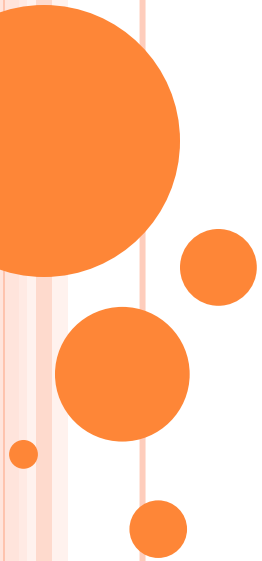
CIS 412
DATABASE MANAGEMENT SYSTEMS



Chapter 4
The Relational Model 3: Advanced Topics

Views (1/7)

- **View**: application program's or individual user's picture of the database
- Less involved than full database
- Simplification
- Security

VIEWS (2/7)

- **Defining query**: SELECT command that creates a view
  - Indicates what to include in the view
- Query acts as a window into the database
- Does not produce a new table
- Query that involves a view
  - DBMS does *not* execute the query in this form
  - Query actually executed is created by merging this query with the query that defines the view

VIEWS (3/7)

```
CREATE VIEW Housewares AS
SELECT PartNum, Description, OnHand, Price
FROM Part
WHERE Class='HW'
;
```

Housewares

PartNum	Description	OnHand	Price
AT94	Iron	50	$24.95
DL71	Cordless Drill	21	$129.95
FD21	Stand Mixer	22	$159.95

FIGURE 4-1: Housewares view

Views (4/7)

- To create a view in Access, create and save a query
- Changing field names in a view
  - SQL: include the new field names in the CREATE VIEW command
  - Access: precede the name of the field with the desired name, followed by a colon
- **Row-and-column subset view**
  - Subset of rows and columns in an individual table

VIEWS (5/7)

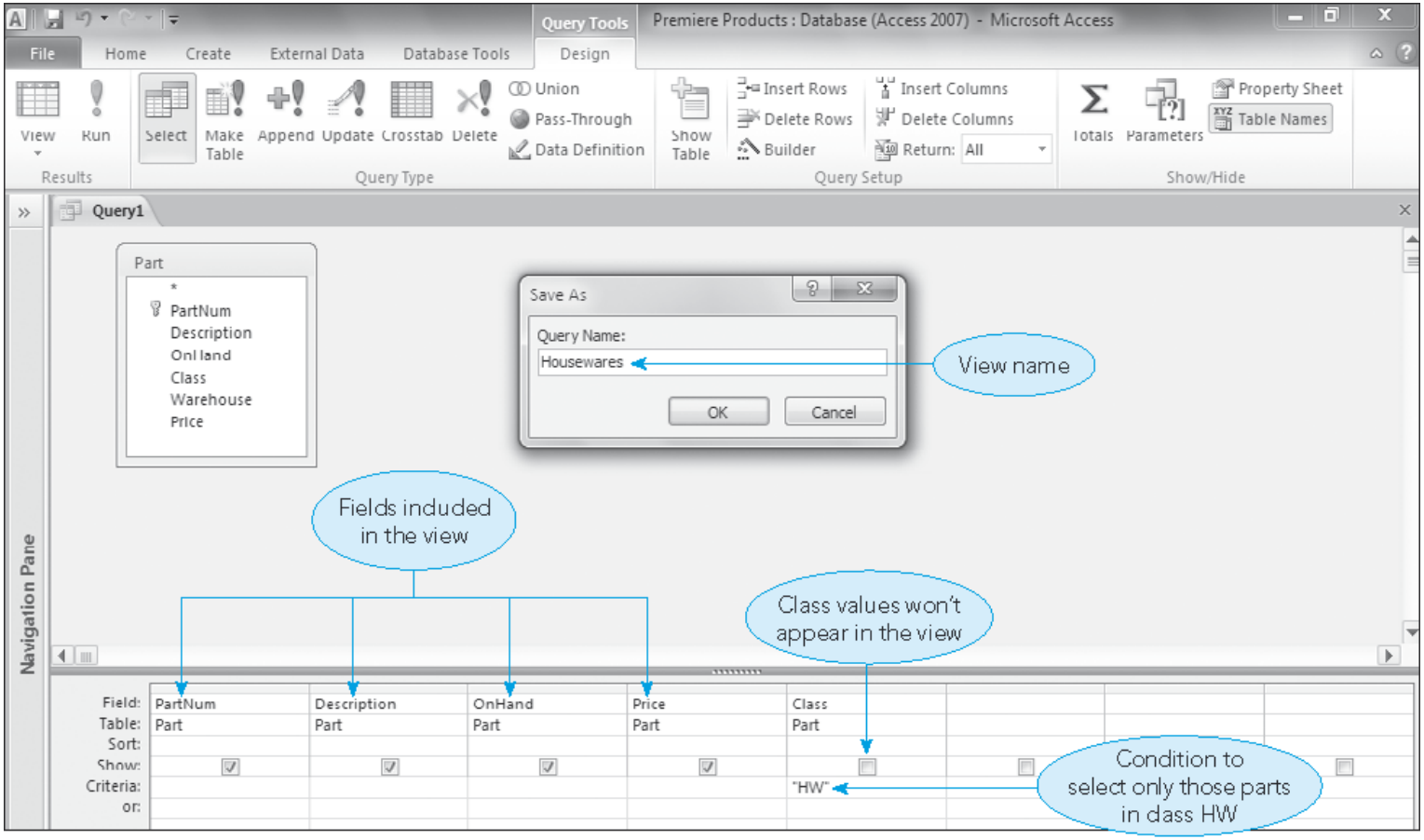


FIGURE 4-3: Access query design of the Housewares view

VIEWS (6/7)

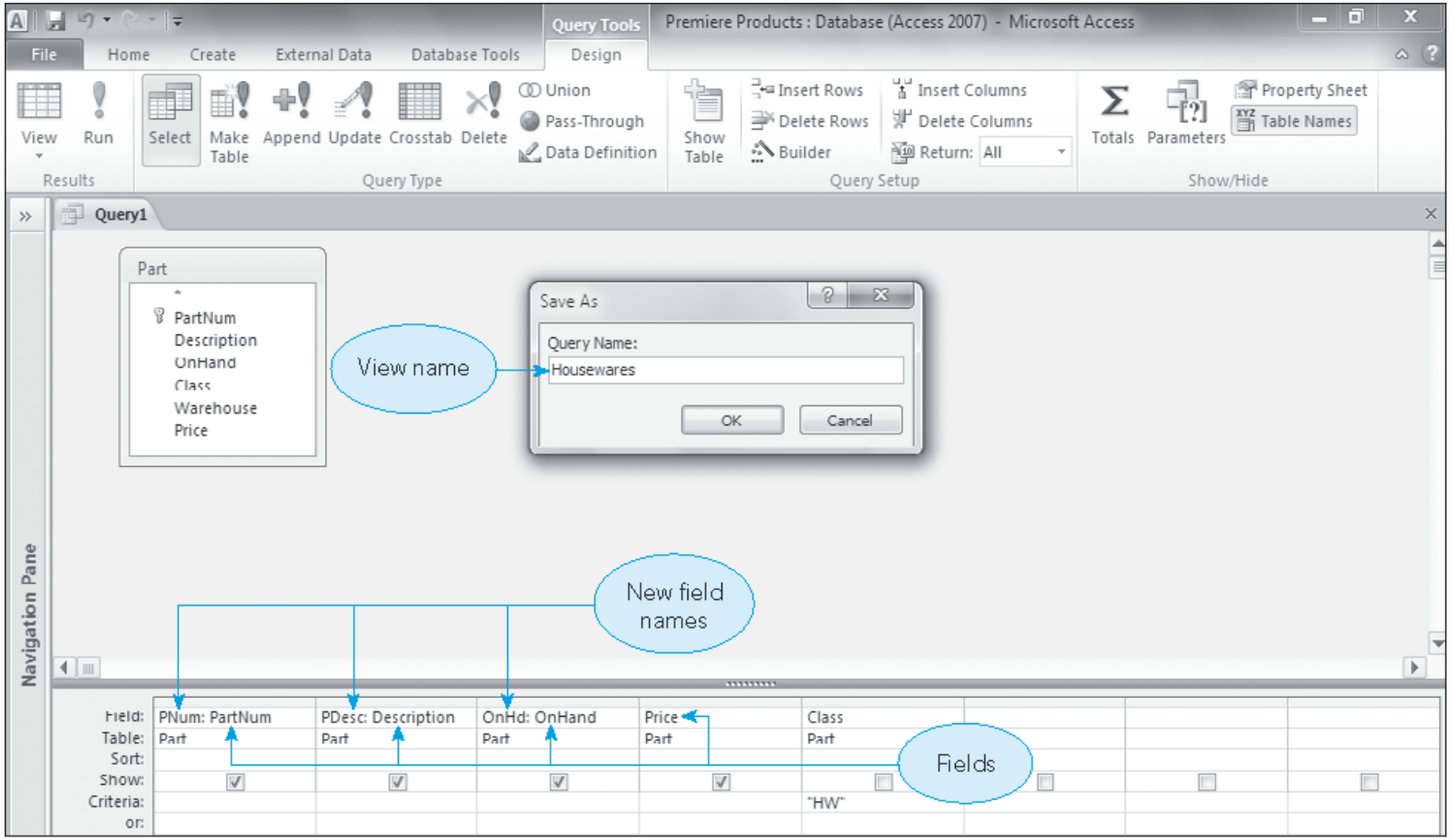


FIGURE 4-5: Access query design of the Housewares view with changed field names

Views (7/7)

- A view can join two or more tables
- Advantages of views
  - Data independence
  - Each user has his or her own view
  - View should contain only fields required by the user
    - Greatly simplifies user's perception of database
    - Security

Indexes (1/7)

- Conceptually similar to book index
- Increase data retrieval efficiency
- Record numbers automatically assigned and used by DBMS
- **Index key**: field or combination of fields on which index is built
- Advantages
  - Makes some data retrieval more efficient

INDEXES (2/7)

Customer

RecordNum	CustomerNum	CustomerName	...	Balance	CreditLimit	RepNum
1	148	Al's Appliance and Sport	...	$6,550.00	$7,500.00	20
2	282	Brookings Direct	...	$431.50	$10,000.00	35
3	356	Ferguson's	...	$5,785.00	$7,500.00	65
4	408	The Everything Shop	...	$5,285.25	$5,000.00	35
5	462	Bargains Galore	...	$3,412.00	$10,000.00	65
6	524	Kline's	...	$12,762.00	$15,000.00	20
7	608	Johnson's Department Store	...	$2,106.00	$10,000.00	65
8	687	Lee's Sport and Appliance	...	$2,851.00	$5,000.00	35
9	725	Deerfield's Four Seasons	...	$248.00	$7,500.00	35
10	842	All Season	...	$8,221.00	$7,500.00	20

FIGURE 4-10: Customer table with record numbers

INDEXES (3/7)

CustomerNum Index

CustomerNum	RecordNum
148	1
282	2
356	3
408	4
462	5
524	6
608	7
687	8
725	9
842	10

FIGURE 4-11: Index for the Customer table on the CustomerNum field

Indexes (4/7)

- Disadvantages
  - Occupies space on disk
  - DBMS must update index whenever corresponding data are updated
- Create an index on a field (or fields) when:
  - Field is the primary key of the table
  - Field is the foreign key in a relationship
  - Field will be frequently used as a sort field
  - Need to frequently locate a record based on a value in this field

Indexes (5/7)

- SQL command to create an index:

```
CREATE INDEX CustomerName
ON Customer (CustomerName)
;
```

- **Single-field index**
  - Key is a single field
  - Also called a **single-column index**
- **Multiple-field index**
  - More than one key field
  - Also called a **multiple-column index**

INDEXES (6/7)

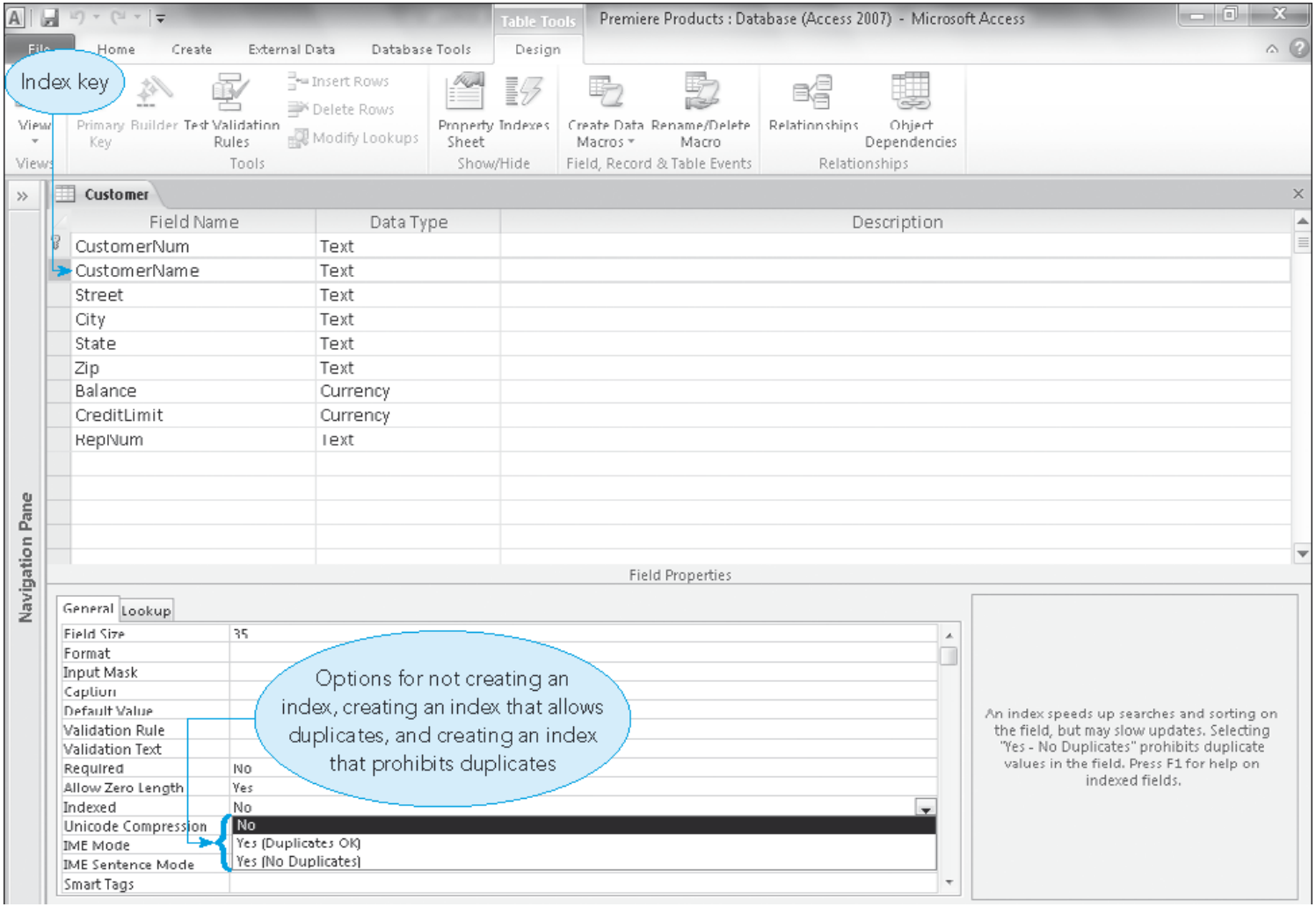


FIGURE 4-13: Creating an index on a single field in Access

INDEXES (7/7)

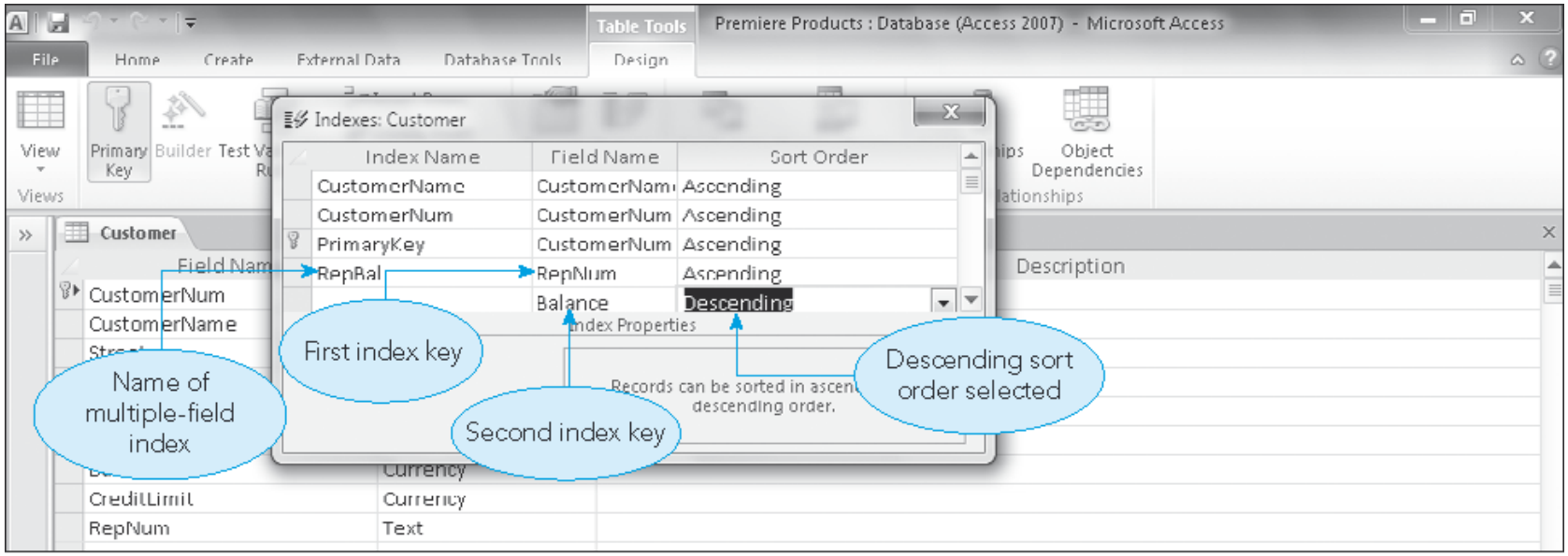


FIGURE 4-14: Creating a multiple-field index in Access

Security

- Prevention of unauthorized access to database
- Database administrator determines types of access various users can have
- SQL security mechanisms
  - GRANT: provides privileges to users

```
GRANT SELECT ON Customer TO Jones
;
```

  - REVOKE: removes privileges from users

```
REVOKE SELECT ON Customer FROM Jones
;
```

Integrity Rules

- Two integrity rules must be enforced by a relational DBMS
  - Integrity rules defined by Dr. E.F. Codd
  - Entity integrity
  - Referential integrity

Entity Integrity (1/2)

- No field that is part of primary key may accept null values
- To specify primary key in SQL:
  - Enter a **PRIMARY KEY** clause in either an ALTER TABLE or a CREATE TABLE command
- To designate primary key in Access:
  - Select primary key field in Table Design view
  - Click the Primary Key button in the Tools group on the Table Tools Design tab

Entity Integrity (continued)

- SQL command to specify a primary key:

```
PRIMARY KEY (CustomerNum)
```

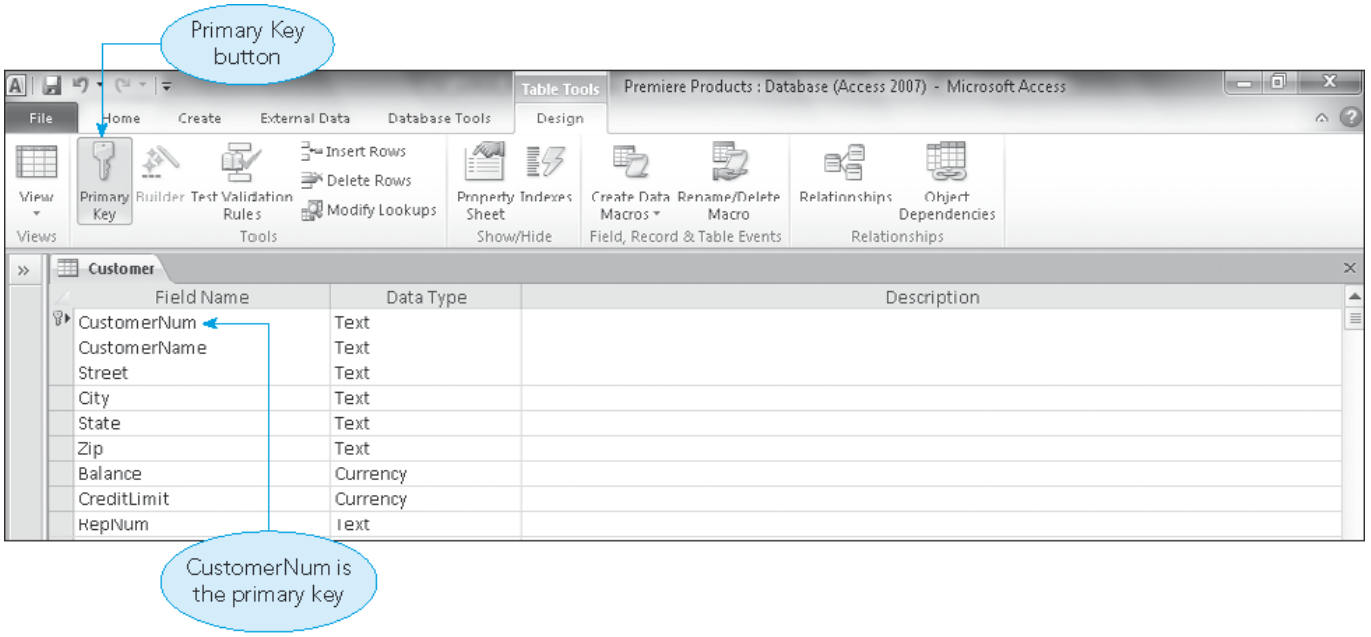


FIGURE 4-15: Specifying a primary key in Access

Entity Integrity (2/2)

- SQL command when more than one field included:

```
PRIMARY KEY (OrderNum, PartNum)
```

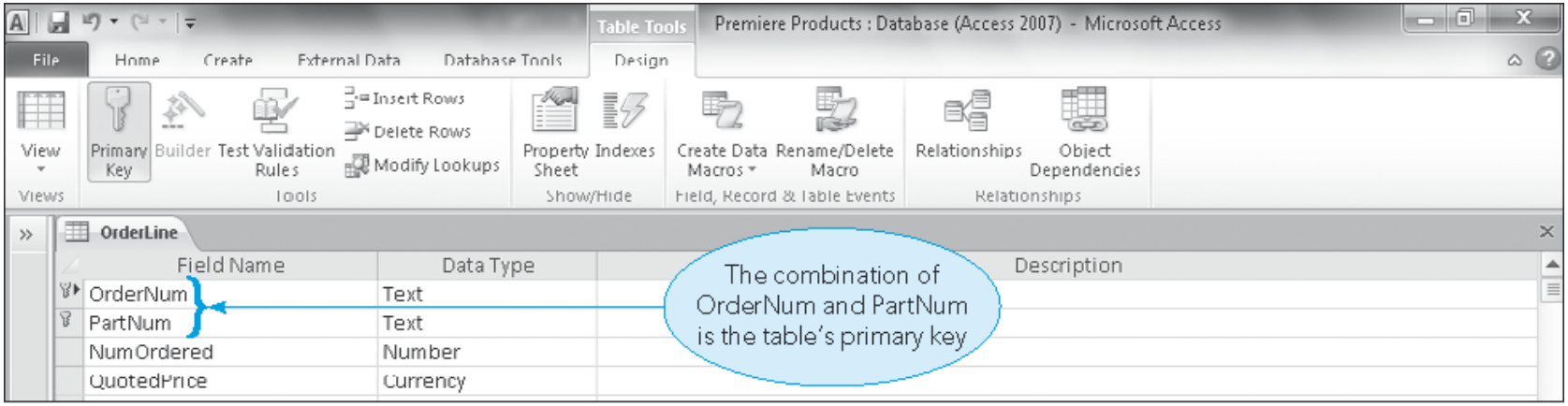


FIGURE 4-16: Specifying a primary key consisting of more than one field in Access

Referential Integrity (1/4)

- **Foreign key**: field(s) whose value is required to match the value of the primary key for a second table
- **Referential integrity**: if table A contains a foreign key that matches the primary key of table B, the values of this foreign key must match the value of the primary key for some row in table B or be null
- To specify referential integrity in SQL:
  - **FOREIGN KEY** clause in either the CREATE TABLE or ALTER TABLE commands

Referential Integrity (2/4)

- To specify a foreign key, must specify both:
  - Field that is a foreign key
  - Table whose primary key the field is to match
- Example:

```
FOREIGN KEY (RepNum) REFERENCES Rep
```

- In Access, specify referential integrity while defining relationships

REFERENTIAL INTEGRITY (3/4)

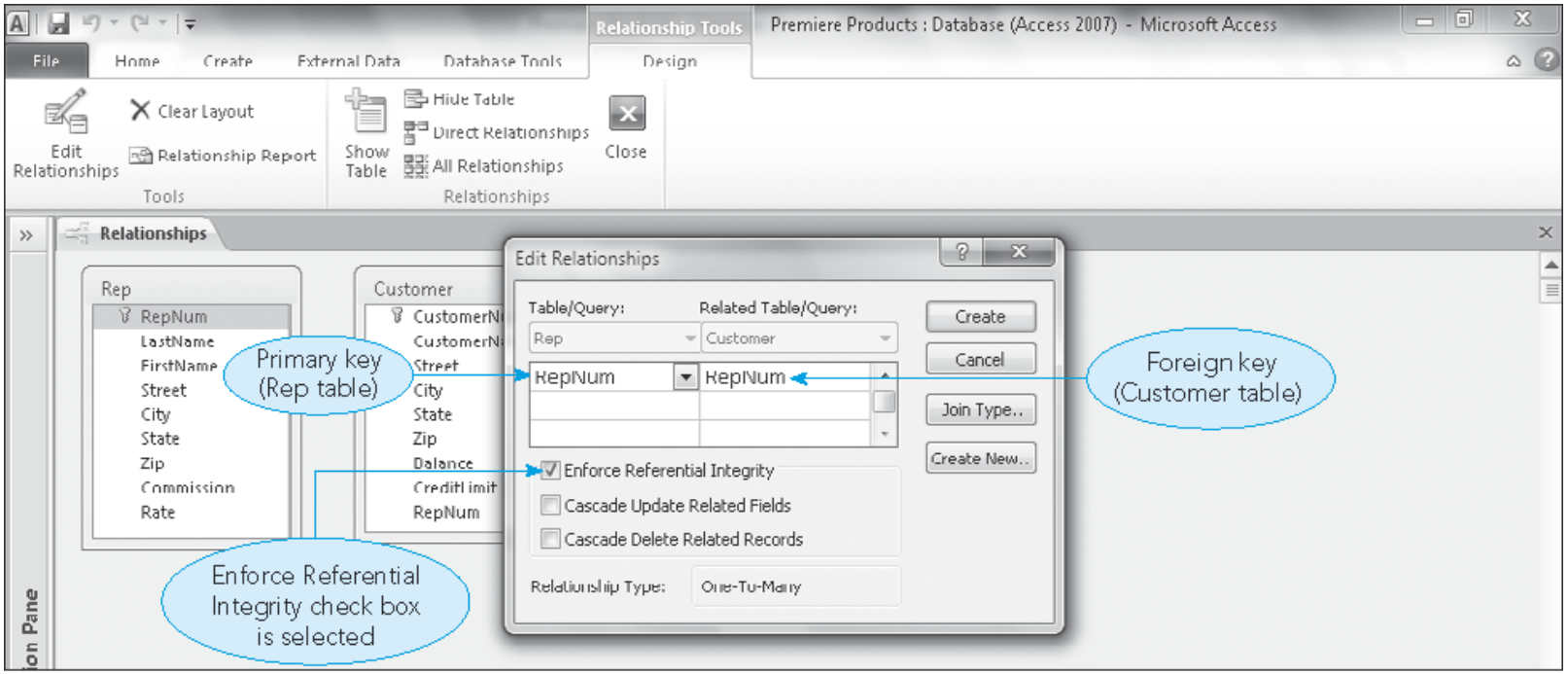


FIGURE 4-18: Specifying referential integrity in Access

REFERENTIAL INTEGRITY (4/4)

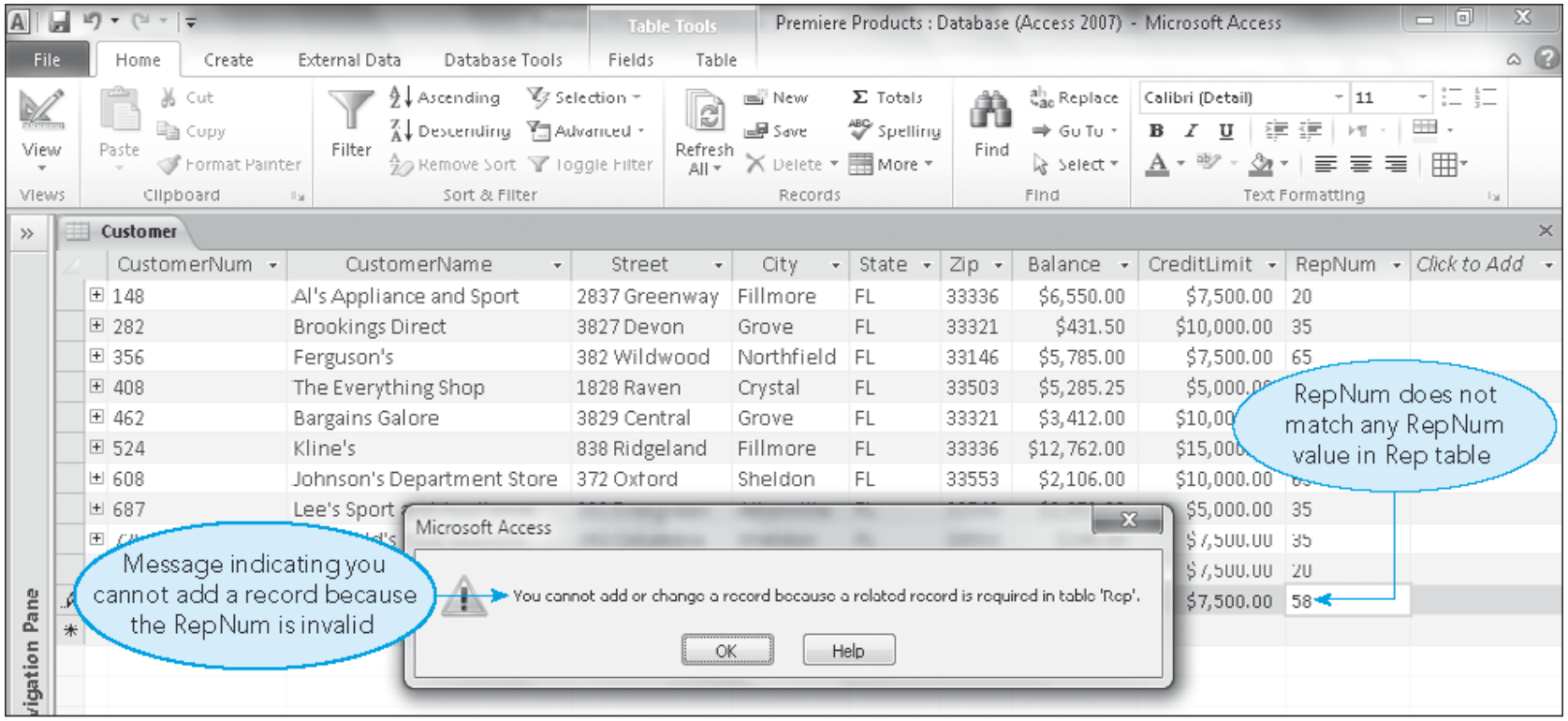


FIGURE 4-19: Referential integrity violation when attempting to add a record

Legal-Values Integrity (1/3)

- Legal values: set of values allowable in a field
- **Legal-values integrity**: no record can exist with a value in the field other than one of the legal values
- SQL
  - **CHECK** clause enforces legal-values integrity
  - Example:

```
CHECK (CreditLimit IN (5000, 7500, 10000,
15000))
```

Legal-Values Integrity (2/3)

- Access
  - **Validation rule**: must be followed by data entered
  - **Validation text**: informs user of the reason for rejection of data that violates the rule

LEGAL-VALUES INTEGRITY (3/3)

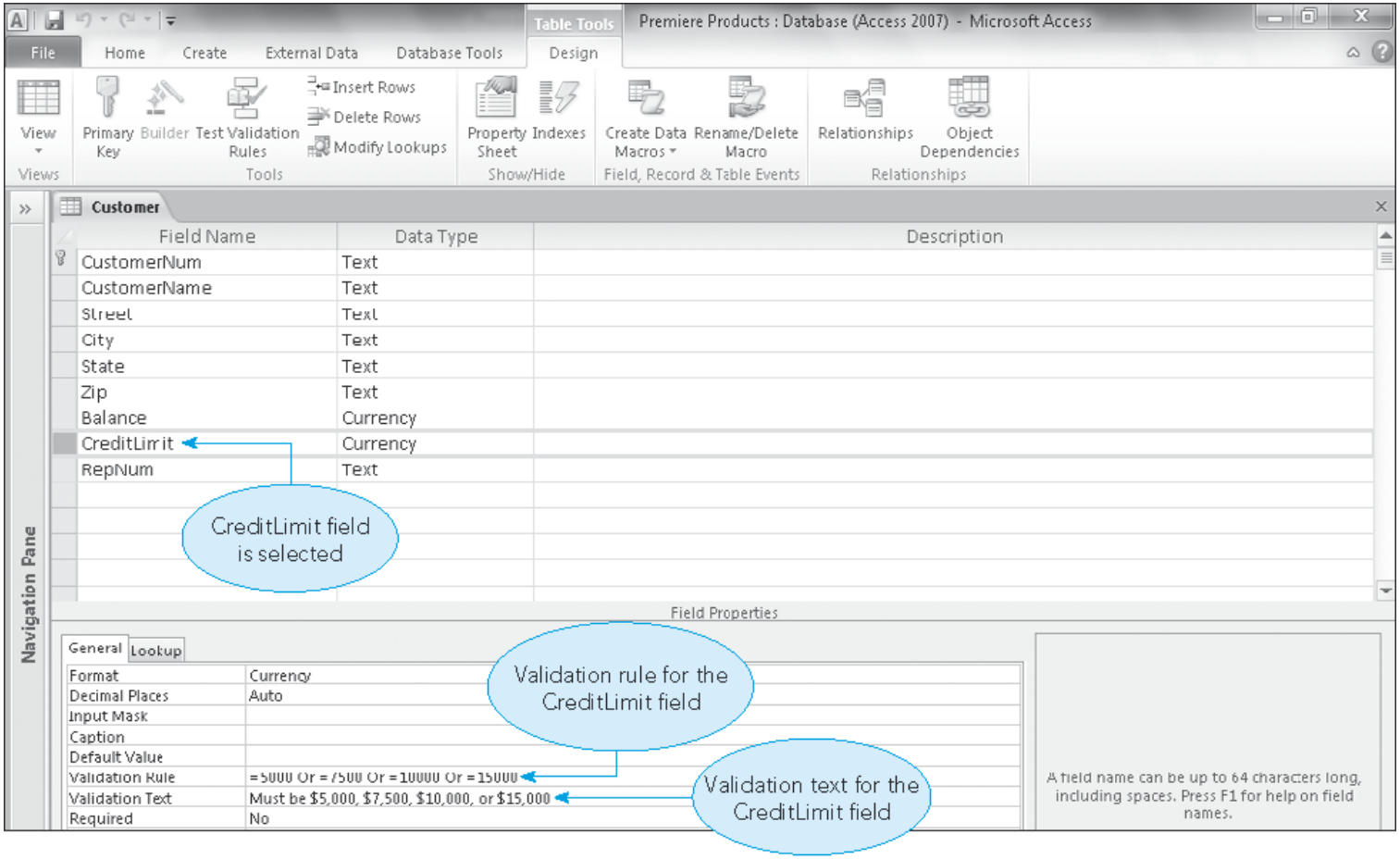


FIGURE 4-21: Specifying a validation rule in Access

Structure Changes (1/6)

- Examples of changes to database structure
  - Adding and removing tables and fields
  - Changing characteristics of existing fields
  - Creating and dropping indexes
- SQL **ALTER TABLE** command changes table's structure
- To add a new field to the Customer table:

```
ALTER TABLE Customer
ADD CustType CHAR(1)
;
```

STRUCTURE CHANGES (2/6)

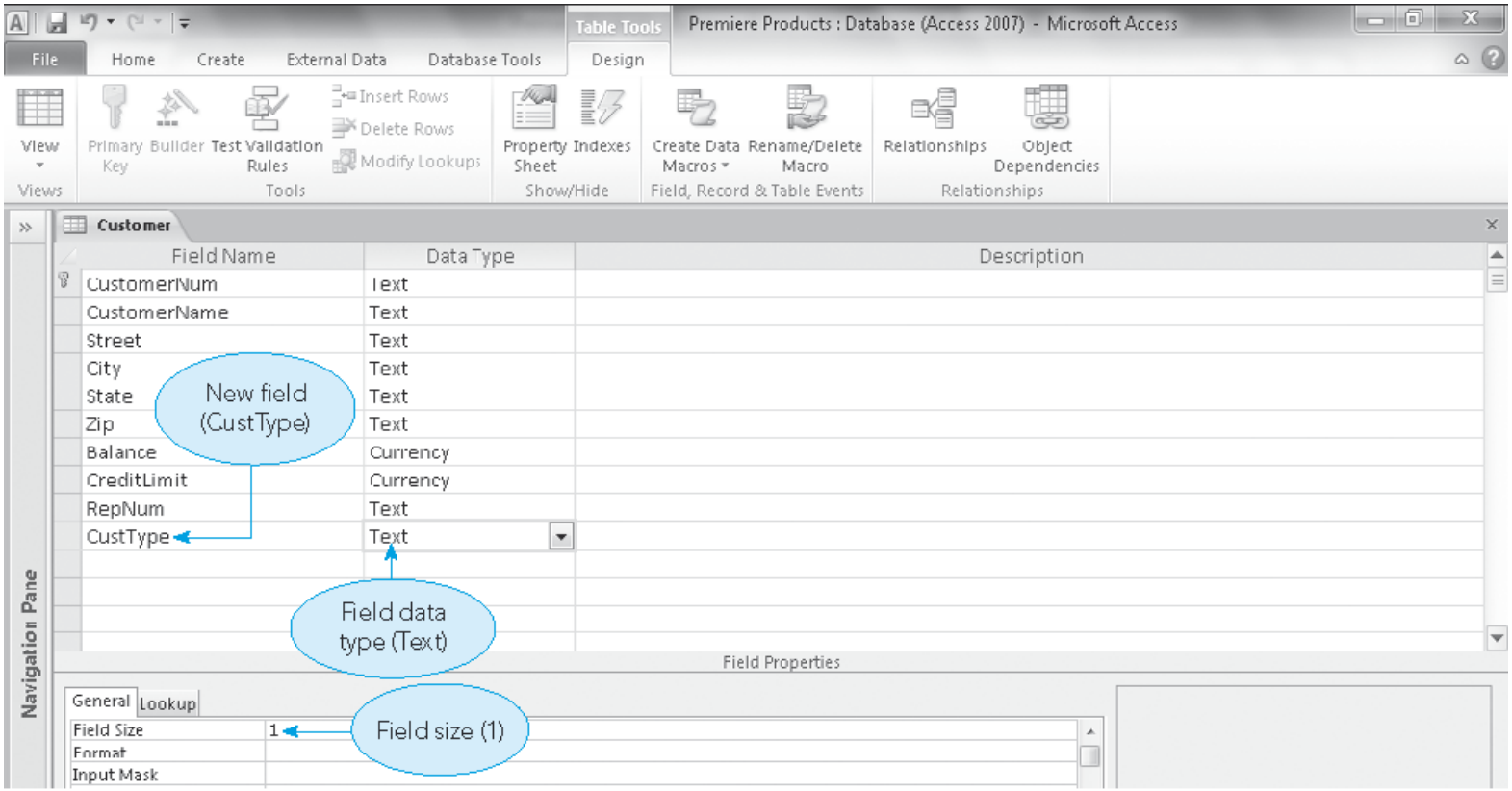


FIGURE 4-22: Adding a field in Access

Structure Changes (3/6)

- Changing properties of existing fields

```
ALTER TABLE Customer
CHANGE COLUMN CustomerName TO CHAR(40)
;
```

- Deleting a field from a table

```
ALTER TABLE Part
DELETE Warehouse
;
```

- **DROP TABLE** command deletes a table

```
DROP TABLE SmallCust
;
```

Structure Changes (4/6)

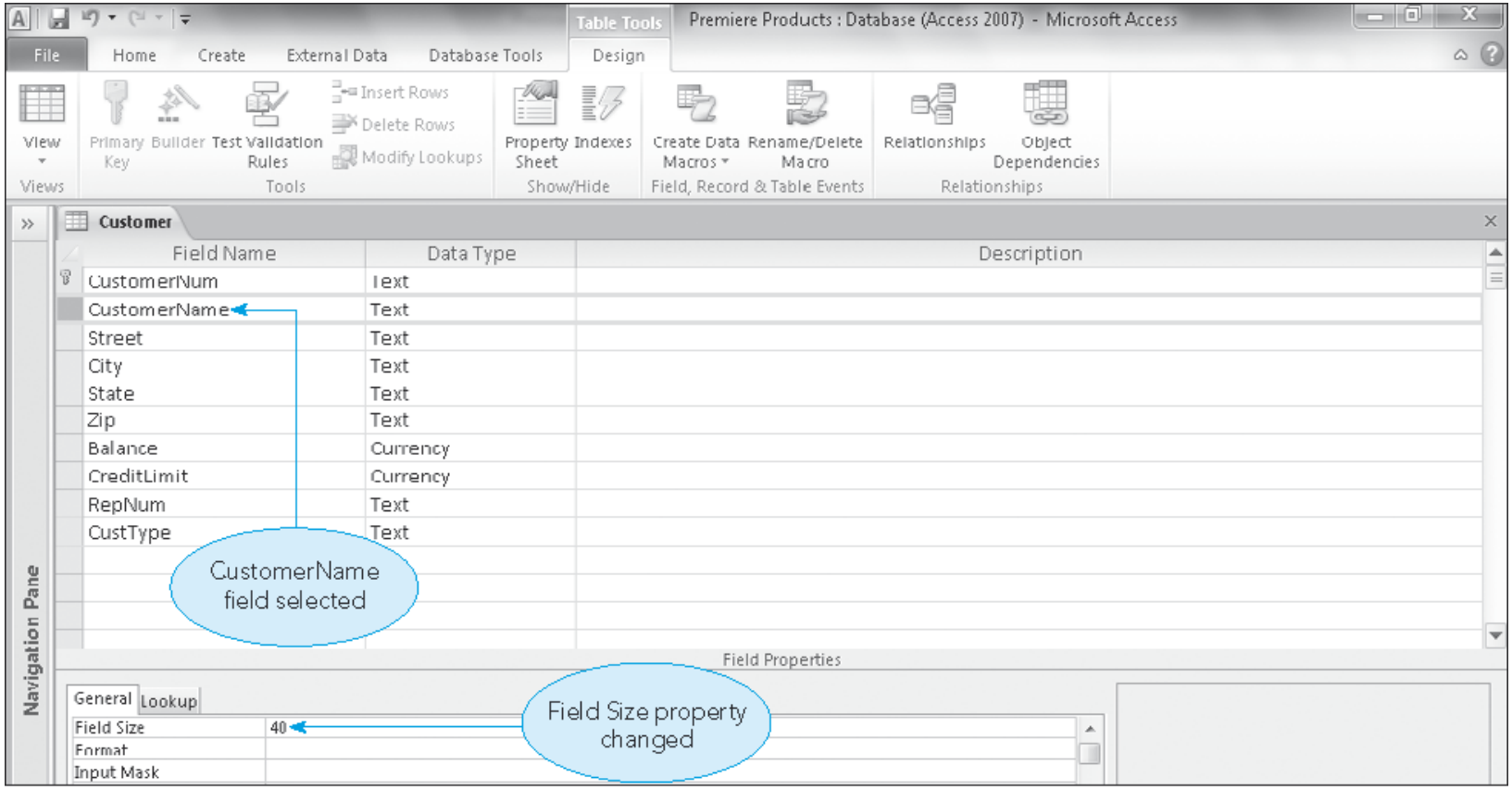


FIGURE 4-23: Changing a field property in Access

STRUCTURE CHANGES (5/6)

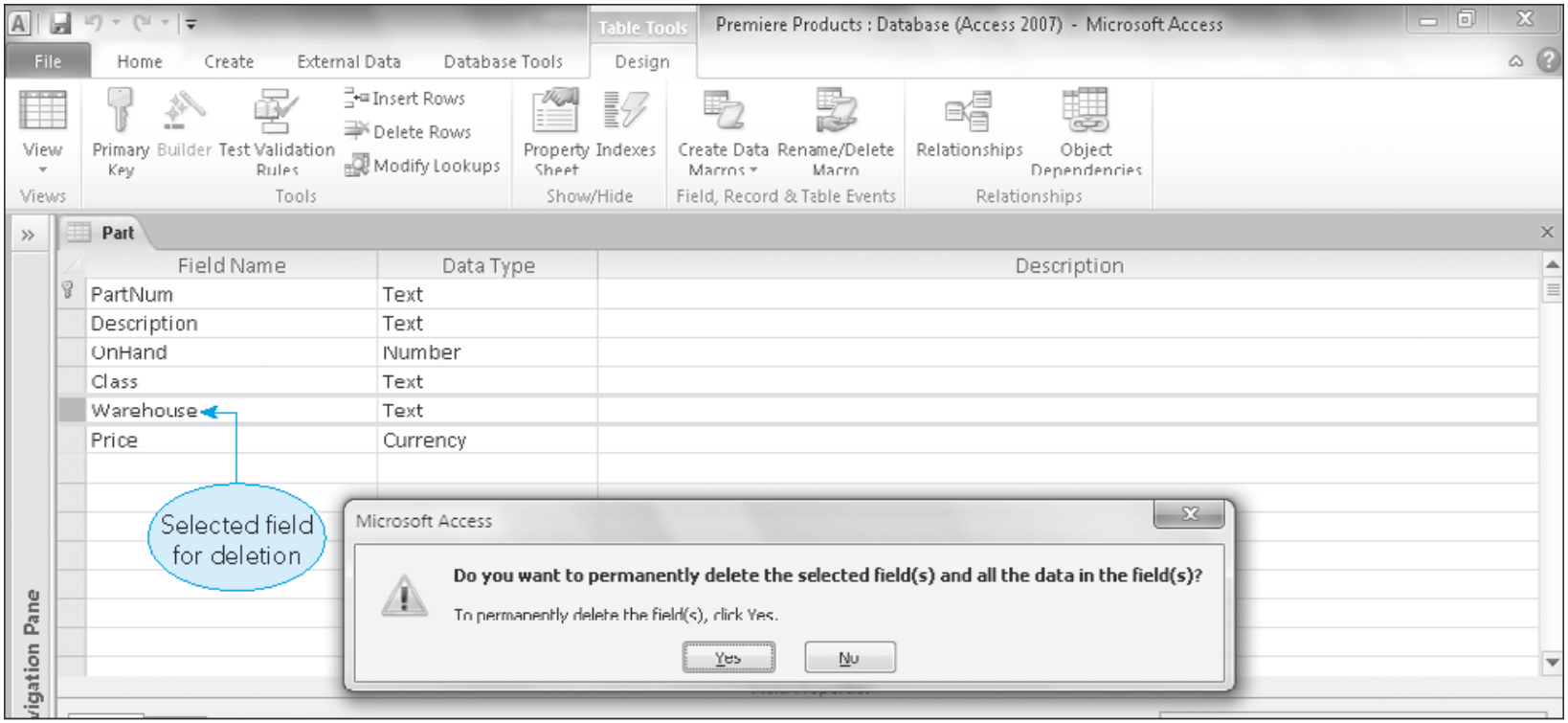


FIGURE 4-24: Dialog box that opens when a field in Access is deleted

STRUCTURE CHANGES (6/6)

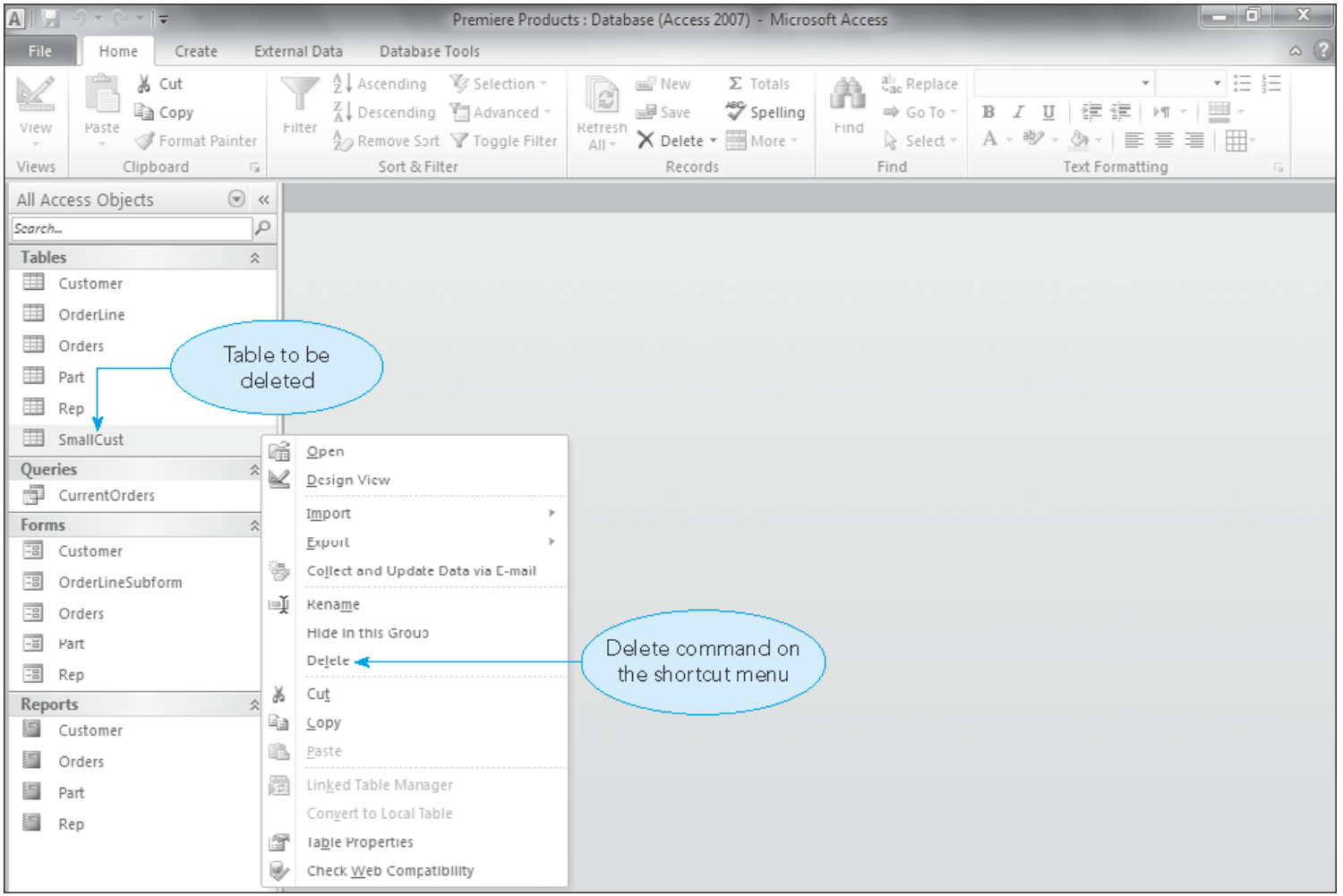


FIGURE 4-25: Deleting a table in Access

Making Complex Changes

- Some changes might not be allowed by your DBMS
- In these situations, you can:
  - Use CREATE TABLE command to describe the new table
  - Insert values into it using INSERT command combined with a SELECT clause
- SELECT INTO command can create the new table in a single operation

System Catalog (1/2)

- **System catalog** (or **catalog**)
  - Contains information about tables in the database
  - Maintained automatically by DBMS
- Example catalog has two tables
  - **Systables**: information about the tables known to SQL
  - **Syscolumns**: information about the columns or fields within these tables

System Catalog (2/2)

- Other possible tables
  - **Sysindexes**: information about indexes
  - **Sysviews**: information about views
- Catalog can be used to determine information about the structure of the database
- **Documenter**: allows user to print detailed documentation about any table, query, report, form, or other object in the database
- MySQL uses SHOW TABLES, SHOW INDEXES, and SHOW COLUMNS commands

Stored Procedures (1/3)

- **Client/server system**
  - Database resides on a computer called the **server**
  - Users access database through clients
- **Client**
  - Computer connected to a network
  - Has access through server to the database

Stored Procedures (2/3)

- **Stored procedure**
  - Special file used to store a query that is run often
  - Placed on the server
  - Improves overall performance
  - Convenience

Stored Procedures (3/3)

- MySQL
  - **Delimiter**: semicolon at the end of a MySQL command
  - Need to temporarily change the delimiter for a stored procedure
  - To use a stored procedure: *CALL* followed by the procedure name
- Access does not support stored procedures
  - Use a parameter query instead

Triggers

- Action that occurs automatically in response to an associated database operation such as an INSERT, UPDATE, or DELETE command
- Stored and compiled on the server
- Need to temporarily change the delimiter
- Access does not support triggers
  - Access 2010 has data macros that have similar functionality

Data Macros in Access 2010

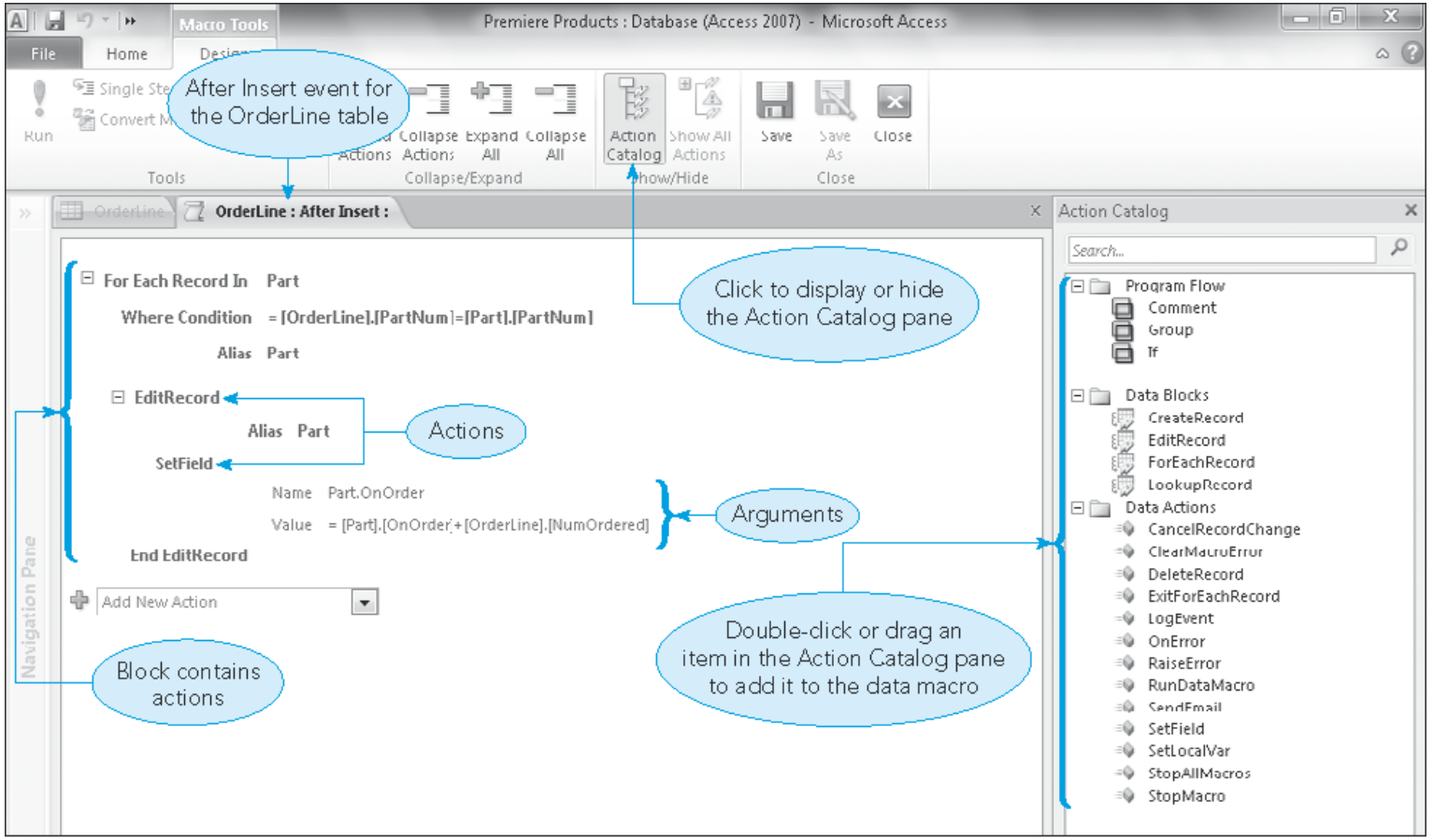


Figure 4-29: Macro Designer window for the After Insert event associated with the OrderLine table