

# EPBI 414 (Fall 2016) - Assignment 3

## *The Relational Model*

### Overview

This homework consists of two parts. For the first part, you'll answer some questions about the material covered this week. Next, you'll review a more complicated CRF, annotate it, and generate a data dictionary.

### Logistics

Submit your assignment in a .zip file labeled in the following matter:

<Case ID>\_EPBI414\_Fall2016\_A4.zip

So, if your Case ID is tar9, you would submit the following zip file:

tar9\_EPBI414\_Fall2016\_A4.zip

### Part 1

Submit a written document with your answers to the following questions.

1. Write a predicate that contains at least four parameters. You may write the predicate about any subject you wish. [4 points] Then, using the predicate, generate four propositions which fit the predicate (for our purposes, you may assume they are true). [4 points]
2. Write three constraints that you might use on numeric values within a relational database. Use standard mathematical notation, like equals ( $=$ ), greater than ( $>$ ), and less than ( $<$ ). Then, rewrite each of these constraints to use only the element of ( $\in$ ) operator. [6 points]
3. Give two examples of a one-to-one relationship, two examples of a one-to-many relationship, and two examples of a many-to-many relationship. [6 points]
4. Consider the following three relations which describe a small healthcare system.
  - a. Relation `doctor`, which contains a unique numeric ID for each doctor, the doctor's name, the doctor's phone number, and the doctor's medical school graduation year.
  - b. Relation `patients`, which contains a unique identifier for each patient, along with their name, email address, and primary care physician.

- c. Relation `visits`, which contains a unique identifier for each visit, along with a visit date, the physician involved, and the patient involved.

Assume that the following rules are true for this system:

- Every patient must have one primary care physician, who must be a doctor working in the healthcare system.
- A doctor may be the primary care physician for multiple patients.
- Any patient may see any doctor within the system, sometimes more than once on the same day.

Given these rules, select appropriate primary keys for each relation. [6 points] Then, select appropriate foreign keys for each relation, and explain how each foreign key relates back to another attribute in a different relation. [6 points] Finally, for each foreign key you identify, state whether the relationship established is one-to-one, one-to-many, or many-to-many. (Hint: You may find it easier to make a table of sample records while doing this.) [6 points]

6. Describe the concept of the single source of truth. [2 points] How should a database be designed to preserve the single source of truth? [5 points]
7. Give an example relation that violates the 1NF, that violates the 2NF while meeting the 1NF, and that violates the 3NF while meeting the 2NF. Write a short note for each explaining how they violate their respective normal form. [15 points]

## **Part 2**

Review the Medication Record CRF included with the assignment. Using a method of your choice, annotate this CRF with the information necessary to document the data structure. As with the previous CRF you annotated, be sure that every field is annotated, and that each field has an appropriate type for the data it collects. Note that this form is more complicated than previous examples. It allows for an unlimited amount of additional pages to be attached, as needed. This means you will **need** to use more than one table to store the results. This should be denoted in your annotations. Hint: you should find a total of 15 fields on the form - you do not need to keep track of the page number. [30 points]

Next, use this annotated version of the CRF to produce a data dictionary, similar in style to the one used as an example in class. Since you will need more than two tables, you need to have more than one tab in your data dictionary (or more than one file, if you put each table's dictionary in a separate file). Be sure to include logic that ensures that the data you collect is complete. Hint: consider the instructions given on the form when assigning data types to variables. [30 points]