CS430/630 – Homework 3

Released Nov 09, Due Nov 25

100 points (10/100 of final grade)

Instructions: The homework is due MIDNIGHT (23:59:59) on Wed Nov 25th. Submit a file called HW3.pdf in your course folder with the solution (**which must be typeset**, **not handwritten**).

Question 1 (20 points)

A university database contains information about professors (identified by social security number *SSN*) and courses (identified by *courseid*). Professors also have a name, an address and a phone number. Courses have a name and a number of credits. Professors teach courses. For each of the following situations, draw an ER diagram that describes it (assuming no further constraints hold).

(a) Every professor must teach some course.
(b) Every professor teaches exactly one course (no more, no less).
(c) Every professor teaches exactly one course (no more, no less), and every course must be taught by some professor.
(d) [630 students only] Modify the diagram from (a) such that a professor can have a set of addresses (which are street-city-state triples) and a set of phones. Recall that in the E/R model there can be only primitive data types (no sets).
(e) [630 students only] Modify the diagram from (d) such that professors can have a set of addresses, and at each address there is a set of phones.

Question 2 (20 points)

Consider a database schema with three relations:

```
Movies (movie_id, title,    year,          studio)
Actors (actor_id, name,     nationality)
StarsIn(actor_id, movie_id, character)
```

Provide SQL statements for the following:

(a) Create a view `CharactersPlayed` that lists actor names, their nationality and the characters they interpreted together with the year they interpreted it in. The view will have four columns with headings: `ActorName`, `ActorNationality`, `CharacterName` and `Year`.
(b) Query the view above to retrieve the set of distinct nationalities for actors that interpreted character "Winston Smith".
(c) Query the view above to find for each year the count of distinct nationalities of actors who starred in some role for that year.

Question 3 (20 points)

Suppose you are given a relation R with four attributes ABCD and the following set of FDs: AB→C, BC→D.

a. Identify the candidate key(s) for R (recall that keys must be *minimal*)

b. Determine if R is in BCNF, 3NF, or none of the above. If it is not in BCNF, decompose it into a set of BCNF relations.

Question 4 (20 points)

Suppose you are given a relation R with four attributes ABCD and the following set of FDs: BC→A, AB→C, C→DA.

a. Identify the key(s) for R (recall that keys must be *minimal*)

b. Determine if R is in BCNF, 3NF, or none of the above. If it is not in BCNF, decompose it into a set of BCNF relations.

Question 5 (20 points)

Show the grant diagrams after steps 7 and 8 of the sequence of actions below, where *A* owns the relation on which the privilege *p* is assigned. Can *C* still exercise privilege *p* after step 8? What about *E*?

Step	Executed by	Action
1	A	GRANT *p* TO *B*
2	A	GRANT *p* TO *C* WITH GRANT OPTION
3	C	GRANT *p* TO *D* WITH GRANT OPTION
4	A	GRANT *p* TO *D* WITH GRANT OPTION
5	D	GRANT *p* TO *B* WITH GRANT OPTION
6	B	GRANT *p* TO *C*
7	D	GRANT *p* TO *E*
8	A	REVOKE *p* FROM *C* CASCADE