



National University of Sciences and Technology (NUST)
School of Electrical Engineering and Computer Science

Department of Computing

Laboratory Manual 02:

Introduction to SQL

CS-220: Database Systems

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Class: BS(CS)-6B

Dr. Amanullah Yasin

Mr. Ahmed Shahzaib Abid Bhatti

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Introduction

Structured Query Language (SQL) was developed at IBM San Jose Research Laboratory as a part of System R project. It is a declarative query language for querying a relational database. It also includes features for defining the structure of the data, for inserting and modifying data in the database, and for specifying security constraints. It is relational complete (it supports all six core relational algebra operations). SQL commands can be classified into three groups DDL, DML & DCL.

Objectives

After performing this lab students should be able to:

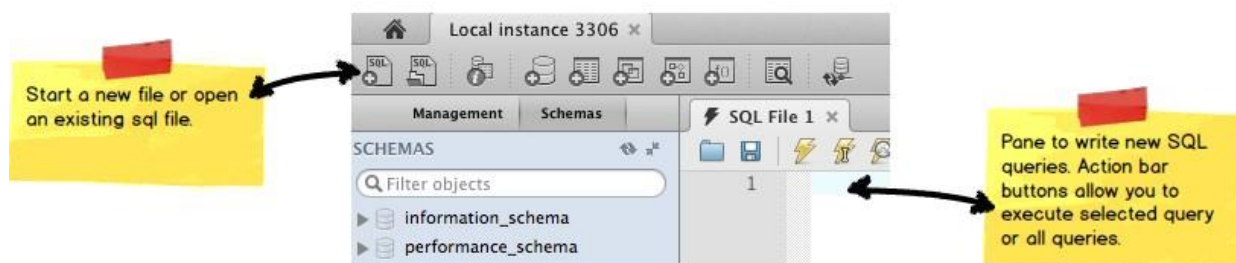
1. Design SQL queries to retrieve data using SELECT clause and various associated operators.
2. Translate relational algebra expressions to SQL queries.
3. Execute SQL queries over MySQL using MySQL Workbench.

Tools/Software Requirement

- MySQL Community Server 5.6
- MySQL Workbench 6.1
- Sakila Database

Description

1. Open MySQL Workbench and open the default connection instance.
2. A new query window would open from where you can write and execute queries.



3. You can save the query file and can also add comments using # symbol.
4. On executing queries, results are displayed in the lower part of the screen.
5. Error or success messages are displayed in action output pane at the bottom.
6. Try running few SQL queries modeled during the lectures to get it going.
7. Continue playing with the Workbench and SQL queries till you are comfortable with the querying mechanism and have learnt the shortcuts to execute queries.



1. SQL Basic Query Structure

The SELECT clause

The most common use of the SQL commands is the selection of data from the tables located in a database. This can be achieved through SELECT command. We need to SELECT information FROM a table. Hence we have the most basic SQL query structure comprising of:

- SELECT
- FROM
- WHERE

The syntax for SELECT clause is as follows:

```
SELECT "column_name(s)" FROM "table_name(s)";
```

There are three ways we can retrieve data from a table:

- Retrieve one column
- Retrieve multiple columns
- Retrieve all columns (Use *)

The select clause can contain arithmetic expressions involving the operation, +, -, *, and /, and operating on constants or attributes of records (tuples).

The FROM clause

The FROM clause can allow to select attributes from single table or multiple tables. When multiple tables are applied, It combines the records from the two or more tables listed and presents every possible combination of the listed attributes in SELECT clause.

This is not very useful until some filtering condition is applied. This is achieved through using the WHERE clause.

The WHERE clause

We can use the WHERE clause to filter the result set based on certain conditions. The syntax for using WHERE in the SELECT statement is as follows:

```
SELECT "column_name(s)"  
FROM "table_name(s)"  
WHERE "condition";
```

"Condition" can include a single comparison clause (called simple condition) or multiple comparison clauses combined together using AND or OR operators (compound condition). Conditions can include other operators like IN, BETWEEN, DISTINCT etc shown in Table 1:

Operator	Description	Example
=	Equal to	Author = 'Alcott'
<>	Not equal to (most DBMS also accept != instead of <>)	Dept <> 'Sales'
>	Greater than	Hire_Date > '2012-01-31'
<	Less than	Bonus < 50000.00
>=	Greater than or equal	Dependants >= 2
<=	Less than or equal	Rate <= 0.05
BETWEEN	Between an inclusive range	Cost BETWEEN 100.00 AND 500.00
LIKE	Match a character pattern	First_Name LIKE 'Will%'
IN	Equal to one of multiple possible values	DeptCode IN (101, 103, 209)
DISTINCT	Force the elimination of duplicates,	SELECT DISTINCT employee_name

Table 1: List of Basic Operators available in SQL



2. Ordering data

The order of rows returned in a query result is undefined. The ORDER BY clause can be used to sort the rows. This clause comes last in the SELECT statement. ASC at the end of the ORDER BY clause specifies ascending order where as DESC specifies descending order. ASC is the default order. The syntax for an ORDER BY statement is as follows:

```
SELECT "column_name"  
FROM "table_name"  
[WHERE "condition"]  
ORDER BY "column_name" [ASC, DESC];
```

3. The Wildcard operators

There are times when we want to match on a string pattern. To do that, we will need to employ the concept of wildcard. In SQL, there are two wildcards:

- % (percent sign) represents zero, one, or more characters.
- _ (underscore) represents exactly one character.

Wildcards are used with the LIKE keyword in SQL.

Below are some wildcard examples:

- 'A_Z': All string that starts with 'A', another character, and end with 'Z'. For example, 'ABZ' and 'A2Z' would both satisfy the condition, while 'AKKZ' would not (because there are two characters between A and Z instead of one).
- 'ABC%': All strings that start with 'ABC'. For example, 'ABCD' and 'ABCABC' would both satisfy the condition.
- '%XYZ': All strings that end with 'XYZ'. For example, 'WXYZ' and 'ZZXYZ' would both satisfy the condition.
- '%AN%': All strings that contain the pattern 'AN' anywhere. For example, 'LOS ANGELES' and 'SAN FRANCISCO' would both satisfy the condition.
- '_AN%': All strings that contain a character, then 'AN', followed by anything else. For example, 'SAN FRANCISCO' would satisfy the condition, while 'LOS ANGELES' would not satisfy the condition.

Lab Task

Using Sakila Database

Formulate SQL queries for the following needs and execute them on Sakila database.

1. Retrieve first and last name of actors who played in AFRICAN EGG.
2. Retrieve actor id and their names with their addresses.
3. Retrieve names of movies starting with A.
4. Retrieve data of all actors whose names are not starting with Z.
5. Retrieve rental and return date for the movie ALASKA PHANTOM.
6. Find and display the Income (payments) generated during August 2005. Sort them in the descending order.
7. Find and display the Email addresses of customers who haven't paid even a single penny yet.
8. Extract information of actors whose names ends with character 'T'

Deliverable

Submit a PDF document including the SQL queries to answer above-mentioned information needs as well as snapshot of their outcome when executed over MySQL using the Workbench.