

Database Management Systems

Homework: Relational Algebra Query

Schema

Write relational algebra queries against the following database schema. The database schema is a very simplified model for a University academic course and registration data. For now, it has only two relations.

1. **Courses**(CNO:CHAR(10), CName:VARCHAR(50), Dept:VARCHAR(20)). Each course is given a unique ID called **CNO**. A longer description of the name of the course is given in the attribute **CName**. The course is offered by an academic department whose name is stored in the attribute **Dept**.
2. **Register**(RNO:CHAR(10), CNO:CHAR(10), Year:INTEGER, Sem:INTEGER, **Grade**:CHAR). This stores tuples to show that a student with Roll No **RNO** is registered for *or* has completed the course with ID **CNO**.
 - (a) The attributes **Year** and **Sem** define the academic semester of this registration. The attribute **Sem** takes one of three values 1,2 or 3, which are short codes referring to the July-Dec semester or Jan-May semester, or the summer semester.
 - (b) The attribute **Grade** specifies the grade obtained by the student for this course offering. The **Grade** attribute takes one value from {'A', 'B', 'C', 'D', 'E', 'F'} or takes the value NULL (if grade has not been given yet).

Note. The table **Register** stores information about course registration data prior to the current semester, as well as the registration data for the current semester.

Problems

1. Find all (**RNO**, **Year**, **Sem**) triples such that a student with Roll No. **RNO** in the semester defined by **Year**, **Sem** has taken/registered for at least three or more distinct courses, each offered by a different department.
2. Find all (**RNO**, **Year**, **Sem**, **Dept**) quadruples such that a student with Roll No. **RNO** and in the semester defined by **Year**, **Sem** is registered for or has completed at least one course offered by the department **Dept**, but not more than two courses offered by that department.
3. Find all pairs (**RNO**, **Dept**) such that the student with Roll No. **RNO** has taken/registered for at most one course offered by the department **Dept** during his/her tenure at this University.
4. Find all triples (**RNO1**, **RNO2**, **Dept**) such that the student with Roll No. **RNO1** has taken/registered for every course in the department **Dept** that the student with Roll No. **RNO2** has taken/registered for. *Note:* If (r_1, r_2, d) is a tuple in the answer then there must be at least one course offered by the department with **Dept** = d that the student with **RNO** = r_2 has taken/registered for.