

SQL Review

Outer Joins

- Returns rows matching the join condition
- Also returns rows with unmatched attribute values for tables to be joined
- Three types
 - Left
 - Right
 - Full
- Left and right designate order in which tables are processed

Outer Joins (continued)

- Left outer join
 - Returns rows matching the join condition
 - Returns rows in left side table with unmatched values
 - Syntax: `SELECT column-list FROM table1 LEFT [OUTER] JOIN table2 ON join-condition`
- Right outer join
 - Returns rows matching join condition
 - Returns rows in right side table with unmatched values

Advanced SELECT Queries

- Logical operators work well in the query environment
- SQL provides useful functions that:
 - Count
 - Find minimum and maximum values
 - Calculate averages, etc.
- SQL allows user to limit queries to:
 - Entries having no duplicates
 - Entries whose duplicates may be grouped

Ordering a Listing

- ORDER BY clause useful when listing order important
- Syntax:
 SELECT *columnlist*
 FROM *tablelist*
 [WHERE *conditionlist*]
 [ORDER BY *columnlist* [ASC | DESC]];
- Ascending order by default

Listing Unique Values

- DISTINCT clause produces list of only values that are different from one another
- Example:

```
SELECT DISTINCT V_CODE  
FROM   PRODUCT;
```
- Access places nulls at the top of the list
 - Oracle places it at the bottom
 - Placement of nulls does not affect list contents

Aggregate Functions

- COUNT function tallies number of non-null values of an attribute
 - Takes one parameter: usually a column name
- MAX and MIN find highest (lowest) value in a table
 - Compute MAX value in inner query
 - Compare to each value returned by the query
- SUM computes total sum for any specified attribute
- AVG function format similar to MIN and MAX

Grouping Data

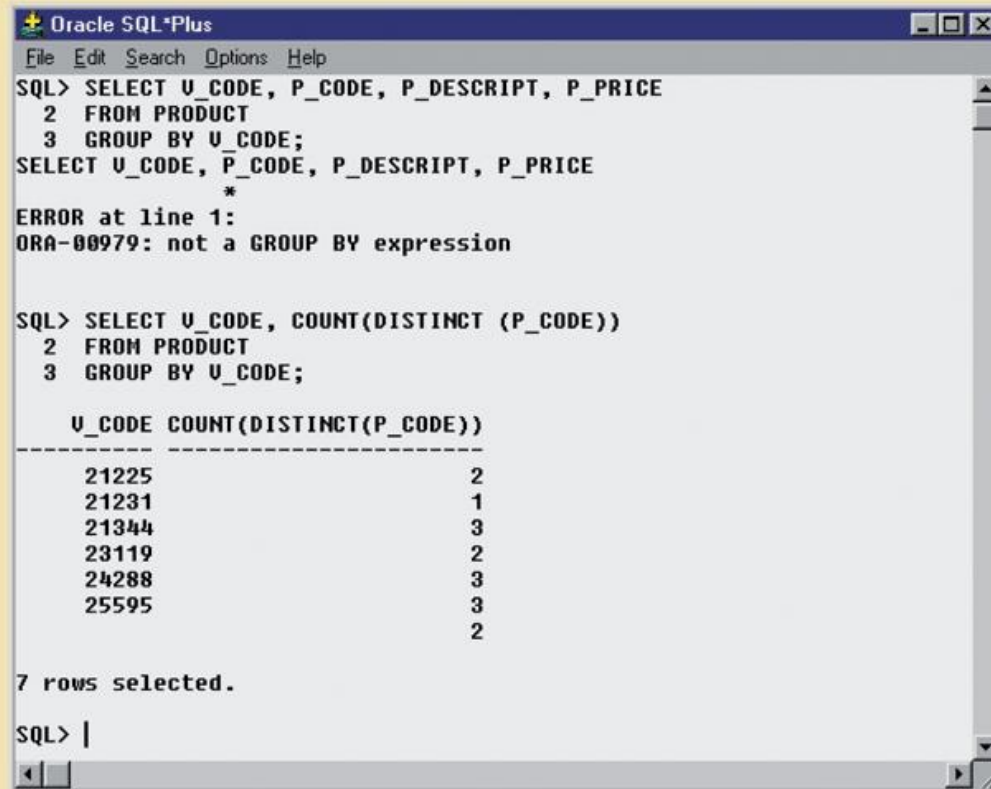
- Frequency distributions created by GROUP BY clause within SELECT statement

- Syntax:

```
SELECT      columnlist
FROM        tablelist
[WHERE      conditionlist]
[GROUP BY  columnlist]
[HAVING     conditionlist]
[ORDER BY  columnlist [ASC | DESC] ] ;
```


FIGURE
7.26

Incorrect and correct use of the GROUP BY clause



```
Oracle SQL*Plus
File Edit Search Options Help
SQL> SELECT U_CODE, P_CODE, P_DESCRIPT, P_PRICE
2 FROM PRODUCT
3 GROUP BY U_CODE;
SELECT U_CODE, P_CODE, P_DESCRIPT, P_PRICE
      *
ERROR at line 1:
ORA-00979: not a GROUP BY expression

SQL> SELECT U_CODE, COUNT(DISTINCT (P_CODE))
2 FROM PRODUCT
3 GROUP BY U_CODE;

  U_CODE COUNT(DISTINCT(P_CODE))
-----
21225           2
21231           1
21344           3
23119           2
24288           3
25595           3
           2

7 rows selected.

SQL> |
```

Subqueries and Correlated Queries

- Often necessary to process data based on other processed data
- Subquery is a query inside a query, normally inside parentheses
- First query is the outer query
 - Inside query is the inner query
- Inner query executed first
- Output of inner query used as input for outer query
- Sometimes referred to as a nested query

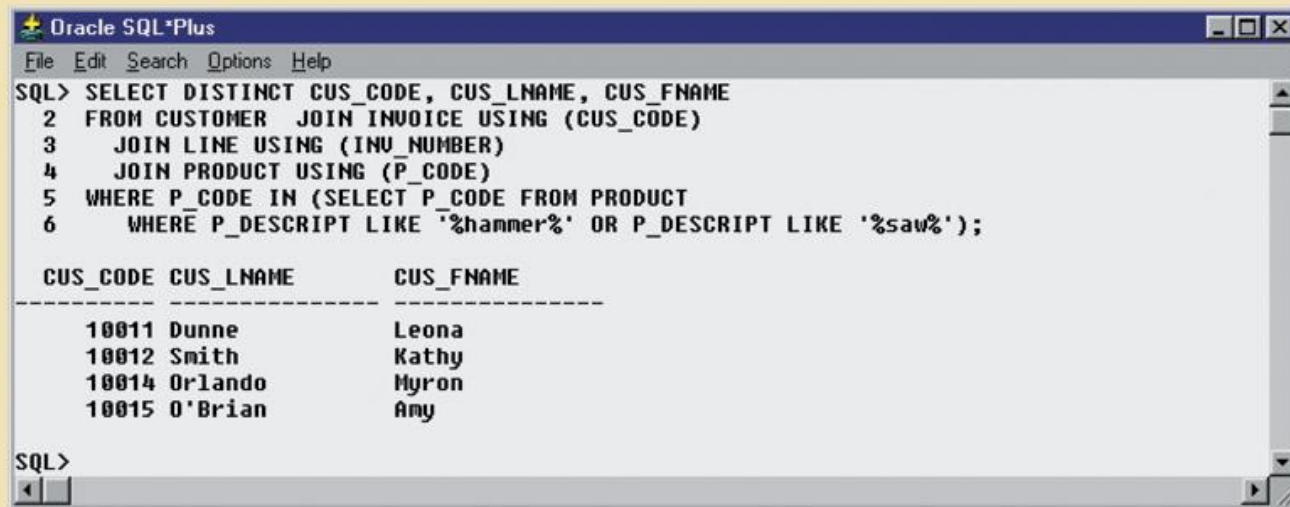
WHERE Subqueries

- Most common type uses inner SELECT subquery on right side of WHERE comparison
 - Requires a subquery that returns only one single value
- Value generated by subquery must be of comparable data type
- Can be used in combination with joins

IN Subqueries

- Used when comparing a single attribute to a list of values

FIGURE 8.14 IN subquery example



The screenshot shows the Oracle SQL*Plus interface. The command window contains the following SQL query:

```
SQL> SELECT DISTINCT CUS_CODE, CUS_LNAME, CUS_FNAME
2  FROM CUSTOMER JOIN INVOICE USING (CUS_CODE)
3  JOIN LINE USING (INU_NUMBER)
4  JOIN PRODUCT USING (P_CODE)
5  WHERE P_CODE IN (SELECT P_CODE FROM PRODUCT
6  WHERE P_DESCRIPT LIKE '%hammer%' OR P_DESCRIPT LIKE '%saw%');
```

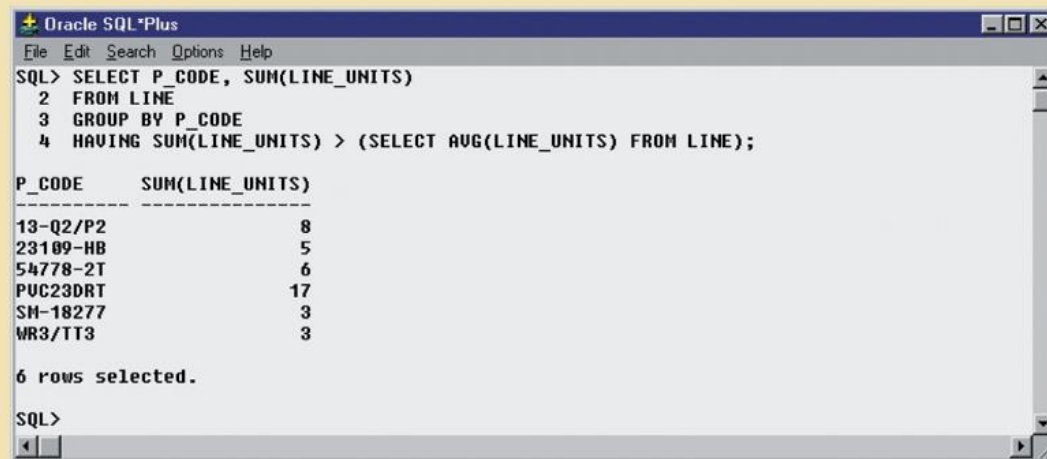
The query results are displayed in a table with three columns: CUS_CODE, CUS_LNAME, and CUS_FNAME. The results are as follows:

CUS_CODE	CUS_LNAME	CUS_FNAME
10011	Dunne	Leona
10012	Smith	Kathy
10014	Orlando	Myron
10015	O'Brian	Amy

HAVING Subqueries

- HAVING clause restricts the output of a GROUP BY query
 - Applies conditional criterion to the grouped

FIGURE 8.15 HAVING subquery example



```
Oracle SQL*Plus
File Edit Search Options Help
SQL> SELECT P_CODE, SUM(LINE_UNITS)
2 FROM LINE
3 GROUP BY P_CODE
4 HAVING SUM(LINE_UNITS) > (SELECT AVG(LINE_UNITS) FROM LINE);

P_CODE      SUM(LINE_UNITS)
-----
13-Q2/P2          8
23109-HB          5
54778-2T          6
PUC23DRT         17
SM-10277          3
WR3/TT3           3

6 rows selected.

SQL>
```

Multirow Subquery Operators: ANY and ALL

- Allows comparison of single value with a list of values using inequality comparison
- “Greater than ALL” equivalent to “greater than the highest in list”
- “Less than ALL” equivalent to “less than lowest”
- Using equal to ANY operator equivalent to IN operator

FROM Subqueries

- Specifies the tables from which the data will be drawn
- Can use SELECT subquery in the FROM clause
 - View name can be used anywhere a table is expected

Attribute List Subqueries

- SELECT statement uses attribute list to indicate columns to project resulting set
 - Columns can be attributes of base tables
 - Result of aggregate function
- Attribute list can also include subquery expression: inline subquery
 - Must return one single value
- Cannot use an alias in the attribute list

Correlated Subqueries

- Subquery that executes once for each row in the outer query
- Correlated because inner query is related to the outer query
 - Inner query references column of outer subquery
- Can also be used with the EXISTS special operator

SQL Functions

- Generating information from data often requires many data manipulations
- SQL functions similar to functions in programming languages
- Functions always use numerical, date, or string value
- Value may be part of a command or attribute in a table
- Function may appear anywhere in an SQL statement

Date and Time Functions

- All SQL-standard DBMSs support date and time functions
- Date functions take one parameter and return a value
- Date/time data types implemented differently by different DBMS vendors
- ANSI SQL standard defines date data types, but not how data types are stored