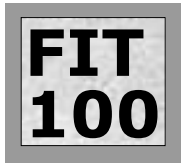
Fluency With Information Technology
CSE100/IMT100



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FIT 100

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

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Overview

- Introduction to SQL
- Data Definition Commands
- Basic Data Management
- Queries

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Introduction to SQL

- 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.

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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.

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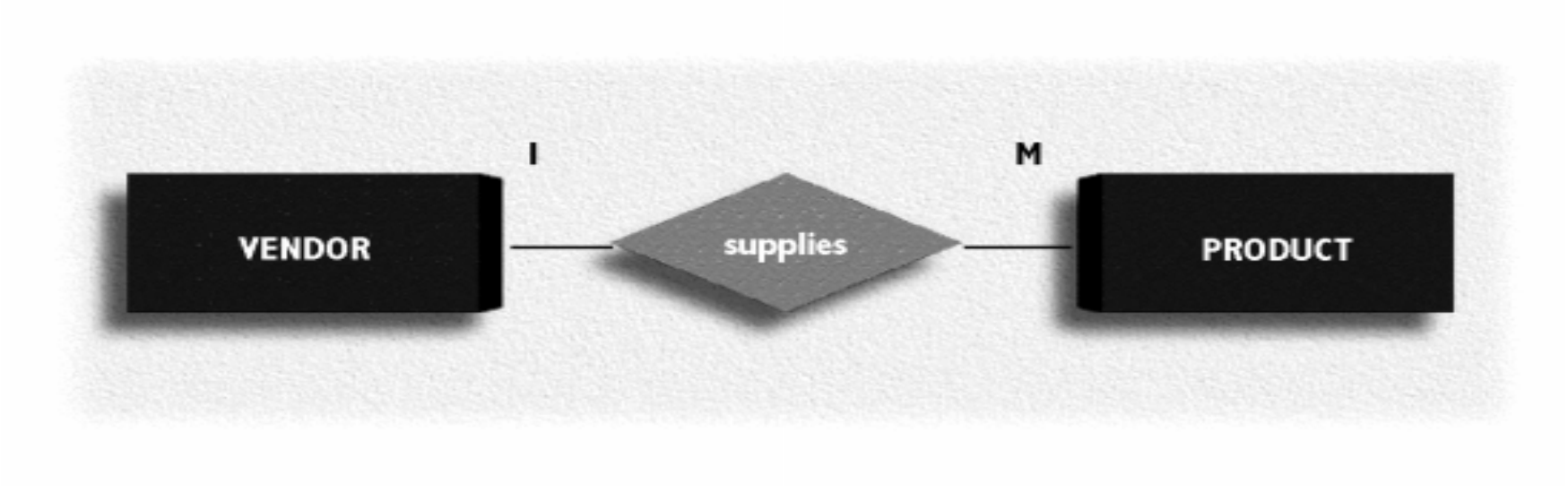
Data Definition Commands

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



The Database Model

FIT 100 Data Definition Commands

- Creating the Database Structure

CREATE SCHEMA AUTHORIZATION <creator>

- Example:
  CREATE SCHEMA AUTHORIZATION JONES

CREATE DATABASE <database name>

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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>);

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Data Definition Commands

```
CREATE TABLE VENDOR
   (V_CODE         FCHAR(5)    NOT NULL   UNIQUE,
    V_NAME         VCHAR(35)   NOT NULL,
    V_CONTACT      VCHAR(15)   NOT NULL,
    V_AREACODE     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));
```

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Data Definition Commands

```
CREATE TABLE PRODUCT
   (P_CODE         VCHAR(10)     NOT NULL   UNIQUE,
    P_DESCRIPT     VCHAR(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);
```

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Data Definition Commands

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

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Basic Data Management

- 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);
```

FIT 100 Basic Data Management

- Checking the Table Contents

  SELECT <attribute names> FROM <table names>;

  - **Examples:**

```
SELECT * FROM PRODUCT;

SELECT P_CODE, P_DESCRIPT, P_INDATE, P_ONHAND,
  P_MIN, P-PRICE, P_DISCOUNT, V_CODE
  FROM PRODUCT;
```

P_CODE	P_DESCRIPT	P_INDATE	P_ONHAND	P_MIN	P_PRICE	P_DISCOUNT	V_CODE
11QER/31	Power painter, 15 psi., 3-nozzle	12/2/96	8	5	$109.99	0.00	25595
13-Q2/P2	7.25-in. pwr. saw blade	11/12/96	32	15	$14.99	0.05	21344

The Product Table's First Two Rows

FIT 100 Basic Data Management

- Saving the Table Contents

  COMMIT <table names>;

  - **Example:**

    ```
    COMMIT PRODUCT;
    ```

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Basic Data Management

- Adding Data to the Table

  INSERT INTO <table name> VALUES(attribute values);

  - **Example:**

```
INSERT INTO PRODUCT
  VALUES('14-Q1/L3', '9.00-in. Pwr. saw lade',
  '11/12/96', 18,12, 17.49, 0.00, 21344);
```

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Basic Data Management

	P_CODE	P_DESCRIPT	P_INDATE	P_ONHAND	P_MIN	P_PRICE	P_DISCOUNT	V_CODE
▶	11QER/31	Power painter, 15 psi., 3-nozzle	12/2/96	8	5	$109.99	0.00	25595
	13-Q2/P2	7.25-in. pwr. saw blade	11/12/96	32	15	$14.99	0.05	21344
	14-Q1/L3	9.00-in. pwr. saw blade	11/12/96	18	12	$17.49	0.00	21344
	1546-QQ2	Hrd. cloth, 1/4-in., 2x50	8/14/96	15	8	$39.95	0.00	23119
	1558-QW1	Hrd. cloth, 1/2-in., 3x50	8/14/96	23	5	$43.99	0.00	23119
	2232/QTY	B&D jigsaw, 12-in. blade	10/29/96	8	5	$109.92	0.05	24288
	2232/QWE	B&D jigsaw, 8-in. blade	9/23/96	6	5	$99.87	0.05	24288
	2238/QPD	B&D cordless drill, 1/2-in.	10/19/96	12	5	$38.95	0.05	25595
	23109-HB	Claw hammer	11/19/96	23	10	$5.95	0.10	21225
	23114-AA	Sledge hammer, 12 lb.	12/1/96	8	5	$14.40	0.05	
	54778-2T	Rat-tail file, 1/8-in. fine	6/14/96	43	20	$4.99	0.00	21344
	89-WRE-Q	Hicut chain saw, 16 in.	7/6/96	11	5	$256.99	0.05	24288
	PVC23DRT	PVC pipe, 3.5-in., 8-ft	12/19/96	188	75	$5.87	0.00	
	SM-18277	1.25-in. metal screw, 25	11/28/96	172	75	$6.99	0.00	21225
	SW-23116	2.5-in. wd. screw, 50	9/23/96	237	100	$8.45	0.00	21231
	WR3/TT3	Steel matting, 4'x8'x1/6", .5" mesh	11/16/96	18	5	$119.95	0.10	25595
*				0	0	$0.00	0.00	0

The Completed PRODUCT Table

Basic Data Management

- Deleting Table Rows

  DELETE FROM <table name>
  WHERE <attribute name> = <attribute value>;

  - **Example:**

```
DELETE FROM PRODUCT
  WHERE P_CODE = '2238/QPD';


DELETE FROM PRODUCT
  WHERE P_MIN = 5;
```

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Queries

- Partial Listing of Table Contents

SELECT <column(s)>
FROM <table name>
WHERE <conditions>;

- **Examples:**

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

	P_DESCRIPT	P_INDATE	P_PRICE	V_CODE
▶	7.25-in. pwr. saw blade	11/12/96	$14.99	21344
	Rat-tail file, 1/8-in. fine	6/14/96	$4.99	21344
	9.00-in. pwr. saw blade	11/12/96	$17.49	21344

Selected PRODUCT Table Attributes for the VENDOR CODE 21344

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Queries

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

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

Selected PRODUCT Table Attributes for VENDOR CODE Other Than 21344

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Queries

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

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

Selected PRODUCT Table Attributes with a P-PRICE Restriction

FIT 100 Queries

Using Mathematical Operators on Dates

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

P_DESCRIPT	P_ONHAND	P_MIN	P_PRICE	P_INDATE
Sledge hammer, 12 lb.	8	5	$14.40	12/1/96
PVC pipe, 3.5-in., 8-ft	188	75	$5.87	12/19/96
1.25-in. metal screw, 25	172	75	$6.99	11/28/96
Power painter, 15 psi., 3-nozzle	8	5	$109.99	12/2/96

Selected PRODUCT Table Attributes:
Date Restriction

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Queries

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

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

P_DESCRIPT	P_INDATE	P_PRICE	V_CODE
7.25-in. pwr. saw blade	11/12/96	$14.99	21344
Rat-tail file, 1/8-in. fine	6/14/96	$4.99	21344
Hicut chain saw, 16 in.	7/6/96	$256.99	24288
B&D jigsaw, 8-in. blade	9/23/96	$99.87	24288
B&D jigsaw, 12-in. blade	10/29/96	$109.92	24288
9.00-in. pwr. saw blade	11/12/96	$17.49	21344

Selected PRODUCT Table Attributes:
The Logical OR

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Queries

```
SELECT P_DESCRIPT, P_INDATE, P_PRICE, V_CODE
  FROM PRODUCT
  WHERE P_PRICE < 50
  AND P_INDATE > 07/15/96;
```

P_DESCRIPT	P_INDATE	P_PRICE	V_CODE
7.25-in. pwr. saw blade	11/12/96	$14.99	21344
Sledge hammer, 12 lb.	12/1/96	$14.40	
2.5-in. wd. screw, 50	9/23/96	$8.45	21231
PVC pipe, 3.5-in., 8-ft	12/19/96	$5.87	
Hrd. cloth, 1/4-in., 2x50	8/14/96	$39.95	23119
Claw hammer	11/19/96	$5.95	21225
1.25-in. metal screw, 25	11/28/96	$6.99	21225
Hrd. cloth, 1/2-in., 3x50	8/14/96	$43.99	23119
9.00-in. pwr. saw blade	11/12/96	$17.49	21344
B&D cordless drill, 1/2-in.	10/19/96	$38.95	25595

Selected PRODUCT Table Attributes:
The Logical AND

FIT 100 Queries

- Special Operators

  BETWEEN is used to define range limits.

  - **Example:**

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

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Queries

LIKE is used to check for similar character strings.

- **Examples:**

```
SELECT * FROM VENDOR
  WHERE 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

Selected PRODUCT Table Attributes:
Partial String Match

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Queries

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

- **Example:**

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

EXISTS is used to check whether an attribute has value.

- **Example:**

```
DELETE FROM PRODUCT
  WHERE P_CODE EXISTS;

SELECT * FROM PRODUCT
  WHERE V_CODE EXISTS;
```

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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>;

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Advanced Data Management Commands

```
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’;
```

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Advanced Data Management Commands

- Copying Parts of Tables

INSERT INTO <receiving table> <receiving table's column names>
SELECT <column names of the columns to be copied>
FROM <contributing table name>;

- **Example:**

```
INSERT INTO PART (PART_CODE, PART_DESCRIPT,
  PART_PRICE)
  SELECT P_CODE, P_DESCRIPT, P_PRICE
  FROM PRODUCT;
```

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Advanced Data Management Commands

- Deleting a Table from the Database

  DROP TABLE <table name>;

  - **Example:**

    ```
    DROP TABLE PART;
    ```

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Advanced Data Management Commands

- Primary and Foreign Key Designation
  - **Examples:**

```
ALTER TABLE PRODUCT
  ADD PRIMARY KEY (P_CODE);

ALTER TABLE PRODUCT
  ADD FOREIGN KEY (V_CODE) REFERENCES VENDOR;
```

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More Complex Queries and SQL Functions

- Ordering a Listing

  ORDER BY <attributes>

  - **Examples:**

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

Results on next slide --->

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More Complex Queries and SQL Functions

	P_CODE	P_DESCRIPT	P_INDATE	P_PRICE
▶	54778-2T	Rat-tail file, 1/8-in. fine	6/14/96	$4.99
	PVC23DRT	PVC pipe, 3.5-in., 8-ft	12/19/96	$5.87
	23109-HB	Claw hammer	11/19/96	$5.95
	SM-18277	1.25-in. metal screw, 25	11/28/96	$6.99
	SW-23116	2.5-in. wd. screw, 50	9/23/96	$8.45
	23114-AA	Sledge hammer, 12 lb.	12/1/96	$14.40
	13-Q2/P2	7.25-in. pwr. saw blade	11/12/96	$14.99
	14-Q1/L3	9.00-in. pwr. saw blade	11/12/96	$17.49
	2238/QPD	B&D cordless drill, 1/2-in.	10/19/96	$38.95
	1546-QQ2	Hrd. cloth, 1/4-in., 2x50	8/14/96	$39.95
	1558-QW1	Hrd. cloth, 1/2-in., 3x50	8/14/96	$43.99
	2232/QWE	B&D jigsaw, 8-in. blade	9/23/96	$99.87
	2232/QTY	B&D jigsaw, 12-in. blade	10/29/96	$109.92
	11QER/31	Power painter, 15 psi., 3-nozzle	12/2/96	$109.99
	WR3/TT3	Steel matting, 4'x8'x1/6", .5" mesh	11/16/96	$119.95
	89-WRE-Q	Hicut chain saw, 16 in.	7/6/96	$256.99

Selected PRODUCT Table Attributes:
Ordered by (Ascending) P_PRICE

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More Complex Queries and SQL Functions

```
SELECT P_CODE, P_DESCRIPT, P_INDATE, P_PRICE
  FROM PRODUCT
  ORDER BY P_PRICE DESC;
```

P_CODE	P_DESCRIPT	P_INDATE	P_PRICE
89-WRE-Q	Hicut chain saw, 16 in.	7/6/96	$256.99
WR3/TT3	Steel matting, 4'x8'x1/6", .5" mesh	11/16/96	$119.95
11QER/31	Power painter, 15 psi., 3-nozzle	12/2/96	$109.99
2232/QTY	B&D jigsaw, 12-in. blade	10/29/96	$109.92
2232/QWE	B&D jigsaw, 8-in. blade	9/23/96	$99.87
1558-QW1	Hrd. cloth, 1/2-in., 3x50	8/14/96	$43.99
1546-QQ2	Hrd. cloth, 1/4-in., 2x50	8/14/96	$39.95
2238/QPD	B&D cordless drill, 1/2-in.	10/19/96	$38.95
14-Q1/L3	9.00-in. pwr. saw blade	11/12/96	$17.49
13-Q2/P2	7.25-in. pwr. saw blade	11/12/96	$14.99
23114-AA	Sledge hammer, 12 lb.	12/1/96	$14.40
SW-23116	2.5-in. wd. screw, 50	9/23/96	$8.45
SM-18277	1.25-in. metal screw, 25	11/28/96	$6.99
23109-HB	Claw hammer	11/19/96	$5.95
PVC23DRT	PVC pipe, 3.5-in., 8-ft	12/19/96	$5.87
54778-2T	Rat-tail file, 1/8-in. fine	6/14/96	$4.99

Selected PRODUCT Table Attributes:
Ordered by (Descending) P_PRICE

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More Complex Queries and SQL Functions

```
SELECT P_CODE, P_DESCRIPT, 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;
```

	P_DESCRIPT	V_CODE	P_INDATE	P_PRICE
▶	B&D cordless drill, 1/2-in.	25595	10/19/96	$38.95
	Hrd. cloth, 1/2-in., 3x50	23119	8/14/96	$43.99
	Hrd. cloth, 1/4-in., 2x50	23119	8/14/96	$39.95
	9.00-in. pwr. saw blade	21344	11/12/96	$17.49
	7.25-in. pwr. saw blade	21344	11/12/96	$14.99
	Rat-tail file, 1/8-in. fine	21344	6/14/96	$4.99
	2.5-in. wd. screw, 50	21231	9/23/96	$8.45

A Query Based on Multiple Restriction

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More Complex Queries and SQL Functions

- Listing Unique Values

  SELECT DISTINCT <attributes> ...

  - **Example:**

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

	V_CODE
▶	
	21225
	21231
	21344
	23119
	24288
	25595

A Listing of Distinct (Different) V_CODE Values in the PRODUCT Table

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More Complex Queries and SQL Functions

The SQL Numeric Functions

FUNCTION	OUTPUT
COUNT	The number of rows containing the specified attribute.
MIN	The minimum attribute value encountered.
MAX	The maximum attribute value encountered.
AVG	The arithmetic mean (average) for the specified attribute.
SUM	The sum of all values for a selected attribute.

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More Complex Queries and SQL Functions

- SQL's Numeric Functions
  - **COUNT**
    - **Examples:**

```
SELECT COUNT(DISTINCT V_CODE)
  FROM PRODUCT;


SELECT COUNT(DISTINCT V_CODE)
  FROM PRODUCT
  WHERE P_PRICE <= 10.00;
```

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More Complex Queries and SQL Functions

MAX and MIN

- **Examples:**

```
SELECT MAX(P_PRICE)
  FROM PRODUCT;


SELECT MIN(P_PRICE)
  FROM PRODUCT;


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:**

```
SELECT SUM(P_ONHAND * P_PRICE)
  FROM PRODUCT;
```

More Complex Queries and SQL Functions

- 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;
```

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More Complex Queries and SQL Functions

- Joining Database Tables
  - **Examples:**

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

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