CS 1555/2055 – Database Management Systems (Spring 2020)
Dept. of Computer Science, University of Pittsburgh

Assignment #2: Relational Model & SQL DDL

Release: Jan. 24, 2020 Due: 8:00pm Jan. 29, 2020

Goal

Gain familiarity with the theoretical foundations of the relational model and basic SQL DDL.

Description

- Assume the following relational database schema that supports a cell phone company, *P_Mobile*, that specializes in inexpensive wireless services to the University of Pittsburgh community of students, faculty, staff, and friends (*pn*, is short for phone number):

  - CUSTOMERS (SSN, fname, lname, cell_pn, home_pn, street, city, zip, state, free_min)
    where fname is first name, and lname is last name.
  - RECORDS (from_pn, to_pn, start_timestamp, duration, type)
    where type is either 'call' or 'SMS'
  - STATEMENTS (cell_pn, start_date, end_date, total_minutes, total_SMS, amount_due)
    where total_minutes or total_SMS does not reflect any free minute discount, but the amount_due should.
  - PAYMENTS (cell_pn, paid_on, amount_paid)
    where the amount_paid does not have to be the same as amount_due.
  - DIRECTORY (pn, fname, lname, street, city, zip, state)
    The directory table contains all phone number known, *P_Mobile* and non_*P_Mobile* (i.e., it is basically White Pages).

  Here are some basic assumptions: For simplicity, we assume that people with the same last name are in the same family. The RECORDS relation records all calls/texts made and their duration(0 for text). Also, we assume that the PAYMENTS table contains one entry for every day, where all the amounts paid during that day are aggregated (i.e, summed) in one single entry.
  State your own assumption clearly if your solution is not based on common thoughts.

- Answer the following questions [for a total of 100 points]:

  1. [20 points] Identify the primary key (PK) and alternate key(UQ), if any, for each of the five relations. Identify the foreign keys (FK) and specify referential integrity constraints. For example, consider the relation STUDENTS that is associated with the relation DEPARTMENT.

     STUDENT (StudentID, Major, SSN)
     PK (StudentID) ; UQ (SSN)
     FK (Major) → DEPARTMENT(DeptCode)

     Please state any assumptions that you make.

2. [40 points] Use CREATE TABLE statement to create tables for these five relations. You need to define the primary keys and foreign keys (if any) and entity constraints (if any) in your statement but *not* alternative keys.
   - Phone numbers: NUMBER(10)
   - Any Name (First, Last, City, State): VARCHAR2(20)
   - Any Minutes/SMS: NUMBER
   - Any $ Amounts: NUMBER(6,2)
   - Any date attribute: DATE
   - Any timestamp: TIMESTAMP
   - Duration: NUMBER(4)
   - Type VARCHAR2(20)
   - Zip: NUMBER(5)
   - SSN: NUMBER(9)
3. [20 points: 5 points each] Use ALTER TABLE statement to incorporate the following information/constraints in the *P_Mobile* Database.
   (a) In each table, add a Unique constraint for every of its alternate keys
   (b) Add a new attribute free_SMS to table CUSTOMERS, which is the number of free SMS a customer can use.
   (c) Add a new attribute previous_balance to table STATEMENTS, which is balance carried over from previous statement. Note that the precision of previous_balance is 6, and the scale of previous_balance is 2.
   (d) In table CUSTOMERS, the free_min and free_SMS default value should be set to 0.
4. [10 points] After creating the database using your SQL statements, populate the database according to the data in `sample-data.txt` using the SQL INSERT command. You must complete your populating process with the SQL COMMIT command.
5. [10 points: 2 points each] Using the simple SQL SELECT statement, list the content of each table.

What to submit

For *Question 1*, create a single file named `hw2-<username>` in PDF (.pdf) or Microsoft Word (.doc) format, containing your answers to all questions. **Do not forget to include your name and username (account name) in the file**.

For *Questions 2-5*, you are required to submit **exactly three** text files under your **pitt_user_name** (e.g, pitt01).
Include as a comment your name and pitt user name at the top of the text file, and identify the question number before each answer as a comment as well.

- **pitt_user_name-db.sql**
  In this file, please submit the answers to question 2 and 3. (i.e., CREATE TABLE and INSERT statements.) In addition to providing the answers, you are expected to:
  - use SQL **DROP TABLE** statements at the beginning of this file so that you can make sure your database does not have pre-existed tables which have the same name as those 5 tables in this assignment.

The entire text file should be composed of **valid SQL statements**.

- **pitt_user_name-insert.sql**
  In this file, please submit the answers to question 4 and 5.
- **pitt_user_name-output.txt**
  In this file, please submit the query results of pitt01-insert.sql. You could use the command "SPOOL log_file_name" in SQLPLUS to record your query results.

To submit your assignment:

1. Submit your assignments through the Web-base submission interface you have used for homework #1. **It is your responsibility to make sure the assignment was properly submitted.**
2. Submit your assignment by the due date (8:00pm Jan 29, 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.