CSE 132A Winter 2017
Assignment #1 (SQL)
Due February 10 (11:59pm)

This is an **individual** *assignment. Please review the academic integrity policy and contact the instructor or TA if you have any questions.*

The university registrar database has the following schema:

student: sid (string)
course: cid (string)
prerequisite: cid (string), pre-cid (string)
record: sid (string), cid (string), qtr (string), year (integer), grade (integer)

Relation *student* provides the ids of all students enrolled in the university, and *course* provides all offered courses. Relation *prerequisite* provides the prerequisites *pre-cid* for each course *cid*. Relation *record* indicates which courses where taken by each student in a given year and quarter (F, W, S), and the grade obtained (for simplicity, grades are provided as integers $4, 3, 2, 1, 0$, corresponding to A, B, C, D, F). Assume that a class can only be taken once. Note that students may have gaps in enrollment, i.e. they need not take courses every quarter.

In addition, the following hold:

- *sid* is the primary key of *student*
- *cid* is the primary key of *course*
- $\{cid, pre\text{-}cid\}$ is the primary key of *prerequisite*; *cid* and *pre-cid* are foreign keys referencing *course*.
- $\{sid, cid, qtr, year\}$ is the primary key of *record* (so grades are unique for each course taken by a student in a given year and quarter), *sid* is a foreign key referencing *student* and *cid* is a foreign key referencing *course*.

A sample instance will be posted separately, together with outputs to the queries in the assignment.

Do the following in SQLite command shell:

A. Create a database with the above schema. The schema should also declare the primary keys and referential integrity constraints stated above.

B. Write the following queries in SQL (of course, the queries must work on all data, not just the sample one):

1. Compute the GPA for the academic year 2015/16 for all students who have taken at least one class during this academic year. The answer should have attributes {*sid, gpa*}.
2. List all pairs of students who have taken at least one course together in Fall 2016. The answer should have attributes {*sid1, sid2*}. Avoid listing pairs of the form $< a, a >$, or listing both $< a, b >$ and $< b, a >$.
3. List, for each quarter, the number of courses with fewer than 5 students (but at least one student) enrolled that quarter. The answer should have attributes $\{qtr, year, num\}$.
4. Find the number of courses each student has taken in Fall 2016. If a student has taken no class that quarter, the number of classes should be zero. The answer should have attributes $\{sid, num\}$.
5. List the students who have taken all prerequisites for CSE132X with a grade of 2 or higher. The answer should have one attribute *sid*. Note that, if CSE132X has no prerequisites, then all students should be in the answer. Provide two SQL queries, using nested sub-queries in different ways:
   - with NOT IN tests only;
   - with NOT EXISTS tests only;
6. Find the students whose quarterly GPA has gone up every quarter they have been enrolled (their GPA in each quarter is strictly higher than their GPA in previous quarters). Recall that students may have gaps in enrollment. **Hint**: It may be helpful to observe that the order of occurrence of quarters in a given **calendar** year is in reverse alphabetical order ('W' > 'S' > 'F'). For example, the quarters occurring in 2016 are, in chronological order, W, S and F.
7. Update relation *record* by swapping enrollments in CSE132A and CSE132B in Fall 2016, without explicitly naming the students involved. That is, all students enrolled in CSE132A should be dropped from that class

and enrolled in CSE132B, and conversely. You may use several update commands if needed.

What and how to turn in

1. Make an SQLite script file queries.sql
   Place your name and login at the top of the files as comments.

   The file queries.sql should contain: part **A. commented out**, and the queries in part **B.** Before the code for each query, enter a comment stating which query the code implements. Before turning in the file, please make sure your queries actually run on SQLite. To do this, set up a test database with the schema defined in (a), and run the file queries.sql on this database.

2. Copy queries.sql to your account on ieng6.

3. Use the turnin program to submit the file queries.sql
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   turnin -c cs132w queries.sql
   ```

4. Before running the turnin program, you need to run the command "prep cs132w".