CSE 4/560 Project 3 (Extra Credit Project)

Due 23:59 12/20/2020 EST

December 14, 2020

This is an INDIVIDUAL project. The goal of this project is to review the design of project 1 with what we learn during the later stage of this course. Please note that academic integrity is strictly implemented, any violation will result in a F grade in this course.

1 Problem Description

Base on the design result of project 1 from your group, answer following problems.

1.1 Problem 1 (1 point)

Verify the relational schema to see if it is in 3NF. Explain the why it is in 3NF. If not, explain why it is not in 3NF. The grade does NOT depend on whether the schema is in 3NF or not. The grade only depends on the correctness of the justification.

1.2 Problem 2 (1 point)

Recall following requirements:

1. A student can enroll different courses. But that student can enroll a course only if
   (a) That student has registered in the semester and the course is offered in that semester. i.e. A student need to register 2020 Spring before enrolling any course in 2020 Spring.
   (b) That student passes all the prerequisite courses

There are two constraints, (a) and (b). For each constraint, *write an INSERT statement to show that schema implements such constraint.* Refer to following cases to construct the INSERT statement:

1. An unregistered student enrolls CSE 560 in 2020 Fall.

2. A registered student enrolls CSE 560 in 2020 Fall but does not pass the prerequisite course, CSE 360, of CSE 560.

You also need to provide the necessary insert statements to build the relevant context. E.g., to provide enroll a CSE 560 class we need to insert CSE 560 course in 2020. If the schema CANNOT prevent the case (In other words, the schema only 'supports' the application to implement the constraint), write a SELECT statement. And explain how the application uses the result from SELECT statement to implement the constraint in the context of application level.

1.3 Problem 3 (1 point)

Continued from problem 2, use the preliminary insert statements to build a student who can satisfies the constraint (b). Then write a DELETE statement to remove the student from USER table. After the deletion, observe the rest of DB carefully, provide a description of what is happening to the rest of data. Also provide a justification which explains the phenomenon.

1.4 Problem 4(1 point)

In this problem, we introduce a new extended relational operator ϱ. This operator provides us to express "some, but not all" in relational algebra. Given two relations, $R_1 := (a_1, a_2, ..., a_{n+k})$ and $R_2 := (a_{n+1}, a_{n+2}, ..., a_{n+k})$, we can construct a RA expression:

$$R_3 := R_1 \ \varrho \ R_2$$

where as $t \in R_3$ *iff* for some $s \in R_2$ and not all $s \in R_2$, it exists $r \in R_1$ such that

- $t[a_0, ..., a_n] = r[a_0, ..., a_n]$ and
- $r[a_{n+1}, ..., a_{n+k}] = s[a_{n+1}, ..., a_{n+k}]$

For example, Given $R_1 := \{(0, 4), (1, 4), (1, 5), (2, 5), (3, 6)\}$ and $R_2 := \{(4), (5)\}$, then $R_3 := R_1 \ \varrho \ R_2$ where as $R_3 := \{(0), (2)\}$

Express the new operator ϱ in terms of essential RA operators.

2 Report template

Provide a PDF report with each problem as a section with your name, UBIT, person number on top. For SQL statements, submit three additional SQL files: *p2a.sql*, *p2b.sql*, and *p3.sql* for the sql statements in problem 2 and problem 3 respectively. Any other format will not be graded.

3 Submission

Failure to comply with the submission specifications will NOT BE GRADED

- What to submit: A zip file has to be submitted through the 'submit_cse460' (if you are CSE460 student) or 'submit_cse560' (if you are CSE560 student) submit script by 12/20/2020 11:59PM EST. Only zip extension will be accepted, please **don't** use any other compression methods such as tar or 7zip. You can submit multiple times, note that **only** the last submission will be kept on the server. **No late submission will be accepted**.
- Zip file naming: Use *ubit_proj3* (**NO SPACE!**) for the filename, for example: *jsmith_proj3.zip*, where *jsmith* is the ubit of submitter.
- Sub-structure of zip file: On unzipping the zip file, there should be a folder named with your ubit *ubit_proj3*, under the folder *ubit_proj3*, there should be three files:
  1. a PDF report
  2. three SQL files (*p2a.sql*, *p2b.sql*, and *p3.sql*)
  3. A copy of your project 1 submission as a ZIP file