Homework 1

Revised: September 18, 2014

Database Systems
CSCI 440, Fall 2014

Due: September 26, 2014 in class

Instructions: Complete the problems enumerated below. Answers must typed and neatly formatted. You will submit a printed hardcopy of your work at the **beginning** of class on the specified due date. Be sure to include your name and email address on your submission.

For these problems, you will use the relation `Instructors`, given on the last page. Additionally, you will create two relations in Problem 3 which you will use in Problems 3-10. If you make changes to `Instructors`, you may use your revision(s) in all subsequent problems.

Problem 1: "Terms of Endearment" [15 pts]

(a) What is the degree of the `Instructors` relation?

(b) What is the cardinality of the tuples of `Instructors` relation?
(Hint: count the distinct tuples).

(c) This is not a flat relational model. Explain why not.

(d) Propose a solution to this problem.

(e) For each of the attributes, give datatype for each (see section 4.1.3). Briefly justify your choice.

(f) Considering only the records given to you, determine if each attribute satisfies the `UNIQUE`ness constraint.

(g) Considering only the records given to you, determine if each attribute satisfies the `NOT NULL` constraint.

(h) Is the `NOT NULL` constraint an **entity integrity constraint** or a **referential integrity constraint**?

Problem 2: "One Key to Rule Them All"' [12 pts]

(a) List any and all candidate keys.

(b) Give a **minimal superkey** for the `Instructors` relation. Justify.

(c) Is your minimal superkey **single** or **composite**?

(d) Which attribute is the primary key (PK)? How do you know?

(e) Is the PK **single** or **composite**?

(f) Why is this PK a poor choice? Explain. Propose a new PK. Does your solution require changing the schema, the constraints, or both? Explain.

Problem 3: "Relationships are Hard" ' [30 pts]

(a) Which attribute would most logically be used as a foreign key to another relation `R`?

(b) Describe, in English, the relation `R` that uses your aforementioned foreign key. What name would you give to relation `R`?

(c) Give a `CREATE TABLE` command for your new relation `R`, including the types and any constraints.

(d) Give example tuples for your new relation `R`, covering at least all the distinct values from the attribute in `Instructors` you chose as your foreign key.

(e) Propose and describe a third relation `S` of your own choosing. However, you must connect this relation to `Instructors` **and** your relation `R` via foreign keys. What name would you give relation `S`?

(f) Give a `CREATE TABLE` command for your new relation `S`, including the types and any constraints.

(g) Give (at least) five example tuples for your new relation `S`.

(h) Draw a schema diagram for all three of these relations. Make sure to mark your PK for *each* relation. Show the relations using arrows. Use Figure 3.7 on p.75 as your guide.

You will use these three relations (`Instructors`, `R`, and `S`) in the remaining problems. In your responses, refer to your names for these relations.

Problem 4: "Pick Me! Pick Me!" ' [12 pts]

(a) Write a `SELECT` command that returns the tuples in the `Instructors` relation of all persons in the Computer Science department.

(b) Modify your last query to return only the first and last names of the persons in the Computer Science department.

(c) Modify your last query to sort the results alphabetically by last name.

(d) One last improvement... Modify your last query to return instructors from ALL departments, and include the Department attribute in your results. Group the results by Department name. Furthermore, within each Department grouping, sort your results alphabetically by last name.

Problem 5: "The Faithful Departed" [6 pts]

(a) Write a query that lists only the unique department names at this University.

(b) Write a new `SELECT` command that returns the first and last name of all Instructors in the Engineering fields (including Computer Science), using **only** the `Instructors` relation.

Problem 6: "No Tuple For You!" [6 pts]

(a) Instructor Burns has been assigned an extended sabbatical[20 years without parole]. Write a command to remove Mr. Burns from the `Instructor` relation.

(b) Unfortunately, because of the negative press, the College is forced to close the Forestry Department. Write an SQL command to remove all the Forestry instructors from the `Instructors` relation. If relevant, also remove any tuples pertaining to Forestry from your relations `R` and/or `S`.

Problem 7: "I Thought You Looked Familiar" [7 pts]

(a) Write a (single) query to return the names of all people that share the same first name with another first name in the DB **and** all those people that share the same last name with another last name in the DB. Note that they do not need to share both first and last name, merely either or. You should eliminate duplicates.

Banks	River
Banks	Robyn
Tsofrenic	S 'Kit'
Case	Justin
Thyme	Justin

Sample results

HINT: You might find aliasing useful here. It is possible to join a table with itself, e.g.,

```
FROM Instructors AS I1, Instructors AS I2
```

Problem 8: "Flying High" [4 pts]

(a) Willie Flye (BS, PhD) has just been hired as the instructor of the newly created department of Aeronautical Engineering. Write a command to add Dr. Flye to `Instructors`. Add additional tuples to your relations `R` and `S` if needed.

Problem 9: "Parallel Keys" [4 pts]

(a) Oh Happy Day! Ms. Minor has announced her recent marriage to the Art instructor. She has decided to take his surname. Write an query that changes her last name to his last name.

Problem 10: "The Case in Point" [4 pts]

(a) Following an audit of the database, it was discovered that the department name of the Law instructor, Mr. Case, is not correct. Write a query to fix this mistake.

Instructors

LName	FName	Degree	Department
Enright	Reed	AB, MA	English
Thyme	Justin	BA, MA	Physics
Hebbra	Al G.	MA, PhD	Mathematics
Dwyer	Barb	BS, MS	Agriculture
Pointer	NULL	BIT	Computer Science
Tsofrenic	S 'Kit'	BA, PhD	Psychology
Banks	River	BS	Ecology
Minor	Bea	BM	Music
Botes	Roe	BS, MS	Mechanical Engineering
Kase	Stär	BA, MA	Architecture
Burns	Willett	GED	Forestry
Uyi	Guy	BS, MS	Software Engineering
Claire	Heidi	BFA	Drama
Paciter	Kay	BS, MS, PhD	Electrical Engineering
Tsofrenic	S 'Kit'	BA, MD	Neuroscience
Major	Arthur	BFA	Art History
Case	Justin	BA, JD	NULL
Wyle	Drew	BS, MS, PhD	Computer Science
Oakey	Carrie	BM, MM	Music
Furr	Douglas	BSF	Forestry
Power	Max	BS, MS	Electrical Engineering
Banks	Robyn	BS, MS, PhD	Criminology
Vine	Beau	BS	Agriculture
Domacese	Rand	BS, MSE	Computer Engineering
Bridges	Ricky T.	NULL	Civil Engineering

`Instructors` relation showing the current list of teachers at Budget Community College.