3. SQL: Structured Query Language

- 3.1 Basic SQL Statement
  - Overview
- 3.2 SQL Select Clauses
  - SELECT statement clauses and aggregate functions
- 3.3 Subqueries
  - WHERE, IN, HAVING, Attribute List, Correlated
- 3.4 Functions, Set Operators, Views, DDL, TCL, DCL

3. SQL: Structured Query Language

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- 3.3 Subqueries
  - WHERE, IN, HAVING, Attribute List, Correlated
- 3.4 DDL, TCL, DCL, Views

Module 3.1 – SQL: Structured Query Language

Learning Outcomes

- Understand and explain SQL statements
- Create and use SQL statements

Textbook Readings

- SQL - Chap 7

Testing*

*Main (but not the only ones) sections of the textbook used for testing are identified in parentheses

- SQL basics (Chap 7.1 – 7.6)

Exercises

- Exercises

Introduction to SQL

- Categories of SQL statements by functions
  - Data definition language (DDL)
  - Data manipulation language (DML)
  - Transaction control language (TCL)
  - Data control language (DCL) … Grant, revoke, …
- SQL Properties
  - Nonprocedural language with basic command
  - Differences in SQL dialects are minor

DDL

COMMAND OR OPTION	DESCRIPTION	COVERED
CREATE SCHEMA AUTHORIZATION	**Creates a database schema**	**Chapter 8**
CREATE TABLE	**Creates a new table in the user's database schema**	**Chapter 8**
NOT NULL	Ensures that a column will not have null values	Chapter 8
UNIQUE	Ensures that a column will not have duplicate values	Chapter 8
PRIMARY KEY	Defines a primary key for a table	Chapter 8
FOREIGN KEY	Defines a foreign key for a table	Chapter 8
DEFAULT	Defines a default value for a column (when no value is given)	Chapter 8
CHECK	Validates data in an attribute	Chapter 8
CREATE INDEX	**Creates an index for a table**	**Chapter 8**
CREATE VIEW	**Creates a dynamic subset of rows and columns from one or more tables**	**Chapter 8**
ALTER TABLE	**Modifies a table's definition (adds, modifies, or deletes attributes or constraints)**	**Chapter 8**
CREATE TABLE AS	**Creates a new table based on a query in the user's database schema**	**Chapter 8**
DROP TABLE	**Permanently deletes a table (and its data)**	**Chapter 8**
DROP INDEX	**Permanently deletes an index**	**Chapter 8**
DROP VIEW	**Permanently deletes a view**	**Chapter 8**

DML Select Statement

COMMAND, OPTION, OR OPERATOR	DESCRIPTION	COVERED
SELECT	**Selects attributes from rows in one or more tables or views**	**Chapter 7**
FROM	Specifies the tables from which data should be retrieved	Chapter 7
WHERE	Restricts the selection of rows based on a conditional expression	Chapter 7
GROUP BY	Groups the selected rows based on one or more attributes	Chapter 7
HAVING	Restricts the selection of grouped rows based on a condition	Chapter 7
ORDER BY	Orders the selected rows based on one or more attributes	Chapter 7
INSERT	**Inserts row(s) into a table**	**Chapter 8**
UPDATE	**Modifies an attribute's values in one or more table's rows**	**Chapter 8**
DELETE	**Deletes one or more rows from a table**	**Chapter 8**
Comparison operators		**Chapter 7**
=, <, >, <=, >=, <>, !=	Used in conditional expressions	Chapter 7
Logical operators		**Chapter 7**
AND/OR/NOT	Used in conditional expressions	Chapter 7
Special operators	**Used in conditional expressions**	**Chapter 7**
BETWEEN	Checks whether an attribute value is within a range	Chapter 7
IN	Checks whether an attribute value matches any value within a value list	Chapter 7
LIKE	Checks whether an attribute value matches a given string pattern	Chapter 7
IS NULL	Checks whether an attribute value is null	Chapter 7
EXISTS	Checks whether a subquery returns any rows	Chapter 7
DISTINCT	Limits values to unique values	Chapter 7
Aggregate functions	**Used with SELECT to return mathematical summaries on columns**	**Chapter 7**
COUNT	Returns the number of rows with non-null values for a given column	Chapter 7
MIN	Returns the minimum attribute value found in a given column	Chapter 7
MAX	Returns the maximum attribute value found in a given column	Chapter 7
SUM	Returns the sum of all values for a given column	Chapter 7
AVG	Returns the average of all values for a given column	Chapter 7

TCL and DCL

Transaction Control Language (TCL) and Data Control Language (DCL).

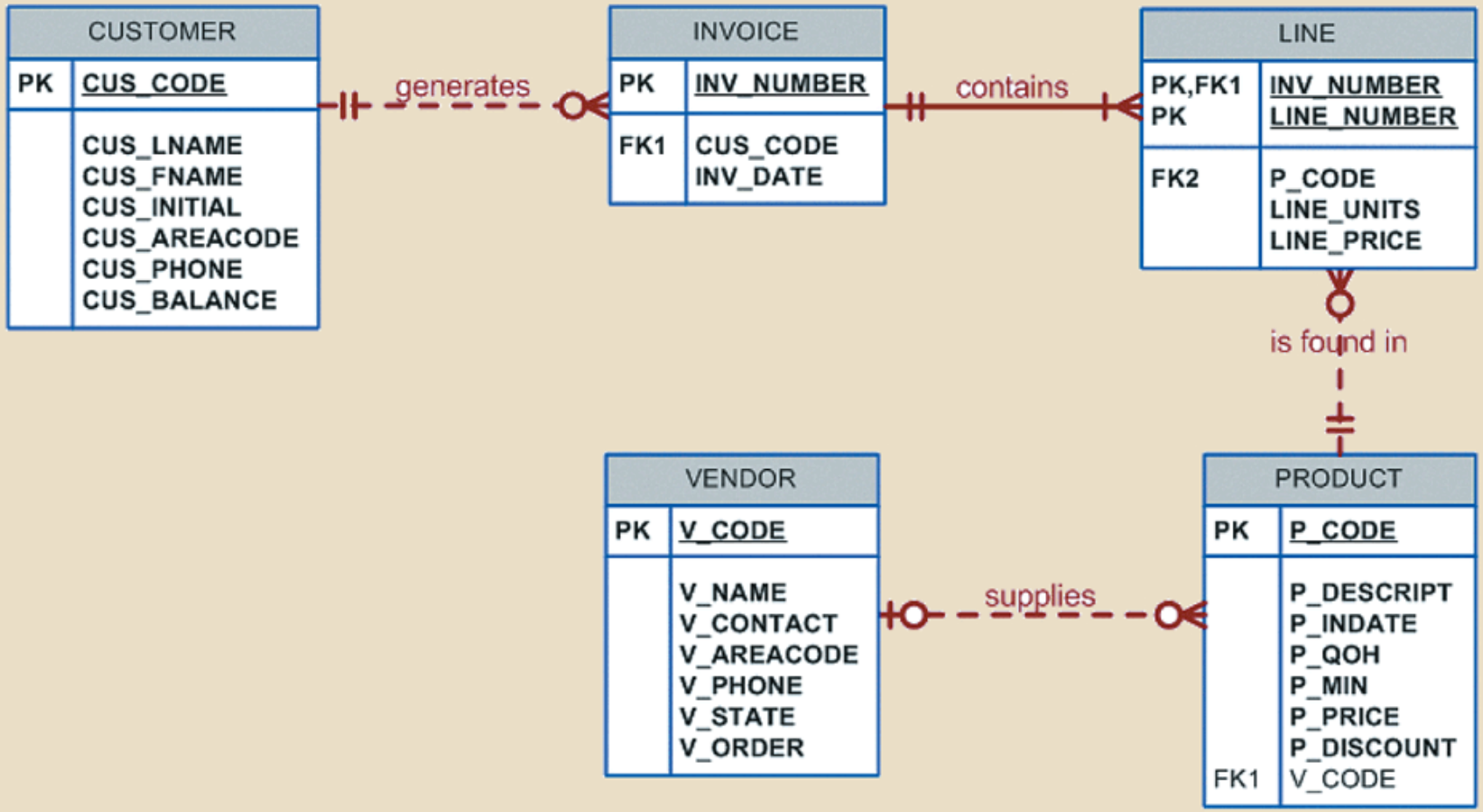
COMMAND OR OPTION	DESCRIPTION	COVERED
Transaction Control Language		
COMMIT	Permanently saves data changes	Chapter 8
ROLLBACK	Restores data to its original values	Chapter 8
Data Control Language		
GRANT	Gives a user permission to take a system action or access a data object	Chapter 16
REVOKE	Removes a previously granted permission from a user	Chapter 16

SQL – Data Types

- Data type: specification about the kinds of data that can be stored in an attribute
  - Influences queries that retrieve data
- Fundamental types of data
  - Character data
  - Numeric data
  - Date data
- SQL query
  - Covers both questions and actions

Sample DB used for Intro to SQL

FIGURE 7.1 THE DATABASE MODEL



Basic SELECT Statement

- Each clause in a SELECT query performs a specific function
  - SELECT: specifies the attributes to be returned by the query
  - FROM: specifies the table(s) from which the data will be retrieved
  - WHERE: filters the rows of data based on provided criteria
  - GROUP BY: groups the rows of data into collections based on sharing the same values in one or more attributes
  - HAVING: filters the groups formed in the GROUP BY clause based on provided criteria
  - ORDER BY: sorts the final query result rows in ascending or descending order based on the values of one or more attributes
- SQL commands can be grouped together on a single line
  - Complex command sequences are best shown on separate lines, with space between the SQL command and the command's components

Basic SELECT Statement … continued

- The SELECT query specifies the columns to be retrieved as a column list
  - Syntax:

    SELECT *columnlist*

    FROM *tablelist;*
  - The columnlist represents one or more attributes, separated by commas
  - A wildcard character is a symbol that can be used as a general substitute for other characters or commands
- Using column aliases
  - Alternative name for a column or table in a SQL statement
- Using computed columns
  - Computed column (also called a calculated column) represents a derived attribute
- Arithmetic operators: the rule of precedence
  - Rules that establish the order in which computations are completed

SQL – Examples: Select All

SELECT * FROM PRODUCT;

FIGURE 7.2 SELECT AN ENTIRE TABLE

P_CODE	P_DESCRIPT	P_INDATE	P_QOH	P_MIN	P_PRICE	P_DISCOUNT	V_CODE
11QER/31	Power painter, 15 psi., 3-nozzle	03-Nov-17	8	5	109.99	0.00	25595
13-Q2/P2	7.25-in. pwr. saw blade	13-Dec-17	32	15	14.99	0.05	21344
14-Q1/L3	9.00-in. pwr. saw blade	13-Nov-17	18	12	17.49	0.00	21344
1546-QQ2	Hrd. cloth, 1/4-in., 2x50	15-Jan-18	15	8	39.95	0.00	23119
1558-QW1	Hrd. cloth, 1/2-in., 3x50	15-Jan-18	23	5	43.99	0.00	23119
2232/QTY	B&D jigsaw, 12-in. blade	30-Dec-17	8	5	109.92	0.05	24288
2232/QWE	B&D jigsaw, 8-in. blade	24-Dec-17	6	5	99.87	0.05	24288
2238/QPD	B&D cordless drill, 1/2-in.	20-Jan-18	12	5	38.95	0.05	25595
23109-HB	Claw hammer	20-Jan-18	23	10	9.95	0.10	21225
23114-AA	Sledge hammer, 12 lb.	02-Jan-18	8	5	14.40	0.05	
54778-2T	Rat-tail file, 1/8-in. fine	15-Dec-17	43	20	4.99	0.00	21344
89-WRE-Q	Hicut chain saw, 16 in.	07-Feb-18	11	5	256.99	0.05	24288
PVC23DRT	PVC pipe, 3.5-in., 8-ft	20-Feb-18	188	75	5.87	0.00	
SM-18277	1.25-in. metal screw, 25	01-Mar-18	172	75	6.99	0.00	21225
SW-23116	2.5-in. wd. screw, 50	24-Feb-18	237	100	8.45	0.00	21231
WR3/TT3	Steel matting, 4'x8'x1/6", .5" mesh	17-Jan-18	18	5	119.95	0.10	25595

SQL – Examples: PROJECT

```
SELECT    P_CODE, P_DESCRIPT, P_PRICE, P_QOH
FROM      PRODUCT;
```

FIGURE 7.3 SELECT WITH A COLUMN LIST

P_CODE	P_DESCRIPT	P_PRICE	P_QOH
11QER/31	Power painter, 15 psi., 3-nozzle	109.99	8
13-Q2/P2	7.25-in. pwr. saw blade	14.99	32
14-Q1/L3	9.00-in. pwr. saw blade	17.49	18
1546-QQ2	Hrd. cloth, 1/4-in., 2x50	39.95	15
1558-QWI	Hrd. cloth, 1/2-in., 3x50	43.99	23
2232/QTY	B&D jigsaw, 12-in. blade	109.92	8
2232/QWE	B&D jigsaw, 8-in. blade	99.87	6
2238/QPD	B&D cordless drill, 1/2-in.	38.95	12
23109-HB	Claw hammer	9.95	23
23114-AA	Sledge hammer, 12 lb.	14.40	8
54778-2T	Rat-tail file, 1/8-in. fine	4.99	43
89-WRE-Q	Hicut chain saw, 16 in.	256.99	11
PVC23DRT	PVC pipe, 3.5-in., 8-ft	5.87	188
SM-18277	1.25-in. metal screw, 25	6.99	172
SW-23116	2.5-in. wd. screw, 50	8.45	237
WR3/TT3	Steel matting, 4'x8'x1/6", .5" mesh	119.95	18

SQL – Examples: Column Aliases

```
SELECT P_CODE, P_DESCRIPT AS DESCRIPTION, P_PRICE AS "Unit Price", P_QOH QTY
FROM PRODUCT;
```

- Not all columns in a query must use an alias
- AS is optional, but recommended
- Aliases that contain a space must be inside a delimiter (quotes)

FIGURE 7.4 SELECT WITH COLUMN ALIASES

P_CODE	DESCRIPTION	Unit Price	QTY
11QER/31	Power painter, 15 psi., 3-nozzle	109.99	8
13-Q2/P2	7.25-in. pwr. saw blade	14.99	32
14-Q1/L3	9.00-in. pwr. saw blade	17.49	18
1546-QQ2	Hrd. cloth, 1/4-in., 2x50	39.95	15
1558-QWI	Hrd. cloth, 1/2-in., 3x50	43.99	23
2232/QTY	B&D jigsaw, 12-in. blade	109.92	8
2232/QWE	B&D jigsaw, 8-in. blade	99.87	6
2238/QPD	B&D cordless drill, 1/2-in.	38.95	12
23109-HB	Claw hammer	9.95	23
23114-AA	Sledge hammer, 12 lb.	14.40	8
54778-2T	Rat-tail file, 1/8-in. fine	4.99	43
89-WRE-Q	Hicut chain saw, 16 in.	256.99	11
PVC23DRT	PVC pipe, 3.5-in., 8-ft	5.87	188
SM-18277	1.25-in. metal screw, 25	6.99	172
SW-23116	2.5-in. wd. screw, 50	8.45	237
WR3/TT3	Steel matting, 4'x8'x1/6", .5" mesh	119.95	18

SQL – Examples: Computed Columns

```
SELECT    P_DESCRIPT, P_QOH, P_PRICE, P_QOH * P_PRICE AS TOTVALUE
FROM      PRODUCT;
```

P_DESCRIPT	P_QOH	P_PRICE	TOTVALUE
Power painter, 15 psi., 3-nozzle	8	109.99	879.92
7.25-in. pwr. saw blade	32	14.99	479.68
9.00-in. pwr. saw blade	18	17.49	314.82
Hrd. cloth, 1/4-in., 2x50	15	39.95	599.25
Hrd. cloth, 1/2-in., 3x50	23	43.99	1011.77
B&D jigsaw, 12-in. blade	8	109.92	879.36
B&D jigsaw, 8-in. blade	6	99.87	599.22
B&D cordless drill, 1/2-in.	12	38.95	467.40
Claw hammer	23	9.95	228.85
Sledge hammer, 12 lb.	8	14.40	115.20
Rat-tail file, 1/8-in. fine	43	4.99	214.57
Hicut chain saw, 16 in.	11	256.99	2826.89
PVC pipe, 3.5-in., 8-ft	188	5.87	1103.56
1.25-in. metal screw, 25	172	6.99	1202.28
2.5-in. wd. screw, 50	237	8.45	2002.65
Steel matting, 4'x8'x1/6", .5" mesh	18	119.95	2159.10

Arithmetic Operators: The Rule of Precedence

Table 7.4: The Arithmetic Operators	
Operator	**Description**
+	Add
-	Subtract
*	Multiply
/	Divide
^	Raise to the power of (some applications use ** instead of ^)

1. Perform operations within parentheses.
2. Perform power operations.
3. Perform multiplications and divisions.
4. Perform additions and subtractions

SQL – Date Arithmetic

Date arithmetic

- Values are stored as a number of days
- Can perform date arithmetic in a query

```
SELECT      P_CODE, P_INDATE, P_INDATE + 90 AS EXPDATE
FROM        PRODUCT;

SELECT      P_CODE, P_INDATE, SYSDATE – 90 AS CUTOFF
FROM        PRODUCT;
```

SQL – Listing Unique Values

```
SELECT    DISTINCT V_CODE
FROM      PRODUCT;
```

FIGURE 7.7 A LISTING OF DISTINCT V_CODE VALUES IN THE PRODUCT TABLE

V_CODE
21225
21231
21344
23119
24288
25595

SQL – FROM Clause options - JOINS

SELECT *target-attribute-list* FROM *list of tables or join phrase*;

One table in the FROM list … retrieval from one table

More than one table in the list or a JOIN phrase => type of JOIN

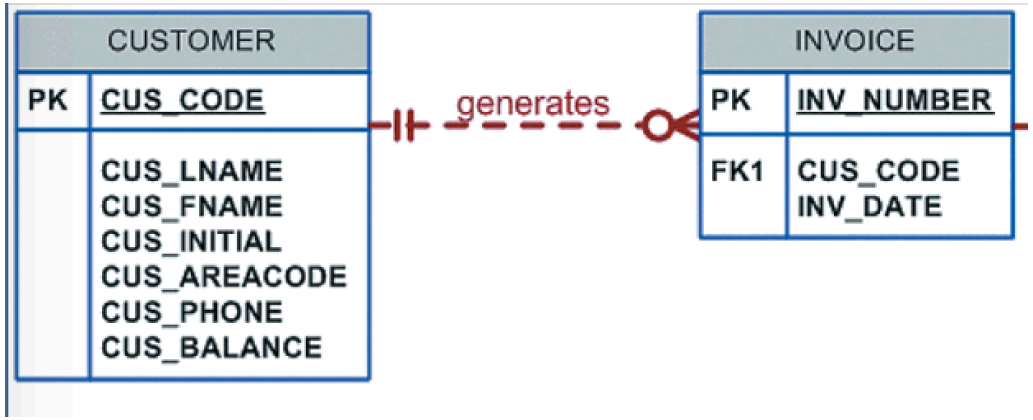
JOINS

- Natural
- Join using Join on
- Left outer join Right outer join
- Join cross Recursive join

SQL – Examples: Natural Join

SELECT column-list FROM *table1 NATURAL JOIN table2* following tasks:

- Find common attribute(s) - attributes with identical names and compatible data types
- Select rows with common values in the common attribute(s).
- Removes duplicates of common columns (same names and data types)
- If there are no common attributes, returns the relational product of the two tables
  (Each row is combined with each and every other rows of the other tables)




```
SELECT    CUS_CODE, CUS_LNAME, INV_NUMBER, INV_DATE
FROM      CUSTOMER NATURAL JOIN INVOICE;
```

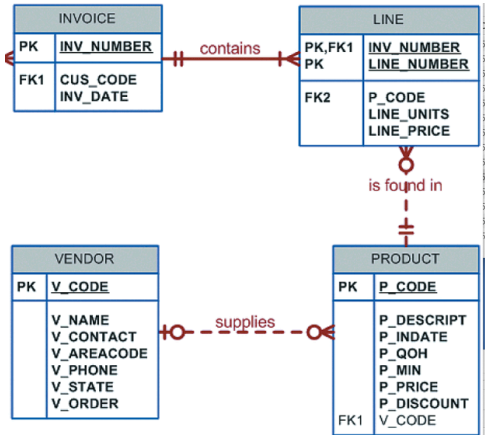
Equivalent to:

```
SELECT    CUS_CODE, CUS_LNAME, INV_NUMBER, INV_DATE
FROM      CUSTOMER, INVOICE
WHERE     CUSTOMER.CUS_CODE = INVOICE.CUS_CODE;
```

CUS_CODE	CUS_LNAME	INV_NUMBER	INV_DATE
10011	Dunne	1002	16-Jan-18
10011	Dunne	1004	17-Jan-18
10011	Dunne	1008	17-Jan-18
10012	Smith	1003	16-Jan-18
10014	Orlando	1001	16-Jan-18
10014	Orlando	1006	17-Jan-18
10015	O'Brian	1007	17-Jan-18
10018	Farriss	1005	17-Jan-18

SQL – Examples: Select All

```
SELECT    NV_NUMBER, P_CODE, P_DESCRIPT, LINE_UNITS, LINE_PRICE
FROM      INVOICE NATURAL JOIN LINE NATURAL JOIN PRODUCT;
```



INV_NUMBER	P_CODE	P_DESCRIPT	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'x1/6", .5" mesh	3	119.95
1008	23109-HB	Claw hammer	1	9.95

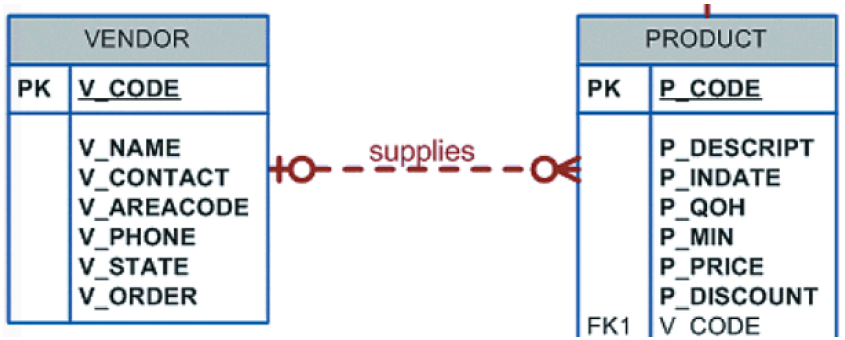
Equivalent to:

```
SELECT   NV_NUMBER, P_CODE, P_DESCRIPT, LINE_UNITS, LINE_PRIC
FROM     INVOICE, LINE, PRODUCT
WHERE    INVOICE.INV_NUMBER = LINE.INV_NUMBER AND
         LINE.P_CODE = PRODUCT.P_CODE ;
```

SQL – JOIN USING

SELECT column-list FROM table1 JOIN table2 USING (common-column)

SELECT P_CODE, P_DESCRIPT, V_CODE, V_NAME, V_AREACODE, V_PHONE
FROM PRODUCT JOIN VENDOR USING (V_CODE);



P_CODE	P_DESCRIPT	V_CODE	V_NAME	V_AREACODE	V_PHONE
23109-HB	Claw hammer	21225	Bryson, Inc.	615	223-3234
SM-18277	1.25-in. metal screw, 25	21225	Bryson, Inc.	615	223-3234
SW-23116	2.5-in. wd. screw, 50	21231	D&E Supply	615	228-3245
13-Q2/P2	7.25-in. pwr. saw blade	21344	Gomez Bros.	615	889-2546
14-Q1/L3	9.00-in. pwr. saw blade	21344	Gomez Bros.	615	889-2546
54778-2T	Rat-tail file, 1/8-in. fine	21344	Gomez Bros.	615	889-2546
1546-QQ2	Hrd. cloth, 1/4-in., 2x50	23119	Randsets Ltd.	901	678-3998
1558-QW1	Hrd. cloth, 1/2-in., 3x50	23119	Randsets Ltd.	901	678-3998
2232/QTY	B&D jigsaw, 12-in. blade	24288	ORDVA, Inc.	615	898-1234
2232/QWE	B&D jigsaw, 8-in. blade	24288	ORDVA, Inc.	615	898-1234
89-WRE-Q	Hicut chain saw, 16 in.	24288	ORDVA, Inc.	615	898-1234
11QER/31	Power painter, 15 psi., 3-nozzle	25595	Rubicon Systems	904	456-0092
2238/QPD	B&D cordless drill, 1/2-in.	25595	Rubicon Systems	904	456-0092
WR3/TT3	Steel matting, 4'x8'x1/6", .5" mesh	25595	Rubicon Systems	904	456-0092

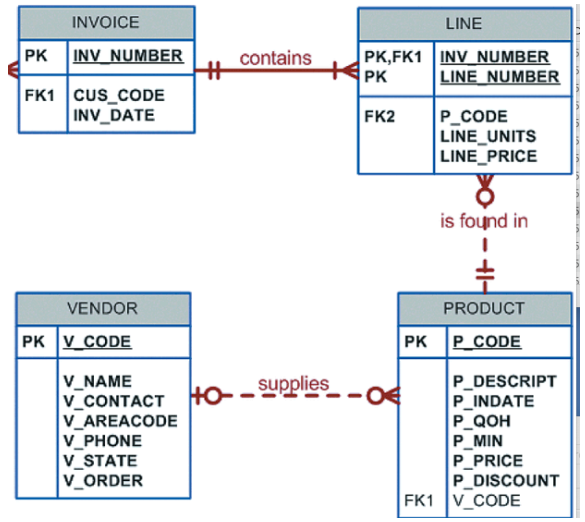
Equivalent to:

```
SELECT P_CODE, P_DESCRIPT, V_CODE, V_NAME, V_AREACODE, V_PHONE
FROM       PRODUCT, VENDOR
WHERE      PRODUCT.V_CODE = VENDOR.V_CODE;
```

SQL – JOIN ON

SELECT column-list FROM table1 JOIN table2 ON join-condition

```
SELECT    INVOICE.INV_NUMBER, PRODUCT.P_CODE, P_DESCRIPT, LINE_UNITS, LINE_PRICE
FROM      INVOICE JOIN LINE ON INVOICE.INV_NUMBER = LINE.INV_NUMBER
          JOIN PRODUCT ON LINE.P_CODE = PRODUCT.P_CODE;
```



Equivalent to:

```
SELECT P_CODE, P_DESCRIPT, V_CODE, V_NAME, V_AREACODE, V_PHONE
FROM      PRODUCT, VENDOR
WHERE     PRODUCT.V_CODE = VENDOR.V_CODE;
```

FIGURE 7.12 JOIN ON RESULTS

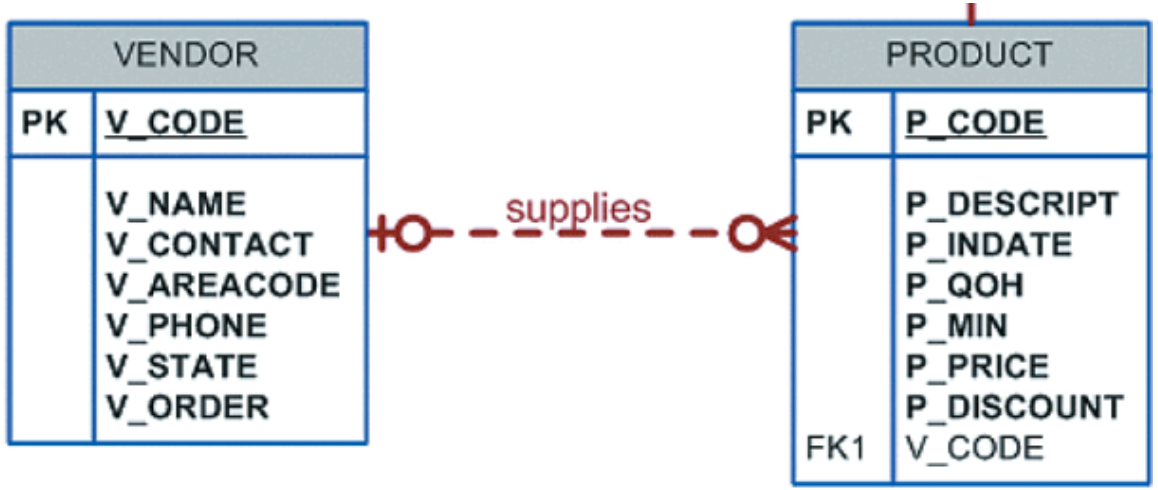
INV_NUMBER	P_CODE	P_DESCRIPT	LINE_UNITS	LINE_PRICE
1001	13-Q2/P2	7.25-in. pwr. saw blade	1	14.99
1001	23109-HB	Claw hammer	1	9.95
1002	54778-2T	Rat-tail file, 1/8-in. fine	2	4.99
1003	2238/QPD	B&D cordless drill, 1/2-in.	1	38.95
1003	1546-QQ2	Hrd. cloth, 1/4-in., 2x50	1	39.95
1003	13-Q2/P2	7.25-in. pwr. 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'x1/6", .5" mesh	3	119.95
1008	23109-HB	Claw hammer	1	9.95

SQL –LEFT [OUTER] JOIN ON

SELECT column-list FROM table1 LEFT [OUTER] JOIN table2 ON join-condition

```
SELECT    P_CODE, VENDOR.V_CODE, V_NAME
FROM      VENDOR LEFT JOIN PRODUCT ON VENDOR. V_CODE = PRODUCT.V_CODE;

SELECT    P_CODE, VENDOR.V_CODE, V_NAME
FROM      VENDOR LEFT OUTER JOIN PRODUCT ON VENDOR. V_CODE = PRODUCT.V_CODE;
```



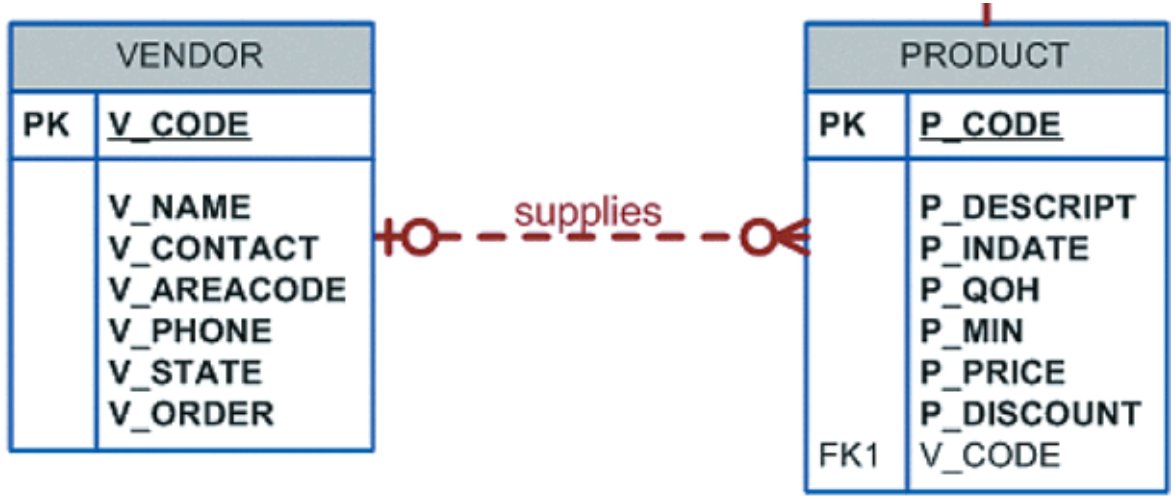
P_CODE	V_CODE	V_NAME
23109-HB	21225	Bryson, Inc.
SM-18277	21225	Bryson, Inc.
	21226	SuperLoo, Inc.
SW-23116	21231	D&E Supply
13-Q2/P2	21344	Gomez Bros.
14-Q1/L3	21344	Gomez Bros.
54778-2T	21344	Gomez Bros.
	22567	Dome Supply
1546-QQ2	23119	Randsets Ltd.
1558-QW1	23119	Randsets Ltd.
	24004	Brackman Bros.
2232/QTY	24288	ORDVA, Inc.
2232/QWE	24288	ORDVA, Inc.
89-WRE-Q	24288	ORDVA, Inc.
	25443	B&K, Inc.
	25501	Damal Supplies
11QER/31	25595	Rubicon Systems
2238/QPD	25595	Rubicon Systems
WR3/TT3	25595	Rubicon Systems

SQL – RIGHT [OUTER] JOIN

SELECT column-list FROM table1 RIGHT [OUTER] JOIN table2 ON join-condition

```
SELECT P_CODE, VENDOR.V_CODE, V_NAME
FROM VENDOR RIGHT JOIN PRODUCT ON VENDOR. V_CODE = PRODUCT.V_CODE;
```

```
SELECT P_CODE, VENDOR.V_CODE, V_NAME
FROM VENDOR RIGHT OUTER JOIN PRODUCT ON VENDOR. V_CODE = PRODUCT.V_CODE;
```

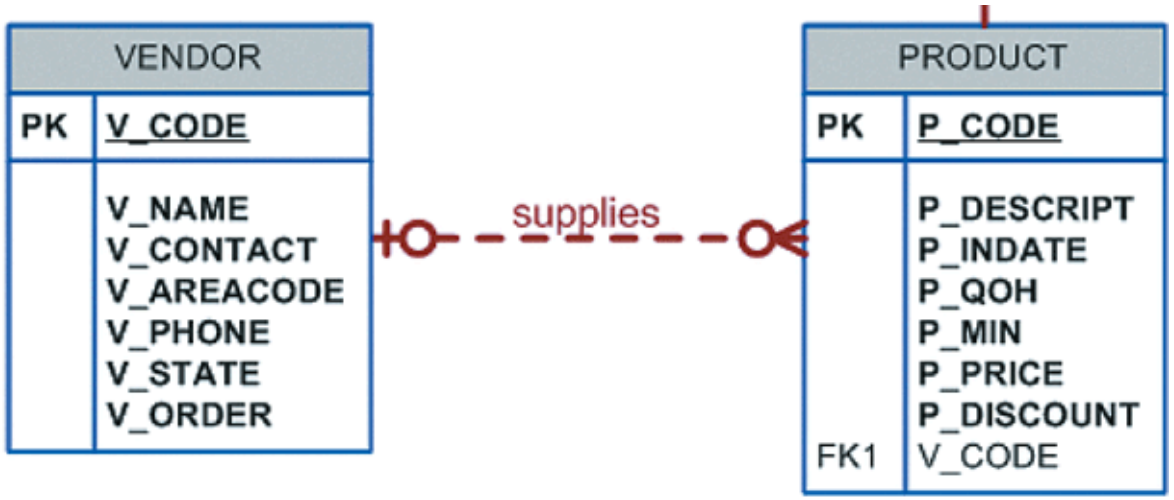


P_CODE	V_CODE	V_NAME
23114-AA		
PVC23DRT		
23109-HB	21225	Bryson, Inc.
SM-18277	21225	Bryson, Inc.
SW-23116	21231	D&E Supply
13-Q2/P2	21344	Gomez Bros.
14-Q1/L3	21344	Gomez Bros.
54778-2T	21344	Gomez Bros.
1546-QQ2	23119	Randsets Ltd.
1558-QW1	23119	Randsets Ltd.
2232/QTY	24288	ORDVA, Inc.
2232/QWE	24288	ORDVA, Inc.
89-WRE-Q	24288	ORDVA, Inc.
11QER/31	25595	Rubicon Systems
2238/QPD	25595	Rubicon Systems
WR3/TT3	25595	Rubicon Systems

SQL – FULL [OUTER] JOIN

SELECT column-list FROM table1 FULL [OUTER] JOIN table2 ON join-condition

```
SELECT      P_CODE, VENDOR.V_CODE, V_NAME
FROM        VENDOR FULL JOIN PRODUCT ON
                VENDOR. V_CODE = PRODUCT.V_CODE;
```



P_CODE	V_CODE	V_NAME
	21226	SuperLoo, Inc.
	22567	Dome Supply
	24004	Brackman Bros.
	25443	B&K, Inc.
	25501	Damal Supplies
11QER/31	25595	Rubicon Systems
13-Q2/P2	21344	Gomez Bros.
14-Q1/L3	21344	Gomez Bros.
1546-QQ2	23119	Randsets Ltd.
1558-QW1	23119	Randsets Ltd.
2232/QTY	24288	ORDVA, Inc.
2232/QWE	24288	ORDVA, Inc.
2238/QPD	25595	Rubicon Systems
23109-HB	21225	Bryson, Inc.
23114-AA		
54778-2T	21344	Gomez Bros.
89-WRE-Q	24288	ORDVA, Inc.
PVC23DRT		
SM-18277	21225	Bryson, Inc.
SW-23116	21231	D&E Supply
WR3/TT3	25595	Rubicon Systems

SQL – CROSS JOIN (CARTESIAN PRODUCT)

Synonyms: Cross Join, Cartesian Product, Cross, Product, Cross Product

SELECT column-list FROM table1 CROSS JOIN table2;

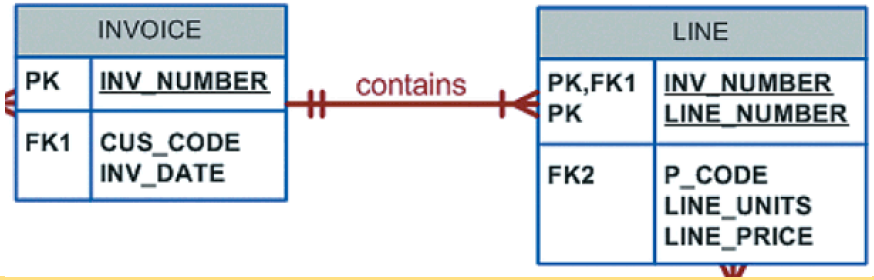
SELECT column-list FROM table1, table2;

SELECT * FROM INVOICE CROSS JOIN LINE;

RESULT: All columns; 144 rows
8 invoice rows and 18 line rows,
yielding 8 × 18 = 144 rows.

SELECT INVOICE.INV_NUMBER, CUS_CODE, INV_DATE, P_CODE
FROM INVOICE, LINE;

RESULT: 3 columns; 144 rows
8 invoice rows and 18 line rows,
yielding 8 × 18 = 144 rows.



SQL – RECURSIVE JOIN

Table that must be joined to itself – recursive join, recursive query => use ALIASES

```
SELECT E.EMP_NUM, E.EMP_LNAME, E.EMP_MGR, M.EMP_LNAME
FROM (EMP E) JOIN (EMP M) ON (E.EMP_MGR = M.EMP_NUM);
```

EMP_NUM	EMP_TITLE	EMP_LNAME	EMP_FNAME	EMP_INITIAL	EMP_DOB	EMP_HIRE_DATE	EMP_AREACODE	EMP_PHONE	EMP_MGR
100	Mr.	Kolmycz	George	D	15-Jun-42	15-Mar-85	615	324-5456	
101	Ms.	Lewis	Rhonda	G	19-Mar-65	25-Apr-86	615	324-4472	100
102	Mr.	Vandam	Rhett		14-Nov-58	20-Dec-90	901	675-8993	100
103	Ms.	Jones	Anne	M	16-Oct-74	28-Aug-94	615	898-3456	100
104	Mr.	Lange	John	P	08-Nov-71	20-Oct-94	901	504-4430	105
105	Mr.	Williams	Robert	D	14-Mar-75	08-Nov-98	615	890-3220	
106	Mrs.	Smith	Jeanine	K	12-Feb-68	05-Jan-89	615	324-7883	105
107	Mr.	Diante	Jorge	D	21-Aug-74	02-Jul-94	615	890-4567	105
108	Mr.	Wiesenbach	Paul	R	14-Feb-66	18-Nov-92	615	897-4358	
109	Mr.	Smith	George	K	18-Jun-61	14-Apr-89	901	504-3339	108
110	Mrs.	Genkazi	Leighla	W	19-May-70	01-Dec-90	901	569-0093	108
111	Mr.	Washington	Rupert	E	03-Jan-66	21-Jun-93	615	890-4925	105
112	Mr.	Johnson	Edward	E	14-May-61	01-Dec-83	615	898-4387	100
113	Ms.	Smythe	Melanie	P	15-Sep-70	11-May-99	615	324-9006	105
114	Ms.	Brandon	Marie	G	02-Nov-56	15-Nov-79	901	882-0845	108
115	Mrs.	Saranda	Hermine	R	25-Jul-72	23-Apr-93	615	324-5505	105
116	Mr.	Smith	George	A	08-Nov-65	10-Dec-88	615	890-2984	108

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 – ORDER BY

SELECT columnlist FROM tablelist
[WHERE condition]
[ORDER BY columnlist [ASC | DESC]];

```
SELECT      P_CODE, P_DESCRIPT, P_QOH, P_PRICE
FROM        PRODUCT
ORDER BY    P_PRICE;
```

P_CODE	P_DESCRIPT	P_QOH	P_PRICE
54778-2T	Rat-tail file, 1/8-in. fine	43	4.99
PVC23DRT	PVC pipe, 3.5-in., 8-ft	188	5.87
SM-18277	1.25-in. metal screw, 25	172	6.99
SW-23116	2.5-in. wd. screw, 50	237	8.45
23109-HB	Claw hammer	23	9.95
23114-AA	Sledge hammer, 12 lb.	8	14.40
13-Q2/P2	7.25-in. pwr. saw blade	32	14.99
14-Q1/L3	9.00-in. pwr. saw blade	18	17.49
2238/QPD	B&D cordless drill, 1/2-in.	12	38.95
1546-QQ2	Hrd. cloth, 1/4-in., 2x50	15	39.95
1558-QW1	Hrd. cloth, 1/2-in., 3x50	23	43.99
2232/QWE	B&D jigsaw, 8-in. blade	6	99.87
2232/QTY	B&D jigsaw, 12-in. blade	8	109.92
11QER/31	Power painter, 15 psi., 3-nozzle	8	109.99
WR3/TT3	Steel matting, 4'x8'x1/6", .5" mesh	18	119.95
89-WRE-Q	Hicut chain saw, 16 in.	11	256.99

SQL – ORDER BY … cascading order sequence

```
SELECT   EMP_LNAME, EMP_FNAME, EMP_INITIAL, EMP_AREACODE, EMP_PHONE
FROM     EMPLOYEE
OREDER BY   EMP_LNAME, EMP_FNAME, EMP_INITIAL;
```

EMP_LNAME	EMP_FNAME	EMP_INITIAL	EMP_AREACODE	EMP_PHONE
Brandon	Marie	G	901	882-0845
Diante	Jorge	D	615	890-4567
Genkazi	Leighla	W	901	569-0093
Johnson	Edward	E	615	898-4387
Jones	Anne	M	615	898-3456
Kolmycz	George	D	615	324-5456
Lange	John	P	901	504-4430
Lewis	Rhonda	G	615	324-4472
Saranda	Hermine	R	615	324-5505
Smith	George	A	615	890-2984
Smith	George	K	901	504-3339
Smith	Jeanine	K	615	324-7883
Smythe	Melanie	P	615	324-9006
Vandam	Rhett		901	675-8993
Washington	Rupert	E	615	890-4925
Wiesenbach	Paul	R	615	897-4358
Williams	Robert	D	615	890-3220

SQL – WHERE CLAUSE OPTIONS

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

```
SELECT   P_DESCRIPT, P_QOH, P_MIN, P_PRICE
FROM     PRODUCT
WHERE    P_PRICE <= 10;
```

```
 SELECT  P_CODE, P_DESCRIPT, P_QOH, P_MIN, P_PRICE
FROM     PRODUCT
WHERE    P_CODE < '1558-QW1';
```

Expression with comparison of strings

P_CODE	P_DESCRIPT	P_QOH	P_MIN	P_PRICE
11QER/31	Power painter, 15 psi., 3-nozzle	8	5	109.99
13-Q2/P2	7.25-in. pwr. saw blade	32	15	14.99
14-Q1/L3	9.00-in. pwr. saw blade	18	12	17.49
1546-QQ2	Hrd. cloth, 1/4-in., 2x50	15	8	39.95

SQL – WHERE CLAUSE with Logical Operators: AND, OR, and NOT

```
SELECT   P_DESCRIPT, P_PRICE, V_CODE
FROM     PRODUCT
WHERE    V_CODE = 25595 OR V_CODE = 24288 AND P_PRICE > 100;
```

Watch for operator precedence => Use parentheses (if in doubt or expression is not simple)

```
SELECT    P_DESCRIPT, P_PRICE, V_CODE
FROM     PRODUCT
WHERE    V_CODE = 25595 OR ( (V_CODE = 24288) AND (P_PRICE > 100) );
```

P_DESCRIPT	P_PRICE	V_CODE
Power painter, 15 psi., 3-nozzle	109.99	25595
B&D jigsaw, 12-in. blade	109.92	24288
B&D cordless drill, 1/2-in.	38.95	25595
Hicut chain saw, 16 in.	256.99	24288
Steel matting, 4'x8'x1/6", .5" mesh	119.95	25595

SQL – Special Operators

- BETWEEN: Used to check whether an attribute value is within a range
- IN: Used to check whether an attribute value matches any value within a value list
- LIKE: Used to check whether an attribute value matches a given string pattern
- IS NULL: Used to check whether an attribute value is null

```
SELECT    *
FROM      PRODUCT
WHERE     P_PRICE BETWEEN 50.00 AND 100.00;

SELECT    *
FROM      PRODUCT
WHERE      V_CODE IN (21344, 24288);
```

SQL – Special Operators … continued

```
SELECT    NAME, V_CONTACT, V_AREACODE, V_PHONE FROM    VENDOR
WHERE     UPPER(V_CONTACT) LIKE 'SMITH%';
```

V_NAME	V_CONTACT	V_AREACODE	V_PHONE
Bryson, Inc.	Smithson	615	223-3234
Dome Supply	Smith	901	678-1419
B&K, Inc.	Smith	904	227-0093

… Last names begin with …

… "%" … any string

```
SELECT    *
FROM      VENDOR
WHERE     V_CONTACT LIKE 'Johns_n';
```

… "_" … any character (wild char)

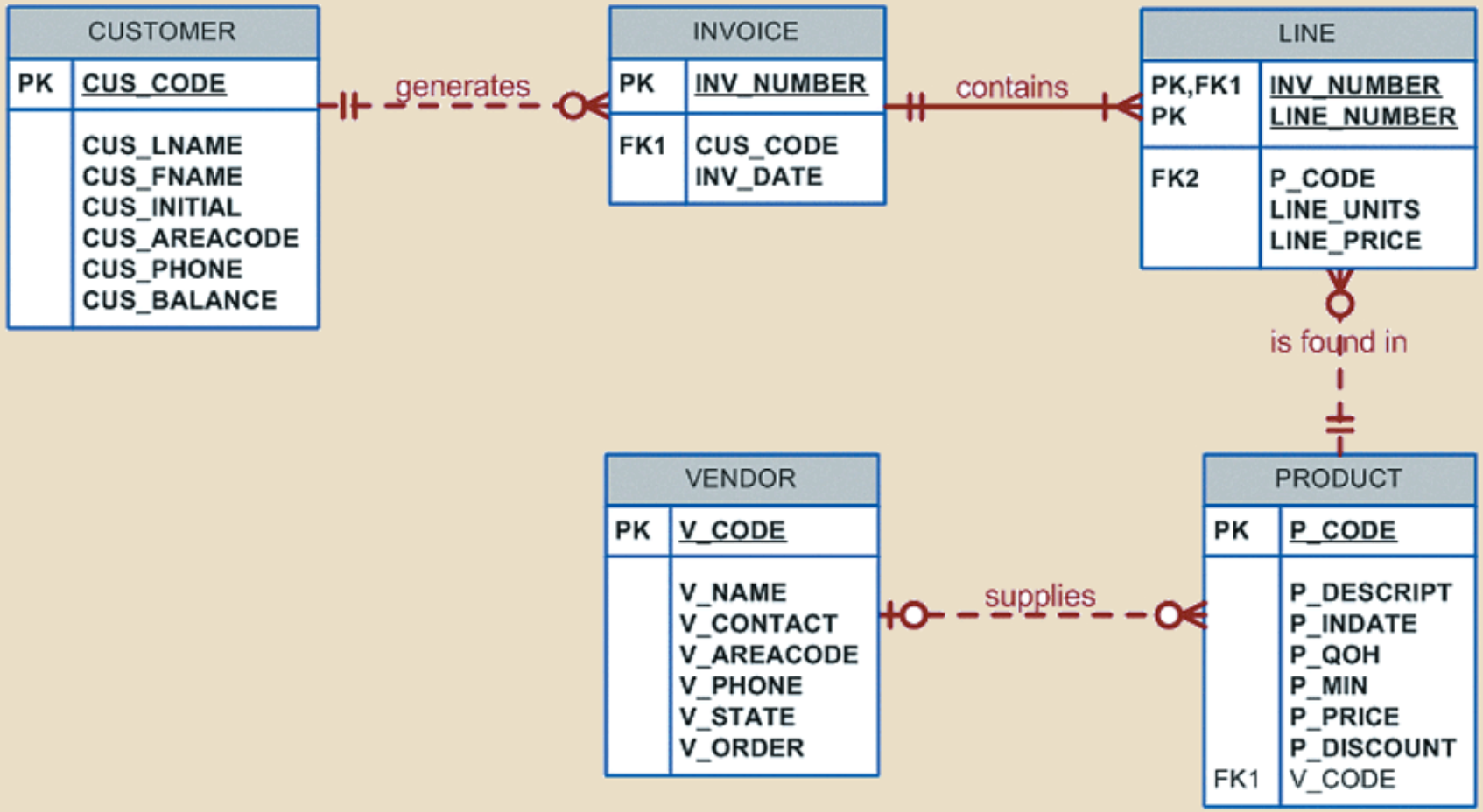
SQL – Special Operators … continued

```
SELECT    P_CODE, P_DESCRIPT, V_CODE
FROM      PRODUCT
WHERE     V_CODE IS NULL;
```

P_CODE	P_DESCRIPT	V_CODE
23114-AA	Sledge hammer, 12 lb.	
PVC23DRT	PVC pipe, 3.5-in., 8-ft	

Sample DB used for Intro to SQL

FIGURE 7.1 THE DATABASE MODEL



Questions and Answers (Q/A)