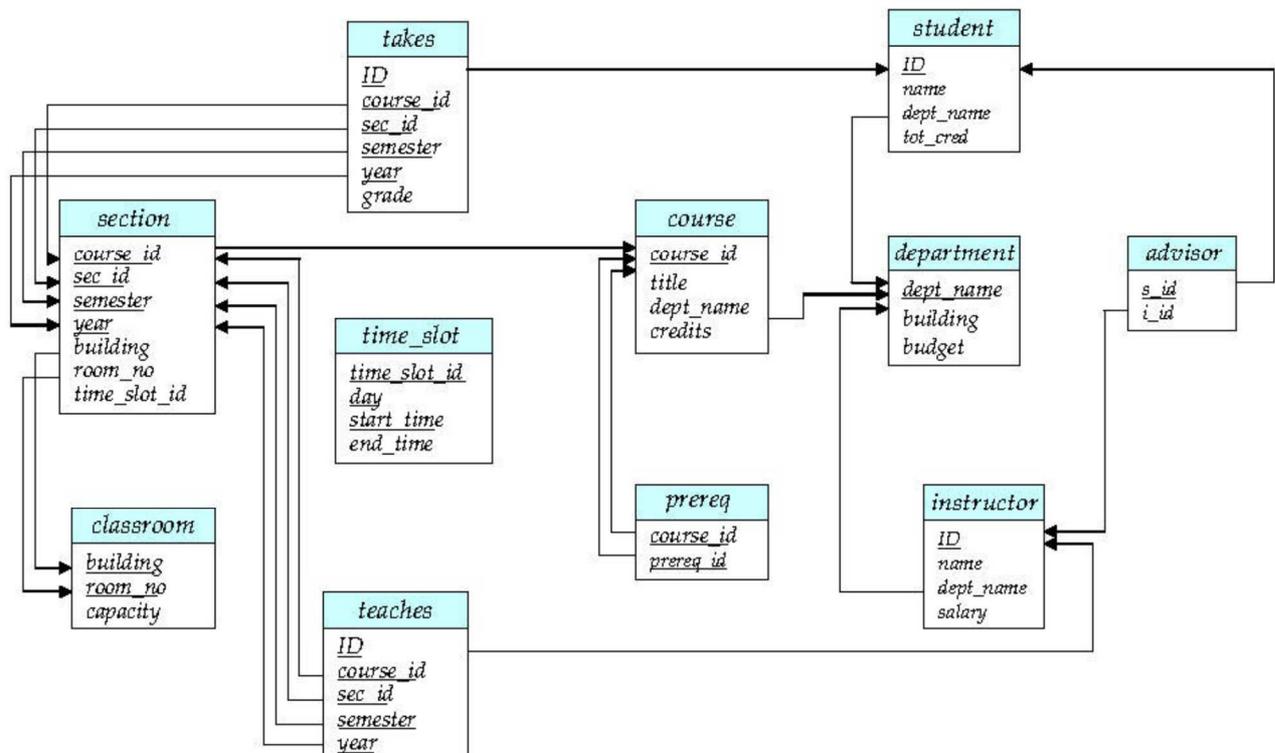


Database Technology

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.