CS1555 Recitation 2 - Solution

Objective: To practice the relational model and SQL DDL

Consider the following relation schemas and states:

Student (SID, Name, Class, Major)
Student_Dir (SID, Address, Phone)
Courses_taken (Course_No, Term, SID, Grade)
Course(Course_No, Name, Level)

1. What are the arities and cardinalities of the relations?

Student

SID	Name	Class	Major
123	John	3	CS
124	Mary	3	CS
126	Sam	2	CS
129	Julie	2	Math

Arity = **4**
Cardinality = **4**

Student_Dir

SID	Address	Phone
123	333 Library St	555-535-5263
124	219 Library St	555-963-9635
129	555 Library St	555-123-4567

Arity = **3**
Cardinality = **3**

Course

Course_No	Name	Course_level
CS1520	Web Programming	UGrad
CS1555	Database Management Systems	UGrad
CS1550	Operating Systems	UGrad
CS 1655	Secure Data Management and Web Applications	Ugrad
CS2550	Database Management Systems	Grad

Arity = **3**
Cardinality = **5**

Course_taken

Course_No	Term	SID	Grade
CS1520	Fall 18	123	3.75
CS1520	Fall 18	124	4
CS1520	Fall 18	126	3
CS1555	Fall 18	123	4
CS1555	Fall 18	124	NULL
CS1550	Spring 19	123	NULL
CS1550	Spring 19	124	NULL

Arity = **4**
Cardinality = **11**

CS1550	Spring 19	126	NULL
CS1550	Spring 19	129	NULL
CS2550	Spring 19	124	NULL
CS1520	Spring 19	126	NULL

2. Find the primary key of each relation, assuming that a student is allowed to take each course only once.

Student: (SID)

Student_Dir: (SID)

Course: (Course_no)

Course_taken: (Course_no, SID)

3. Now given that a student may re-take a course if she or he fails to obtain a proper grade for that course, what is the primary key of the Course-taken relation?

(Course_no, SID, term)

4. Find the foreign key(s) of each relation, if any. Where does each foreign key reference to?

FK1: Student_Dir(SID) references Student (SID)

FK2: Course_Taken(SID) references Student (SID)

FK3: Course_Taken(Course_No) references Courses (Course_No)

5. Use CREATE TABLE statement to create tables for each of the relations above. You need to define the primary keys, foreign keys and any other constraints.

```
CREATE TABLE student (
      sid          char(5)      NOT NULL,
      name         varchar(15)  NOT NULL,
      class        int,
      major        varchar(10),
      CONSTRAINT pk_student PRIMARY KEY(sid) );

CREATE TABLE student_Dir (
      sid          char (5)     NOT NULL,
      address      varchar(100),
      phone        varchar(20),
      CONSTRAINT pk_student_Dir PRIMARY KEY (sid),
      CONSTRAINT fk_student_Dir FOREIGN KEY (sid) REFERENCES student(sid)
            ON DELETE CASCADE ON UPDATE CASCADE);
```

```
CREATE TABLE course (
      course_no    varchar(10)  NOT NULL,
      name         varchar(100),
      course_level varchar(10),
      CONSTRAINT pk_Course PRIMARY KEY (course_no));

CREATE TABLE course_taken (
      course_no    varchar(10) NOT NULL,
      term         varchar(15) NOT NULL,
      sid          char(5) NOT NULL,
      grade        numeric,
      CONSTRAINT pk_course_taken PRIMARY KEY(course_no, sid, term),
      CONSTRAINT fk_1_course_taken FOREIGN KEY (sid) REFERENCES student(sid)
            ON DELETE CASCADE ON UPDATE CASCADE,
      CONSTRAINT fk_2_course_taken FOREIGN KEY (course_no)
            REFERENCES Course(course_no) ON DELETE CASCADE ON UPDATE
CASCADE);
```

6. What will happen if the first two CREATE TABLE statements are switched. Will the statements run smoothly without a problem?

No. An error will be thrown saying that the STUDENT table does not exist.

7. Would the following actions be valid given the current data? If not, why?
- Add a tuple <CS1550, Spring 19, 130, NULL> to course_taken
  No. FK2 would be violated since there is no student of SID 130 in Student.

- Delete the tuple <CS1520, Spring 19, 126, NULL> from course_taken
  Yes.

- Delete the tuple <123, John, 3, CS> from Student
  No. FK2 and FK1 would be violated because there are tuples in Course_Taken and in Student_Dir having SID = 123.

- Delete the tuple <123, John, 3, CS> from Student, with foreign keys referring to SID in the Student table are declared with the "on delete cascade" option
  Yes. It would be valid if the foreign keys FK1 and FK2 are declared with the "ON DELETE CASCADE" option. The tuples for John in Student_Dir and Course_Taken will also be deleted.

- Delete the tuple <123, 333 Library St, 555-535-5263> from Student_Dir

  Yes.

- In the table Course, update the name of the course CS1520 to Java Programming

  Yes.

- In the table Course, update the course_no of the course CS1520 to CS6666

  No. FK3 would be violated.

- In the table Course, update the course_no of the course CS1520 to CS6666, with foreign keys referring to Course_No in Course table are declared with the "on update cascade" option

  Yes. It would be valid if the foreign key FK3 is declared with the "ON UPDATE CASCADE" option. The course_no for CS1520 in the Course_Taken table will also be updated to CS6666.