

Assignment #3: Relational Model & Relational Algebra

Release: Sep. 16, 2020

Due: 8:00 PM, Sep. 25, 2020.

Goal:

The objective of this assignment is to work on Relational Model concepts and Relational Algebra queries. We will continue with the *ticket system* database schema of Assignment #2.

Description:

Consider the following relational database schema that supports the technical support ticketing system, *CS_Tech*. *CS_Tech* keeps track of the tickets, their status, who is working on them, and who submitted them. The full specification of the tables and their constraints are given in `hw3-cstech-db.txt`.

- TECH_PERSONNEL (pplSoft, fname, lname, pittID, expertise, office_phone, years_of_experience, supervisor)
Where fname is first name, and lname is last name.
- USERS (pplSoft, fname, lname, pittID, office_phone)
- CATEGORIES (category_id, category, description).
Where this table lists all possible categories of submitted tickets. Examples of categories are *Display_problem*, *HD_problem*, *OS_update*, *Virus_infected*, etc.
- INVENTORY (machine_name, ip_address, network_port, mac_address, location_id)
- LOCATIONS (location_id, location, building, notes)
- TICKETS (ticket_number, owner_pplSoft, date_submitted, date_closed, days_worked_on, category_id, machine_name, description)
- ASSIGNMENT (ticket_number, tech_pplSoft, date_assigned, status, outcome)
Where status field is an enumeration, could be: *assigned*, *in_progress*, *delegated*, *closed_successful*, or *closed_unsuccessful*.

Questions [Total: 100 points]

1. [15 points: 5 points each] Assuming that the relations TICKETS and ASSIGNMENT have 6 and 12 tuples, respectively, find the arity or degree and cardinality of the following relations and explain your answer: (For those whose accurate values can not be determined, give the min and max values)
 - (a) $\Pi_{machine_name} TICKETS$;
 - (b) $TICKETS * ASSIGNMENT$;
 - (c) $TICKETS \Join ASSIGNMENT$;

2. Write the *relational algebra* expression to answer each of the following queries. Use the **nesting** notation.
 - (a) [7 points] List the first and last names of all the Tech personnel whose expertise is hardware.
 - (b) [7 points] List the number of machines located in Sennott Square ('SENSQ') building.
3. Write the *relational algebra* expression to answer each of the following queries. Use the **sequence** notation. For dates, use the DD-MON-YYYY format.
 - (a) [9 points] List all the ticket information for all the tickets with status assigned which have been assigned to Bob Hoffman.
 - (b) [9 points] List all the users' pplSoft numbers along with the most recent submitted ticket number(s) within the month December 2019.
 - (c) [9 points] List the first and last names of users who submitted more than 5 tickets during the month of February 2019.
 - (d) [11 points] Find the tech personnel who has contributed the most in solving problems (i.e., all tech staff who worked on resolved tickets more than any other tech personnel) and list their first and last names.
 - (e) [11 points] Identify the most problematic machines during the months of June and August 2019 and list as "Device Name" the names of these machines (Hint: these machines had the maximum number of tickets in the given period).
 - (f) [11 points] Find the expertise of each tech staff by listing the most frequent categories of tickets assigned to them.
 - (g) [11 points] For all the possible unique categories of submitted tickets during September 2019, list the first name, last name, and pitt_ID of users who submitted tickets for all unique categories during that month.

What to submit:

1. You are required to electronically submit **exactly one** PDF (.pdf) or Microsoft Word (.docx) file named **hw3-<pitt_user_name>** (e.g., **hw3-pitt01.pdf** or **hw3-pitt01.docx**). *Do not forget to include your name and username (account name) in the beginning of the file. No hand-written solutions are accepted.*
2. If you have trouble generating any of the relational algebra symbols, for example $R \bowtie_{A=B} S$, use a descriptive word, e.g., $R \text{ Join}(A=B) S$.

How to submit it:

1. Submit your file (i.e., the PDF or DOCX file) that contains your solution through the class Web-based submission interface you have used for previous Assignments. **It is your responsibility to make sure the assignment was properly submitted.**
2. Submit your files by the due date (**8:00pm Sep. 25, 2020**). **There is no late submission.**

Academic Honesty

The work in this assignment is to be done *independently*. Discussions with other students on the assignment should be limited to understanding the statement of the problem. Cheating in any way, including giving your work to someone else will result in an F for the course and a report to the appropriate University authority.