

# Relational Model Exercises

## Sample Solutions

1. Consider this schema:

One(this, that, other)  
Two(tweedledee, tweedledum)  
 $\text{One}[\text{this}] \subseteq \text{Two}[\text{tweedledee}]$

Suppose relation *One* has 20 tuples. What do we know about the number of tuples in *Two*? Circle the one statement below that is the strongest thing we can be certain of.

- (a) The number of tuples in relation *Two* must be  $\geq 20$ .
- (b) The number of tuples in relation *Two* must be  $\leq 20$ .
- (c) The number of tuples in relation *Two* must be 20.
- (d) The number of tuples in relation *Two* must be  $\geq 1$ .
- (e) The number of tuples in relation *Two* must be  $\geq 0$ .

### Solution:

- (d) The number of tuples in relation *Two* must be  $\geq 1$ .

2. Consider this schema:

Hare(queen, knave)  
Turtle(alice, hatter)  
 $\text{Turtle}[\text{hatter}] \subseteq \text{Hare}[\text{queen}]$

Suppose relation *Hare* has 15 tuples. What do we know about the number of tuples in *Turtle*? Circle the one statement below that is the strongest thing we can be certain of.

- (a) The number of tuples in relation *Turtle* must be  $\geq 15$ .
- (b) The number of tuples in relation *Turtle* must be  $\leq 15$ .
- (c) The number of tuples in relation *Turtle* must be 15.
- (d) The number of tuples in relation *Turtle* must be  $\geq 1$ .
- (e) The number of tuples in relation *Turtle* must be  $\geq 0$ .

### Solution:

- (b) The number of tuples in relation *Turtle* must be  $\leq 15$ .

3. Recall the Movies schema:

Movies(mID, title, director, year, length)

Artists(aID, aName, nationality)

Roles(mID, aID, character)

Roles[mID]  $\subseteq$  Movies[mID]

Roles[aID]  $\subseteq$  Artists[aID]

Suppose we add this constraint: Movies[mID]  $\subseteq$  Roles[mID]

- (a) Make a very small instance of the database that violates this constraint but otherwise satisfies the schema. You will only need one or two rows.

**Solution:**

Any instance that includes an mID in the Movies table that does not occur as an mID in the Roles table violates this constraint.

- (b) Restate this constraint in plain English.

**Solution:**

“Every movie in the database must have at least one role.”

- (c) Is this a foreign-key constraint? Explain.

**Solution:**

No, because mID is not a key in the Roles table. It is part of a key, but it is not a key.

4. Are the following expressions equivalent?

$$\Pi_{director, length}(\sigma_{length > 140} Movies)$$
$$\sigma_{length > 140}(\Pi_{director, length} Movies)$$

That is, do they have the same value for all possible instances of our schema?

- (a) Yes. In fact, you can *always* reverse a project and a select and get an equivalent expression.
- (b) Yes, these two are equivalent. But you cannot always reverse a project and a select and get an equivalent expression. It depends on the circumstances.
- (c) No. They do not they have the same value for all possible instances.
- (d) These are not both valid expressions, so we can't even discuss whether or not they are equivalent!

**Solution:**

(b) Yes, these two are equivalent. But you cannot always reverse a project and a select and get an equivalent expression. It depends on the circumstances.