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| CS 460/CS 580 Database Concepts |
| Fall 2021 Lab 2 |
| Lab topic: Relational algebra |

# Lab Overview:

For this lab we will be working on practicing relational algebra. This lab uses a Java library that comes from the Elmasri & Navathe textbook that interprets relational algebra expressions and lets you see their results against a database. You should be able to run this lab on any machine with a JRE. You will be downloading the relational algebra interpreter library, a compatible version of the COMPANY database and then practicing creating the relational algebra expressions to return the expected results from the queries below.

# Getting started:

You will need the following for this lab (all available via Blackboard):

* Lab2-RelationalAlgebraLab.docx (this document – instructions for the lab)
* aql.jar (RA relational algebra interpreter)
* company.zip (company DB in format for the interpreter)
* BookCh2LabManual.pdf (textbook’s lab manual for working with the RA interpreter)

Extract the Company.zip file. The extracted directory will contain a Company folder that contains several “.dat” files. Copy that inner company folder to where you aql.jar file is located.

## Starting the RA interpreter

To start the RA interpreter, open a terminal window/command prompt and navigate to the directory where your aql.jar file is located. Then execute the following from the command line:

java -cp aql.jar edu.gsu.cs.ra.RA company

This will start up RA with the downloaded jar file in the current directory and look for a “company” directory in this directory for the database. After executing this you should be greeted with the RA prompt:

RA>

Check that your database has been loaded by entering the following expression and hitting return:

RA> **project[fname,lname,address](select[lname='Jones'](employee));**

Your response should be:

temp1(FNAME:VARCHAR,LNAME:VARCHAR,ADDRESS:VARCHAR)

Number of tuples = 1

Jon:Jones:111 Allgood, Atlanta, GA:

In response to a query, the interpreter displays the schema of the result followed by the answer to the query. Individual values within a tuple are terminated by a “:”.

# Getting familiar with RA interpreter

When developing your RA expressions, **I strongly recommend writing them in a text editor that tells you the column position of the cursor first such as Notepad++** then copy to the command line to execute it**.** The RA interpreter is very sensitive to problems in the grammar. If a problem occurs, the error message is not particularly helpful, but it does return the character position where the error was based which can make an editor such as Notepad++ extremely helpful in figuring out problems with syntax.

Now familiarize yourself with RA’s syntax by scanning 2.2.1 – 2.2.3 of the BookCh2LabManual.pdf.

**For each query below enter your RA query and paste either the actual output or a screenshot of the output.**

Then try out one of the queries we did on the board in Lec10:

**Query 1: Retrieve the name and address of employees who work for the "Research" department.**

project[fname,lname,address]((rename[dname,dno,mgrssn,mgrstartdate](

select[dname='Research'](department))

join

employee

));

Now create the RA queries to answer the following queries:

**Query 2**: For every project located in "Houston", list the project name, the controlling

department number, and the department manager's last name, address, and birth date.

**Query 3**: Make a list of project numbers and project names for projects that involve an employee whose last name is

"Smith", either as a worker or as a manager of the department that controls the project.

**Query 4**: List the names of all managers with no dependents.

**Query 5**: List the names of all managers with at least one dependent.

**Question 6:** Create a query somebody might ask that would make sense to use the UNION operator to answer it (that isn’t in the lab manual). Give what that query would be in words and then how to execute that query in RA syntax.

**Question 7:** Create a query somebody might ask that would make sense to use the MINUS operator to answer it (that isn’t in the lab manual). Give what that query would be in words and then how to execute that query in RA syntax.

**Question 8:** Create a query somebody might ask that would make sense to use the INTERSECT operator to answer it (that isn’t in the lab manual). Give what that query would be in words and then how to execute that query in RA syntax.