Fluency With Information Technology
CSE100/IMT100

Larry Snyder & Mel Oyler, Instructors
Ariel Kemp, Isaac Kunen, Gerome Miklau & Sean Squires, Teaching Assistants
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An Introduction to Structured Query Language (SQL)

- Objectives
  - Understand basics of database languages
  - Learn how to create a database using SQL
  - Learn how to manipulate and manage a database using SQL
Overview

- Introduction to SQL
- Data Definition Commands
- Basic Data Management
- Queries
SQL meets ideal database language requirements:

- SQL coverage fits into three categories:
  1. Data definition.
  2. Data management.
  3. Data query.
- SQL is relatively easy to learn.
- ANSI prescribes a standard SQL.
Introduction to SQL

Reasons for Studying SQL:

- The ANSI standardization effort has led to a de facto query standard for relational databases.
- SQL has become the basis for present and expected future DBMS integration efforts.
- SQL has become the catalyst in the development of distributed databases and database client/server architecture.
The Database Model

- Database -- PRODUCT and VENDOR tables
  - Each product is supplied by only a single vendor.
  - A vendor may supply many products.
Creating the Database Structure

CREATE SCHEMA AUTHORIZATION <creator>

Example:
CREATE SCHEMA AUTHORIZATION JONES

CREATE DATABASE <database name>
Data Definition Commands

- Creating Table Structures

CREATE TABLE <table name>
  (attribute1 name and attribute1 characteristics,
   attribute2 name and attribute2 characteristics,
   attribute3 name and attribute3 characteristics,
   primary key designation,
   foreign key designation and foreign key requirement);
CREATE TABLE VENDOR

(V_CODE   FCHAR(5)    NOT NULL    UNIQUE,
 V_NAME    VCHAR(35)   NOT NULL,
 V_CONTACT VCHAR(15)   NOT NULL,
 V_AREA CODE FCHAR(3)  NOT NULL,
 V_PHONE   FCHAR(3)    NOT NULL,
 V_STATE   FCHAR(2)    NOT NULL,
 V_ORDER   FCHAR(1)    NOT NULL,
 PRIMARY KEY (V_CODE));
CREATE TABLE PRODUCT

(P_CODE       VARCHAR(10)    NOT NULL    UNIQUE,
 P_DESCRIPT   VARCHAR(35)    NOT NULL,
 P_INDATE     DATE           NOT NULL,
 P_ONHAND     SMALLINT       NOT NULL,
 P_MIN        SMALLINT       NOT NULL,
 P_PRICE      DECIMAL(8,2)   NOT NULL,
 P_DISCOUNT   DECIMAL(4,1)   NOT NULL,
 V_CODE       SMALLINT,

PRIMARY KEY (P_CODE),
FOREIGN KEY (V_CODE) REFERENCES VENDOR
ON DELETE RESTRICT
ON UPDATE CASCADE);
Data Definition Commands

- SQL Integrity Constraints
  - Entity Integrity
    - PRIMARY KEY
    - NOT NULL and UNIQUE
  - Referential Integrity
    - FOREIGN KEY
    - ON DELETE
    - ON UPDATE
Data Entry

INSERT INTO <table name> VALUES (attribute 1 value, attribute 2 value, ... etc.);

Examples:

INSERT INTO VENDOR
VALUES('21225', 'Brson, Inc.', 'Smithson', '615', '223-3234', 'TN', 'Y');

INSERT INTO PRODUCT
VALUES('11 QER/31', 'Power painter, 15 psi., 3-nozzle', '12/2/96', 8.5, 109.99, 0.00, 25595);
Basic Data Management

- Checking the Table Contents
  
  SELECT <attribute names> FROM <table names>;

- Examples:
  
  SELECT * FROM PRODUCT;

  SELECT P_CODE, P_DESCRIP, P_INDATE, P_ONHAND, P_MIN, P_PRICE, P_DISCOUNT, V_CODE FROM PRODUCT;

<table>
<thead>
<tr>
<th>P_CODE</th>
<th>P_DESCRIP</th>
<th>P_INDATE</th>
<th>P_ONHAND</th>
<th>P_MIN</th>
<th>P_PRICE</th>
<th>P_DISCOUNT</th>
<th>V_CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>110ER/31</td>
<td>Power painter, 15 psi, 3-nozzle</td>
<td>12/2/96</td>
<td>8</td>
<td>5</td>
<td>$109.99</td>
<td>0.00</td>
<td>25595</td>
</tr>
<tr>
<td>13-Q2/P2</td>
<td>7.25 in. pwr. saw blade</td>
<td>11/12/96</td>
<td>32</td>
<td>15</td>
<td>$14.99</td>
<td>0.05</td>
<td>21344</td>
</tr>
</tbody>
</table>

The Product Table’s First Two Rows
Basic Data Management

- Saving the Table Contents
  COMMIT <table names>;
  
  Example:
  COMMIT PRODUCT;
Basic Data Management

- Adding Data to the Table
  
  ```sql
  INSERT INTO <table name> VALUES(attribute values);
  ```

  **Example:**

  ```sql
  INSERT INTO PRODUCT VALUES('14-Q1/L3', '9.00-in. Pwr. saw lade', '11/12/96', 18, 12, 17.49, 0.00, 21344);
  ```
<table>
<thead>
<tr>
<th>P_CODE</th>
<th>P_DESCRPT</th>
<th>P_INDATE</th>
<th>P_ONHAND</th>
<th>P_MIN</th>
<th>P_PRICE</th>
<th>P_DISCOUN</th>
<th>V_CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>110ER/31</td>
<td>Power painter, 15 psi, 3-nozzle</td>
<td>12/2/96</td>
<td>8</td>
<td>5</td>
<td>$109.99</td>
<td>0.00</td>
<td>25595</td>
</tr>
<tr>
<td>13-Q2/P2</td>
<td>7.25-in. pwr. saw blade</td>
<td>11/12/96</td>
<td>32</td>
<td>15</td>
<td>$14.99</td>
<td>0.05</td>
<td>21344</td>
</tr>
<tr>
<td>14-Q1/L3</td>
<td>9.00-in. pwr. saw blade</td>
<td>11/12/96</td>
<td>18</td>
<td>12</td>
<td>$17.49</td>
<td>0.00</td>
<td>21344</td>
</tr>
<tr>
<td>1546-QQ2</td>
<td>Hrd. cloth, 1/4-in., 2x50</td>
<td>8/14/96</td>
<td>15</td>
<td>8</td>
<td>$39.95</td>
<td>0.00</td>
<td>23119</td>
</tr>
<tr>
<td>1558-QW1</td>
<td>Hrd. cloth, 1/2-in., 3x50</td>
<td>8/14/96</td>
<td>23</td>
<td>5</td>
<td>$43.99</td>
<td>0.00</td>
<td>23119</td>
</tr>
<tr>
<td>2232/QTY</td>
<td>B&amp;D jigsaw, 12-in. blade</td>
<td>10/29/96</td>
<td>8</td>
<td>5</td>
<td>$109.92</td>
<td>0.05</td>
<td>24288</td>
</tr>
<tr>
<td>2232/QWE</td>
<td>B&amp;D jigsaw, 8-in. blade</td>
<td>9/23/96</td>
<td>6</td>
<td>5</td>
<td>$99.87</td>
<td>0.05</td>
<td>24288</td>
</tr>
<tr>
<td>2238/QPD</td>
<td>B&amp;D cordless drill, 1/2-in.</td>
<td>10/19/96</td>
<td>12</td>
<td>5</td>
<td>$38.95</td>
<td>0.05</td>
<td>25595</td>
</tr>
<tr>
<td>23109-HB</td>
<td>Claw hammer</td>
<td>11/19/96</td>
<td>23</td>
<td>10</td>
<td>$5.95</td>
<td>0.10</td>
<td>21225</td>
</tr>
<tr>
<td>23114-AA</td>
<td>Sledge hammer, 12 lb.</td>
<td>12/1/96</td>
<td>8</td>
<td>5</td>
<td>$14.40</td>
<td>0.05</td>
<td>21344</td>
</tr>
<tr>
<td>54778-2T</td>
<td>Rat-tail file, 1/8-in. fine</td>
<td>6/14/96</td>
<td>43</td>
<td>20</td>
<td>$4.99</td>
<td>0.00</td>
<td>21344</td>
</tr>
<tr>
<td>89-WRE-Q</td>
<td>Hicut chain saw, 16 in.</td>
<td>7/6/96</td>
<td>11</td>
<td>5</td>
<td>$266.99</td>
<td>0.05</td>
<td>24288</td>
</tr>
<tr>
<td>PVC23DRT</td>
<td>PVC pipe, 3.5-in., 8-ft</td>
<td>12/19/96</td>
<td>188</td>
<td>75</td>
<td>$5.87</td>
<td>0.00</td>
<td>21225</td>
</tr>
<tr>
<td>SM-18277</td>
<td>1.25-in. metal screw, 25</td>
<td>11/28/96</td>
<td>172</td>
<td>75</td>
<td>$6.99</td>
<td>0.00</td>
<td>21225</td>
</tr>
<tr>
<td>SW-23116</td>
<td>2.5-in. wd. screw, 50</td>
<td>9/23/96</td>
<td>237</td>
<td>100</td>
<td>$8.45</td>
<td>0.00</td>
<td>21231</td>
</tr>
<tr>
<td>WR3/TT3</td>
<td>Steel matting, 4x8x1/6&quot;, 5&quot; mesh</td>
<td>11/16/96</td>
<td>18</td>
<td>5</td>
<td>$119.95</td>
<td>0.10</td>
<td>25595</td>
</tr>
</tbody>
</table>

The Completed PRODUCT Table
Basic Data Management

- Deleting Table Rows
  
  \[
  \text{DELETE FROM} \ <\text{table name}> \\
  \text{WHERE} \ <\text{attribute name}> = <\text{attribute value}>; \\
  \]

- Example:
  
  \[
  \text{DELETE FROM PRODUCT} \\
  \text{WHERE} \ P\_CODE = '2238/QPD'; \\
  \]

  \[
  \text{DELETE FROM PRODUCT} \\
  \text{WHERE} \ P\_MIN = 5; \\
  \]


Queries

- Partial Listing of Table Contents
  
  ```sql
  SELECT <column(s)>
  FROM <table name>
  WHERE <conditions>;
  ```

- Examples:
  ```sql
  SELECT P_DESCRIPT, P_INDATE, P_PRICE, V_CODE
  FROM PRODUCT
  WHERE V_CODE = 21344;
  ```

<table>
<thead>
<tr>
<th>P_DESCRIPT</th>
<th>P_INDATE</th>
<th>P_PRICE</th>
<th>V_CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.25-in. pwr. saw blade</td>
<td>11/12/96</td>
<td>$14.99</td>
<td>21344</td>
</tr>
<tr>
<td>Rat-tail file, 1/8-in. fine</td>
<td>6/14/96</td>
<td>$4.99</td>
<td>21344</td>
</tr>
<tr>
<td>9.00-in. pwr. saw blade</td>
<td>11/12/96</td>
<td>$17.49</td>
<td>21344</td>
</tr>
</tbody>
</table>

Selected PRODUCT Table Attributes for the VENDOR CODE 21344
Queries

```
SELECT P_DESCRIPT, P_INDATE, P_PRICE, V_CODE
FROM PRODUCT
WHERE V_CODE <> 21344;
```

<table>
<thead>
<tr>
<th>P_DESCRIPT</th>
<th>P_INDATE</th>
<th>P_PRICE</th>
<th>V_CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5-in. wd. screw, 50</td>
<td>9/23/96</td>
<td>$8.45</td>
<td>21231</td>
</tr>
<tr>
<td>Hicut chain saw, 16 in.</td>
<td>7/6/96</td>
<td>$256.99</td>
<td>24288</td>
</tr>
<tr>
<td>B&amp;D jigsaw, 8-in. blade</td>
<td>9/23/96</td>
<td>$99.87</td>
<td>24288</td>
</tr>
<tr>
<td>Hrd. cloth, 1/4-in., 2x50</td>
<td>8/14/96</td>
<td>$39.95</td>
<td>23119</td>
</tr>
<tr>
<td>Claw hammer</td>
<td>11/19/96</td>
<td>$5.95</td>
<td>21225</td>
</tr>
<tr>
<td>B&amp;D jigsaw, 12-in. blade</td>
<td>10/29/96</td>
<td>$109.92</td>
<td>24288</td>
</tr>
<tr>
<td>1.25-in. metal screw, 25</td>
<td>11/28/96</td>
<td>$6.99</td>
<td>21225</td>
</tr>
<tr>
<td>Hrd. cloth, 1/2-in., 3x50</td>
<td>8/14/96</td>
<td>$43.99</td>
<td>23119</td>
</tr>
<tr>
<td>B&amp;D cordless drill, 1/2-in.</td>
<td>10/19/96</td>
<td>$38.95</td>
<td>25595</td>
</tr>
<tr>
<td>Steel matting, 4'x8'x1/6&quot;, .5&quot; mesh</td>
<td>11/16/96</td>
<td>$119.95</td>
<td>25595</td>
</tr>
<tr>
<td>Power painter, 15 psi., 3-nozzle</td>
<td>12/2/96</td>
<td>$109.99</td>
<td>25595</td>
</tr>
</tbody>
</table>

Selected PRODUCT Table Attributes for
VENDOR CODE Other Than 21344
Queries

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

<table>
<thead>
<tr>
<th>P_DESCRIPT</th>
<th>P_ONHAND</th>
<th>P_MIN</th>
<th>P_PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5-in. wd. screw, 50</td>
<td>237</td>
<td>100</td>
<td>$8.45</td>
</tr>
<tr>
<td>PVC pipe, 3.5-in., 8-ft</td>
<td>188</td>
<td>75</td>
<td>$5.87</td>
</tr>
<tr>
<td>Rat-tail file, 1/8-in. fine</td>
<td>43</td>
<td>20</td>
<td>$4.99</td>
</tr>
<tr>
<td>Claw hammer</td>
<td>23</td>
<td>10</td>
<td>$5.95</td>
</tr>
<tr>
<td>1.25-in. metal screw, 25</td>
<td>172</td>
<td>75</td>
<td>$6.99</td>
</tr>
</tbody>
</table>

Selected PRODUCT Table Attributes with a P-PRICE Restriction
Using Mathematical Operators on Dates

```
SELECT P_DESCRIPT, P_ONHAND, P_MIN, P_PRICE
FROM PRODUCT
WHERE P_INDATE >= 11/25/96;
```

Selected PRODUCT Table Attributes:
Date Restriction
Queries

- Logical Operators: AND, OR, and NOT
  
  **Examples:**

  ```sql
  SELECT P_DESCRIPT, P_INDATE, P_PRICE, V_CODE
  FROM PRODUCT
  WHERE V_CODE = 21344
  OR V_CODE = 24288;
  ```

<table>
<thead>
<tr>
<th>P_DESCRIPt</th>
<th>P_INDATE</th>
<th>P_PRICE</th>
<th>V_CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.25-in. pwr. saw blade</td>
<td>11/12/96</td>
<td>$14.99</td>
<td>21344</td>
</tr>
<tr>
<td>Rat-tail file, 1/8-in. fine</td>
<td>6/14/96</td>
<td>$4.99</td>
<td>21344</td>
</tr>
<tr>
<td>Hicut chain saw, 16 in.</td>
<td>7/6/96</td>
<td>$256.99</td>
<td>24288</td>
</tr>
<tr>
<td>B&amp;D jigsaw, 8-in. blade</td>
<td>9/23/96</td>
<td>$99.87</td>
<td>24288</td>
</tr>
<tr>
<td>B&amp;D jigsaw, 12-in. blade</td>
<td>10/29/96</td>
<td>$109.92</td>
<td>24288</td>
</tr>
<tr>
<td>9.00-in. pwr. saw blade</td>
<td>11/12/96</td>
<td>$17.49</td>
<td>21344</td>
</tr>
</tbody>
</table>

  Selected PRODUCT Table Attributes:
  The Logical OR
SELECT P_DESCRIPT, P_INDATE, P_PRICE, V_CODE
FROM PRODUCT
WHERE P_PRICE < 50
AND P_INDATE > 07/15/96;

Selected PRODUCT Table Attributes:
The Logical AND
Special Operators

**BETWEEN** is used to define range limits.

- **Example:**

```sql
SELECT *
FROM PRODUCT
WHERE P_PRICE BETWEEN 50.00 AND 100.00;
```
**LIKE** is used to check for similar character strings.

- **Examples:**
  ```sql
  SELECT * FROM VENDOR
  WHERE V_CONTACT LIKE 'Smith%';
  ```

<table>
<thead>
<tr>
<th>V_NAME</th>
<th>V_CONTACT</th>
<th>V_AREAACODE</th>
<th>V_PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bryson, Inc.</td>
<td>Smithson</td>
<td>615</td>
<td>223-3234</td>
</tr>
<tr>
<td>Dome Supply</td>
<td>Smith</td>
<td>901</td>
<td>678-1419</td>
</tr>
<tr>
<td>B&amp;K, Inc.</td>
<td>Smith</td>
<td>904</td>
<td>227-0093</td>
</tr>
</tbody>
</table>

Selected PRODUCT Table Attributes:
  Partial String Match
**Queries**

**IN** is used to check whether an attribute value matches a value contained within a (sub)set of listed values.

- **Example:**
  
  ```sql
  SELECT * FROM PRODUCT
  WHERE V_CODE IN (21344, 24288);
  ```

**EXISTS** is used to check whether an attribute has value.

- **Example:**
  
  ```sql
  DELETE FROM PRODUCT
  WHERE P_CODE EXISTS;
  ```

  ```sql
  SELECT * FROM PRODUCT
  WHERE V_CODE EXISTS;
  ```
Advanced Data Management Commands

- Changing Table Structures

  ALTER TABLE <table name>
  MODIFY <column name> <new column characteristics>;

  ALTER TABLE <table name>
  ADD <column name> <new column characteristics>;
UPDATE PRODUCT
  SET P_SALECODE = '2'
  WHERE P_INDATE < 8/15/96;

UPDATE PRODUCT
  SET P_SALECODE = '1'
  WHERE P_INDATE >= '11/15/96'
      AND P_INDATE < '12/1/96';
Advanced Data Management Commands

- Copying Parts of Tables

  \[
  \text{INSERT INTO} \ <\text{receiving table}> \ <\text{receiving table’s column names}> \\
  \text{SELECT} \ <\text{column names of the columns to be copied}> \\
  \text{FROM} \ <\text{contributing table name}>; \\
  \]

- Example:

  \[
  \text{INSERT INTO} \ \text{PART} \ (\text{PART\_CODE, PART\_DESCRIPT, PART\_PRICE}) \\
  \text{SELECT} \ \text{P\_CODE, P\_DESCRIPT, P\_PRICE} \\
  \text{FROM} \ \text{PRODUCT}; \\
  \]
Deleting a Table from the Database

DROP TABLE <table name>;

Example:

DROP TABLE PART;
Advanced Data Management Commands

- Primary and Foreign Key Designation
  - **Examples:**
    
    ```sql
    ALTER TABLE PRODUCT
    ADD PRIMARY KEY (P_CODE);
    
    ALTER TABLE PRODUCT
    ADD FOREIGN KEY (V_CODE) REFERENCES VENDOR;
    ```
More Complex Queries and SQL Functions

- Ordering a Listing
  ORDER BY <attributes>

- Examples:
  ```sql
  SELECT P_CODE, P_DESCRIP, P_INDATE, P_PRICE
  FROM PRODUCT
  ORDER BY P_PRICE;
  ```

  Results on next slide --->
Selected PRODUCT Table Attributes:
Ordered by (Ascending) P_PRICE

<table>
<thead>
<tr>
<th>P_CODE</th>
<th>P_DESCRIP</th>
<th>P_INDATE</th>
<th>P_PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>54778-2T</td>
<td>Rat-tail file, 1/8-in. fine</td>
<td>6/14/96</td>
<td>$4.99</td>
</tr>
<tr>
<td>PVC23DRT</td>
<td>PVC pipe, 3.5-in., 8-ft</td>
<td>12/19/96</td>
<td>$5.87</td>
</tr>
<tr>
<td>23109-HB</td>
<td>Claw hammer</td>
<td>11/19/96</td>
<td>$5.95</td>
</tr>
<tr>
<td>SW-23116</td>
<td>2.5-in. wd. screw, 50</td>
<td>9/23/96</td>
<td>$8.45</td>
</tr>
<tr>
<td>23114-AA</td>
<td>Sledge hammer, 12 lb.</td>
<td>12/1/96</td>
<td>$14.40</td>
</tr>
<tr>
<td>13-Q2/P2</td>
<td>7.25-in. pwr. saw blade</td>
<td>11/12/96</td>
<td>$14.99</td>
</tr>
<tr>
<td>14-Q1/L3</td>
<td>9.00-in. pwr. saw blade</td>
<td>11/12/96</td>
<td>$17.49</td>
</tr>
<tr>
<td>2238/QPD</td>
<td>B&amp;D cordless drill, 1/2-in.</td>
<td>10/19/96</td>
<td>$38.95</td>
</tr>
<tr>
<td>1546-QQ2</td>
<td>Hrd. cloth, 1/4-in., 2x50</td>
<td>8/14/96</td>
<td>$39.95</td>
</tr>
<tr>
<td>1558-QW1</td>
<td>Hrd. cloth, 1/2-in., 3x50</td>
<td>8/14/96</td>
<td>$43.99</td>
</tr>
<tr>
<td>2232/QWE</td>
<td>B&amp;D jigsaw, 8-in. blade</td>
<td>9/23/96</td>
<td>$99.87</td>
</tr>
<tr>
<td>2232/QTY</td>
<td>B&amp;D jigsaw, 12-in. blade</td>
<td>10/29/96</td>
<td>$109.92</td>
</tr>
<tr>
<td>11QER/31</td>
<td>Power painter, 15 psi., 3-nozzle</td>
<td>12/2/96</td>
<td>$109.99</td>
</tr>
<tr>
<td>WR3/TT3</td>
<td>Steel matting, 4&quot;x8&quot;x1/6&quot;, .5&quot; mesh</td>
<td>11/16/96</td>
<td>$119.95</td>
</tr>
<tr>
<td>89-WRE-Q</td>
<td>Hicut chain saw, 16 in.</td>
<td>7/6/96</td>
<td>$256.99</td>
</tr>
</tbody>
</table>
SELECT P_CODE, P_DESCRIPT, P_INDATE, P_PRICE
FROM PRODUCT
ORDER BY P_PRICE DESC;

<table>
<thead>
<tr>
<th>P_CODE</th>
<th>P_DESCRIPT</th>
<th>P_INDATE</th>
<th>P_PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>09-WRE-0</td>
<td>Hicut chain saw, 16 in.</td>
<td>7/6/96</td>
<td>$256.99</td>
</tr>
<tr>
<td>WR3/TT3</td>
<td>Steel matting, 4'x8'x1/6&quot;, 5&quot; mesh</td>
<td>11/16/96</td>
<td>$119.95</td>
</tr>
<tr>
<td>11QER/31</td>
<td>Power painter, 15 psi, 3-nozzle</td>
<td>12/2/96</td>
<td>$109.99</td>
</tr>
<tr>
<td>2232/QTY</td>
<td>B&amp;D jigsaw, 12-in. blade</td>
<td>10/29/96</td>
<td>$109.92</td>
</tr>
<tr>
<td>2232/QWE</td>
<td>B&amp;D jigsaw, 8-in. blade</td>
<td>9/23/96</td>
<td>$99.87</td>
</tr>
<tr>
<td>1558-QW1</td>
<td>Hrd. cloth, 1/2-in., 3x50</td>
<td>8/14/96</td>
<td>$43.99</td>
</tr>
<tr>
<td>1546-QQ2</td>
<td>Hrd. cloth, 1/4-in., 2x50</td>
<td>8/14/96</td>
<td>$39.95</td>
</tr>
<tr>
<td>2238/QPD</td>
<td>B&amp;D cordless drill, 1/2-in.</td>
<td>10/19/96</td>
<td>$38.95</td>
</tr>
<tr>
<td>14-Q1/L3</td>
<td>9.00-in. pwr. saw blade</td>
<td>11/12/96</td>
<td>$17.49</td>
</tr>
<tr>
<td>13-Q2/P2</td>
<td>7.25-in. pwr. saw blade</td>
<td>11/12/96</td>
<td>$14.99</td>
</tr>
<tr>
<td>23114-AA</td>
<td>Sledge hammer, 12 lb.</td>
<td>12/1/96</td>
<td>$14.40</td>
</tr>
<tr>
<td>SW-23116</td>
<td>2.5-in. wd. screw, 50</td>
<td>9/23/96</td>
<td>$8.45</td>
</tr>
<tr>
<td>23109-HB</td>
<td>Claw hammer</td>
<td>11/19/96</td>
<td>$5.95</td>
</tr>
<tr>
<td>PVC23DRT</td>
<td>PVC pipe, 3.5-in., 8-ft</td>
<td>12/19/96</td>
<td>$5.87</td>
</tr>
<tr>
<td>54778-2T</td>
<td>Rat-tail file, 1/8-in. fine</td>
<td>6/14/96</td>
<td>$4.99</td>
</tr>
</tbody>
</table>

Selected PRODUCT Table Attributes:
Ordered by (Descending) P_PRICE
More Complex Queries and SQL Functions

```
SELECT P_CODE, P_DESCRIP, P_INDATE, P_PRICE 
FROM PRODUCT 
WHERE P_INDATE < 9/15/96 
AND P_PRICE <= 50.00 
ORDER BY V_CODE DESC, P_PRICE DESC;
```

A Query Based on Multiple Restriction
More Complex Queries and SQL Functions

- Listing Unique Values

  SELECT DISTINCT <attributes> ...

  Example:
  
  ```sql
  SELECT DISTINCT V_CODE
  FROM PRODUCT;
  ```

<table>
<thead>
<tr>
<th>V_CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>21225</td>
</tr>
<tr>
<td>21231</td>
</tr>
<tr>
<td>21344</td>
</tr>
<tr>
<td>23119</td>
</tr>
<tr>
<td>24288</td>
</tr>
<tr>
<td>25595</td>
</tr>
</tbody>
</table>

  A Listing of Distinct (Different) V_CODE Values in the PRODUCT Table
## More Complex Queries and SQL Functions

### The SQL Numeric Functions

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNT</td>
<td>The number of rows containing the specified attribute.</td>
</tr>
<tr>
<td>MIN</td>
<td>The minimum attribute value encountered.</td>
</tr>
<tr>
<td>MAX</td>
<td>The maximum attribute value encountered.</td>
</tr>
<tr>
<td>AVG</td>
<td>The arithmetic mean (average) for the specified attribute.</td>
</tr>
<tr>
<td>SUM</td>
<td>The sum of all values for a selected attribute.</td>
</tr>
</tbody>
</table>
More Complex Queries and SQL Functions

- SQL’s Numeric Functions
  - COUNT
    - Examples:
      ```sql
      SELECT COUNT(DISTINCT V_CODE)
      FROM PRODUCT;
      
      SELECT COUNT(DISTINCT V_CODE)
      FROM PRODUCT
      WHERE P_PRICE <= 10.00;
      ```
More Complex Queries and SQL Functions

MAX and MIN

- **Examples:**

  ```sql
  SELECT MAX(P_PRICE)
  FROM PRODUCT;
  ```

  ```sql
  SELECT MIN(P_PRICE)
  FROM PRODUCT;
  ```

  ```sql
  SELECT P_CODE, P_DESCRIPT, P_PRICE
  FROM PRODUCT
  WHERE P_PRICE =
    (SELECT MAX(P_PRICE) FROM PRODUCT);
  ```
More Complex Queries and SQL Functions

SUM

- Example:
  
  ```sql
  SELECT SUM(P_ONHAND * P_PRICE)
  FROM PRODUCT;
  ```
Virtual Tables: Creating a View

CREATE VIEW <view name> AS
SELECT ... FROM ... WHERE ...;

Example:

CREATE VIEW PRODUCT_3 AS
SELECT P_DESCRIPT, P_ONHAND, P_PRICE
FROM PRODUCT
WHERE P_PRICE > 50.00;
More Complex Queries and SQL Functions

- Joining Database Tables
  - Examples:

    ```sql
    SELECT PRODUCT.P_DESCRIPT, PRODUCT.P_PRICE,
           VENDOR.V_NAME, VENDOR.V_CONTACT,
           VENDOR.V_AREAACODE, VENDOR.V_PHONE
    FROM PRODUCT, VENDOR
    WHERE PRODUCT.V_CODE = VENDOR.V_CODE;
    ```

    ```sql
    SELECT P_DESCRIPT, P_PRICE, V_NAME, V_CONTACT,
           V_AREAACODE, V_PHONE
    FROM PRODUCT, VENDOR
    WHERE PRODUCT.V_CODE = VENDOR.V_CODE
    ORDER BY P_PRICE;
    ```
More Complex Queries and SQL Functions

SELECT P_DESCRIPT, P_PRICE, V_NAME, V_CONTACT, V_AREAACODE, V_PHONE
FROM PRODUCT, VENDOR
WHERE PRODUCT.V_CODE = VENDOR.V_CODE
AND P_INDATE > '11/15/96';

SELECT P_DESCRIPT, P_PRICE, V_NAME, V_CONTACT, V_AREAACODE, V_PHONE
FROM PRODUCT A, VENDOR B
WHERE A.V_CODE = B.V_CODE
ORDER BY P_PRICE;