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.