CS1555 Recitation 3 - 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 )

COURSE\_TAKEN ( course\_no, term, sid, grade )

COURSE ( course\_no, name, level )

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

**STUDENT**

Arity = 4

Cardinality = 4

|  |  |  |  |
| --- | --- | --- | --- |
| sid | name | class | major |
| 123 | John | 3 | CS |
| 124 | Mary | 3 | CS |
| 126 | Sam | 2 | CS |
| 129 | Julie | 2 | Math |

**STUDENT \_DIR**

Arity = 3

Cardinality = 3

|  |  |  |
| --- | --- | --- |
| sid | address | phone |
| 123 | 333 Library St | 555-535-5263 |
| 124 | 219 Library St | 555-963-9635 |
| 129 | 555 Library St | 555-123-4567 |

**COURSE**

Arity = 3

Cardinality = 5

|  |  |  |
| --- | --- | --- |
| 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 |

**COURSE\_TAKEN**

Arity = 4

Cardinality = 11

|  |  |  |  |
| --- | --- | --- | --- |
| course\_no | term | sid | grade |
| CS1520 | Fall 19 | 123 | 3.75 |
| CS1520 | Fall 19 | 124 | 4 |
| CS1520 | Fall 19 | 126 | 3 |
| CS1555 | Fall 19 | 123 | 4 |
| CS1555 | Fall 19 | 124 | NULL |
| CS1550 | Spring 20 | 123 | NULL |
| CS1550 | Spring 20 | 124 | NULL |
| CS1550 | Spring 20 | 126 | NULL |
| CS1550 | Spring 20 | 129 | NULL |
| CS2550 | Spring 20 | 124 | NULL |
| CS1520 | Spring 20 | 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 COURSE (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 int NOT NULL,

name varchar(15)NOT NULL,

class int,

major varchar(10),

CONSTRAINT PK\_ STUDENT PRIMARY KEY (sid)

);

CREATE TABLE STUDENT\_DIR (

sid int 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 int NOT NULL,

grade real,

CONSTRAINT PK\_COURSE\_TAKEN PRIMARY KEY (course\_no, sid, term),

CONSTRAINT FK1\_COURSE\_TAKEN FOREIGN KEY (sid) REFERENCES STUDENT (sid) ON DELETE CASCADE ON UPDATE CASCADE,

CONSTRAINT FK2\_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, Fall 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, Fall 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 CS7896

No. FK3 would be violated.

* In the table COURSE, update the ***course\_no*** of the course CS1520 to CS7896, 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 FK2 is declared with the “ON UPDATE CASCADE” option. The ***course\_no*** for CS1520 in the COURSE\_TAKEN table will also be updated to CS7896.