Join

"Code with Passion!"

Topics

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

Join

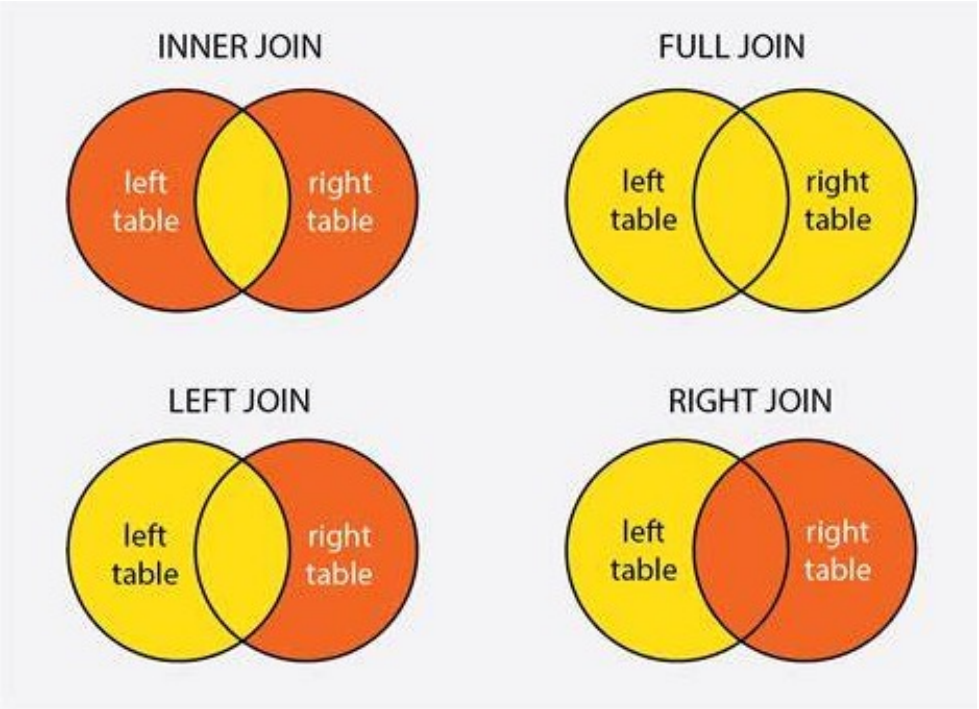
What is Join?

- 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 ON clause

- The joined tables are typically related with foreign keys

Types of Join

- Cross join
- Inner join
- Outer join
  - Left Outer join
  - Right Outer join
  - Full Outer join



Note: MySQL does not support Full Outer Join
but you can simulate it by using UNION – basically
unionizing the Left Outer join and Right Outer 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

Cross Join Examples

```
/* 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 | NULL        |
| Cross Join | newperson | 5000.00 | NULL        |
| Cross Join | newperson | 5000.00 | NULL        |
| Cross Join | newperson | 5000.00 | NULL        |
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 ON or USING 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
INNER JOIN departments
ON employees.department_id=departments.department_id;

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

/* Inner Join Option #3  - Use USING instead of ON */
SELECT 'Inner Join', employees.ename, employees.salary, departments.dname
FROM employees
INNER JOIN departments
USING (department_id);

/* Inner Join Option #4 */
SELECT 'Inner Join', employees.ename, employees.salary, departments.dname
FROM employees, departments
WHERE 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)
```

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 n-m 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

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 if there is an 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`))
```

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)
```

Code with Passion!