Benha University
2nd Term (May2018) FinalExam
Class: 3rd Year Students
Subject: Database Management Systems
Course Code: DBA 372

Faculty of Computers & Informatics
Date: 31/5/2018
Time: 3 Hours
Examiner(s): Dr. Walaa Medhat

Answer the following questions: Model Answer

Question No. 1 [10 Marks]

a) Define the following terms: *attribute*a property or description of an entity, *domain*a set of possible values for an attribute, *relation cardinality*is the number of tuples in the relation. and *relation degree*the number of fields (or columns) in the relation.

b) **What is the objective of Normalization?**
to create relations where every dependency is on the key, the whole key, and nothing but the key".

c) **What is referential integrity?**
Item named in one relation must correspond to tuple(s) in another that describes the item

d) **What is the purpose of physical database design?**
translate the logical description of data into the *technical specifications* for storing and retrieving data

e) **What does inheritance between entities means?**

a. Subtype entities inherit values of all attributes of the supertype
b. An instance of a subtype is also an instance of the supertype

Question No. 2 [15Marks]

Consider the following table from a company database. This database holds information about employees and their jobs. The jobs are title dependent. Each employee wirks for a certain department and he/she has some tasks to do as his/her title tells. It also contains information about where his employee works and the telephone number of the room he works in.

Emp#	Ename	Room#	Room Phone	Dept#	JobTitle	Tasks
E1	Mohamed	101	261	D102	RND	Deicision Making, Design
E2	Ahmad	101	261	D102	RND	Design, Implementation
E3	Ahmad	101	261	D102	RND	Design, Implementation
E4	Moataz	105	265	D205	Media	Design, Animation
E5	Mahmoud	107	279	D205	Media	Design
E6	Ibrahim	102	222	D103	Marketing	Selling
E7	Osama	305		D100	Services	Tea making

a) What is wrong with this table?

a) The table contains a multi-valued attribute that should be in a separate relation. There's also associations between the room # & Dept# also bet. Dept# & Job title

b)

Emp (Emp#, Ename, Room#, Room phone, Dept#)

Dept (Dept#, Jobtitle)

Emp-tasks (Emp#, task)

c) Emp: Candidate Key (Emp#, Ename)

Primary Key (Emp#)

Foreig Key (Dept#)

Dept: Candidate Key (Dept#, Job-title)

Priviary Ky (Dept#)

F K (—)

Emp-task: Cand. Key (Emp#)

P. Key (Emp#)

F. Key (Emp#)

d) Emp-tasks → Emp → Dept

b) Correct the above problems. (Hint: redesign the database) 5

c) For the tables you got indicate (Candidate Keys, Primary keys, Foreign keys) 4

d) Draw a suitable referential diagram for the database you got. 3

Question No. 3 [15 Marks]

Consider the insurance database, where the primary keys are underlined. Construct the following SQL queries for this relational database.

Person (driver id, name, address)
Car (license, model, year)
Accident (report number, date, location)
Owns (driver id, license)
Participated (driver id, car, report number, damage amount)

Use SQL to write the following queries:

a) Find the total number of people who owned cars that were involved in accidents in 1989. Note: this is not the same as the total number of accidents in 1989. We must count people with several accidents only once.

```
select count (distinct name) or select count (driver-id)

from accident, participated, person

where accident.report number = participated.report number

and participated.driver id = person.driver id

and date between date '1989-00-00' and date '1989-12-31 ;
```

b) Add a new accident to the database; assume any values for required attributes.

We assume the driver was "Jones," although it could be someone else. Also, we assume "Jones" owns one Toyota. First we must find the license of the given car. Then the participated and accidentrelations must be updated in order to both record the accident and tie it to the given car. We assume values "Berkeley" for location, '2001-09-01' for date and date, 4007 for report number and 3000 for damage amount.

```
insert into accident values (4007, '2001-09-01', 'Berkeley')

insert into participated

select o.driver id, c.license, 4007, 3000

from person p, owns o, car c

where p.name = 'Jones' and p.driver id = o.driver id

and o.license = c.license and c.model = 'Toyota'
```

c) Delete the Mazda belonging to "John Smith".

Since model is not a key of the car relation, we can either assume that only one of John Smith's cars is a Mazda, or delete all of John Smith's Mazdas (the query is the same). Again assume name is a key for person.

delete from car

where model = 'Mazda' and license in

(select license

from person p, owns o

where p.name = 'John Smith' and p.driver id = o.driver id)

Note: The owns, accident and participated records associated with the Mazda still exist.Remove employees whose salary is more than $100000.

d) Find the location that has the maximum number of accidents.

e) Find the models of cars who had accidents.

select location
From Accident, Partiaipated
where a.reportn = p.report-nd
having max ((select count (location)
From ac

Question No. 4 [15 Marks]

For a hospital, the following ERD is drawn. Each department must have many medical staff. Each staff must be allocated in only one department. Staffs may be classified into doctors, nurses, or technicians. Each doctor must investigate onr or more patients. Each patient must be examined by at least one doctor. One nurse must supervise one region but one region must contain many nurses. A technician may or may not work in a lab, but labs must contain many technicians. Each department must contain many rooms, and each room must be assigned to one department. Rooms are classified as either labs or regions or others.

a) Indicate on the diagram all missing symbols that indicate cardinality ratio, participation and subclasses.

b) Derive normalized tables from the ERD, indicating all candidate, primary and foreign keys for each relation.

c) Write the SQL statements required to create these relations, including appropriate versions of all primary and foreign key integrity constraints.

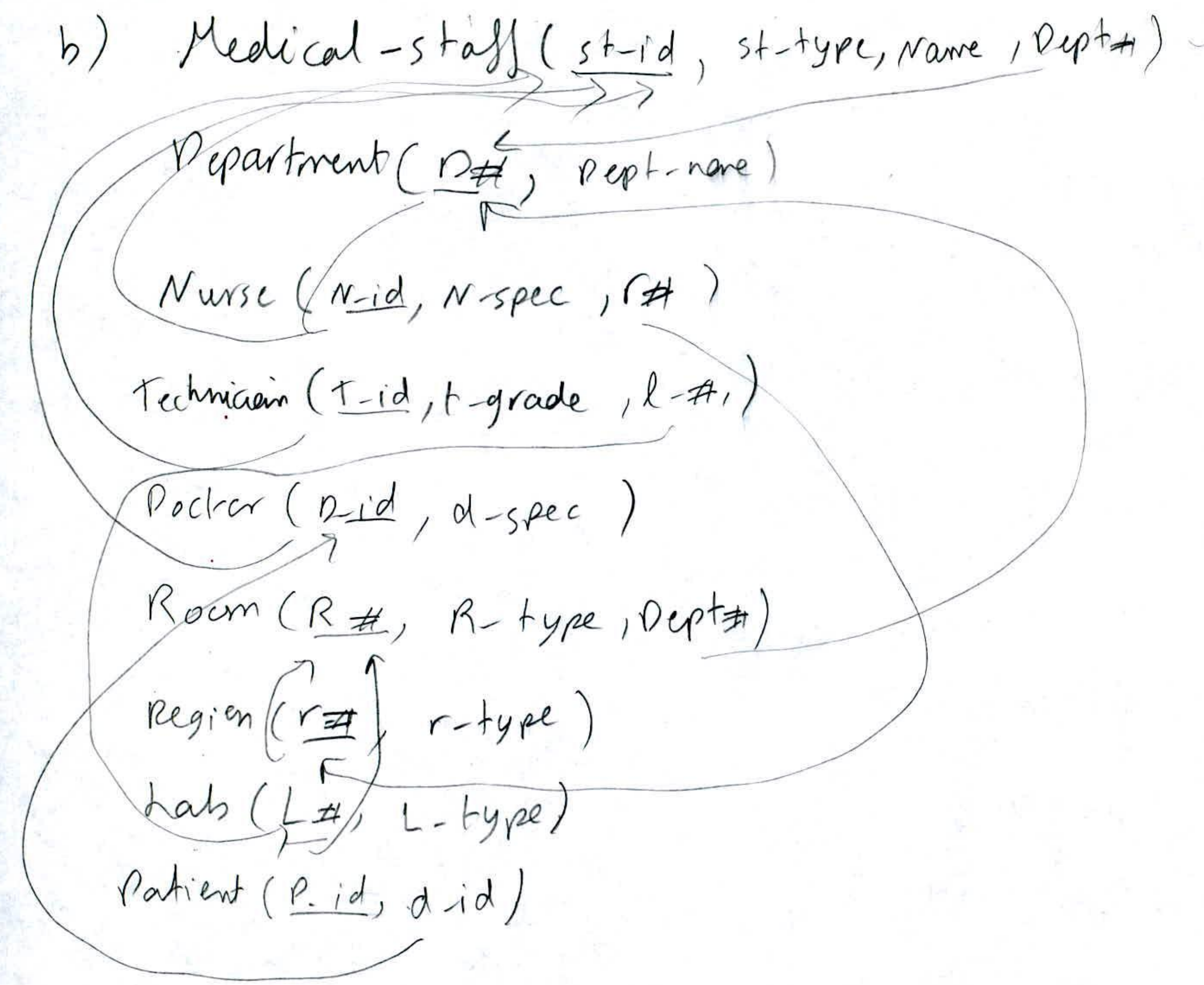
Indicate any assumption you make that might or might not hold.

Selec

d) Select Location Max y.num
From Accident, (select count (distinct location) As num
From Accident, Participated
where a. report-no = p.report-no)
As y

e) Select Model
From Car, Owns, Participated
where Co.license = o. license
AND O. drive-Id = P. driver-id

b)



Medical-staff (st-id , st-type, Name , Dept#)

Department (D# , Dept-name)

Nurse (N-id, N-spec , r#)

Technicain (T-id , t-grade , l-#,)

Docter (D-id , d-spec)

Room (R#, R-type , Dept#)

Regien (r# , r-type)

Lab (L#, L-type)

Patient (P. id, d-id)

c)

```
Create table Medical-staff ( st-id number(10),
                             st-type char(20),
                             Name    char(30),
                             Dept#   Number(10),
                           Primery key st-id,
                           Foreign key Dept# references Department);

Create table Department ( D# Number(10),
                          Dept-name char(30),
                          primery key D# );

Createtable Nurse ( N-id  Number(10)
                 N-spec  char (30)
                 r#   Number10)
               Primery key N-id,
               Foreign key N-id references Medical_staff
                    ''      r#      ''     region);
```

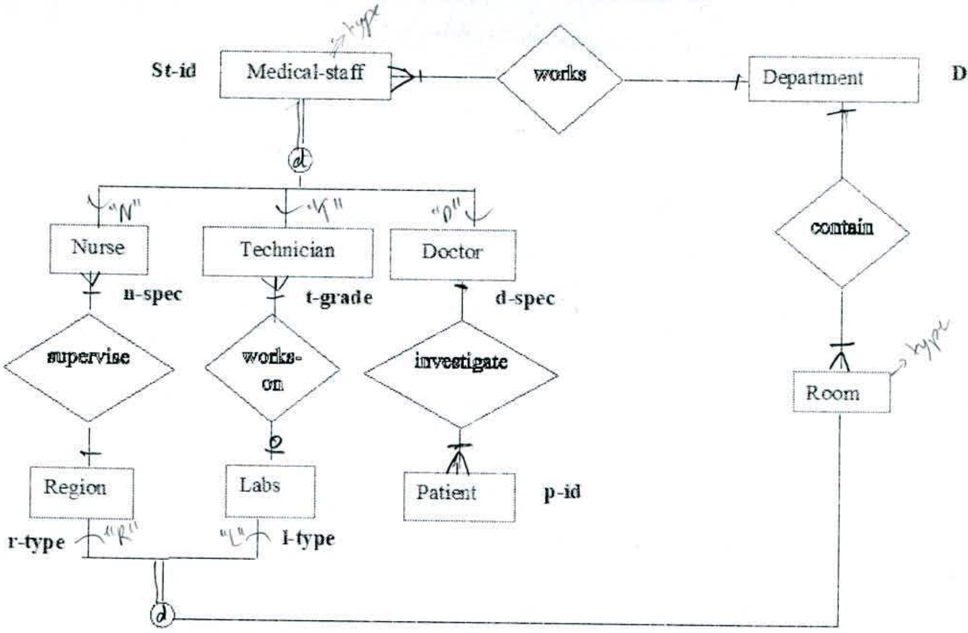


Figure 1 Q4

Question No. 5 [~~12~~ 10 Marks]

Suppose you are given a relation *R* with four attributes *ABCD*. For each the following sets of FDs, assuming those are the only dependencies that hold for *R*, do the following:
a) Identify the candidate key(s) for *R*.
b) Identify the best normal form that *R* satisfies (1NF, 2NF, 3NF, or BCNF).
c) If *R* is not in BCNF, decompose it into a set of BCNF relations that preserve the dependencies.

1. $B \rightarrow C$, $D \rightarrow A$
2. $A \rightarrow B$, $BC \rightarrow D$, $A \rightarrow C$

A, B, C, D

B, D, A, C

1.(a) Candidate keys: *BD*
(b) *R* is in 1NF but not 2NF.
(c) Both $B \rightarrow C$ and $D \rightarrow A$ cause BCNF violations. The decomposition: *AD*, *BC*, *BD* (obtained by first decomposing to *AD*, *BCD*) is BCNF and losslessand join-preserving.

A, B, C, D

2. (a) Candidate keys: *A*
(b) *R* is in 2NF but not 3NF (because of the FD: $BC \rightarrow D$).
(c) $BC \rightarrow D$ violates BCNF since *BC* does not contain a key. So we split up *R*as in: *BCD*, *ABC*.

GOOD LUCK

```
Create table Technician (T-id Number(10),
                         t-grade char(30),
                         l-# Number(10),
                         Primery Key T-id,
                         Forig Key T-id references Medical-staff,
                         Foreginkey l# references Lab);

Create Table Doctor ( D-id Number(10),
                      D-spec char(30),
                      Primery Key (D-id);

Create table Room ( R-# Number(10),
                    R-type Char(30),
                    Dept# Number(10),
                    primery key R#,
                    Foreign Key Dept# references Department);

Create table Region ( r# Number(10),
                      r-type Char(30),
                      Primary Key r#,
                      Foreign Key r# references Room);

Creabe table Lab ( l# Number(10)
                   l-type char(30);
                   Primary Ky l#,
                   Foreign Key l# references Room);

Create table Patient ( P-id Number(10),
                       D-id Number(10),
                       Primary Key P-id,
                       Foreign Key D-id references Doctor);
```