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The Fastest Way to Build and Deploy Powerful Web Applications

Slicing and Dicing Data in CF and SQL: Part 2

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Agenda

- Slicing and Dicing Data in Many Ways
- Cross-Referencing Tables (Joins)
- Handling Nulls
- Handling Long Text
- Where to Learn More
- Q&A

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Slicing and Dicing Data in Many Ways

- **As we learned in Part 1, there's more to database processing than simply selecting columns for display. May want to massage the data:**
  - Handling distinct column values
    - Show each distinct lastname for employees
    - Create a phone directory with each lastname listed only once
  - Manipulating data before or after selecting it
    - Show the first 30 characters of a description column
    - Find rows where the year in a date column is a particular year

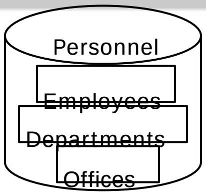
Slicing and Dicing Data in Many Ways (cont.)

- **May also want to:**
  - Cross-reference tables
    - Show each employee and their department
    - Show all employees and their department, even if not assigned to one
    - Show each employee and their manager
  - Handle Nulls
    - Show employees who have not been terminated (TerminationDate column is null)
    - Count how many employees do not live in NYC
  - Handle Long Text Fields
    - Retrieve a column that has thousands of characters

Working with Data in SQL Versus ColdFusion

- **SQL provides the means to do each of those tasks**
  - And ColdFusion has some means to do some of them
- **Many developers create complicated CF programs to do what both CF and SQL can enable with simpler constructs**
  - Same problems arise in other web app dev environments
- **Experienced developers will admonish:**
  - Don’t do things in your program that you can better do in SQL
  - The challenge is deciding which to use
- **This seminar is about:**
  - making maximum use of both CF and SQL for query processing and data manipulation
  - saving time for you and your system
  - creating more effective applications
  - Only 1 topic, though, is CF-specific. Rest is pure SQL

Understanding Relational Database Design



- ***Relational Databases* are comprised of several tables, each storing data about a particular aspect of the subject being described**
- **Goals are:**
  - store only related data in a single table
  - don’t repeat data (don’t store it in more than one place)
  - ensure integrity of data cross-referenced between tables
- **Can be challenging to cross-reference that data**

Understanding Foreign Keys

- **Recall previous examples of GROUPing on Dept column**
  - Assumed that Employees table had DEPT column holding string values for department name

Employees			
EmpID	**Name**	**HireDate**	**Dept**
1	**Bob**	**06-04-98**	**Sales**
2	**Cindy**	**12-01-00**	**Engineering**
3	**John**	**01-01-01**	**Sales**
4	**Beth**	**05-30-99**	**Enginering**

  - Problems with this include:
    - We're storing the same string multiple times on many records
    - If a mistake is made entering a given value, that record will no longer be found in searches on value (see EmpID 4)

Understanding Foreign Keys

- **More appropriate solution:**
  - Have Department table with just a list of each valid Dept and a unique DeptID (that table's primary key)
  - Then in Employees table, simply store that DeptID to indicate an employee's department

Employees			
EmpID	**Name**	**HireDate**	**DeptID**
1	**Bob**	**06-04-98**	**1**
2	**Cindy**	**12-01-00**	**2**
3	**John**	**01-01-01**	**1**
4	**Beth**	**05-30-99**	**2**

Departments	
DeptID	**Dept**
1	**Sales**
2	**Engineering**

- This DeptID in the Employees table is called a *Foreign Key*
  - Since it holds a value that comes from the primary key of another table
  - This is the fundamental aspect of a "relational" design

Cross-Referencing Tables (Joins)

- **Typical Problems:**
  - Show each employee and their department
  - Show all employees and their department, even if not assigned to one
  - Show each employee and their manager
- **May be tempting for beginners to loop through resultset of one query (departments) and search for related records (employees for each dept)**
  - Bad! Bad! Bad!
  - Correct solution is to instead JOIN the tables together
  - There are several kinds of joins, each serving different purposes

Understanding Joins

- **To retrieve data from multiple tables, simply list both tables in FROM clause, such as:**

```
SELECT Name, Dept
FROM Employees, Departments
```

  - Note that if columns of the same name existed in each table, we'd need to prefix the table name to the column
- **Only problem is that this selects all combinations of the values in the two columns**
  - In our example table, would create 8 rows in result
    - 4 employees times 2 departments
  - Not really what we likely wanted
    - Called a *cartesian product* or a *cross join*

Bob	Sales
Cindy	Sales
John	Sales
Beth	Sales
Bob	Engineering
Cindy	Engineering
John	Engineering
Beth	Engineering

Inner Joins

- **Problem: Show each employee and their department**
- **Solution: Perform *Inner Join* of the two tables**
  - indicate columns in each table that share common value. SQL automatically matches them
    - Typically, where one table's foreign key maps to its corresponding primary key in a related table
- **Example:**

```
SELECT Name, Dept
FROM Employees, Departments
WHERE Employees.DeptID = Departments.DeptID
```

- **Correct Result:**

Bob	Sales
Cindy	Engineering
John	Sales
Beth	Engineering

- **Note: the datatype of the columns being joined must match**

Join via WHERE vs JOIN clause

- **ANSI SQL standard (and most databases) supports an alternative means of indicating joins**
  - Rather than indicate joined columns in WHERE clause
    - Use them with JOIN keyword on FROM clause
- **Example:**

```
SELECT Name, Dept
FROM Employees INNER JOIN Departments
ON Employees.DeptID = Departments.DeptID
```

- **Notes:**
  - If INNER keyword is not specified, INNER may be assumed
    - Not true in MS Access
  - Can join more than two tables with additional join clauses (of either format)
    - Any limit will be set by DBMS
    - Practical limit is that performance suffers with too many joins in a single SELECT

Outer Joins

- **With inner join, if value of join columns don't match, records will not be retrieved**
  - Unexpected problems can occur when foreign key is null
- **Assume we had at least one employee with no department indicated (null value for DeptID)**

Employees			
EmpID	**Name**	**HireDate**	**DeptID**
5	**Bill**	**11-22-00**	

  - With inner join, his record will not be displayed at all
    - he has no DeptID to match on DeptIDs in Departments table
  - Could be a real problem if expecting SELECT to show all employees!

Outer Joins

- **Problem: Show all employees and their department, even if not assigned to one**
- **Solution: Perform *Outer Join* of the two tables**
- **Example:**

```
SELECT Name, Dept
FROM Employees LEFT OUTER JOIN Departments
ON Employees.DeptID = Departments.DeptID
```

- **Possible Query Result Set Values:**

Bob	**Sales**
Cindy	**Engineering**
John	**Sales**
Beth	**Engineering**
Bill	

Notes:
  - This example indicated LEFT OUTER JOIN: there are 2 other types
    - LEFT join means retrieve all rows from table on left of JOIN even if they don't have match for join column in right table
  - Creates null values in join columns that did not match

Outer Joins (cont.)

- **WHERE clause syntax for LEFT join:**
  ```
  WHERE ON Employees.DeptID *= Departments.DeptID
  ```
  - Syntax not supported in MS Access
- **Two other kinds of Outer joins:**
  - RIGHT OUTER JOIN retrieves all rows from table on right
    - In current example, that would be useful if we had a row in Departments not pointed to by an employee

Departments	
DeptID	**Dept**
5	**Accounting**

    - A RIGHT join would then show a row in the resultset for Accounting (with name being null)
      - Even though no employees had that DeptID
    - WHERE clause syntax for LEFT join (where supported):
      ```
      WHERE ON Employees.DeptID =* Departments.DeptID
      ```

Outer Joins (cont.)

- **Second kind of Outer join**
  - A FULL OUTER JOIN (or FULL JOIN) retrieves rows from both tables even if join values don't match
    - In current example, would show both:
      - a row for Bill with no department and
      - A row with no employee name for Accounting
  - Not supported in MS Access
  - No equivalent WHERE clause syntax at all

Self-Joins

- **Is possible to join a table to itself**
- **Assume Employees table has column for ManagerID, to indicate each employees manager**
  - Values for that ManagerID column simply point to the EmpID for their manager

Employees				
EmpID	**Name**	**HireDate**	**DeptID**	**ManagerID**
1	Bob	06-04-98	1	5
2	Cindy	12-01-00	2	4
3	John	01-01-01	1	1
4	Beth	05-30-99	2	5
5	Bill	10-10-97		

  - How to show who works for who?

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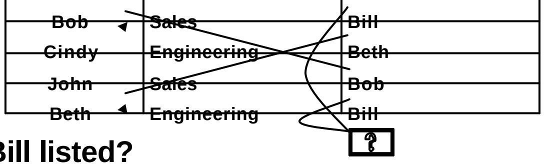
Self-Joins

- **Problem: Show each employee and their manager**
- **Solution: Use self-join (just join table to itself using alias)**
  - There is no SELF keyword
- **Example:**

```
SELECT Employees.Name, Employees.Dept, Mgr.Name
FROM Employees INNER JOIN Employees as Mgr
ON Employees.ManagerID = Mgr.EmpID
```

- **Possible Query Result Set Values:**



Bob	Sales	Bill
Cindy	Engineering	Beth
John	Sales	Bob
Beth	Engineering	Bill

?

- **Note: Why isn't Bill listed?**
  - This was an INNER join. He has null ManagerID
    - We can see from others that he's the boss and has no boss
    - To show him in table, would need OUTER join

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Handling Nulls

- **About Nulls**
  - Columns that have no value are considered NULL
    - Null is not the same as a space or 0 or empty string (""). It's no value at all
  - A column can be defined to not allow nulls
  - Can select which columns are or aren't null with IS NULL or IS NOT NULL in WHERE clause
  - When a column with a null value is selected and referred to the ColdFusion variable for the column, it will appear as an empty string
- **Typical Problems:**
  - Show employees who have not been terminated
  - Count how many employees do not live in NYC

Handling Nulls: Searching for Nulls

- **Problem: Show employees who have not been terminated**
  - Assume TerminationDate is null if not yet terminated
- **Solution: Use IS NULL in WHERE clause**
- **Example:**

```
SELECT *
FROM Employees
WHERE TerminationDate IS NULL
```

Handling Nulls: Negated Searching And Impact of Nulls

- **Problem: Count how many employees do not live in NYC**
  - Be careful selecting records that don't have some given value
  - Tempting to use:
```
Select count(*)
FROM Employees
WHERE City <> 'New York'
```
  - Problem is it doesn't find records that don't have a value for city
    - Consider 200 records: 10 in New York, 5 are null
    - Is answer 185 or 190? Depends on if you think nulls count
      - City <> 'New York' ignores records with null values (null is neither equal to nor not equal to "new york"
- **Solution: May want to add "OR column IS NULL"**
- **Example:**
```
SELECT Count(*)
FROM Employees
WHERE CITY <> 'New York'
OR CITY IS NULL
```

Handling Long Text

- **See Long Text Retrieval Settings for a given ODBC datasource in CF Administrator**
  - Hidden under "CF Settings" button
  - Can enable retrieval of very long text fields
  - Enabling the option will hamper query performance
- **May want to consider creating multiple datasources for same database**
  - one for when retrieving such columns
  - one for when not doing so
- **Place long text fields last in list of columns being SELECTed**

Some Other Tidbits for You to Investigate

- **Nesting multiple joins**
- **TOP, TOP n PERCENT options on SELECT**
- **UNIONs**
- **Nested Subquery**
- **EXISTS predicate**
- **Using NULL in INSERT, UPDATE**

Where to Learn More

- **Version 5 CF manuals:**
  - Installing and Configuring ColdFusion Server
  - Developing ColdFusion Applications
  - CFML Reference
- **Books by Ben Forta:**
  - Teach Yourself SQL in 10 Minutes
  - Certified ColdFusion Developer Study Guide
  - ColdFusion Web Application Construction Kit
  - Advanced ColdFusion Development
- **Many other CF and SQL books available, including**
  - Practical SQL Handbook (new edition available)
  - SQL For Smarties (any Joe Celko book)