CIS 560 Database System Concepts

Spring 2008

Homework 3 of 10: Problem Set (PS3)

More Relational Algebra; Domain and Tuple Relational Calculus

Assigned: Sat 16 Feb 2008
Due: Wed 27 Feb 2008 (before midnight)

The purpose of this assignment is to exercise your basic understanding of relational algebra and relational calculus and help you prepare for the **first hour exam on Mon 03 Mar 2008**. **Note**: several of the problems in this problem set are similar to exam problems from 2006 and 2007.

This homework assignment is worth a total of 20 points. Type your solution and upload it to your KSOL drop box.

Dunder Mifflin Paper Company, Inc. a New York-based office supply distributor, has hired your consulting company to modernize its personnel database, which currently has the schema:

Office: (branch-city, branch-state, manager-last-name, manager-first-name)
Employee: (last-name, first-name, branch-city, role, department)

Office

branch-city	branch-state	head-last-name	head-first-name
Albany	NY	Anton	Craig
Buffalo	NY	Gore	Daniel
New York	NY	Wallace	David
Scranton	PA	Scott	Michael
Utica	NY	Filippelli	Karen

Employee

last-name	first-name	branch-city	role	department
Anderson	Roy	Scranton	dock worker	warehouse
Beesly	Pamela	Scranton	manager	branch
Bratton	Creed	Scranton	quality assurance officer	products
Filippelli	Karen	Utica	manager	branch
Flenderson	Tobias	Scranton	human resources rep	corporate
Gore	Daniel	Buffalo	manager	branch
Halpert	James	Scranton	sales representative	sales
Howard	Ryan	New York	vice-president	corporate
Hudson	Stanley	Scranton	sales representative	sales
Kapoor	Kelly	Scranton	customer service rep	products
Malone	Kevin	Scranton	accountant	accounting
Martin	Angela	Scranton	supervisor	accounting
Martinez	Oscar	Scranton	accountant	accounting
Palmer	Meredith	Scranton	supplier relations rep	products
Philbin	Darryl	Scranton	supervisor	warehouse
Scarn	Michael	Utica	supervisor	accounting
Schrute	Dwight	Scranton	assistant manager	branch
Scott	Michael	Scranton	manager	branch
Vance	Phyllis	Scranton	sales representative	sales
Wallace	David	New York	chief financial officer	corporate

1. **(20%) Relational algebra.** Consider the following query.

   Return the last name of every manager of a branch in New York state. (Note: the person should have the title of *manager*, rather than just being the head of an office. A specific exception is the CFO of the corporate office in NYC.)

   a) Write the above query in relational algebra.
   b) What relation is returned?

2. **(10%) Structured query language (SQL).** Write the query from Problem 1(a) in SQL, using:

   a) **inner join**
   b) No **inner join**

3. **(10%) Relational division.** Use the relational division operator to write an expression for the relation containing the names (i.e., cities) of all branches whose accounting department contains all accounting positions in the corporation.

4. **(20%) Relational calculus.** Rewrite the query from problem 3 using:

   a) Domain relational calculus
   b) Tuple relational calculus

5. **(10%) Datalog.** Rewrite the query from problem 1(a) using Datalog.

6. **(10%) Graphical query-by-example (GQBE).** Rewrite the query from problem 1(a) using GQBE.

7. **(20%) Database design and normalization preliminaries.**

   a) What is wrong with the design of the Employee table in terms of redundancy?
   b) How would you fix it? (**Hint**: you can divide the table into two or more.)
   c) What is wrong with the design of the Employee table in terms of ambiguity?
   d) How would you fix it? (**Hint**: you can add both key and non-key attributes, but indicate which are which.)

Reference:

Dunderpedia. (2008). *Dunderpedia* wiki. Wikia.com. Retrieved from: http://theoffice.wikia.com.
Wikipedia. (2008). List of characters from The Office (US). Retrieved from: http://en.wikipedia.org/wiki/Characters_from_The_Office_%28US%29.

Class participation (required): Post any questions you have about relational algebra, SQL, relational calculus, datalog, or GQBE to the class mailing list, CIS560-L@listserv.ksu.edu, before turning in the assignment. If you have no questions, make up a better example query that can be answered using relational division and post the specification (as given in Problem 3 above) to the mailing list. Also, w*hich of the different ways of writing queries was most natural to you, for the above specifications, and why?*