Paper 72-27

A Visual Introduction to SQL Joins

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Abstract

Real systems rarely store all their data in one large table. To do so would require maintaining several duplicate copies of the same values and could threaten the integrity of the data. Instead, IT departments everywhere almost always divide their data among several different tables. Because of this, a method is needed to simultaneously access two or more tables to help answer the interesting questions about our data. This paper visually illustrates how a join process works and then shows how an SQL query is constructed so some or all of the specified tables contents can be brought together.

Introduction

Joining two or more tables of data is a powerful feature found in the relational model and the SQL procedure. Information in a database system is rarely stored in a single table because it would result in the duplication of data values. A duplicated data value is not only inefficient, but also makes for more complex queries and updates. As a result, data is split between two or more tables.

The SQL procedure is a simple and flexible tool for joining tables of data together. This paper presents the importance of joins, how joins are performed without a WHERE clause, with a WHERE clause, using table aliases, and with three tables of data. Certainly many of these techniques can be accomplished using other methods, but the simplicity and flexibility found in the SQL procedure makes it especially interesting, if not indispensable, as a tool for the information practitioner.

Why join Anyway?

As relational database systems continue to grow in popularity, the need to access normalized data that has been stored in separate tables becomes increasingly important. By relating matching values in key columns in one table with key columns in two or more tables, information can be retrieved as if the data were stored in one huge file. Consequently, the process of joining data from two or more tables can provide new and exciting insights between data relationships.

SQL Joins

A join of two or more tables provides a means of gathering and manipulating data in a single SELECT statement. A "JOIN" statement does not exist in the SQL language. The way two or more tables are joined is to specify the tables names in a WHERE clause of a SELECT statement. A comma separates each table specified in an inner join.

Joins are specified on a minimum of two tables at a time, where a column from each table is used for the purpose of connecting the two tables. Connecting columns should have ***"like"*** values and the same datatype attributes since the join's success is dependent on these values.

Example Tables

A relational database is simply a collection of tables. Each table contains one or more columns and one or more rows of data. The examples presented in this paper apply an example database consisting of three tables: CUSTOMERS, MOVIES, and ACTORS. Each table appears below.

CUSTOMERS

CUST_NO	NAME	CITY	STATE
11321	John Smith	Miami	FL
44555	Alice Jones	Baltimore	MD
21713	Ryan Adams	Atlanta	GA

MOVIES

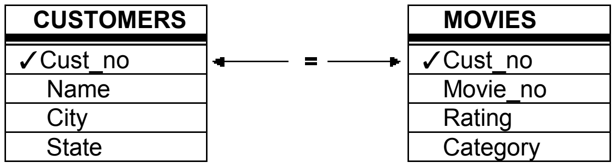
CUST_NO	MOVIE_NO	RATING	CATEGORY
44555	1011	PG-13	Adventure
21713	3090	G	Comedy
44555	2198	G	Comedy
37753	4456	PG	Suspense

ACTORS

MOVIE_NO	LEAD_ACTOR
1011	Mel Gibson
2198	Clint Eastwood
3090	Sylvester Stallone

Joining Two Tables with a Where Clause

Joining two tables together is a relatively easy process in SQL. To illustrate how a join works, a two-table join is linked in the following diagram.



The following SQL code references a join on two tables with CUST_NO specified as the connecting column.

```
PROC SQL;
  SELECT *
    FROM CUSTOMERS, MOVIES
      WHERE CUSTOMERS.CUST_NO  =
                 MOVIES.CUST_NO;
QUIT;
```

In this example, tables CUSTOMERS and MOVIES are used. Each table has a common column, CUST_NO which is used to connect rows together from each when the value of CUST_NO is equal, as specified in the WHERE clause. A WHERE clause restricts what rows of data will be included in the resulting join.

Creating a Cartesian Product

When a WHERE clause is omitted, all possible combinations of rows from each table is produced. This form of join is known as the ***Cartesian Product***. Say for example you join two tables with the first table consisting of 10 rows and the second table with 5 rows. The result of these two tables would consist of 50 rows. Very rarely is there a need to perform a join operation in SQL where a WHERE clause is not specified. The primary importance of being aware of this form of join is to illustrate a base for all joins. Visually, the two tables would be combined without a corresponding WHERE clause as illustrated in the following diagram. Consequently, no connection between common columns exists.

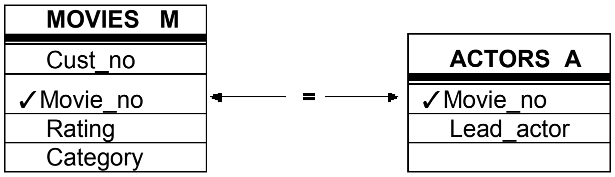
CUSTOMERS
Cust_no
Name
City
State
MOVIES
Cust_no
Movie_no
Rating
Category

To inspect the results of a Cartesian Product, you could submit the same code as before but without the WHERE clause.

```
PROC SQL;
  SELECT *
    FROM CUSTOMERS, MOVIES;
QUIT;
```

Table Aliases

Table aliases provide a "short-cut" way to reference one or more tables within a join operation. One or more aliases are specified so columns can be selected with a minimal number of keystrokes. To illustrate how table aliases in a join works, a two-table join is linked in the following diagram.



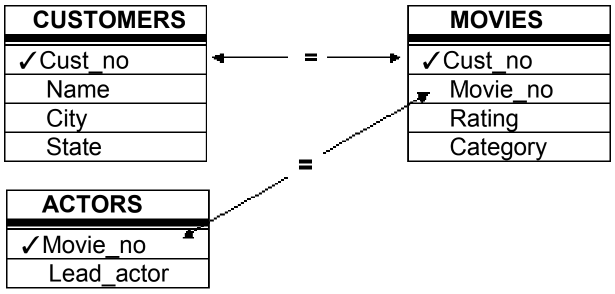
The following SQL code illustrates a join on two tables with MOVIE_NO specified as the connecting column. The table aliases are specified in the SELECT statement as qualified names, the FROM clause, and the WHERE clause.

```
PROC SQL;
  SELECT M.MOVIE_NO,
         M.RATING,
         A.LEADING_ACTOR
    FROM MOVIES M, ACTORS A
      WHERE M.MOVIE_NO  =
            A.MOVIE_NO;
QUIT;
```

Joining Three Tables

In an earlier example, you saw where customer information was combined with the movies they rented. You may also want to display the leading actor of each movie along with the other information. To do this, you will need to extract information from three different tables: CUSTOMERS, MOVIES, and ACTORS.

A join with three tables follows the same rules as in a two-table join. Each table will need to be listed in the FROM clause with appropriate restrictions specified in the WHERE clause. To illustrate how a three table join works, the following diagram should be visualized.



The following SQL code references a join on three tables with CUST_NO specified as the connecting column for the CUSTOMERS and MOVIES tables, and MOVIE_NO as the connecting column for the MOVIES and ACTORS tables.

```
PROC SQL;
  SELECT C.CUST_NO,
         M.MOVIE_NO,
         M.RATING,
         M.CATEGORY,
         A.LEADING_ACTOR
    FROM CUSTOMERS C,
         MOVIES M,
         ACTORS A
      WHERE C.CUST_NO = M.CUST_NO AND
            M.MOVIE_NO = A.MOVIE_NO;
QUIT;
```

Conclusion
The SQL procedure provides a powerful way to join two or more tables of data. It's easy to learn and use. More importantly, since the SQL procedure follows ANSI (American National Standards Institute) guidelines, your knowledge is portable to other platforms and vendor implementations. The simplicity and flexibility of performing joins with the SQL procedure makes it an especially interesting, if not indispensable, tool for the information practitioner.

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References
Lafler, Kirk. Ten Great Reasons to Learn the SQL Procedure, SAS Users Group International, 1999.

SAS Guide to the SQL Procedure: Usage and Reference, Version 6, First Edition; SAS Institute, Cary, NC, U.S.A.

Trademark Citations

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Kirk is a SAS Alliance Partner® and SAS Certified Professional® with 25 years of SAS software experience. He has written over one hundred articles for professional journals and SAS User Group proceedings. His popular SAS Tips column appears regularly in the SANDS and SESUG Newsletters. His expertise includes application design and development, training, and programming using base-SAS, SQL, ODS, SAS/FSP, SAS/AF, SCL, FRAME, and SAS/EIS software.

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