

CPSC 304 Midterm 1
Oct 11, 2006
Total: 20 points

Question 1 (7 points) You are hired to set up a relational database for a small community hospital. The first thing you do is to go to the hospital and find out the attributes that need to be stored, and their inter-relationships. Here are your findings:

- Every room has a unique room number (integer).
- Every room has one designated usage (char [40]), but different rooms may have the same usage.
- Every patient is assigned a room, but many patients may be assigned to the same room.
- Every patient has a unique patient number (integer)
- Every patient has a name (char[40]) which is not necessarily unique.
- A patient may be treated by more than one doctor, and a doctor may attend to more than one patient.
- Every doctor has a unique doctor number (integer) and a unique phone (char[10]).

a) (3 points) Draw an entity-relationship diagram to represent the information described above.

b) (4 points) Suppose every entity set and every relationship set is to be represented by a different relation. Give the SQL data definition (i.e., create table statements) for those relations representing relationship sets.

Question 2 (6 points) Consider the following create table statement:

```
CREATE TABLE r1
(a1 INTEGER, a2 INTEGER, a3 INTEGER, a4 INTEGER, a5 INTEGER,
PRIMARY KEY (a1, a2),
UNIQUE (a3,a4),
FOREIGN KEY (a5) REFERENCES r2(a5) )
```

- (2 points) List all the non-trivial functional dependencies pertaining to the attributes of r1 that can be inferred from the create table statement.
- (2 points) Is r1 in BCNF? Give a brief explanation.
- (2 points) Is r1 in 3NF? Give a brief explanation.

Question 3 (3 points) Consider the following relation instance:

| A | B | C |
|------|---|-----|
| John | 1 | Van |
| John | 2 | Rmd |
| Jane | 3 | Rmd |
| Jane | 3 | Rmd |
| Jill | 4 | Bby |
| Jill | 5 | Cql |

Observe that $B \rightarrow A$ appears to hold with respect to the given instance. Check to see if all of the following dependencies hold with respect to the instance and explain why:

a) $A \rightarrow B$

b) $B \rightarrow C$

c) $C \rightarrow A$

Question 4 (4 points) Use the following three axioms:

- (reflexivity) if $\beta \subseteq \alpha$, then $\alpha \rightarrow \beta$
- (augmentation) if $\alpha \rightarrow \beta$, then $\alpha \vee \gamma \rightarrow \beta \vee \gamma$
- (transitivity) if $\alpha \rightarrow \beta$ and $\beta \rightarrow \gamma$, then $\alpha \rightarrow \gamma$

to determine if the following two statements are true or false. If you think it is true, give a proof; otherwise, give a counter-example.

(a) (2 points) if $\alpha \rightarrow \beta \vee \gamma$, then $\alpha \rightarrow \beta$

(b) (2 points)) if $\alpha \rightarrow \beta$ and $\beta \vee \gamma \rightarrow \delta$, then $\alpha \vee \gamma \rightarrow \delta$

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