CS1555 Recitation 4 Solution

Objective: To practice relational algebra

Consider the following relation schemas and states:

Student (SID, Name, Class, Major)

Student\_Dir (SID, Address, Phone)

FK: (SID) → Student (SID)

Course (Course\_No, Name, Level)

Courses\_taken (Course\_No, Term, SID, Grade)

FK: (Course\_No) → Course (Course\_No)

FK: (SID) → Student (SID)

**Student**

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

**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 |

**Course**

|  |  |  |
| --- | --- | --- |
| Course\_No | Course\_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**

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

**PART 1:**

1. Identify the arity and cardinality of the 4 given relations.

Student: arity = 4, cardinality = 4

Student\_Dir: arity = 3, cardinality = 3

Course: arity = 3, cardinality = 5

Course\_taken: arity = 4, cardinality = 11

1. For each of the four relational algebra queries below:
   1. Identify the expected arity, schema, and min/max cardinality of the relation resulted from the below queries, without actually evaluating the query and based only on the schemas and cardinalities of the 4 given relations.
   2. Find the resulted relation given the above states of the 4 relations.

(Note: we are using |T| notation to denote the Arity of relation T and |r(T)| notation to denote the cardinality of relation T)

a  Term = 'Spring 20'(Courses\_taken )

|T1| =4;

T1(Course\_No, Term, SID, Grade)

min|r(T1)|=0; max|r(T1)| =|r(Course\_Taken)|

**T1**

|  |  |  |  |
| --- | --- | --- | --- |
| Course\_No | Term | SID | Grade |
| 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 |

b. Course\_No ( Term = 'Spring 20' (Courses\_taken ))

|T2| =1

T2(Course\_No)

Min|r(T2)| =0; Max|r(T2)| =|r(Course)|

**T2**

|  |
| --- |
| Course\_No |
| CS1550 |
| CS2550 |
| CS1520 |

**PART 2:** Write a relational algebra query for each of the queries below and analyze the efficiency of each query.

1. List the course\_no and grade of all the courses that were taken by the student whose SID is 124.

L1 🡨 πCourse\_No, Grade(σSID=124(Course\_taken))