Database Management Systems

Introduction to Database Management

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Objectives

- Introduce Premiere Products, the company that is used as the basis for many of the examples throughout the text
- Introduce basic database terminology
- Describe database management systems (DBMSs)
- Explain the advantages and disadvantages of database processing
- Introduce Henry Books, the company that is used in a case that appears throughout the text
- Introduce Alexamara Marina Group, the company that is used in another case that appears throughout the text

What Is a Database System?

- Database:
  - a very large, integrated collection of data.
- Models a real-world *enterprise*
  - Entities (e.g., teams, games)
  - Relationships
  - More recently, also includes active components , often called "business logic".
- A *Database Management System (DBMS)* is a software system designed to store, manage, and facilitate access to databases.

The Purpose of a Database is …

- …to manage and keep track of things (Entities):
  - Orders
  - Customers
  - Jobs
  - Skills
  - Employees
  - ……

Walmart Invoice Example

What are the different things you need to track and manage?

Walmart
Save money. Live better.

MANAGER MIKE JUDD
(585) 292 - 6000
ST# 1619 OP# 00007616 TE# 03 TR# 00999

VIT D MILK	007880011210 F	1.87 O
TOM ON VINE	000000004664KF	
1.62 lb @	1 lb /1.88	3.05 N
ROMA TOMATO	000000004087KF	
1.48 lb @	1 lb /1.00	1.48 N
HONEY TURKEY	004470006411 F	5.98 O
TILAPIA FIL	022063610608 F	6.08 L
LC SPAGHETTI	001380016635 F	1.98 L
LC SPAGHETTI	001380016635 F	1.98 L
GREEN ONIONS	003338360503 F	1.18 L
5 RED	003338300003 F	6.47 N
CHERRIES	000000004045KF	
WAS 3.48/lb YOU SAVED 0.50		
1.74 lb @	1 lb /2.98	5.19 O
ZIPLOC CONT	002570010878	2.16 X
PP LUNCH RED	006128204743	6.96 X
2GALLON BAGS	002570001132	3.68 X
2GALLON BAGS	002570001132	3.68 X
FREEZER BAGS	002570000382	3.68 X
STORAGE BAGS	007874207966	2.64 X
2 CLIPPERS	007160309625	3.97 X
MICROBAN BD	088369911109	10.97 X
SUBTOTAL		72.70
TAX 1 8.000 %		3.00
TOTAL		75.70
MCARD TEND		75.70

ACCOUNT # 6748
APPROVAL # 03386P
CHANGE DUE 0.00

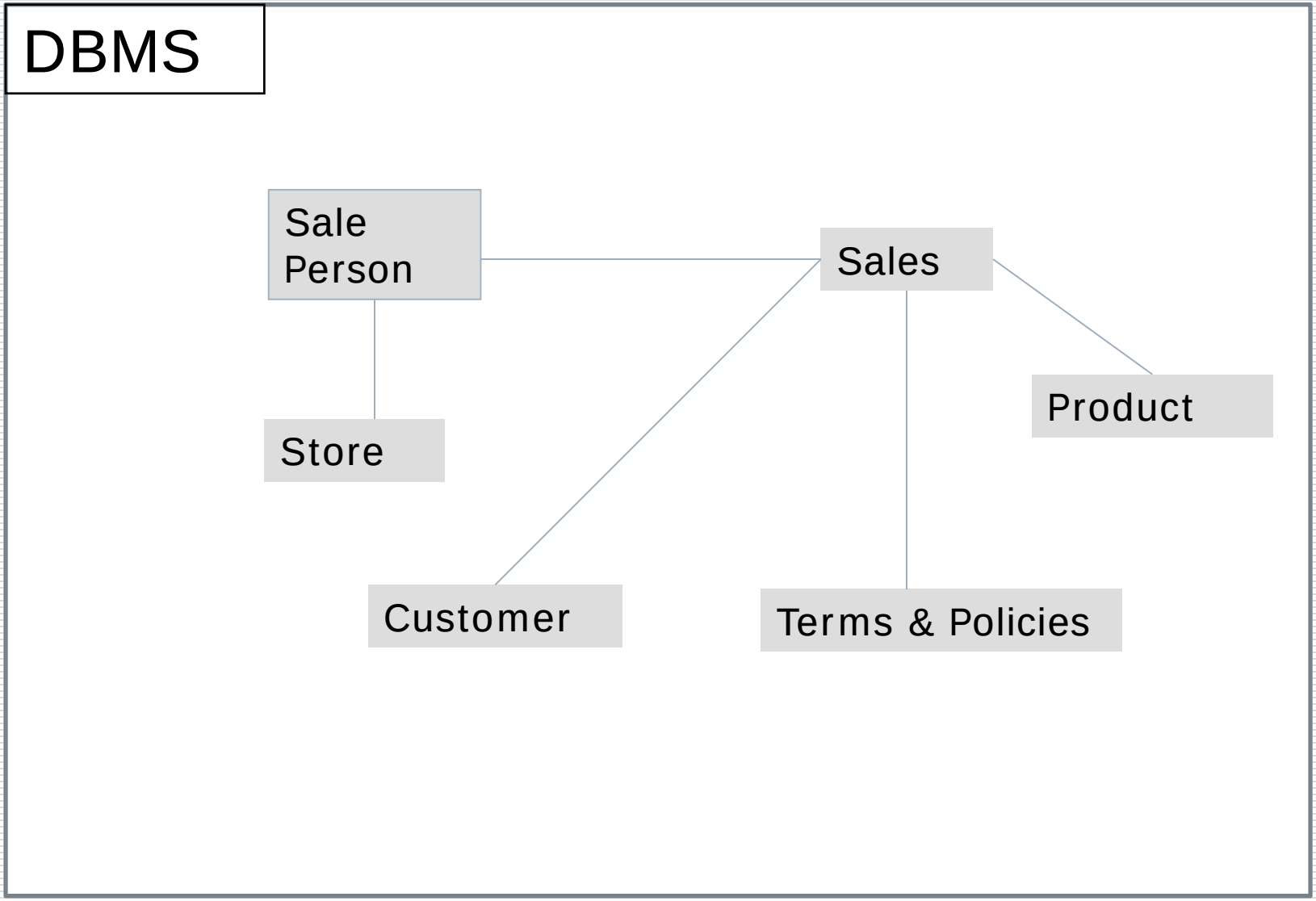
ITEMS SOLD 18

TC# 0345 3070 6110 1134 9386

Shop at Walmart & Get
Your Back to School List for Less.
08/29/10 16:01:21

CUSTOMER COPY

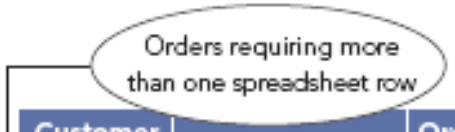
WalMart Database



Premiere Products Background

- Premiere Products
  - Distributor of appliances, houseware, and sporting goods
  - Uses spreadsheet software to maintain important data
  - Recent growth has made spreadsheet approach problematic

Premiere Products Background (continued)



Customer Number	Customer Name	Order Number	Order Date	Part Number	Part Description	Number Ordered	Quoted Price	Warehouse	Rep Number
148	Al's Appliance and Sport	21608	10/20/2010	AT94	Iron	11	$21.95	3	20
148	Al's Appliance and Sport	21619	10/23/2010	DR93	Gas Range	1	$495.00	2	20
282	Brookings Direct	21614	10/21/2010	KT03	Dishwasher	2	$595.00	3	35
356	Ferguson's	21610	10/20/2010	DR93	Gas Range	1	$495.00	2	65
356	Ferguson's	21610	10/20/2010	DW11	Washer	1	$399.99	3	65
408	The Everything Shop	21613	10/21/2010	KL62	Dryer	4	$329.95	1	35
608	Johnson's Department Store	21617	10/23/2010	BV06	Home Gym	2	$794.95	2	65
608	Johnson's Department Store	21617	10/23/2010	CD52	Microwave Oven	4	$150.00	1	65
608	Johnson's Department Store	21623	10/23/2010	KV29	Treadmill	2	$1,290.00	2	65

FIGURE 1-1: Sample orders spreadsheet

Premiere Products Background (continued)

- Problems using spreadsheet
  - **Redundancy**
    - Duplication of data or the storing of the same data in more than one place
    - What problems does redundancy cause?
  - Difficulty accessing related data (customer's address)
    - Limited security (being accessed by unauthorized users)
    - Size limitations (multiple spread sheets)

Premiere Products Background (continued)

- Information Premiere Products needs to maintain
  - Sales Reps
    - Sales rep number, last name, first name, address, total commission, commission rate
  - Customers
    - Customer number, name, address, current balance, credit limit, number of customer's sales rep
  - Parts Inventory
    - Part number, description, number units on hand, item class, warehouse number, unit price
  - Order
    - Order number, order date, customer number, part number, number units ordered, quoted price

Database Background

- Database
  - Structure that can store information about:
    - Different categories of information
    - Relationships between those categories of information
- **Entity**
  - Person, place, object, event, or idea
  - Entities for Premiere Products: sales reps, customers, orders, and parts

Database Background (continued)

- **Attribute**
  - Characteristic or property of an entity
  - Example: Customer has name, street, city, etc.
  - May also be called a **field** or **column**

Exercise

- Students in a student organization
- Students in a course
- students on an athletic team
- Student health records

Database Background (continued)

- **Relationship**
  - Association between entities
  - **One-to-many relationship**
    - Each rep is associated with many customers
    - Each customer is associated with a single rep

Types of Relationships in ERD

- **One-to-many** relationships (1:M)
  - PAINTER (1) paints PAINTING (M)
- **Many-to-many** relationships (M:N)
  - EMPLOYEE (M) learns SKILL (N)
- **One-to-one** relationships (1:1)
  - EMPLOYEE (1) manages STORE (1)

Entity and Attributes

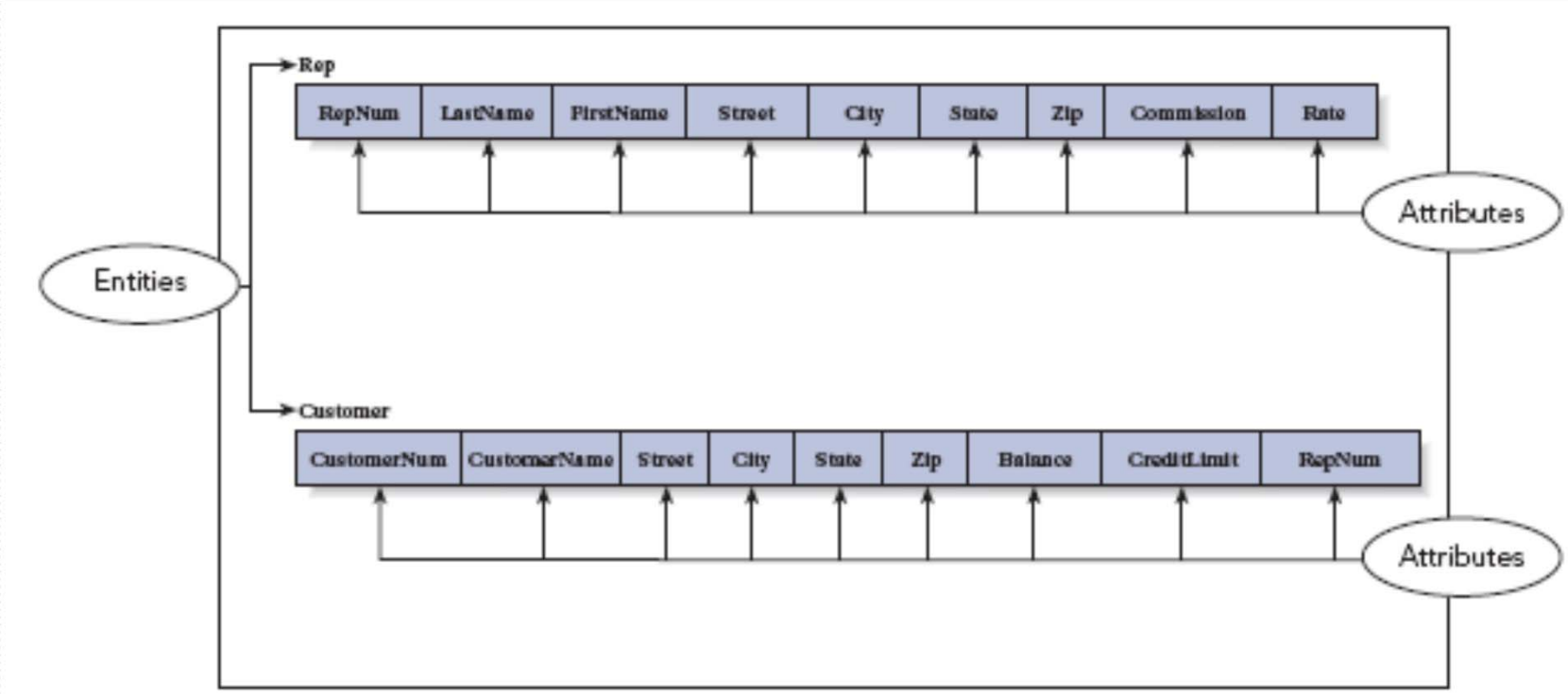


FIGURE 1-3: Entities and attributes

One to Many Relationship

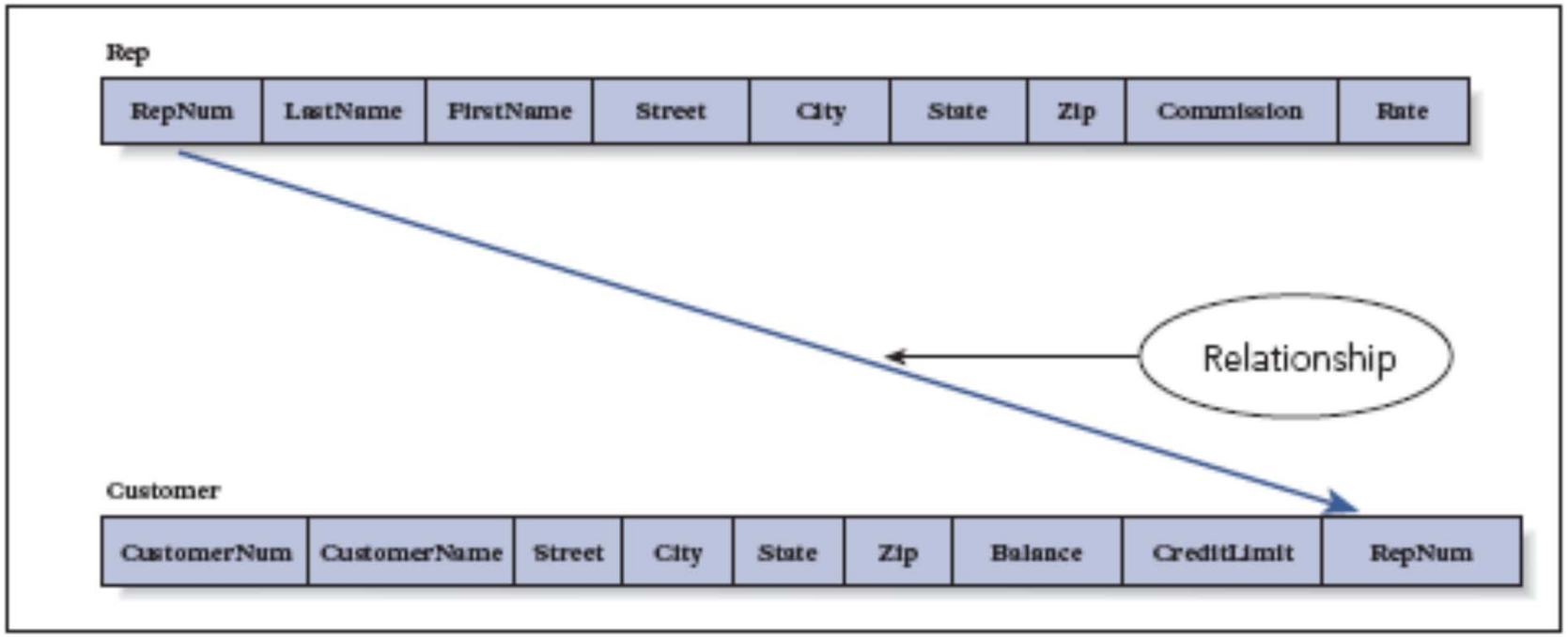


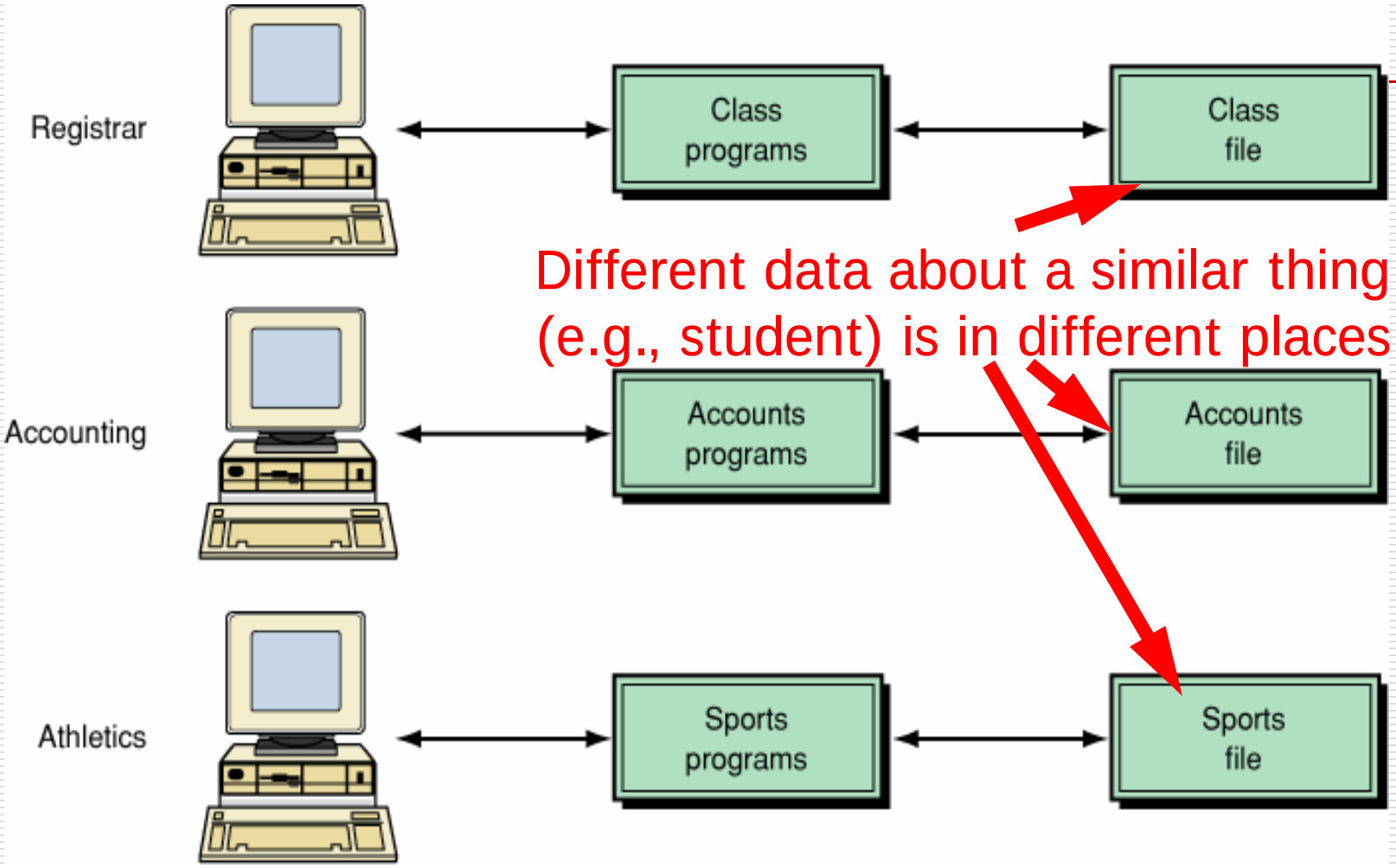
FIGURE 1-4: One-to-many relationship

How does a database differ from a spreadsheet?

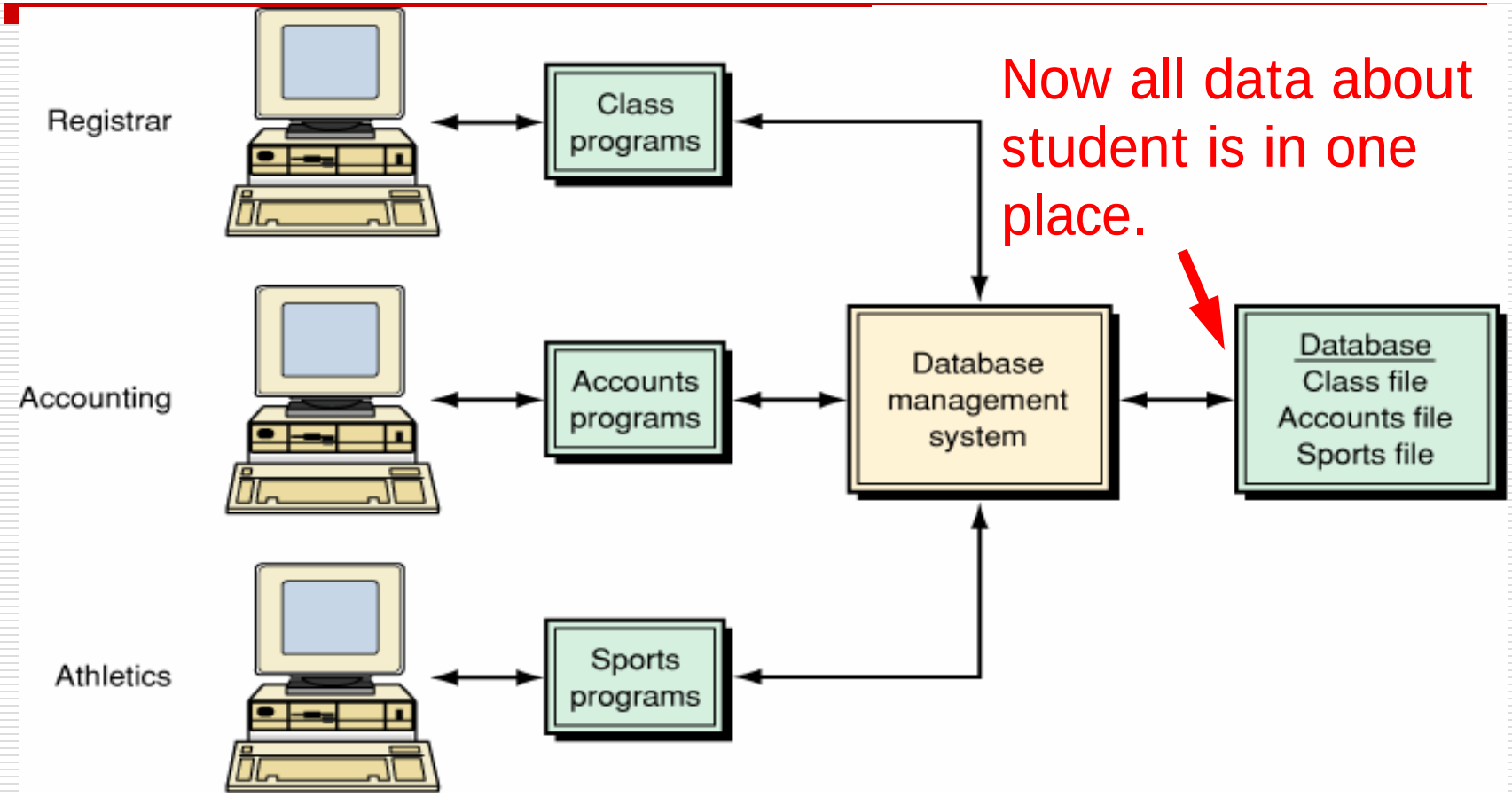
Datafile vs Database

- **Data file**
  - File used to store data
  - Computer counterpart to ordinary paper file
- **Database**
  - Structure that can store information about:
    - Multiple types of entities
    - Attributes of those entities
    - Relationships between the entities

File Management Systems



So, How's That Look In A Database



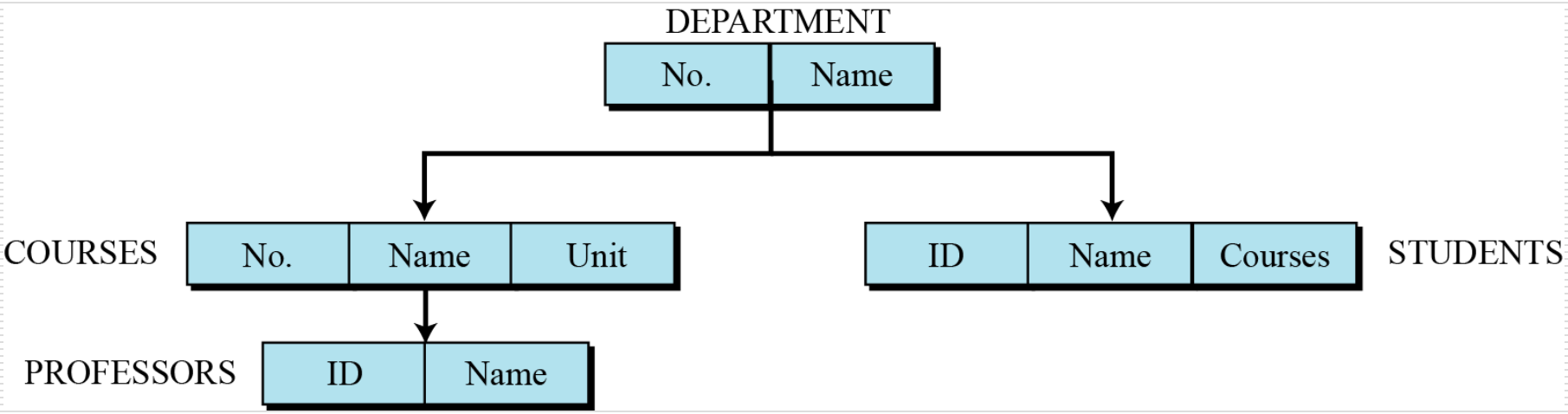
Types of Database Model

A database model defines the logical design of data. The model also describes the relationships between different parts of the data. In the history of database design, three models have been in use: the hierarchical model, the network model and the relational model.

- Hierarchical database model (legacy systems)
- Network database model (legacy systems)
- Relational database model (focus in this course)

Hierarchical database model

In the hierarchical model, data is organized as an inverted tree. Each entity has only one parent but can have several children. At the top of the hierarchy, there is one entity, which is called the root.



An example of the hierarchical model representing a university

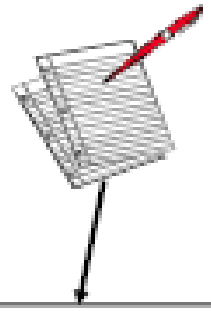
Hierarchical Database Model

- Started by IBM and known as IMS DB
- It influenced later DB's
- Basic structure
  - Each parent can have many children
  - Each child can have only one parent
- The path is from left to right and the top of the tree is the root
- It is important that the most used records be placed to the left of the tree
- This model is useful when there are many one-to-many relationships that remain fixed over time

A Hierarchical Database Model

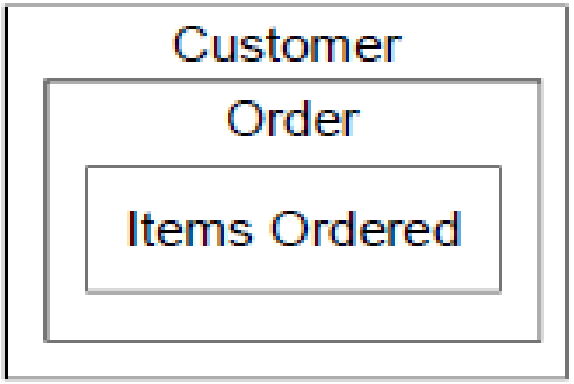
Customers

Orders



Items

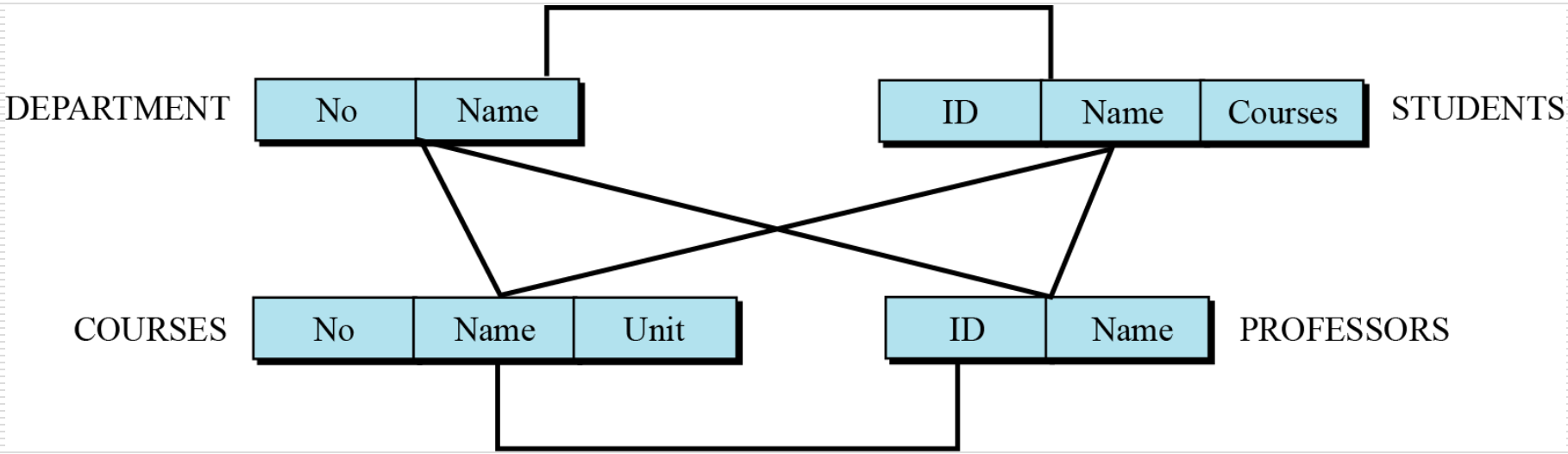
Item	Description	Quantity
998	Dog Food	12
764	Cat Food	11



To retrieve data, you must start at the top (customer). When you retrieve a customer, you retrieve all nested data.

Network database model

In the network model, the entities are organized in a graph, in which some entities can be accessed through several paths (Figure 14.4).



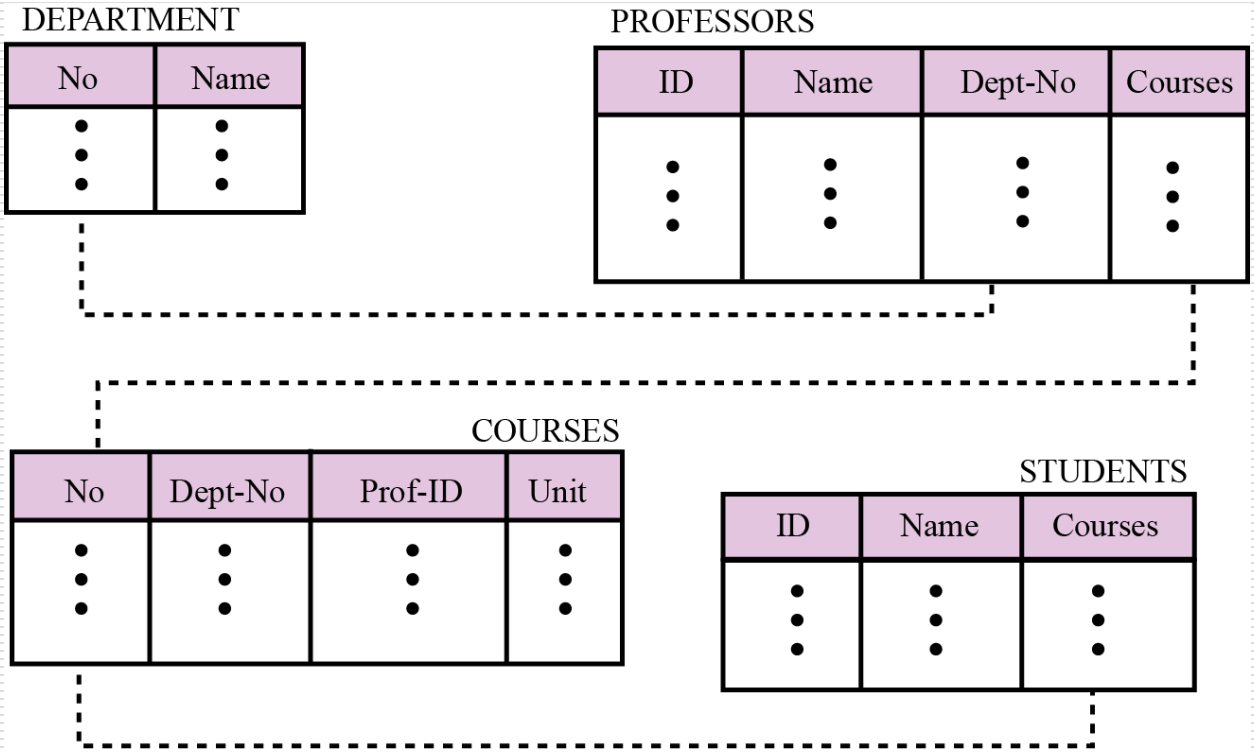
An example of the network model representing a university

Network Database Model

- The model came about to 1. Improve DB performance, 2. Handle more complex business situations, and 3. To set DB standards
- Basic structure
  - Series of one-to-many relationships
  - A parent may have many children
  - A child (record) may have many parents

Relational database model

In the relational model, data is organized in two-dimensional tables called relations. The tables or relations are, however, related to each other, as we will see shortly.

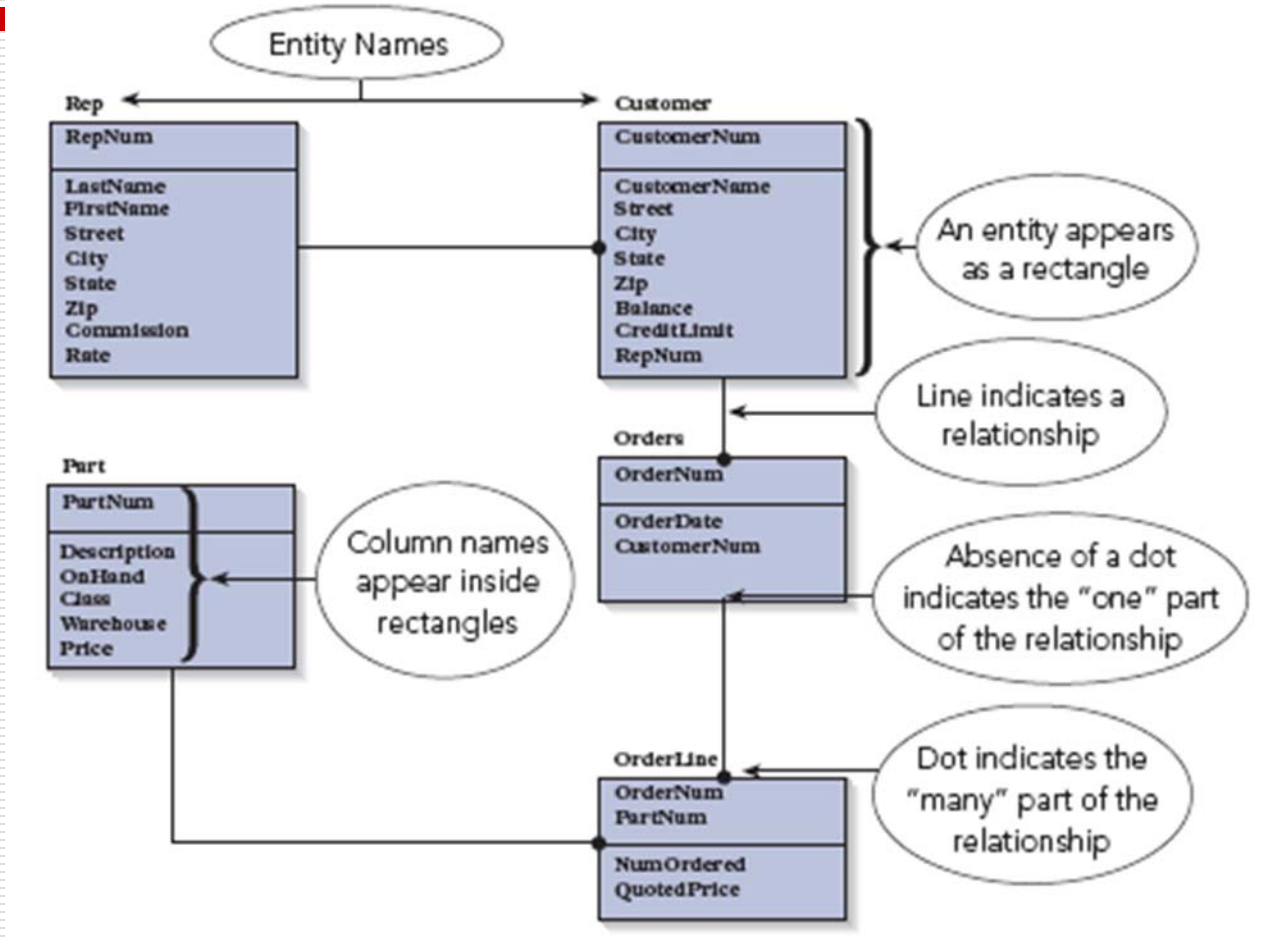


An example of the relational model representing a university

Entity-Relationship (E-R) Diagram

- Entity-relationship (E-R) diagram
  - Visual way to represent a database
  - Rectangles represent entities
  - Lines represent relationships between connected entities

Premiere Product E-R Diagram



Database Management Systems

- **Database management system (DBMS)**
  - Program, or collection of programs, through which users interact with a database
- Popular DBMSs: Access, Oracle, DB2, MySQL, and SQL Server
- Premiere Products decides to use Access
- **Database design**
  - Determining the structure of the required database

Database Management Systems (continued)

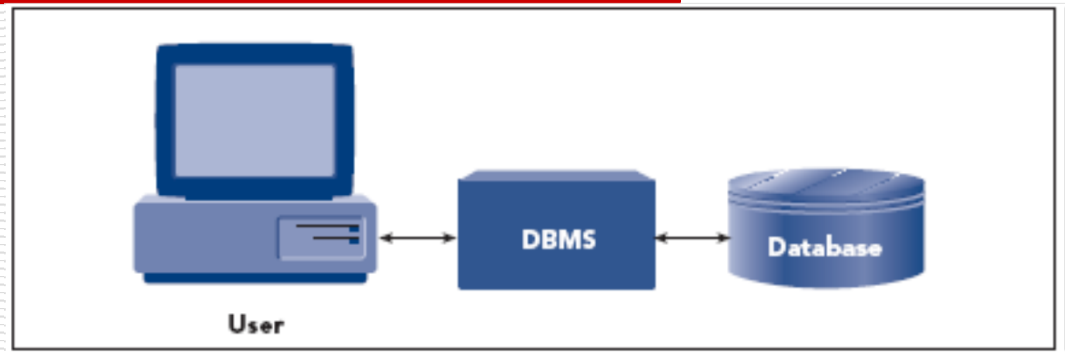


FIGURE 1-8: Using a DBMS directly

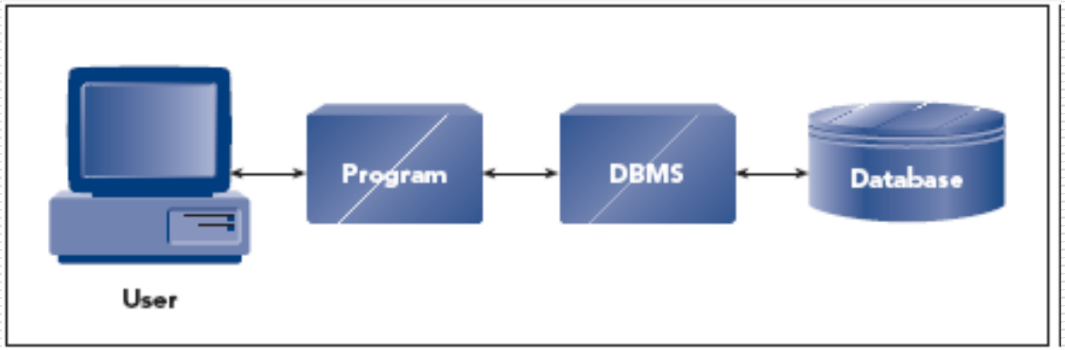


FIGURE 1-9: Using a DBMS through another program

Database Management Systems (continued)

- Forms
  - Screen objects used to maintain, view, and print data from a database
  - DBMS creates forms that Premiere Products needs
- Reports
  - DBMS creates reports for Premiere Products based on user's answers about the desired content and appearance of each report

Database Management Systems (continued)

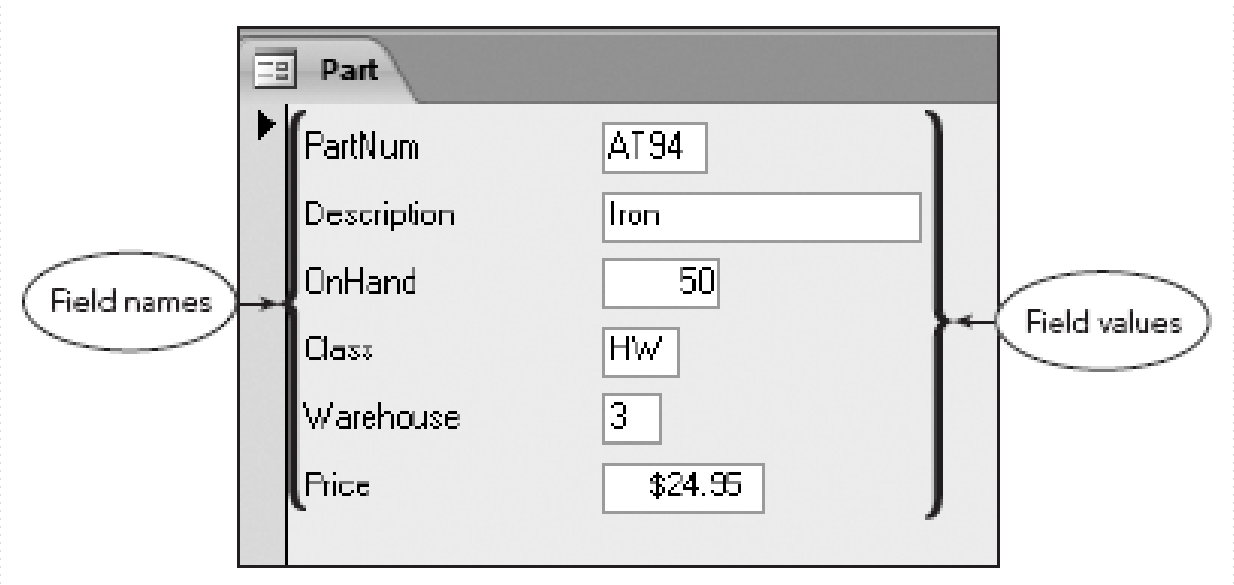


FIGURE 1-10: Part form

Database Management Systems (continued)

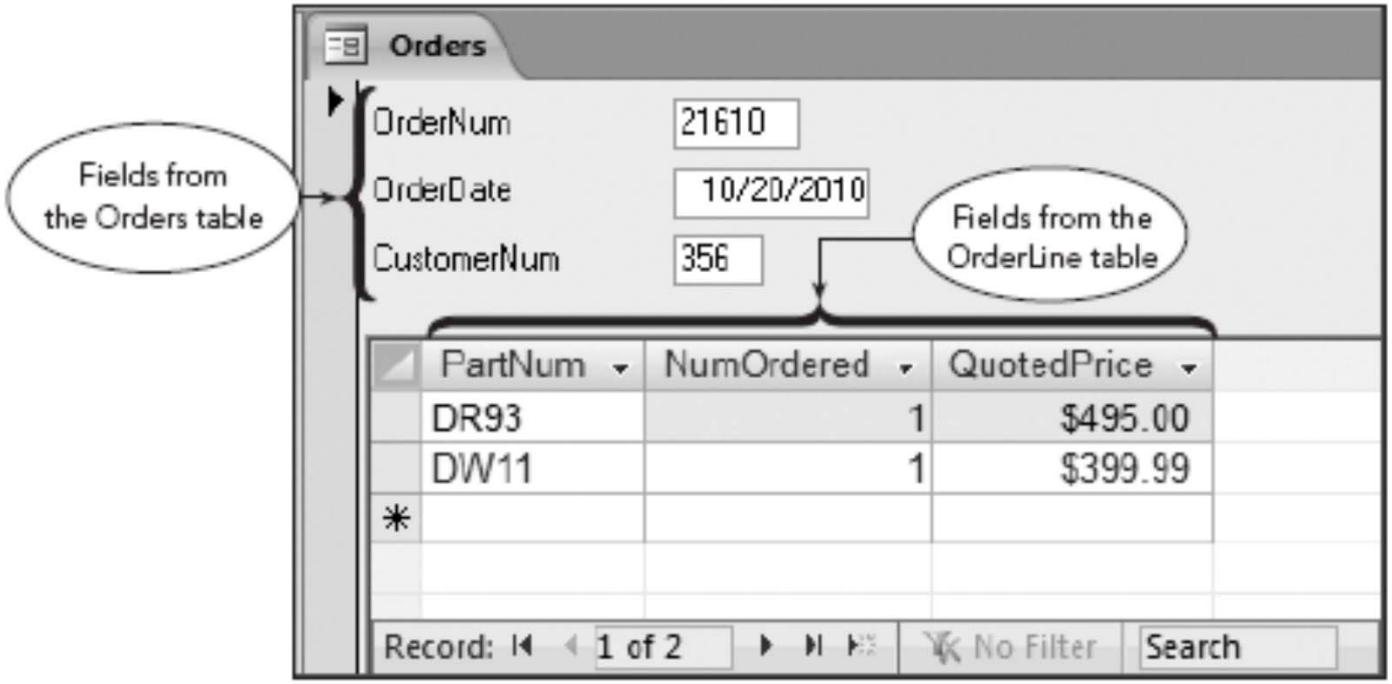


FIGURE 1-11: Orders form

Database Management Systems (continued)

Parts

PartNum	Description	OnHand	Class	Warehouse	Price
AT94	Iron	50	HW	3	$24.95
BV06	Home Gym	45	SG	2	$794.95
CD52	Microwave Oven	32	AP	1	$165.00
DL71	Cordless Drill	21	HW	3	$129.95
DR93	Gas Range	8	AP	2	$495.00
DW11	Washer	12	AP	3	$399.99
FD21	Stand Mixer	22	HW	3	$159.95
KL62	Dryer	12	AP	1	$349.95
KT03	Dishwasher	8	AP	3	$595.00
KV29	Treadmill	9	SG	2	$1,390.00

FIGURE 1-12: Parts report

Advantages of Database Processing

1. Getting more information from the same amount of data
2. Sharing data
3. Balancing conflicting requirements
   - **Database administrator** or **database administration (DBA):** person or group in charge of the database
4. Controlling redundancy
5. Facilitating consistency

Advantages of Database Processing (continued)

6. Improving integrity
   - **Integrity constraint:** a rule that data must follow in the database
7. Expanding security
   - **Security:** prevention of unauthorized access
8. Increasing productivity
9. Providing data independence
   - **Data independence:** can change structure of a database without changing the programs that access the database

Disadvantages of Database Processing

1. Larger file size
2. Increased complexity
3. Greater impact of failure
4. More difficult recovery

Summary

- Problems with non-database approaches to data management: redundancy, difficulties accessing related data, limited security features, limited data sharing features, and potential size limitations
- Entity: person, place, object, event, or idea for which you want to store and process data
- Attribute, field, or column: characteristic or property of an entity
- Relationship: an association between entities

Summary (continued)

- One-to-many relationship: each occurrence of first entity is related to many occurrences of the second entity and each occurrence of the second entity is related to only one occurrence of the first entity
- Database: structure that can store information about multiple types of entities, attributes of entities, and relationships among entities
- Premiere Products requires information about reps, customers, parts, orders, and order lines
- Entity-relationship (E-R) diagram: represents a database visually by using various symbols

Summary (continued)

- Database management system (DBMS): program through which users interact with a database; lets you create forms and reports quickly and easily, and obtain answers to questions about the data
- Advantages of database processing: getting more information from the same amount of data, sharing data, balancing conflicting requirements, controlling redundancy, facilitating consistency, improving integrity, expanding security, increasing productivity,

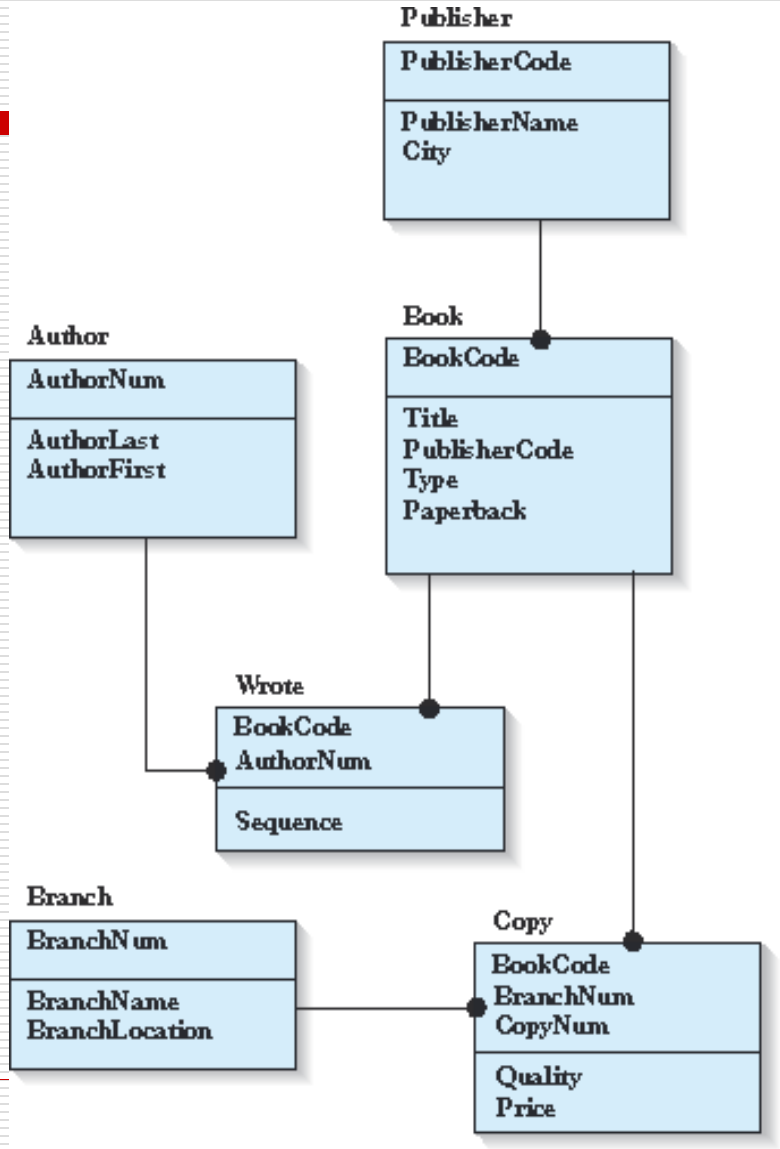
Summary (continued)

- Disadvantages of database processing: larger file size, increased complexity, greater impact of failure, and more difficult recovery

Introduction to Henry Books Case

- Henry Books
  - Book store chain operated by Ray Henry
- Henry decided to use database to gather and store information on:
  - Branches
  - Publishers
  - Authors
  - Books

Introduction to Henry Books Database Case (continued)



Introduction to the Alexamara Marina Group Database Case

- Alexamara Marina Group offers in-water boat storage to owners
  - Provides boat slips that boat owners can rent on an annual basis
  - Two marinas: Alexamara East and Alexamara Central
  - Provides boat repair and maintenance services
- Database used to store data

Alexamara Marina Group E-R Diagram