



Chapter 7

Introduction to Structured Query Language (SQL)

Subqueries (1 of 3)

- Key characteristics

- *A subquery is a query (SELECT statement) inside another query*
- *A subquery is normally expressed inside parentheses*
- *The first query in the SQL statement is known as the outer query*
- *The query inside the SQL statement is known as the inner query*
- *The inner query is executed first*
- *The output of an inner query is used as the input for the outer query*
- *The entire SQL statement is sometimes referred to as a nested query*

- Subquery can return one or more values

- *One single value (one column and one row)*
- *A list of values (one column and multiple rows)*
- *A virtual table (multicolumn, multirow set of values)*

Subqueries (2 of 3)

- WHERE subqueries
 - *Most common type of subquery uses an inner SELECT subquery on the right side of a WHERE comparison expression*
- IN subqueries
 - *IN operator: used to compare a single attribute to a list of values*
 - *IN subquery: values are not known beforehand, but can be derived using a query*
- HAVING subqueries
 - *HAVING clause: used to restrict the output of a GROUP BY query by applying conditional criteria to the grouped rows*
- Multirow subquery operators: ALL and ANY
 - *ALL operator compares a single value with a list of values returned by the first subquery using a comparison operator other than equals*
 - *ANY operator compares a single value to a list of values and select only the rows greater than or less than any value in the list*

Subqueries (3 of 3)

- FROM subqueries
 - *FROM clause specifies the table(s) from which the data will be drawn*
- Attribute list subqueries
 - *Inline subquery: subquery expression*
 - Example: can be used to list the difference between each product's price and the average product price
- Correlated subquery
 - *Executes once for each row in the outer query*
 - *Inner query is related to the outer query; the inner query references a column of the outer subquery*
 - *Can also be used with the EXISTS special operator*
 - Can be used whenever there is a requirement to execute a command based on the result of another query
 - Can be used with uncorrelated subqueries, but it is almost always used with correlated subqueries

FROM Clause Options (1 of 6)

- FROM clause of the query specifies the table or tables from which the data is to be retrieved
 - *Inner joins return only rows from the tables that match on a common value*
 - *Outer joins return the same matched rows as the inner join, plus unmatched rows from one table or the other*
- Natural join returns all rows with matching values in the matching columns and eliminates duplicate columns
 - *Determines the common attribute(s) by looking for attributes with identical names and compatible data types*
 - *Selects only the rows with common values in the common attribute(s)*
 - *If there are no common attributes, returns the relational product of the two tables*
 - *Syntax:*
`SELECT column-list FROM table1 NATURAL JOIN table2`

FROM Clause Options (2 of 6)

Table 7.5 Creating Links through Foreign Keys		
Table	Attributes To Be Shown	Linking Attribute
PRODUCT	P_DESCRIPT, P_PRICE	V_CODE
VENDOR	V_NAME, V_CONTACT, V_AREACODE, V_PHONE	V_CODE

FROM Clause Options (3 of 6)

- JOIN USING syntax

- *Returns only the rows with matching values in the column indicated in the USING clause—and that column must exist in both tables*
- *Syntax:*
`SELECT column-list FROM table1 JOIN table2 USING (common-column)`

- JOIN ON syntax

- *Express a join when the tables have no common attribute names*
- *Query returns only the rows that meet the indicated join condition*
- *Syntax:*
`SELECT column-list FROM table1 JOIN table2 ON join-condition`

- Common attribute names

- *Most common cause of duplicate column names is the existence of a foreign key*

FROM Clause Options (4 of 6)

FIGURE 7.12 JOIN ON RESULTS

INV_NUMBER	P_CODE	P_DESCRIPTION	LINE_UNITS	LINE_PRICE
1001	13-Q2/P2	7.25-in. pwr. saw blade	1	14.99
1001	23109-HB	Claw hammer	1	9.95
1002	54778-2T	Rat-tail file, 1/8-in. fine	2	4.99
1003	2238/QPD	B&D cordless drill, 1/2-in.	1	38.95
1003	1546-QQ2	Hrd. cloth, 1/4-in., 2x50	1	39.95
1003	13-Q2/P2	7.25-in. pwr. saw blade	5	14.99
1004	54778-2T	Rat-tail file, 1/8-in. fine	3	4.99
1004	23109-HB	Claw hammer	2	9.95
1005	PVC23DRT	PVC pipe, 3.5-in., 8-ft	12	5.87
1006	SM-18277	1.25-in. metal screw, 25	3	6.99
1006	2232/QTY	B&D jigsaw, 12-in. blade	1	109.92
1006	23109-HB	Claw hammer	1	9.95
1006	89-WRE-Q	Hicut chain saw, 16 in.	1	256.99
1007	13-Q2/P2	7.25-in. pwr. saw blade	2	14.99
1007	54778-2T	Rat-tail file, 1/8-in. fine	1	4.99
1008	PVC23DRT	PVC pipe, 3.5-in., 8-ft	5	5.87
1008	WR3/TT3	Steel matting, 4'x8'x1/8", .5" mesh	3	119.95
1008	23109-HB	Claw hammer	1	9.95

FROM Clause Options (5 of 6)

- Outer joins
 - *Returns not only the rows matching the join condition (rows with matching values in the common columns) and returns the rows with unmatched values*
 - *ANSI standard defines three types of outer joins: left, right, and full*
- Cross join
 - *Performs a relational product (also known as the Cartesian product) of two tables*
- Joining tables with an alias
 - *An alias may be used to identify the source table from which the data is taken*
 - *The ability to specify a table alias is very useful*
 - Using a table alias allows the database programmer to improve the maintainability of the code by using a table alias that is descriptive of what data the table is providing within the query
- Recursive joins
 - *Recursive query: joins a table to itself*

<https://www.youtube.com/watch?v=Yh4CrPHVBdE&t=47s>



FROM Clause Options (6 of 6)

FIGURE 7.17 USING AN ALIAS TO JOIN A TABLE TO ITSELF

EMP_NUM	E.EMP_LNAME	EMP_MGR	M.EMP_LNAME
112	Johnson	100	Kolmycz
103	Jones	100	Kolmycz
102	Vandam	100	Kolmycz
101	Lewis	100	Kolmycz
115	Saranda	105	Williams
113	Smythe	105	Williams
111	Washington	105	Williams
107	Diante	105	Williams
106	Smith	105	Williams
104	Lange	105	Williams
116	Smith	108	Wiesenbach
114	Brandon	108	Wiesenbach
110	Genkazi	108	Wiesenbach
109	Smith	108	Wiesenbach

SQL Functions

- SQL functions are very useful tools
 - *Many types*
- Date and time functions
 - *All date functions take one parameter of a date or character data type and return a value; refer to Table 7.10*
- Numeric functions
 - *Can be grouped in many different ways, such as algebraic, trigonometric, and logarithmic; refer to Table 7.11*
- String functions
 - *Among the most-used functions in programming; refer to Table 7.12*
- Conversion functions
 - *Allow you to take a value of a given data type and convert it to the equivalent value in another data type; refer to Table 7.13*

Relational Set Operators (1 of 2)

■ UNION

- *Combines rows from two or more queries without including duplicate rows*
- *Syntax:*
query UNION query

■ UNION ALL

- *Used to produce a relation that retains the duplicate rows*
- *Used to unite more than just two queries*

■ INTERSECT

- *Can be used to combine rows from two queries, returning only the rows that appear in both sets*
- *Syntax:*
query INTERSECT query NOT AVAILABLE ON MYSQL WORKBENCH

Relational Set Operators (2 of 2)

- EXCEPT (MINUS)

- *Combines rows from two queries and returns only the rows that appear in the first set but not in the second*
- *Syntax:*
 - query EXCEPT query*
 - and*
 - query MINUS query*
- *Not supported on MySQL (use Left JOIN and IS NULL)*

- Syntax alternatives

- *Alternative syntax used to achieve the same output*

Crafting SELECT Queries (1 of 2)

- Know your data
 - *The importance of understanding the data model that you are working in cannot be overstated*
 - *Real-world databases are messy; most database systems remain in service in an organization for decades*
- Know the problem
 - *Understand the question you are attempting to answer*
 - *Information reporting requests will come from a range of sources; may be one-time events or ongoing operations within an application*

Crafting SELECT Queries (2 of 2)

- Build one clause at a time
 - *FROM*
 - *WHERE*
 - *GROUP BY*
 - *HAVING*
 - *SELECT*
 - *ORDER BY*

Summary (1 of 2)

- SQL commands can be divided into two overall categories: data definition language (DDL) commands and data manipulation language (DML) commands
- The ANSI standard data types are supported by all RDBMS vendors in different ways
 - *The basic data types are NUMBER, NUMERIC, INTEGER, CHAR, VARCHAR, and DATE*
- The SELECT statement is the main data retrieval command in SQL
- The column list represents one or more column names separated by commas
- Operations that join tables can be classified as inner joins and outer joins
- A natural join returns all rows with matching values in the matching columns and eliminates duplicate columns
- Joins may use keywords such as USING and ON
- The ORDER BY clause is used to sort the output of a SELECT statement

Summary (2 of 2)

- The WHERE clause can be used with the SELECT, UPDATE, and DELETE statements to restrict the rows affected by the DDL command
- Aggregate functions (COUNT, MIN, MAX, and AVG) are special functions that perform arithmetic computations over a set of rows
- Subqueries and correlated queries are used when it is necessary to process data based on other processed data
- Most subqueries are executed in a serial fashion
- SQL functions are used to extract or transform data
- SQL provides relational set operators to combine the output of two queries to generate a new relation
- Crafting effective and efficient SQL queries requires a great deal of skill