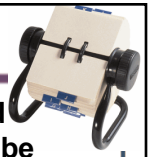
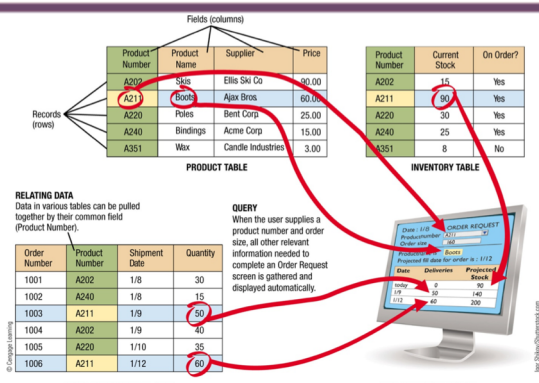
Databases



- ***Database*** **– A collection of related data stored in a manner so it can be retrieved as needed**
- ***Database Management System***
  - **Software that organizes data for fast and easy access (*DBMS*)**
  - **Used to create, maintain, and access databases**
- **Phone books, file cabinets, and index cards are non-computer versions of a database**

 1

What is a Database?



 2

Evolution of Databases

MODEL	FLAT FILES	HIERARCHICAL	NETWORK	RELATIONAL	OBJECT-ORIENTED	MULTI-DIMENSIONAL
YEAR BEGAN	1940s	1960s	1960s	1970s	1980s	1990s
DATA ORGANIZATION	Flat files	Trees	Trees	Tables and relations	Objects	Data cubes, tables and relations, or a combination
DATA ACCESS	Low-level access	Low-level access with a standard navigational language	Low-level access with a standard navigational language	High-level, nonprocedural languages	High-level, nonprocedural, object-oriented languages	OLAP tools or programming languages
SKILL LEVEL REQUIRED TO ACCESS DATA	Programmer	Programmer	Programmer	User	User	User
ENTITY RELATIONSHIPS SUPPORTED	One-to-one	One-to-one, one-to-many	One-to-one, one-to-many, many-to-many	One-to-one, one-to-many, many-to-many	One-to-one, one-to-many, many-to-many	One-to-one, one-to-many, many-to-many
DATA AND PROGRAM INDEPENDENCE	No	No	No	Yes	Yes	Yes

 3

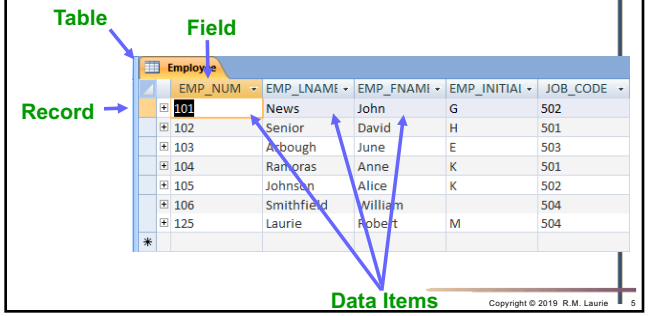
Database Provides Information

- **Information created from data**
  - **Timely relevant information key to decision making**
  - **Good decision making key to organization survival**
- **Database Management System (DBMS)**
  - **Manages database structure -- tables and relationships**
  - **Controls access to data – Security**
  - **Contains query language -- SQL**
- **Relational DBMS advantages**
  - **Integrated data (All items accessible)**
  - **Integrity (Accurate, up to date, no duplication)**
  - **Reduced redundancy (Enter data once)**
  - **User Security Level Access**
  - **Easy Data Archive**

 4

A Database Table

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



 5

Relational DB Model Data Structure

- *Data Value* (Cell), *Characters in textbook*
  - Contents of a field contained in a record
  - "Raw Facts" that can be recognized
- *Field* or Attribute (Column)
  - Group of characters representing something with same data format
- *Record* or Entity or Tuple (Row)
  - Collection of related fields
- *Table* or Entity Set (*File*)
  - Collection of related records and fields
  - Ordering of Columns and Rows is immaterial

 6

Field Name and Data Type

- Each Field must have a unique name.
  LastName FirstName HomeAddress
  PhoneNum CustID AgentCode
- Fields 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

 7

Creating a Database

- Design Database Table Field Structure
  - Field Names
  - Field Types (Character, Numbers, Logical)
  - Field Widths (Max Characters for Entry)
  - Unique Primary Key Field (For Query Use)
- Link Tables using *Relationships*
  - Primary Key fields must be unique
  - Foreign Key fields must join with primary key field data in another table
- Entering Data
  - Using Tables
  - Using Forms

 8

Designing Database Tables

First create a paper sketch of the tables and the kind of data that will be put into each field

Tour-id	Description	Cost	Hours	Food	Walk	Stairs
14	San Juan Islands	25	3.5	y	N	N

MS Access Navigation

- ***Access Objects***
  Provides interface to database components
  - ***Tables***
    Containers for data
  - ***Forms***
    Input one record
  - ***Reports***
    Information output
  - ***Queries***
    Ask?

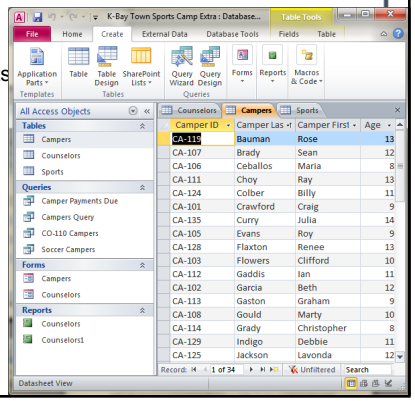
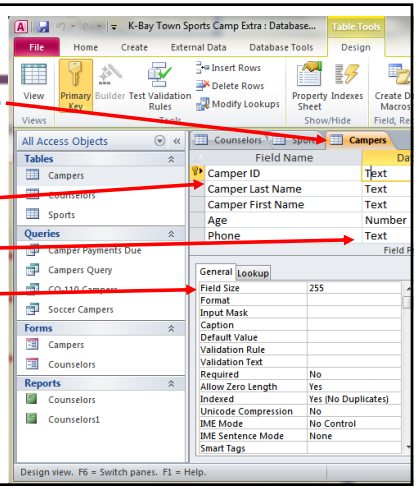


Table Design View

Design Field Structure

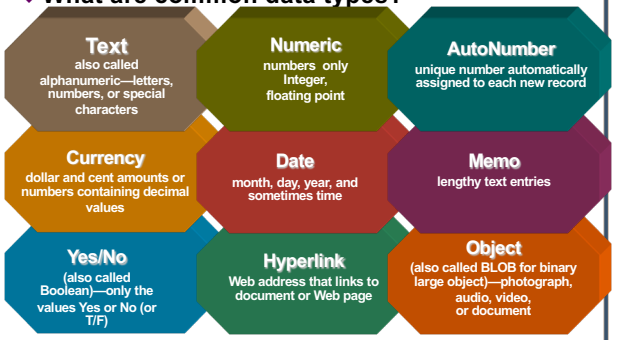
- *Table Name*
- *Field Name*
- *Data Types*
- *Field Width*

Data Dictionary:
Contains data about each file in database and each field within those files



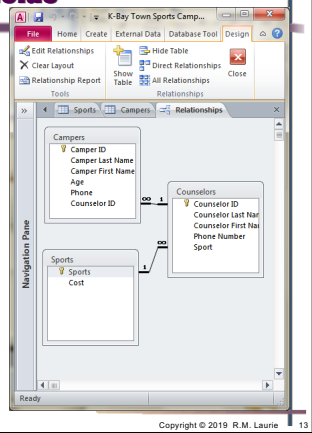
The Hierarchy of Data

- **What are common data types?**



Key Fields

- A *key field* is determines table relationships
  - A Key field determines all other fields in a record
- *Primary Key Field*
  - Uniquely identifies all other fields in a record
  - The One side of a 1 to Many Relationship
- *Foreign key*
  - Field that links records in table to records in another table
  - The Many side of a 1 to Many Relationship



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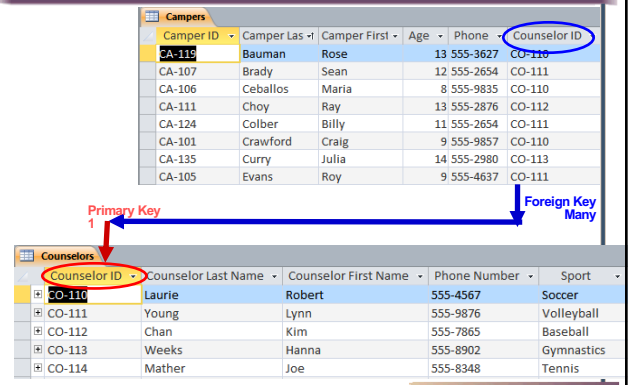
Enter Data into Tables or Forms



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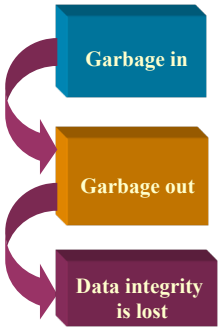
Data and Information

- What is data integrity?
  - Degree to which data is correct
  - Garbage in, garbage out (GIGO)
    - Computer phrase that means you cannot create correct information from incorrect data



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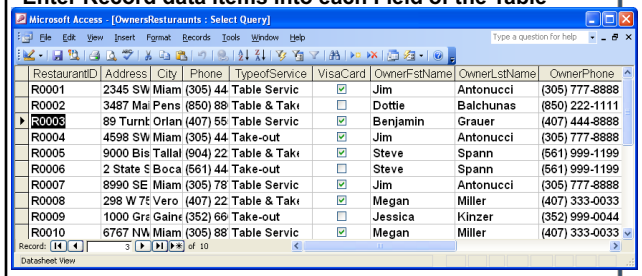
Data Anomalies: Restaurant Owner Database

Enter Record data items into each Field of the Table



- Do you see any potential problems with this table?
  - *Data Redundancy leads to Data Inconsistencies*
  - *Update Data Anomaly*
  - *Deletion Data Anomaly*

 16

Removing Data Redundancy

RestaurantID	Address	City	Phone	TypeofService	VisaCard	OwnerFstName	OwnerLstName	OwnerPhone
R0001	2345 SW	Miam	(305) 44	Table Servic	☑	Jim	Antonucci	(305) 777-8888
R0002	3487 Ma	Pens	(850) 88	Table & Take	☐	Dottie	Balchunas	(850) 222-1111
R0003	89 Turnb	Orlan	(407) 55	Table Servic	☑	Benjamin	Grauer	(407) 444-8888
R0004	4598 SW	Miam	(305) 44	Take-out	☑	Jim	Antonucci	(305) 777-8888
R0005	9000 Bis	Tallal	(904) 22	Table & Take	☑	Steve	Spann	(561) 999-1199
R0006	2 State S	Boca	(561) 44	Take-out	☐	Steve	Spann	(561) 999-1199
R0007	8990 SE	Miam	(305) 78	Table Servic	☑	Jim	Antonucci	(305) 777-8888
R0008	298 W 75	Vero	(407) 22	Table & Take	☑	Megan	Miller	(407) 333-0033
R0009	1000 Gra	Gaine	(352) 66	Take-out	☐	Jessica	Kinzer	(352) 999-0044
R0010	6767 NW	Miam	(305) 88	Table Servic	☑	Megan	Miller	(407) 333-0033

1. Remove any duplicate records
2. Determine Primary Key Fields: RestaurantID
3. *Normalize* to remove *non key data dependencies*

RestaurantID	Address	City	Phone	TypeofService	VisaCard	OwnerFstName	OwnerLstName	OwnerPhone

RestaurantID	Address	City	Phone	TypeofService	VisaCard	FranchiseeID

OwnerID	OwnerFstNa	OwnerLstNan	OwnerPhone

 17

Making a Better Database

RestaurantID	Address	City	Phone	TypeofService	VisaCard	FranchiseeID
R0001	2345 SW 98 St	Miami	(305) 444-8787	Table Service	☑	F001
R0002	3487 Main Highr	Pensacola	(850) 886-5555	Table & Take	☐	F002
R0003	89 Turnberry Dri	Orlando	(407) 555-9999	Table Service	☑	F004
R0004	4598 SW 136 S	Miami	(305) 444-4444	Take-out	☑	F001
R0005	9000 Biscayne	Tallahassee	(904) 222-1111	Table & Take	☑	F003
R0006	2 State Street	Boca Raton	(561) 444-1100	Take-out	☐	F003
R0007	8990 SE 2 Aven	Miami	(305) 787-7889	Table Service	☑	F001
R0008	298 W 75 Terra	Vero Beach	(407) 222-9999	Table & Take	☑	F005
R0009	1000 Grand Ave	Gainesville	(352) 666-7788	Take-out	☐	F006
R0010	6767 NW 75 St	Miami	(305) 887-8877	Table Service	☑	F005

Primary Key

Foreign Key

OwnerID	OwnerFstNa	OwnerLstNan	OwnerPhone
F001	Jim	Antonucci	(305) 777-8888
F002	Dottie	Balchunas	(850) 222-1111
F003	Steve	Spann	(561) 999-1199
F004	Benjamin	Grauer	(407) 444-8888
F005	Megan	Miller	(407) 333-0033
F006	Jessica	Kinzer	(352) 999-0044
F007	Carlos	Portu	(305) 787-8778

Data Redundancy Eliminated

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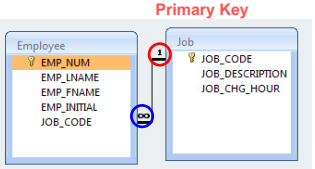
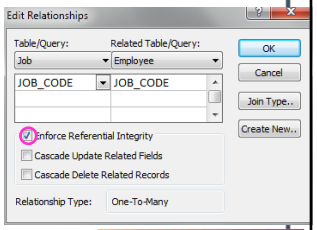
Enforcing Referential Integrity

- 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

Primary Key



Foreign Key



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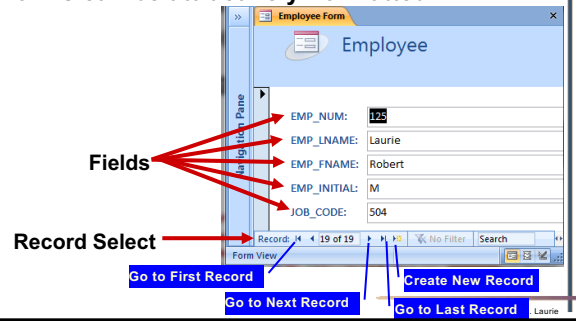
Database Form

- Forms allow the user to enter or view fields for one record at a time
- Forms can be attractively Formatted



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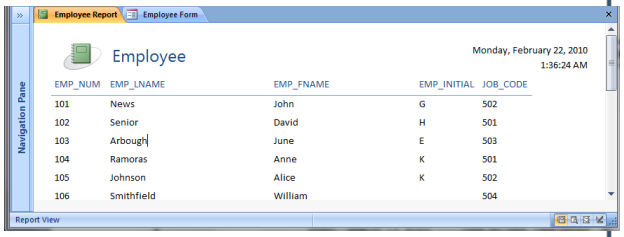
REPORTS: Information Output

Reports are for information output only

You cannot enter data or edit data using reports



 21

QUERY: What If?

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

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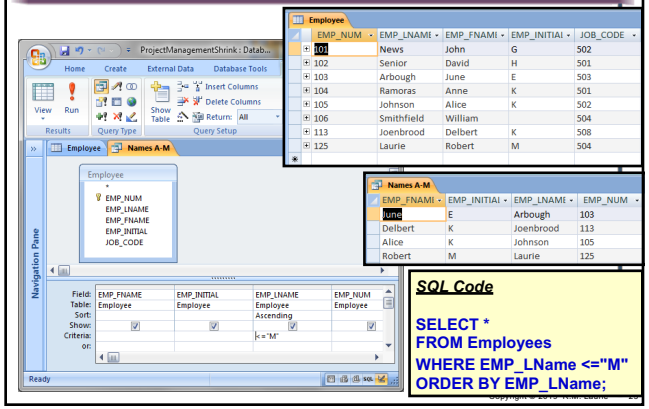
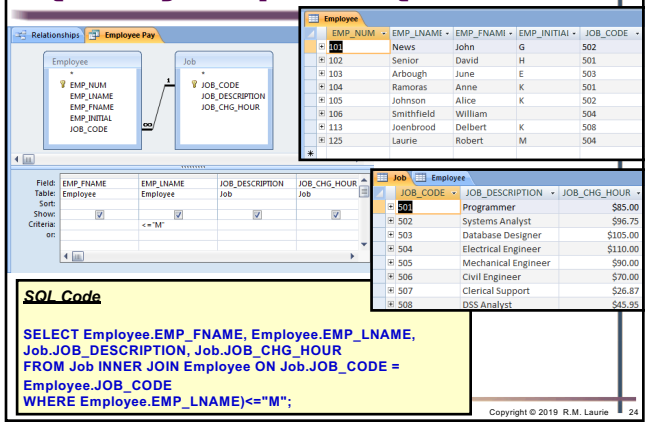
QUERY By Example and SQL: Single Table



SQL Code

```
SELECT *
FROM Employees
WHERE EMP_LName <="M"
ORDER BY EMP_LName;
```

QUERY By Example and SQL: Multi Table



SQL Code

```
SELECT Employee.EMP_FNAME, Employee.EMP_LNAME,
Job.JOB_DESCRIPTION, Job.JOB_CHG_HOUR
FROM Job INNER JOIN Employee ON Job.JOB_CODE =
Employee.JOB_CODE
WHERE Employee.EMP_LNAME)<="M";
```

 24

What is data security?

- DBMS provides means to ensure only authorized users can access data
- Access privileges define activities that specific user or group of users can perform
  - Read-only privileges - user can view data, but cannot change it
  - Full-update privileges -user can view and change data

 25

Single-User vs. Muiltiuser DBMS

- Single-User Database System
  - Located on a single computer
  - Designed to be accessed by one user
  - Widely used for personal applications
- Multiuser Database System
  - Designed to be accessed by multiple users
  - Most business databases today
  - Client-Server Database Systems
    - Has both clients (front end) and at least one database server (back end)

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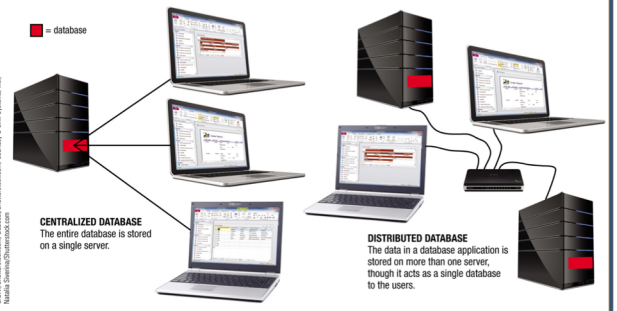
Centralized vs. Distributed DBMS



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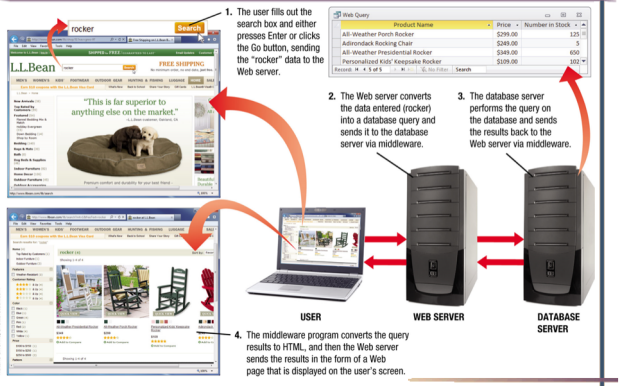
Databases and the Web



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