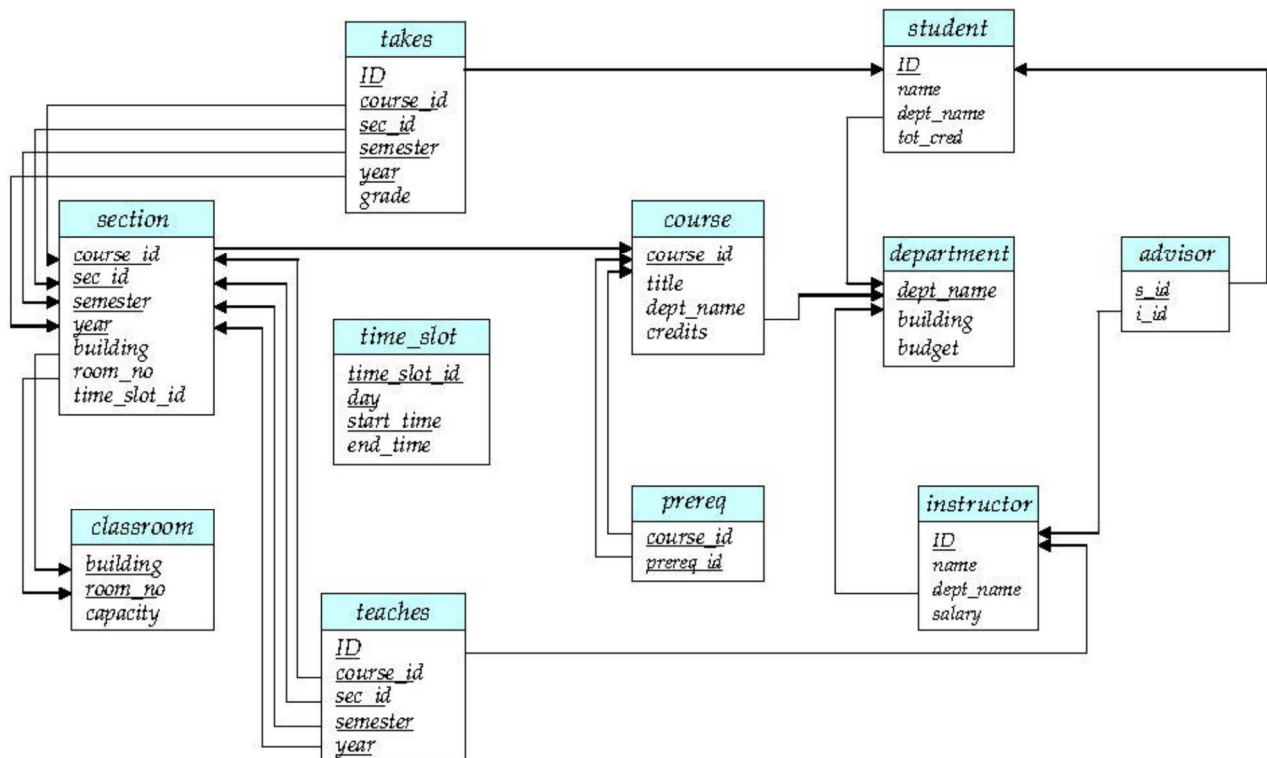


# Database Technology

## Exercise 2: SQL Part 1

### 2.1. SQL queries using university database

1. Start the XAMPP Control Panel and start MySQL/MariaDB and Apache
2. Open your Browser and browse to <http://localhost/phpmyadmin>
3. Click on the SQL tab and formulate SQL queries (using the university database) for the following tasks:
  - a. Find the highest salary of any instructor.
  - b. Find the titles of courses in the Comp. Sci. department that have 3 credits.
  - c. Find the IDs of all students who were taught by an instructor named Einstein; make sure there are no duplicates in the result.
  - d. Find the enrollment of each section that was offered in Spring 2009.
  - e. Find all instructors earning the highest salary (there may be more than one with the same salary).
  - f. Find the maximum enrollment, across all sections, in Spring 2009.
  - g. Find the sections that had the maximum enrollment in Spring 2009.



## 2.2. Left outer join

Suppose we have three relations  $r(A, B)$ ,  $s(B, C)$ , and  $t(B, D)$ , with all attributes declared as not null. Consider the expressions

- $r$  natural left outer join  $(s$  natural left outer join  $t)$
  - $(r$  natural left outer join  $s)$  natural left outer join  $t$
- a. Give instances of relations  $r$ ,  $s$  and  $t$  such that in the result of the second expression, attribute  $C$  has a null value but attribute  $D$  has a non-null value.
  - b. Is the above pattern, with  $C$  null and  $D$  not null possible in the result of the first expression? Explain why or why not.

## 2.3. SQL Like

The SQL “like” operator is case sensitive, but the `lower()` function on strings can be used to perform case insensitive matching. To show how, write a query that finds departments whose names contain the string “sci” as a substring, regardless of the case.

## 2.4. Cartesian Product

Consider the SQL query

```
SELECT p.a1
FROM p, r1, r2
WHERE p.a1 = r1.a1 or p.a1 = r2.a1
```

Under what conditions does the preceding query select values of  $p.a1$  that are either in  $r1$  or in  $r2$ ? Examine carefully the cases where one of  $r1$  or  $r2$  may be empty.

## 2.5. Relational algebra

Consider the following relational database. Give an expression in SQL for each of the queries.

employee (employee\_name, street, city)  
works (employee\_name, company\_name, salary)  
company (company\_name, city)  
manages (employee\_name, manager\_name)

- a. Find the names and cities of residence of all employees who work for First Bank Corporation.
- b. Find the names, street addresses, and cities of residence of all employees who work for First Bank Corporation and earn more than \$10,000.
- c. Assume that the companies may be located in several cities. Find all companies located in every city in which Small Bank Corporation is located.
- d. Find the company that has the most employees.
- e. Find those companies whose employees earn a higher salary, on average, than the average salary at First Bank Corporation.
- f. Find all employees in the database who do not work for First Bank Corporation.
- g. Find all employees in the database who earn more than each employee of Small Bank Corporation.