Lab 4: Triggers, Functions, Relational Algebra, and Indexes

University of Toronto Mississauga
Due: Monday, March 21^{st}, 2022 at 11:59AM ET

Released: March 11^{th}, 2022

Relational Algebra (30 marks)

This question is a direct extension of Lab 3's CPT schema, please refer back to the sample ERD provided. You will use this ERD to help you solve your questions (not the DDL file provided!).

Write and provide the Relational Algebra (RA) for each of the following 6 questions, which are similar to those seen in Lab 3. The attributes in **bold** are the only columns asked to be returned as output in your answer. You will return them as denoted in the database unless otherwise specified in "quotation marks".

(q1) Find the number of seniors (as "**totalSeniors**") in the database. A *senior* is defined as being 65-years of age or older (on November 14th, 2019).

(q2) Identify all your profitable ships. *Profitable* is defined as a ship which has advertising revenue strictly greater than $\$10,000$. The only information required from this query is the **ships' unique identifier**, **age**, and **manufacturer**.

(q3) For each pilot, return the **total demerit points** and total fines incurred (named "**totalFine**"). Pilots with less than 2 demerit points are irrelevant and can be omitted. Results must be sorted in a manner which places the most offending pilot (by demerit points then highest amount of fines) first on the list.

(q4) Determine the most popular ship route on September 7, 2019. *Popularity* is defined by the largest number of passengers. Results must provide the **route's unique identification** and the number of passenger trips (as "**number of times**").

(q5) Find all the people who visited any '*library*' on either September 5, 2019 or September 6, 2019. We want to know their occupation, but we do not want to list duplicates. Therefore, return their **occupation** and "**occurrences**", where *occurrences* reflects the count of the number of times that specific occupation has appeared.

(q6) Find all students who attended the '*Jedi Knight Basketball*' game at the '*Jedi Temple*' and arrived via a ship on route #4. Return the student's **first name**, **last name**, **gender**, and **phone number**. Note: CPT may not have a phone number for all people.

Triggers (20 marks)

To help with data analytics for `CPT`, and to make data tracking a bit easier, you are tasked with writing a trigger and function that computes the total earnings based on the 'Take' table.

To get started with this question, you will need to create a new schema and then re-run the `createTable.ddl` file from Lab 3. After you've run this file, create a new table called `Earnings` (see `lab4_skeleton.dml` for details):

```
CREATE TABLE IF NOT EXISTS Earnings(
  Type varchar(20) NOT NULL,
  TotalEarnings decimal(10,2)
);
```

The `Earnings` table stores the type of passenger (corresponding `Passenger.type`) and `TotalEarnings` represents the total amount `CPT` has earned for that passenger type. You may find question 4 (a) from Lab 3 to be particularly useful here!

Your trigger will be named `insert_passenger_fare_trigger` and will execute after an insertion on the `Take` table, while your function will be named `insert_passenger_fare` and will be responsible for updating the `Earnings` table. Note: if a type does not exist in `Earnings`, then it must be created. Additionally, earnings are to only be computed after an insertion, so if data already exists in the database, you do not add that into this table.

Requirements and Submission

This lab is to be completed in partners (in the same pairs of 2 selected in Lab 1, propagated from Lab 3) unless written permission is given by the Course Coordinator. You and your partner are required to work together, equally contribute to, and understand all parts of your submission. Please refer to the syllabus for additional details on groups and the "Minimum Standards for Submitted Work".

You are **required** to use Lab 3's `createTable.ddl` file (provided for last week's lab) and `lab4_skeleton.dml`. You will use the skeleton file (i.e., `lab4_skeleton.dml`) and rename that file to `lab4_triggers.dml`, where you must add your SQL function and trigger (i.e., your solutions) and personal information where indicated to do so. Please ensure that your SQL code is syntactically correct and that they are executable on the MCS PostgreSQL server. Non-executable queries (or those producing no output) will receive a grade of 0. Do not leave your code commented out, this will also result in a grade of 0.

You are submitting **three files** called **`lab4.tex`**, **`lab4_triggers.dml`**, and **`lab4.pdf`**.
In **`lab4_triggers.dml`**, you must include your, and your partner's, full name and student ID number at the top this DDL file where specified (see "PREAMBLE" in `lab4_skeleton.dml`). Failure to do so will lead to administrative penalties. In **`lab4.tex`** and **`lab4.pdf`**, you should include your answers for the relational algebra questions. Note: no hand-written solution will be accepted.

All files are to be submitted using the MarkUs platform (https://markus108.utm.utoronto.ca/csc343s22/). You or your partner must create the "group" and the other must accept the invitation to join. Once your group is formed on MarkUs, only one person from each group is required to submit the file(s). You may submit as many times as you like, in fact you are encouraged to do so! Groups that were created in Lab 1 will persist (so there may be no need for you to create a group!).