a date of birth, and a gender.
- A user can write reviews for courses. A review has an ID, a content, a score, and a timestamp.
- Each course offers multiple assignments. Assignments have an ID, a deadline, and a content.
- Users answer the assignments that the course offers.

Exercise 4:


title
start date
end date
prerequisites
ID
courses
1
taught by
1
instructor
gender
name
email address
profile picture
affiliation
N
1
take
M
M
belong to
1
timestamp
ID
conten
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score
offer
users
1
write
M
reviews
agency company
name
reputation
instructors
M
answer
M
N
assignments
ID
deadline
content