**CSC 453 Database Technologies 901/910**

**Assignment 3 (4/17)**

**Due 5:45pm, Friday 4/25.**

**Reading:** In Elmasri and Navathe, Sections 5.1 (for nested queries) and 15.1-15.3.

No script to write this week – just some written exercises. Submit a .doc, .txt or other electronic document with your answers under “Assignment 3”.

**Problems:**

**1.** Consider the following relational database schema:

TYPE(TypeName, NumberOfGuns, GunBore, Weight)

SHIP(ShipName, Country, ShipType, DateLaunched)

BATTLE(BattleName, Date)

OUTCOME(BattleName, ShipName, Result)

ShipType is a foreign key referencing the TypeName attribute of TYPE. BattleName and ShipName are foreign keys referencing the attributes with the same names in BATTLE and SHIP.

The TYPE relation records information about different types of ships: the name describing the type (e.g., Carrier), the number of guns on the ship and their bore (i.e., diameter), and the ship’s weight. The SHIP relation records information about particular ships: the ship name, its country and type, and the date it was launched. The BATTLE relation records information on battles fought at sea: a unique name for each battle, and its date. The OUTCOME relation records information on the effects of battles on the ships that participated in them: the name of a battle, the name of a ship that fought in it, and the result of the battle for that ship (e.g., undamaged, disabled, sunk).

Write SQL queries for this schema to do the following:

**a.** Give the names of the countries that have a ship with the smallest weight among all ships.

**b.** Give the types of ships for which no ship of that type has ever been sunk in a battle.

**c.** Give the names of all ships (not their types, but the names of the individual ships) with at least 6 guns.

**d.** Give the names of all battles in which a ship of type Destroyer participated.

**2.** Consider a relation *R* with schema *R*(A, B, C, D), and the following three functional dependencies: A 🡪 D ; B 🡪 A ; C,D 🡪 B .

**a.** For every non-empty subset X of the set{A, B, C, D} of attributes, find the closure of X under the set of three functional dependencies given above. (Yes, there are 15 such subsets to consider, but most of the closures do not take long to compute. If you are unsure why there are 15 possible non-empty subsets of the set {A, B, C, D}, google “power set”…)

**b.** List all superkeys of *R*.

**c.** List all candidate keys of *R*.

(As an aside, it turns out that no matter which candidate key we choose to be the primary key, the normalization process that we discussed this week will not apply. This is because every attribute in *R* is a *prime* attribute – that is, every attribute is part of some candidate key. In this case we must consider a more formal definition of 3NF that we will discuss next week.)

**3.** Consider the following relational schema:

APPOINTMENT(DentistID, DentistName, PatientID, PatientName, InsurancePlan, PlanType, Date, Room)

Each tuple in a relation state represents one patient’s appointment with one dentist on one particular date. Each dentist has a unique ID, as does each patient. Each patient has a single insurance plan, and each insurance plan has a single type. When a patient makes an appointment with a dentist for a particular date, that appointment is assigned to some examination room.

**a.** List the functional dependencies in this relation, and identify the primary key.

**b.** The APPOINTMENT relation is in first normal form. Transform APPOINTMENT into a set of linked relational schemas in third normal form. (You can describe the relational schemas as I did in Problem 1 – underline primary keys and explain foreign keys verbally – if you don’t want to draw a picture.)

**Remarks:**

1.  It is your responsibility to make sure that the file you have uploaded is readable and in the correct location.  You should check that you can successfully download your submitted file back from the course web site immediately after submitting it to be sure that it has been uploaded correctly.

2.  Please remember that all work must be completed individually, and without copying from posted examples.

Eric J. Schwabe – 04/17/14