Join/Subquery/View

Sang Shin
JPassion.com
“Code with Passion!”

Topics

- Join
- Table relationship
  - Primary key and foreign key
  - Types of relationship
  - Referential integrity
  - Automatic delete and update
- Union
- Subquery
- View

Join

What is Join?

- A SQL JOIN clause combines records from two or more tables to produce a “result set”
  - A JOIN is a means for combining fields from two tables by using values common to each
  - Specified in WHERE clause
- The joined tables are typically related with foreign keys

Types of Join

- Cross join
- Inner join
- Outer join
- Self join

Join:
Cross Join

Cross Join

- Matches each row from one table to every row from another table
  - Cartesian Product
  - Very costly (in terms of CPU time)
  - May take a while to return a large result set - Suppose tables A and B each has 1000 records, the Cartesian product will result in 1000,000 in the result set
  - Rarely used in production environment
- Default
  - If you do not specify how to join rows from different tables, the database server assumes you want Cross Join

Cross Join Examples

```
/* Cross Join Option #1 from “employees” table and “departments” table */
SELECT 'Cross Join', e.ename, e.salary, d.dname
FROM employees AS e, departments AS d;

/* Cross Join Option #2, same as the above*/
SELECT 'Cross Join', e.ename, e.salary, d.dname
FROM employees AS e CROSS JOIN departments AS d;
```

Let's support we have test tables..

```
/* Let's assume we have two tables */

+---------------+-------------+
| department_id | dname       |
+---------------+-------------+
|             1 | Engineering |
|             2 | Sales       |
|             3 | Marketing   |
|             4 | HR          |
+---------------+-------------+
+-------------+-----------+---------------+---------+
| employee_id | enam      | department_id | salary  |
+-------------+-----------+---------------+---------+
|           1 | jack      |             1 | 3000.00 |
|           2 | mary      |             2 | 2500.00 |
|           3 | nichole   |             1 | 4000.00 |
|           4 | angie     |             2 | 5000.00 |
|           5 | jones     |             3 | 5000.00 |
|           6 | newperson |          NULL | 5000.00 |
+-------------+-----------+---------------+---------+
```

Cross Join Result Set

```
+------------+-----------+---------+-------------+
| Cross Join | ename     | salary  | dname       |
+------------+-----------+---------+-------------+
| Cross Join | jack      | 3000.00 | Engineering |
| Cross Join | jack      | 3000.00 | Sales       |
| Cross Join | jack      | 3000.00 | Marketing   |
| Cross Join | jack      | 3000.00 | HR          |
| Cross Join | mary      | 2500.00 | Engineering |
| Cross Join | mary      | 2500.00 | Sales       |
| Cross Join | mary      | 2500.00 | Marketing   |
| Cross Join | mary      | 2500.00 | HR          |
| Cross Join | nichole   | 4000.00 | Engineering |
| Cross Join | nichole   | 4000.00 | Sales       |
| Cross Join | nichole   | 4000.00 | Marketing   |
| Cross Join | nichole   | 4000.00 | HR          |
| Cross Join | angie     | 5000.00 | Engineering |
| Cross Join | angie     | 5000.00 | Sales       |
| Cross Join | angie     | 5000.00 | Marketing   |
| Cross Join | angie     | 5000.00 | HR          |
| Cross Join | jones     | 5000.00 | Engineering |
| Cross Join | jones     | 5000.00 | Sales       |
| Cross Join | jones     | 5000.00 | Marketing   |
| Cross Join | jones     | 5000.00 | HR          |
| Cross Join | newperson | 5000.00 | Engineering |
| Cross Join | newperson | 5000.00 | Sales       |
| Cross Join | newperson | 5000.00 | Marketing   |
| Cross Join | newperson | 5000.00 | HR          |
24 rows in set (0.00 sec)
```

Join:
Inner Join

Inner Join

- Most common (popular) type of Join
  - The most common type of Inner Join is “equi-join” where certain fields of the joined tables are equated to each other using equality (=) operator
- Require a match in each table
  - The match condition is specified with WHERE clause
  - Rows that do not match are excluded from the result set (Difference from Outer Join)

Inner Join Examples

```
/* The following Inner Join statements are equivalent */

/* Inner Join Option #1 */
SELECT 'Inner Join', employees.ename, employees.salary, departments.dname
FROM employees, departments
WHERE employees.department_id=departments.department_id;

/* Inner Join Option #2 */
SELECT 'Inner Join', employees.ename, employees.salary, departments.dname
FROM employees
JOIN departments
WHERE employees.department_id=departments.department_id;

/* Inner Join Option #3 */
SELECT 'Inner Join', employees.ename, employees.salary, departments.dname
FROM employees
INNER JOIN departments
WHERE employees.department_id=departments.department_id;

/* Inner Join Option #4 */
SELECT 'Inner Join', employees.ename, employees.salary, departments.dname
FROM employees
INNER JOIN departments
ON employees.department_id=departments.department_id;
```

Inner Join Result Set

```
+-------------+-----------+------------+-------------+
| Inner Join | ename    | salary     | dname        |
+-------------+-----------+-----------+-------------+
| Inner Join | jack        | 3000.00 | Engineering |
| Inner Join | nichole   | 4000.00 | Engineering |
| Inner Join | mary       | 2500.00 | Sales           |
| Inner Join | angie      | 5000.00 | Sales          |
| Inner Join | jones      | 5000.00 | Marketing   |
+------------+---------+---------+------------+
5 rows in set (0.00 sec)
```

Join:
Outer Join

Outer Join

- All records from one side of the Join are included in the result set regardless of whether they match records on the other side of the Join
  - Difference from Inner Join
- LEFT JOIN or RIGHT JOIN depending which side of the Join is “all included”
  - LEFT JOIN: All records of the table on the left side of the Join will be included
  - RIGHT JOIN: All records of the table on the right side of the Join will be included

OUTER LEFT JOIN Example

```
/* Outer Join could be either LEFT JOIN or RIGHT JOIN */

/* Outer Join #1 - LEFT JOIN */
/* All records of the "employees" table
 * are included in the result set because the "employees" table is
 *  left side of the JOIN */
SELECT 'Outer Join - LEFT JOIN ', employees.ename, employees.salary, departments.dname
FROM employees
LEFT JOIN departments
ON employees.department_id=departments.department_id;
```

OUTER LEFT JOIN Result Set

```
// Notice that all records of employees
// table are included in the result set regardless of the match because
// employees table is the left side of the outer left join.
+----------------------------+---------------+-----------+----------------+
| Outer Join - LEFT JOIN  | ename        | salary    | dname           |
+----------------------------+---------------+-----------+----------------+
| Outer Join - LEFT JOIN  | jack           | 3000.00 | Engineering |
| Outer Join - LEFT JOIN  | mary          | 2500.00 | Sales             |
| Outer Join - LEFT JOIN  | nichole       | 4000.00 | Engineering |
| Outer Join - LEFT JOIN  | angie         | 5000.00 | Sales             |
| Outer Join - LEFT JOIN  | jones         | 5000.00 | Marketing     |
| Outer Join - LEFT JOIN  | newperson | 5000.00 | NULL             |
+----------------------------+---------------+------------+---------------+
6 rows in set (0.00 sec)
```

OUTER RIGHT JOIN Examples

```
/* Outer Join could be either LEFT JOIN or RIGHT JOIN */

/* Outer Join #2 - RIGHT JOIN */
/* All records (actually fields of the records) of the "departments" table
 * are included in the result set because the "departments" table is
 * right side of the JOIN */
SELECT 'Outer Join - RIGHT JOIN', employees.ename, employees.salary, departments.dname
FROM employees
RIGHT JOIN departments
ON employees.department_id=departments.department_id;
```

OUTER RIGHT JOIN Result Set

```
// Notice that all records of departments
// table are included in the result set regardless of the match because
// the departments table is the right side of the outer right join.
+--------------------------+--------------+----------+--------------+
| Outer Join - RIGHT JOIN | ename        | salary   | dname        |
+--------------------------+--------------+----------+--------------+
| Outer Join - RIGHT JOIN | jack         | 3000.00 | Engineering |
| Outer Join - RIGHT JOIN | nichole      | 4000.00 | Engineering |
| Outer Join - RIGHT JOIN | mary         | 2500.00 | Sales        |
| Outer Join - RIGHT JOIN | angie        | 5000.00  | Sales        |
| Outer Join - RIGHT JOIN | jones        | 5000.00  | Marketing   |
| Outer Join - RIGHT JOIN | NULL         |   NULL   | HR           |
+--------------------------+--------------+----------+--------------+
6 rows in set (0.00 sec)
```

Lab:

Exercise 1: “Joins”
1612_mysql_join.zip

Table Relationship:
Primary key and Foreign key

Primary key and Foreign key

- A primary key is a field or combination of fields that uniquely identify a record (row) in a table
- A foreign key (sometimes called a referencing key) is a key used to link two tables together
- Typically you take the primary key field from one table and insert it into the other table where it becomes a foreign key

Primary key and Foreign key Example

```
/* Create departments table */
CREATE TABLE departments (
    department_id int(11) NOT NULL AUTO_INCREMENT,
    dname varchar(255) NOT NULL,
    PRIMARY KEY  (department_id)
) ENGINE=InnoDB;


/* Create "employees" table with FOREIGN KEY */
 CREATE TABLE employees (
    employee_id int(11) NOT NULL AUTO_INCREMENT,
    ename varchar(255) NOT NULL,
    d_id int(11) NOT NULL,
    salary decimal(7,2) NOT NULL,
    PRIMARY KEY  (employee_id),
    FOREIGN KEY (d_id) REFERENCES departments (department_id)
) ENGINE=InnoDB;
```

Table Relationship:
Types of relationship

Types of Relationship

- One-to-one (1-1)
- One-to-many (1-n)
- Many-to-many (n-m)

One-to-One Relationship

- Example: A person has only one primary address
- “person” table has 1-1 relationship with “primary-address” table
- The “primary-address” table has a foreign key field referring to the primary key field of the “person” table

One-to-One Relationship Example

```
/* Create "person" table */
CREATE TABLE person (
    person_id INT NOT NULL AUTO_INCREMENT,
    pname varchar(255) NOT NULL,
    PRIMARY KEY  (person_id)
) ENGINE=InnoDB;


/* Create "primary_address" table with FOREIGN KEY */
 CREATE TABLE primary_address (
    primary_address_id INT NOT NULL,
    address varchar(255) NOT NULL,
    p_id INT NOT NULL,
    PRIMARY KEY  (primary_address_id),
    FOREIGN KEY (p_id) REFERENCES person (person_id)
) ENGINE=InnoDB;
```

One-to-One Relationship Example

```
+-------------+----------------+
| person_id | pname          |
+-------------+----------------+
|              1 | Sang Shin     |
|              2 | Casey Jones  |
|              3 | Bull Fighter   |
|              4 | Passion You  |
+-------------+------------------+

+-------------------------+-------------------------+------+
| primary_address_id | address                      | p_id |
+-------------------------+-------------------------+------+
|                              11 | 11 dreamland       |    1 |
|                              12 | 5 king road          |    2 |
|                              13 | 67 nichole st         |    3 |
|                              14 | 32 Washington st  |    4 |
+-----------------------+---------------------------+------+
```

One-to-Many (1-n) Relationship

- Example: A department has many employees and an employee belongs to only a single department
- “department” table has 1-n relationship with “employee” table
- The “employee” table has a foreign key field referring to the primary key field of the “department” table

One-to-Many Relationship Example

```
/* Create departments table */
CREATE TABLE departments (
    department_id int(11) NOT NULL AUTO_INCREMENT,
    dname varchar(255) NOT NULL,
    PRIMARY KEY  (department_id)
) ENGINE=InnoDB;


/* Create "employees" table with FOREIGN KEY */
 CREATE TABLE employees (
    employee_id int(11) NOT NULL AUTO_INCREMENT,
    ename varchar(255) NOT NULL,
    d_id int(11) NOT NULL,
    salary decimal(7,2) NOT NULL,
    PRIMARY KEY  (employee_id),
    FOREIGN KEY (d_id) REFERENCES departments (department_id)
) ENGINE=InnoDB;
```

One-to-Many Relationship Example

```
+---------------+-------------+
| department_id | dname       |
+---------------+-------------+
|             1 | Engineering |
|             2 | Sales       |
|             3 | Marketing   |
|             4 | HR          |
+---------------+-------------+

+-------------+---------+------+---------+
| employee_id | ename   | d_id | salary  |
+-------------+---------+------+---------+
|           1 | jack    |    1 | 3000.00 |
|           2 | mary    |    2 | 2500.00 |
|           3 | nichole |    1 | 4000.00 |
|           4 | angie   |    2 | 5000.00 |
|           5 | jones   |    3 | 5000.00 |
+-------------+---------+------+---------+
```

Many-to-Many (n-m) Relationship

- Example: A student takes many courses and each course has many students
- “student” and “course” has m-n relationship with each other
- Need a join table (intersection table) called “student-course”
  - “student-course” table has foreign key fields to both “student” and “course” tables
  - “student-course” table's primary key is typically composite of the student's and course's primary keys
  - “student-course” table can contain other fields of its own such as “course registration date”

Many-to-Many Relationship Example

```
/* Create student table */
CREATE TABLE student (
    student_id INT NOT NULL AUTO_INCREMENT,
    sname varchar(255) NOT NULL,
    PRIMARY KEY  (student_id)
) ENGINE=InnoDB;


/* Create course table */
CREATE TABLE course (
    course_id INT NOT NULL AUTO_INCREMENT,
    cname varchar(255) NOT NULL,
    PRIMARY KEY  (course_id)
) ENGINE=InnoDB;
```

Many-to-Many Relationship Example

```
/* Create "student_course" join table with FOREIGN KEY to
 * both student and course tables. */
CREATE TABLE student_course (
    s_id INT NOT NULL,
    c_id INT NOT NULL,
    PRIMARY KEY  (s_id, c_id),
    FOREIGN KEY (s_id) REFERENCES student (student_id),
    FOREIGN KEY (c_id) REFERENCES course (course_id)
) ENGINE=InnoDB;
```

Many-to-Many Relationship Example

```
+-----------+---------------------+
| course_id | cname               |
+-----------+---------------------+
|        11 | Computer Science 101 |
|        22 | MySQL               |
|        33 | Java programming    |
+-----------+---------------------+
3 rows in set (0.00 sec)

+------------+---------+
| student_id | sname   |
+------------+---------+
|          1 | jack    |
|          2 | mary    |
|          3 | nichole |
|          4 | mike    |
+------------+---------+
4 rows in set (0.00 sec)
```

Many-to-Many Relationship Example

```
+------+------+
 s_id | c_id |
+------+------+
|    1 |   11 |
|    1 |   22 |
|    3 |   22 |
|    4 |   22 |
+------+------+
```

Lab:

Exercise 2: Foreign Keys
1612_mysql_join.zip

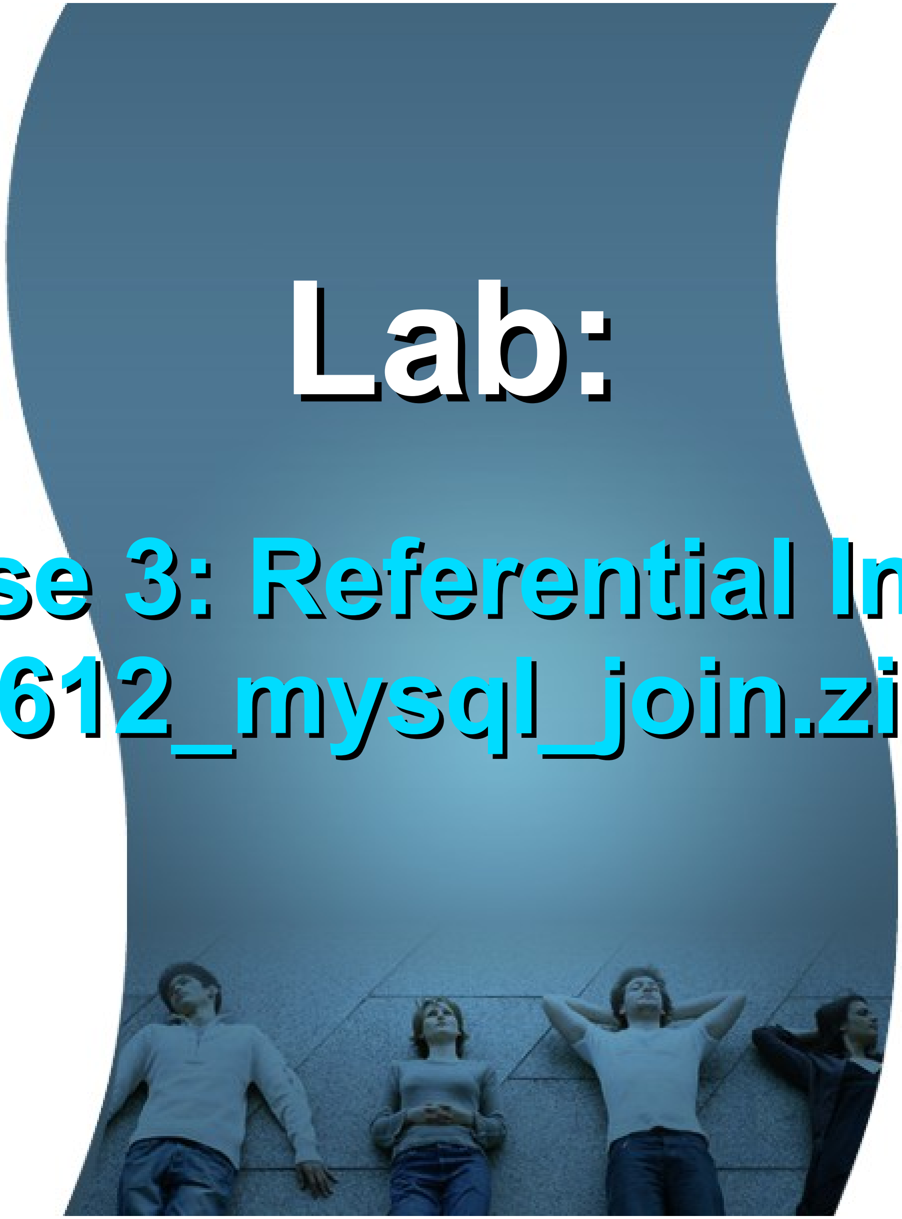
Table Relationship:
Referential Integrity

What is Referential Integrity?

- FOREIGN KEY constraint specifies that the data in a foreign key must match the data in the primary key of the linked table
- The “d_id” foreign key field of the “employees” table must contain a valid department number
  - You cannot add a new employee which has a d_id value that is not existent in department table
- The departments table cannot be dropped as long as there is a employee whose foreign key refers to it

Referential Integrity Example

```
+---------------+-------------+
| department_id | dname       |
+---------------+-------------+
|             1 | Engineering |
|             2 | Sales       |
|             3 | Marketing   |
|             4 | HR          |
+---------------+-------------+
+-------------+--------+------+---------+
| employee_id | ename  | d_id | salary  |
+-------------+--------+------+---------+
|           1 | jack   |    1 | 3000.00 |
|           2 | mary   |    2 | 2500.00 |
|           3 | nichole|    1 | 4000.00 |
|           4 | angie  |    2 | 5000.00 |
|           5 | jones  |    3 | 5000.00 |
+-------------+--------+------+---------+
mysql> INSERT INTO employees(employee_id, ename, salary, d_id)
    -> VALUES (6, 'newperson', '5000.00', 10);
ERROR 1452 (23000): Cannot add or update a child row: a foreign key constraint fails (`mydb`.`employees`,
CONSTRAINT `employees_ibfk_1` FOREIGN KEY (`d_id`) REFERENCES `departments` (`department_id`))
```



Lab:

Exercise 3: Referential Integrity 1612_mysql_join.zip

Table Relationship: Automatic Delete and Update

Automatic Delete and Update

- The ON DELETE CASCADE or ON UPDATE CASCADE clause to the FOREIGN KEY .. REFERENCES modifier enabled automatic deletion or update of the records

```
/* Create "employees" table with FOREIGN KEY */
CREATE TABLE employees (
    employee_id int(11) NOT NULL AUTO_INCREMENT,
    ename varchar(255) NOT NULL,
    d_id int(11) NOT NULL,
    salary decimal(7,2) NOT NULL,
    PRIMARY KEY  (employee_id),
    FOREIGN KEY (d_id) REFERENCES departments (department_id)
    ON DELETE CASCADE
    ON UPDATE CASCADE
) ENGINE=InnoDB;
```

Automatic Delete Example

```
mysql> DELETE FROM departments WHERE department_id = 2;
Query OK, 1 row affected (0.05 sec)

mysql> SELECT * FROM departments;
+---------------+-------------+
| department_id | dname       |
+---------------+-------------+
|             3 | Marketing   |
|             4 | HR          |
|            11 | Engineering |
+---------------+-------------+
3 rows in set (0.00 sec)

// Observe that the employee record whose foreign key is 2 are automatically deleted.
mysql> SELECT * FROM employees;
+-------------+---------+------+---------+
| employee_id | ename   | d_id | salary  |
+-------------+---------+------+---------+
|           1 | jack    |   11 | 3000.00 |
|           3 | nichole |   11 | 4000.00 |
|           5 | jones   |    3 | 5000.00 |
+-------------+---------+------+---------+
3 rows in set (0.00 sec)
```

Lab:

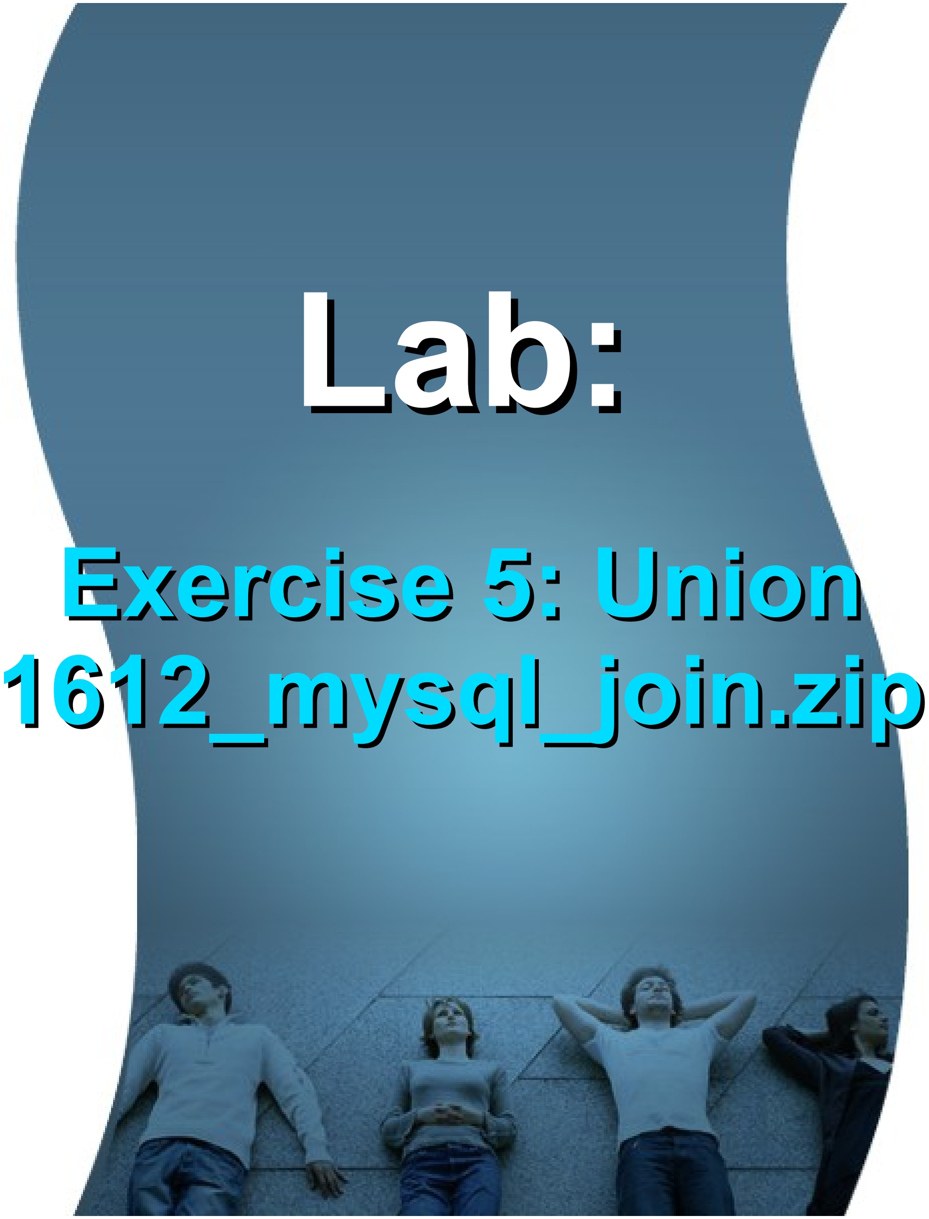
Exercise 4: Automatic Delete/Update
1612_mysql_join.zip

Union

Union

- UNION is used to combine the result from multiple SELECT statements into a single result set

```
/* Combine the output of multiple SELECT */
SELECT ename, salary FROM HighSalaryEmployees
UNION
SELECT ename, salary FROM LowSalaryEmployees;
```



Lab:

Exercise 5: Union

1612_mysql_join.zip

Subquery

What is Subquery?

- A subquery is a SELECT statement within another statement except that its result set always returns a single column containing one or more values
- A subquery can be used anywhere an expression can be used
- A subquery must always appear within parentheses

Why Subquery?

- They allow queries that are structured so that it is possible to isolate each part of a statement.
- They provide alternative ways to perform operations that would otherwise require complex joins and unions.
- They are, in general, more readable than complex joins or unions.

Sunquery Example #1

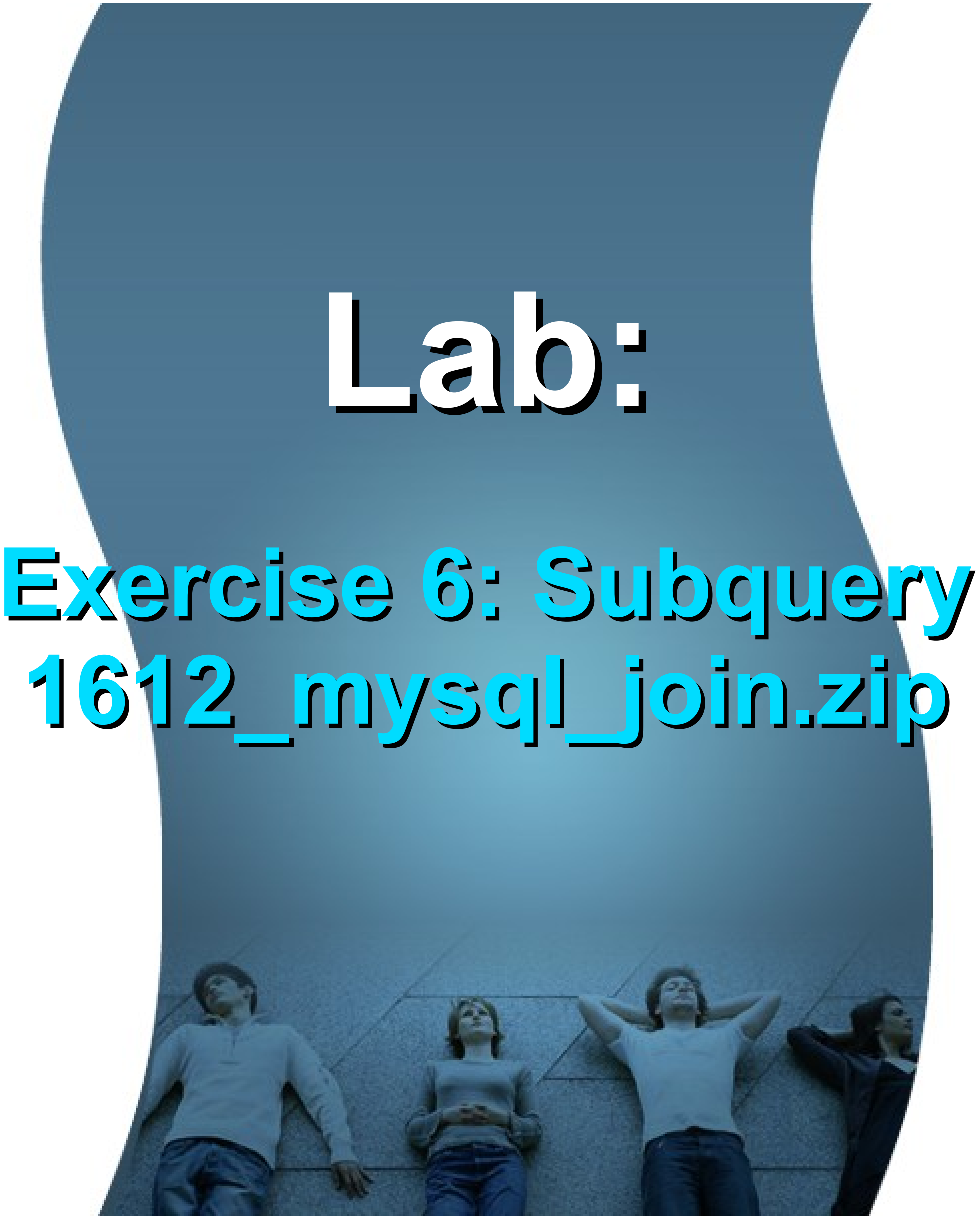
```
SELECT ename, salary FROM employees
WHERE salary >
    (SELECT AVG(salary) FROM employees);

+-----------+---------+
| ename     | salary  |
+-----------+---------+
| nichole   | 4000.00 |
| angie     | 5000.00 |
| jones     | 5000.00 |
+-----------+---------+
```

Sunquery Example #2

```
SELECT ename, salary FROM employees
WHERE d_id =
    (SELECT department_id FROM departments
     WHERE dname = 'Sales');
```

```
+-------+---------+
| name  | salary  |
+-------+---------+
| mary  | 2500.00 |
| angie | 5000.00 |
+-------+---------+
2 rows in set (0.00 sec)
```



Lab:

Exercise 6: Subquery
1612_mysql_join.zip

View

What is a View?

- A view is a virtual table which is composed of result set of a SELECT query.
- Because view is like the table which consists of row and column so you can retrieve and update data on it in the same way with table.
- When the tables which are the source data of a view changes; the data in the view change also

Why View?

- When a complex query is called repeatedly, it would be beneficial to create a virtual table (view)

View Example

```
CREATE VIEW v_HighSalaryEmployees AS
  SELECT ename, salary FROM employees
  WHERE salary > 4000;

CREATE VIEW v_LowSalaryEmployees AS
  SELECT ename, salary FROM employees
  WHERE salary < 3000;

mysql> SELECT * from v_HighSalaryEmployees;
+--------+---------+
| ename  | salary  |
+--------+---------+
| angie | 5000.00 |
| jones | 5000.00 |
+--------+---------+
2 rows in set (0.00 sec)
```

Lab:

Exercise 7: View 1612_mysql_join.zip

Code with Passion!
JPassion.com