

## Slide Set 2: Relational Database Model

### *Relational Database Model*

- ❖ The relational database model's structural and data independence enables us to view data **logically**
- ❖ Implicit Relationships
- ❖ Frees designers from need to specify every relationships prior to building the database as with Hierarchical Database structures
- ❖ Does not rely on physical (explicit) relationships
- ❖ Easy to modify

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### *A Logical View of Data*

- ❖ An **entity** is a person, place, event, or thing for which we intend to collect data.
  - ◆ University -- Students, Faculty Members, Courses
  - ◆ Airlines -- Pilots, Aircraft, Routes, Suppliers
- ❖ Each entity has certain characteristics known as **attributes**.
  - ◆ Student -- Student Number, Name, GPA, Date of Enrollment, Date of Birth, Home Address, Phone Number, Major
  - ◆ Aircraft -- Aircraft Number, Date of Last Maintenance, Total Hours Flown, Hours Flown since Last Maintenance

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### *A Logical View of Data*

- ❖ A grouping of related entities becomes an **entity set**.
  - ◆ The STUDENT entity set contains all student entities.
  - ◆ The FACULTY entity set contains all faculty entities.
  - ◆ The AIRCRAFT entity set contains all aircraft entities.

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### *Relational DB Model Data Structure*

- ❖ **Data Value (Cells)**
  - ◆ Contents of a field contained in a record
  - ◆ "Raw Facts" that can be recognized
- ❖ **Attributes or Fields or (Columns)**
  - ◆ Group of characters representing something with same data format
- ❖ **Entities or Records or Tuples (Rows)**
  - ◆ Collection of related fields
- ❖ **Entity Set or Table (File)**
  - ◆ Collection of related records
  - ◆ Ordering of Columns and Rows is immaterial

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## Slide Set 2: Relational Database Model

*Database File = Table*

- Columns are the **fields**
- Rows are the **records**

Data Items

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*Entity Set = Table*

- Columns are the **attributes**
- Rows are the **entities**

Data Values

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*Keys*

- ❖ A **key** is one or more attributes that determine entity set (Tables) relationships
  - ◆ **Controlled redundancy** (shared common attributes) makes the relational database work
  - ◆ Attribute B is **functionally dependent** on A if A determines B
  - ◆ Attribute that is part of a key is a **key attribute**
  - ◆ A multi-attribute key is known as a **composite key**
- ❖ **Primary key**
  - ◆ Uniquely identifies all other attributes in a row
- ❖ **Foreign key**
  - ◆ Values must match primary key in another table
- ❖ **Secondary key**
  - ◆ Used only for data retrieval

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*Fig 2.2: Simple Relational Database*

Table name: PRODUCT Database name: CH2\_SALE\_CO  
 Primary key: PROD\_CODE  
 Foreign key: VEND\_CODE

	PROD_CODE	PROD_DESCRIPT	PROD_PRICE	PROD_ON_HAND	VEND_CODE
▶	001278-AB	Claw hammer	\$12.95	23	232
+	123-21UUY	Housette chain saw, 16-in. bar	\$189.99	4	235
+	GER-34256	Sledge hammer, 16-lb. head	\$18.63	6	231
+	SRE-657UG	Rat-tail file	\$2.99	15	232
+	ZZX/3245Q	Steel tape, 12-ft. length	\$6.79	8	235

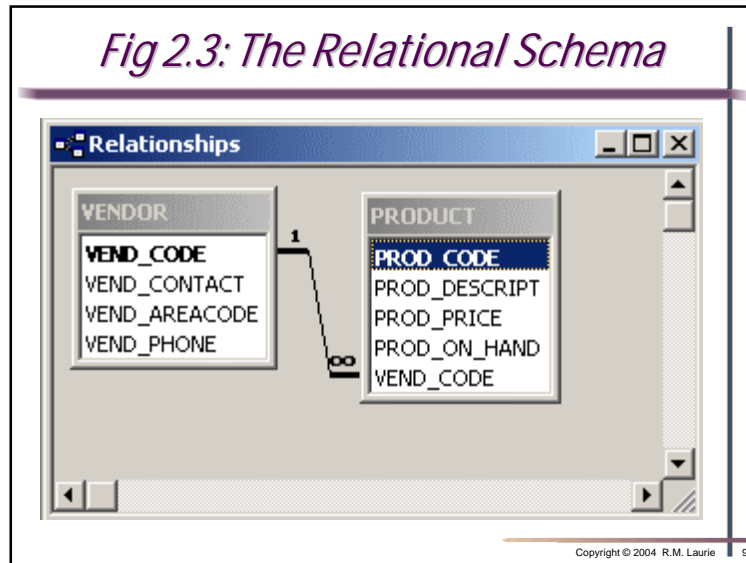
Table name: VENDOR  
 Primary key: VEND\_CODE  
 Foreign key: none

	VEND_CODE	VEND_CONTACT	VEND_AREACODE	VEND_PHONE
▶	230	Shelly K. Smithson	608	555-1234
+	231	James Johnson	615	123-4536
+	232	Annelise Crystall	608	224-2134
+	233	Candice Wallace	904	342-6567
+	234	Arthur Jones	615	123-3324
+	235	Henry Ortozo	615	899-3425

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Fig 2.3: The Relational Schema



## Integrity

### ❖ Entity Integrity

- ◆ The **Primary Key** (Key Field) uniquely identifies each given entity (Record). Null not permitted!

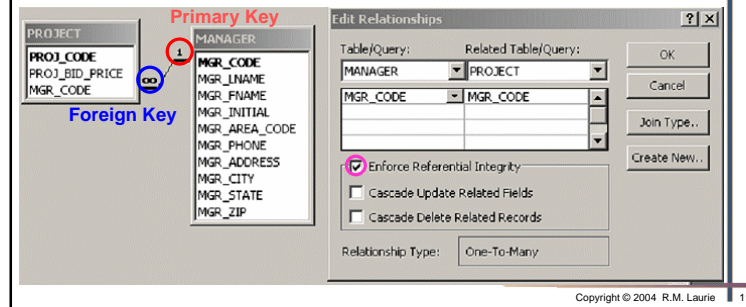
### ❖ Referential Integrity

- ◆ Exhibited when the **Foreign Key** contains either matching values or null, that connects with Primary keys of another table
- ◆ A **Foreign Key** of one table is used to link to the **Primary Key** in another table.

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## Enforcing Referential Integrity

- ❖ Foreign key must match primary key values or be null value
- ❖ Impossible to delete row whose primary key has matching foreign key values in other table



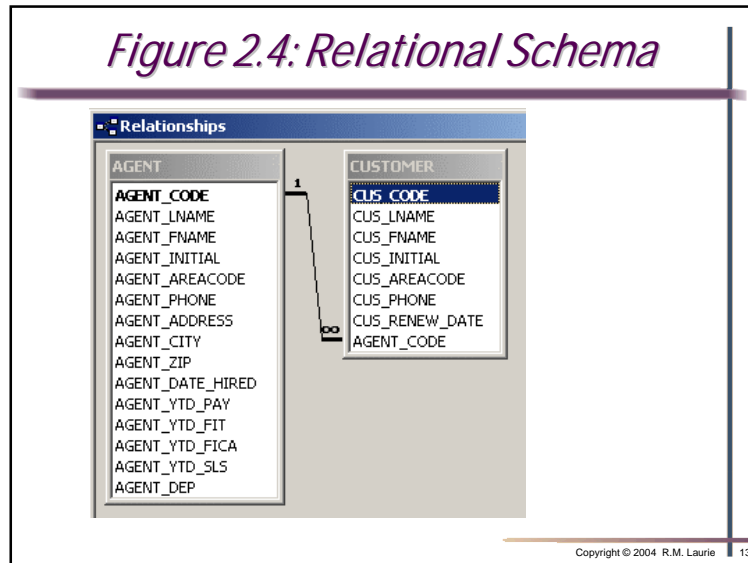
## Figure 2.4: Integrity Rules?

CUS_CODE	CUS_LNAME	CUS_FNAME	CUS_INITIAL	CUS_RENEW_DATE	AGENT_CODE
10010	Ramas	Alfred	A	Friday, March 12, 1999	502
10011	Dunne	Leona	K	Tuesday, May 23, 2000	501
10012	Smith	Kathy	W	Tuesday, January 05, 1999	502
10013	Olowski	Paul	F	Monday, September 20, 1999	
10014	Orlando	Myron		Monday, December 04, 2000	501
10015	O'Brian	Amy	B	Tuesday, August 29, 2000	503
10016	Brown	James	G	Wednesday, March 01, 2000	502
10017	vWilliams	George		Friday, June 23, 2000	503
10018	Farriss	Anne	G	Tuesday, November 09, 1999	501
10019	Smith	Olette	K	Friday, February 18, 2000	503
*	0				0

AGENT_CODE	AGENT_AREACODE	AGENT_PHONE	AGENT_LNAME	AGENT_YTD_SLS
501	713	228-1249	Alby	\$1,735.00
502	615	882-1244	Hahn	\$4,967.00
503	615	123-5589	Okon	\$3,093.00
*	0			\$0.00

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## Slide Set 2: Relational Database Model



*Data Dictionary and System Catalog*

- ❖ **Data dictionary** contains metadata that provides detailed description of all tables within the database
- ❖ **System catalog** is a very detailed system data dictionary that describes all objects within the database.
  - ◆ System catalog is a system-created database whose tables store the database characteristics and contents
  - ◆ System catalog tables can be queried just like any other tables
  - ◆ System catalog automatically produces database documentation

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*How To Create A Database*

- ❖ Careful planning will include a paper sketch of the table and the kind of data that will be put into each attribute (field).

<i>Tour-id</i>	<i>Description</i>	<i>Cost</i>	<i>Hours</i>	<i>Food</i>	<i>Walk</i>	<i>Stairs</i>
14	San Juan Islands	25	3.5	Y	N	N

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*Attribute Name and Data Type*

- ❖ Each Attribute (field) must have a unique name.  
**Last First Address Phone**
- ❖ Attributes may contain one of four data types:
  - ◆ **Character** = descriptive data (text).
  - ◆ **Numeric** = numbers used for calculation
  - ◆ **Date** = Month Day Year and/or time
  - ◆ **Logic** = T/F, Y/N, Checked/Unchecked
- ❖ Field width determines the maximum number of characters or digits to be contained in the field

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### Table 2.6: A Sample Data Dictionary

TABLE NAME	ATTRIBUTE NAME	CONTENTS	TYPE	FORMAT	RANGE	REQUIRED	PK OF FK	FK REFERENCED TABLE
CUSTOMER	CUS_CODE	Customer account code	CHAR(5)	99999	1000-99999	Y	PK	
	CUS_LNAME	Customer last name	VCHAR(20)	Xxxxxxxxxxx		Y		
	CUS_FNAME	Customer first name	VCHAR(20)	Xxxxxxxxxxx		Y		
	CUS_INITIAL	Customer middle initial	CHAR(1)	X				
	CUS_RENEW_DATE	Customer insurance renewal date	DATE	DD_MMM/YYYY				
AGENT	AGENT_CODE	Insurance agent code	CHAR(3)	999			FK	AGENT
	AGENT_AREACODE	Agent's area code	CHAR(3)	999		Y		
	AGENT_PHONE	Agent's telephone number	CHAR(8)	999-9999		Y		
	AGENT_LNAME	Agent's last name	VARCHAR(20)			Y		
	AGENT_YTD_SALES	Agent's year-to-date sales	NUMBER(9,2)	9,999,999.99	0.00-9,999,999.99	Y		

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### MS Access Navigation

The Tables, Queries, Forms, and Reports are accessed on the Database Dialog Box

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### MS Access Table Layout View

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### Enter & Display Data Using Table

Record data items are entered into each field of the Table.

Field = Attribute

Record = Entity

First Name	Last Name	Address	City	State/Province	Postal Code
Janet	Leverling	722 Moss Bay I	Kirkland	WA	98033-
Margaret	Peacock	4110 Old Redn	Redmond	WA	98052-
Nancy	Davolio	507 - 20th Ave.	Seattle	WI	98122-
Andrew	Fuller	908 W. Capital	Tacoma	WA	98401-
Steven	Buchanan	14 Garrett Hill	London		SW1 8JR

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## Slide Set 2: Relational Database Model

### Enter & Display Data Using Form

A Form allows you to enter or view data fields for one record at a time.

**Fields**

**Record Select**

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### REPORTS: Information Output

Reports are used to display all data records. You can not do data entry or modification using reports.

#### Addresses2

First Name	Last Name	
Andrew	Fuller	
Address		
908 W. Capital Way		
City	State/Province	Postal Code
Tacoma	WA	98401-
First Name	Last Name	
Janet	Leverling	
Address		
722 Moss Bay Blvd.		
City	State/Province	Postal Code
Kirkland	WA	98033-

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### QUERY: What If?

- ❖ Structured Query Language = SQL
- ❖ SQL became an ANSI Standard 1992
- ❖ Queries can be used to answer “What If?” type questions by selecting records which match a relational expression
- ❖ Relational Functions:
  - ◆ SELECT, PROJECT, JOIN, INTERSECT, UNION, DIFFERENCE, PRODUCT, and DIVIDE.
- ❖ Relational Operators are described below:
  - ◆ < Less Than
  - ◆ > Greater Than
  - ◆ = Equal To
  - ◆ <= Less Than or Equal To
  - ◆ >= Greater Than or Equal To
  - ◆ <> Not Equal To

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### Access also uses Query-by-Example

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