FIT3171 Databases

Week 4 Tutorial Activities

FIT Database Teaching Team

Complete the week 4 activities:

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Author: FIT Database Teaching Team

Important

Remember before starting any tutorial activity which involves working with files, first use SQL Developer to pull from the FIT GitLab server so as to ensure your local and server files are in sync.

Learning Objectives

At the completion of these tutorial activities, you should be able to:

- understand the relational model and its components
- identify super keys, candidate keys and primary keys
- write relational algebra (exhibiting an understanding of query efficiency) to produce a required result relation

4.1 The Relational Model

In this week's work, we will look at the fundamental concepts on which the Relational Database model is built.

4.1.1 Class Discussion

Given these two relations:

CUSTOMER (cust_id, cust_name, cust_address)

ORDER (order_id, order_date, cust_id)

Assuming that a customer may have any number of orders and each order is placed by a single customer, discuss the following terms based on the above relations:

1. Relation
2. Attribute
3. Domain
4. Tuple
5. Degree and cardinality of a relation
6. Primary key and foreign key

4.1.2 Choosing the Primary key

You should discuss the answers for this section with your group and write your group answers in a shared MS Word document on your group's MS Teams private channel.

1. In any relation, tuples must be unique. However, in many cases, the set of all the attributes in a relation is not considered a candidate key. Why not? On the other hand, suppose we do have a relation where the set of all attributes is a candidate key. In this case, show that this set must, therefore, be the only candidate key and hence the primary key.

2. Identify the primary key and foreign key for these three relations:

   ORDER (order_id, order_date, cust_id)

   ORDERLINE (order_id, prod_no, ol_qtyordered, ol_lineprice)

   PRODUCT (prod_no, prod_desc, prod_unitprice)

3. Consider a relation that depicts a dental surgery appointment system.

   APPOINTMENT (dentist_id, dentist_name, patient_id, patient_name,
   appointment_datetime, surgery_roomno)

   Identify the superkey(s), candidate key(s) and the primary key for the relation if the following business rules are applicable:

   - A dentist can only see a single patient at a particular date and time
   - A dentist treats a patient in a particular surgery room, and
   - A patient can see the same dentist multiple times

4.2 Relational Algebra

4.2.1 Relational Algebra Exercise

This exercise is adapted from Exercise 3.6 of *Thomas, C., Carolyn, B. (01/2015). Database Systems: A Practical Approach to Design, Implementation, and Management, Global Edition, 6th Edition*.

If you are using Google Docs or Ms Word to record your answers, the project (**π**), select (**σ**), join (⋈) etc symbols can be easily added via the unicode values:

Symbol	Unicode
σ	03c3
π	03c0
⋈	22c8

- Google Docs - Insert - Special Characters (then simply type in the search by keyword box the unicode value or draw the value):

or

- MS Word - insert - Advanced Symbol or more simply, in Microsoft Word for Windows type the Unicode value then press ALT+X, in Microsoft Word for Mac use the Character Viewer (Ctrl+Command+Space) then search for the unicode value and click on the symbol to add.

The following tasks should be completed as an individual, you may choose to use MS Word or Google Docs. If you record your answers in Google docs please place a PDF of your answers into your repo, if you use MS word save the document in your repo (remember to push the file to the GitLab server regularly).

Suppose we have the following 4 relations:

HOTEL (hotel_no, hotel_name, hotel_city)

ROOM (room_no, hotel_no, room_type, room_price)

BOOKING (hotel_no, guest_no, bdate_from, bdate_to, room_no)

GUEST (guest_no, guest_name, guest_address)

Write the relational algebra for the following queries (your answer **must** show an understanding of query efficiency ie. you must not make use of unnecessary joins, nor carry attributes and tuples up through the query which are not necessary) :

1. List the names and cities of all hotels
2. List all single rooms with a price below $50
3. List the names of all hotels in Melbourne
4. List all names of hotels which have presidential suite room
5. List the price and type of all rooms at the Grosvenor Hotel
6. List all names and addresses of guests currently staying in deluxe room of any hotel (assume that if the guest has a tuple in the BOOKING relation, then they are currently staying in the hotel)
7. List all names and addresses of guests currently staying at the Grosvenor Hotel (assume that if the guest has a tuple in the BOOKING relation, then they are currently staying in the hotel)

4.2.2 Additional Relational Algebra Exercise

If your tutor has time at the end of the class, let's apply your knowledge from the world of relational algebra above to see if you can solve a theoretical problem.

Considers these four relations:

CUSTOMER (cust_id, cust_name, cust_address)

PRODUCT (prod_id, prod_desc, prod_unitprice, prod_stock)

STAFF(staff_name, staff_position)

SALE (cust_id, sale_date, prod_id, sale_qty, sold_by)
*Note that sold_by value is the name of staff who made the sale

also refer to the following tables as seen in an RDBMS

CUSTOMER

cust_id	cust_name	cust_address
111	Clive	India Rd
112	Clark	Kent St
113	Charles	Windsor Av
114	Cilla	Black St

PRODUCT

prod_id	prod_desc	prod_unitprice	prod_stock
K3	Knife Set	$17.95	105
K5	Ladle	$6.95	0
K11	Scraper	$0.95	66
L12	Rack	$22.95	0
L3	Table	$399.50	4
L6	Stool	$17.95	13

STAFF

staff_name	staff_position
Clark	Manager
Simon	Clerk
Steve	Packer
Sean	Clerk
Sorcha	Director
Charles	Clerk

SALE

cust_id	sale_date	prod_id	sale_qty	sold_by
112	20170311	K3	6	Simon
114	20170121	K11	1	Simon
114	20170123	K11	1	Simon
113	20161130	L12	5	Sorcha
114	20170228	L12	1	Sean
113	20161129	K3	2	Sean

Using Relational Algebra, answer the following queries. You must represent your answer in symbolic notation and where a query has several solutions, your answer must represent the most efficient solution.

1. List names of customers and descriptions of products bought by the customer. How many tuples will be returned by the relational algebra query that you have constructed as your answer?
2. List all names which are shared by customers and staff
3. List descriptions of products that haven't been sold
4. List names of clerks who don't have any sales yet
5. List categories (positions) of staff who have made sales

Important

After you have completed your current lab activities, at the end of each session remember to add, commit and push any changes you have made to the FIT GitLab server.

You need to get into the habit of establishing this as a standard FIT3171 workflow - Use SQL Developer to pull at the start of your working session, work on the activities you wish to/are able to complete during this week, add files (stage)/commit changes and then push the changes back to the FIT GitLab server.

Remember you should also regularly use the Web UI (login to the web interface of the server) to check that your files are correctly being pushed. Note that you must not modify (add, update, and delete) the files in the server using the Web UI.