CSCD 327 Homework 2

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1 Find the names and majors of all students from the Mathematics department.

$\Pi_{name,major}(\sigma_{dept\_name='Mathematics'}(student \bowtie department))$

2 For all students who have enrolled in at least one course, list the names of the students with the titles and credits of the courses they have enrolled in.

$\Pi_{name,title,credits}(student \bowtie enrollment \bowtie course \bowtie_{(course.departmentID=department.departmentId)} department)$

3 List the student IDs and names for all students who have not enrolled in any course offered by the department with department ID 101.

$ToRemove \leftarrow \sigma_{departmentID=101}(student \bowtie enrollment \bowtie course)$
$\Pi_{studentID,name}(student) - \Pi_{studentID,name}(ToRemove)$

4 List all course IDs and course titles offered by the Finance department or the Business department.

$\Pi_{courseID,title}(\sigma_{dept\_name='Finance' \vee dept\_name='Business'}(course \bowtie department))$

5 Find the names of students who have enrolled in both courses with course IDs MIS101 and CS202.

$Mis \leftarrow \sigma_{courseID='MIS101'}(student \bowtie enrollment)$
$Cs \leftarrow \sigma_{courseID='CS202'}(student \bowtie enrollment)$
$\Pi_{name}(Mis) \cap \Pi_{name}(Cs)$

6 List the course titles and their offering departments' names for all courses that no students have enrolled in.

$EmptyCourses \leftarrow \Pi_{courseID}(course) - \Pi_{courseID}(enrollment)$
$\Pi_{title,dept\_name}(EmptyCourses \bowtie course \bowtie department)$

7 List the names of students who received a grade of A or B in any course, along with the titles and names of the offering departments of those courses.

$GoodGrades \leftarrow \sigma_{grade='A' \vee grade='B'}(enrollment)$
$\Pi_{name,title,dept\_name}(GoodGrades \bowtie student \bowtie course \bowtie_{(course.departmentID=department.departmentId)} department)$

8 Find the names and majors of all students who have enrolled in at least one course offered by the Physics department.

$PhysicsCourses \leftarrow \Pi_{courseID}(\sigma_{dept\_name='Physics'}(course \bowtie department))$
$PhysicsStudents \leftarrow \Pi_{studentID}(enrollment \bowtie PhysicsCourses)$
$\Pi_{name,major}(PhysicsStudents \bowtie student)$

9 List the titles of the courses that no students who are in Freshman year have enrolled in.

$Freshmen \leftarrow \Pi_{studentID}(\sigma_{year='Freshman'}(student))$
$FreshmanCourses \leftarrow \Pi_{courseID}(enrollment \bowtie Freshmen)$
$UpperClasses \leftarrow \Pi_{courseID}(course) - FreshmanCourses$
$\Pi_{title}(UpperClasses \bowtie course)$

10 Find the names of the students who have enrolled in the course with the title Database Systems, along with the name of the offering department.

$DbCourse \leftarrow \Pi_{courseID,dept\_name}(\sigma_{title='DatabaseSystems'}(course \bowtie department))$
$\Pi_{name,dept\_name}(DbCourse \bowtie enrollment \bowtie_{enrollment.studentID=student.studentID} student)$

11 Produce the output of the following queries

$club \bowtie student$

SID	name	class	CID	club_name
1001	John Smith	Freshman	C101	Robotics Club
1002	Emma White	Junior	C102	Coding Club
1002	Emma White	Junior	C103	Chess Club
1005	NULL	NULL	C104	Science Club

A Left Outer Join of club and student will produce all rows from the club table, and any matching rows from the student table. If there is no match, it fills in null. There is 1 row in the club table with no match in the student table, so that row will have null values for the student attributes. The resulting table will have duplicate attributes removed, leaving us with 5 columns.

$club \ltimes student$

SID	name	class	CID	club_name
1001	John Smith	Freshman	C101	Robotics Club
1002	Emma White	Junior	C102	Coding Club
1002	Emma White	Junior	C103	Chess Club
1003	Amber Brown	Senior	NULL	NULL
1004	David Hernandez	Junior	NULL	NULL

A Right Outer Join of club and student will produce all rows from the student table, and any matching rows from the club table. If there is no match, it fills in null. There are 2 rows in student with no matches in club, so they appear with nulls in the club columns.

$student \rtimes club$

SID	name	class	CID	club_name
1001	John Smith	Freshman	C101	Robotics Club
1002	Emma White	Junior	C102	Coding Club
1002	Emma White	Junior	C103	Chess Club
1003	Amber Brown	Senior	NULL	NULL
1004	David Hernandez	Junior	NULL	NULL
1005	NULL	NULL	C104	Science Club

A full outer join between student and club will produce all rows from both tables. The matching rows will be combined, and the rest will have nulls for missing attributes. As before, there are 5 attributes in the resulting table.