COS 221 Practical Assignment 2

UNIVERSITEIT VAN PRETORIA
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- Date Issued: **1st March 2019**
- Date Due: **13th March 2019** before **08:00 (morning)**
- Submission Procedure: **Upload to the web server (`whaetley`) and CS web**
- This assignment consists of **7 tasks** for a total of **65 marks**.

1 Introduction

In this assignment, you are required to use the relational database schema from the textbook, called COMPANY, where COMPANY = {EMPLOYEE, DEPARTMENT, DEPT_LOCATIONS, PROJECT, WORKS_ON, DEPENDENT} as given in Figure 1. The underlined attributes in the figure, represent primary keys. Figure 2 shows the relational database state corresponding to the COMPANY schema. You are required to use the given schema and database state to specify and execute queries in SQL and Relational Algebra (RA). For RA, a RA [1] interpreter will be used.

After successful completion of this assignment you should be able to:

- implement various referential integrity constraints on any database schema,

- create and accurately populate referenced tables in a given relation schema,

- specify and execute basic retrieval requests as relational algebra expressions,

- apply the basic SQL constructs for specifying retrieval queries.

2 Constraints

1. You must complete this assignment individually.

2. The SQL scripts will be marked

    (a) Scripts which run and perform what they are supposed to do get full marks

    (b) Scripts which run but do not perform as required, will receive partial marks

    (c) Scripts which do not run will be allocated partial marks based on the functionality they would have exhibited.

3. You may ask the Teaching Assistants for help but they will not be able to give you the solutions.

4. You may utilise any text editor or IDE, upon an OS of your choice. In the Informatorium, you will use either MySQL Workbench or Data Grip to create the COMPANY database on **wheatley web server** and install RA interpreter to access and retrieve the information from the database.

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[1]RA is a simple relational algebra interpreter written in Java. It is built on top of an SQL-based relational database system. It implements relational algebra queries by translating them into SQL queries and executing them on the underlying database system through JDBC. RA is packaged with SQLiteJDBC, so you can use RA as a standalone relational-algebra database system. Alternatively, you can use RA as a relational-algebra frontend to other database systems.

3   Submission Instructions

You are required to upload all your source files (as a text file) to the Computer Science web-portal. You also need to make sure that `wheatley` mirrors what you uploaded to CS web and works on the web server before the deadline. No late submissions will be accepted, so make sure you upload in good time. You will be required to download the files you uploaded to CS web and load them onto `wheatley` as part of the assessment of the practical assignment.

4   Online resources

Access a free SQL Tutorial at: `https://www.w3schools.com/sql/sql_create_table.asp`

Download the RA interpreter on your computer, by using the official site: `https://users.cs.duke.edu/~junyang/ra2/`

Get started with the RA interpreter documentation available at: `https://users.cs.duke.edu/~junyang/radb/`

Follow the RA Github project at: `https://github.com/junyang/RA`

There are many other resources online for example Stack overflow – `https://stackoverflow.com/` a platform for developers to learn, share knowledge and build a career.

IMPORTANT NOTE: Bring to the practical session your textbook[2] and/or the lecture notes for Relational Algebra and SQL in which the content was explained.

5   Rubric for marking

Connecting to MySQL on `wheatley`	2
Creating a database	1
Creating tables	
Use of datatypes	6
implementation of constraints	6
Population of tables	
Use of correct clauses	6
correct data entry	6
Installing RA interpreter	5
Queries	
SQL Queries	14
RA Queries	14
Database dump	5
Total	**65**

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[2]All references in the practical will be to pages in Edition 7 [1]

6 Assignment Instructions

Task 1: Connecting to MySQL on `wheatley` ....(2 marks)

Use command `mysql -u{username} -p{password} -h{host server ip}` where {username} is your student number starting with u, {password} is your CS password and {host server ip} as `wheatley.cs.up.ac.za` to launch mysql on the `wheatley` web server.

Note: You need to `ftp wheatley.cs.up.ac.za` in cmd, enter your CS login credentials before you connect to MySQL on `wheatley`. Otherwise your access will be denied

Task 2: Creating a database ....(2 marks)

Create the database and name it `uXXXXXXXX_COMPANY` where `XXXXXXXX` is your student number.

Task 3: Creating tables ....(12 marks)

Create the corresponding six Tables as shown in Figure 1 with the appropriate constraints and attributes.

integrity.JPG integrity.JPG

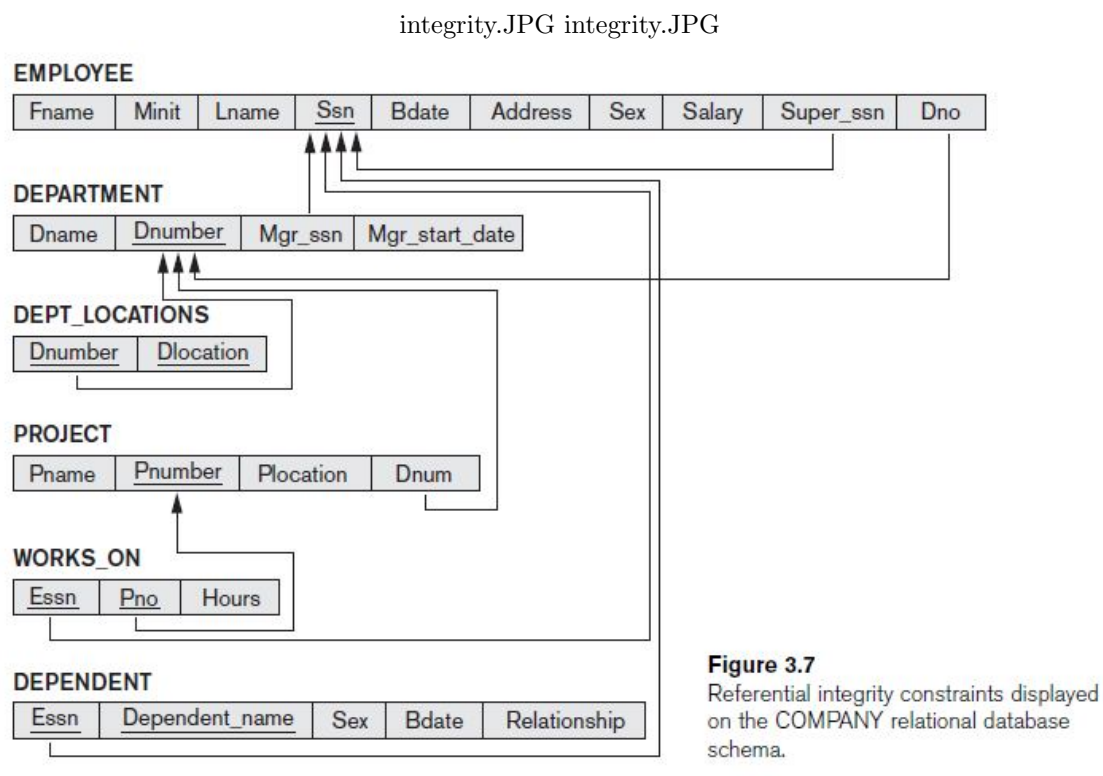Figure 1: constraints

Task 4: Populating tables ....(18 marks)

Populate the tables with the values given in Figure 2 to ensure that the database is in a valid state

Task 5: Installing and configuring RA interpreter ....(5 marks)

Download the RA interpreter zip file by using the link: `https://users.cs.duke.edu/~junyang/ra2/ra-2.2b.zip` or `https://users.cs.duke.edu/~junyang/ra2/ra-2.2b.tgz`.

To run the RA do the following:

- check whether java is installed on your computer → Open the command prompt and type `java -version`. If you get the version info, Java is installed correctly and PATH is also set correctly.

- locate the downloaded zip file, extract it anywhere on Windows,

- create a copy of the `sample.properties file`

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	NULL	1

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

DEPT_LOCATIONS

Dnumber	Dlocation
1	Houston
4	Stafford
5	Bellaire
5	Sugarland
5	Houston

WORKS_ON

Essn	Pno	Hours
123456789	1	32.5
123456789	2	7.5
666884444	3	40.0
453453453	1	20.0
453453453	2	20.0
333445555	2	10.0
333445555	3	10.0
333445555	10	10.0
333445555	20	10.0
999887777	30	30.0
999887777	10	10.0
987987987	10	35.0
987987987	30	5.0
987654321	30	20.0
987654321	20	15.0
888665555	20	NULL

PROJECT

Pname	Pnumber	Plocation	Dnum
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

DEPENDENT

Essn	Dependent_name	Sex	Bdate	Relationship
333445555	Alice	F	1986-04-05	Daughter
333445555	Theodore	M	1983-10-25	Son
333445555	Joy	F	1958-05-03	Spouse
987654321	Abner	M	1942-02-28	Spouse
123456789	Michael	M	1988-01-04	Son
123456789	Alice	F	1988-12-30	Daughter
123456789	Elizabeth	F	1967-05-05	Spouse

Figure 2: Database state

- rename the copy file `uXXXXXXXX_COMPANY.properties` (This is your configuration file) where XXXXXXXX is your student number. Ensure that it is part of the `ra-2.2b folder`.

- open your configuration file, under MySQL-specific, set your path details as shown below;

    – `url=jdbc:mysql://wheatley.cs.up.ac.za/uXXXXXXXX_COMPANY`

    – `user = uXXXXXXXX`

    – `password = your cs password`

    Note: The user configuration file is useful for telling RA how to connect to your own database server. Please make sure other required properties are not active (commented). We are only interested in MySQL settings

- open cmd and navigate to the extracted `ra-2.2b folder` and type
  `java -jar ra.jar uXXXXXXXX_COMPANY.properties`
  You should be able to get RA running on `wheatley` after successfully executing this command.

- type the command `backslash list;` in the prompt to see the tables you created.

Task 6: Specifying and executing Queries . . . . (28 marks)

You are required to specify and execute the following queries both in SQL and in relational algebra using the RA interpreter on the COMPANY database schema.

1. List the names of all employees in department 5 who work more than 10 hours per week on the ProductX project.

2. For each project, list the project name and the total hours per week (by all employees) spent on that project.

3. List the names of employees who are directly supervised by Franklin Wong.

4. For each department, retrieve the department name, and the average salary of employees working in that department.

5. List the names of employees who do not work on any project.

6. List the names and addresses of employees who work on at least one project located in Houston but whose department has no location in Houston.

7. List the names of department managers who have no dependents.

    Note: Please refer to the RA documentation at`https://users.cs.duke.edu/~junyang/radb/basic.html` and the notes to familiarise yourself with the relevant commands for interacting with your database most appropriately

Task 7: Database dump . . . . (5 marks)

Dump your database structure and data into a text file or .sql file from `wheateley`. Your queries should also be extracted and placed in a separate test file, one for your SQL queries and one for the RA queries. If you use the ra_file [3], make sure it is part of the text files that you will submit for marking. Create a single archive (zip file) containing the MySQL dump, a text file containing the SQL queries and a text file containing the RA queries. Upload this archive to the CS website. You will be required to use these files for your demo during the marking session. No extra files will be marked apart from the submitted files.

References

[1] R. Elmasri and S. Navathe, *Fundamentals of database systems*, 7th ed. Addison-Wesley Publishing Company, 2015.

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[3] RA also supports the command `source 'ra_file';`. This command makes RA read statements from the specified file and execute them. Note that ra_file must be enclosed in single quotes. The file should be just a simple text file containing RA statements and comments. This file can be prepared manually with a text editor, or it can be the result of a save command.