Databases
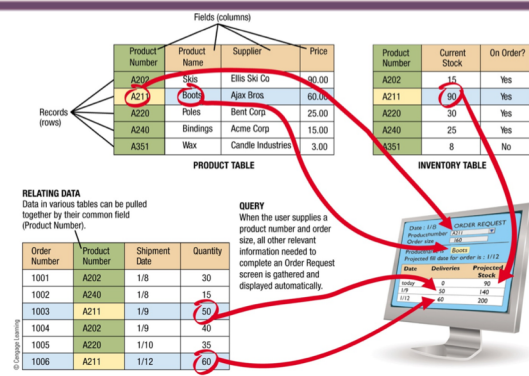
❖ *Database* – **A collection of related data stored in a manner so it can be retrieved as needed**

❖ *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**

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What is a Database?

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

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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**

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A Database Table

❖**Columns are the *fields***
❖**Rows are the *records***

Table

Field

Record

Employee				
EMP_NUM	EMP_LNAME	EMP_FNAME	EMP_INITIAL	JOB_CODE
101	News	John	G	502
102	Senior	David	H	501
103	Arbough	June	E	503
104	Ramoras	Anne	K	501
105	Johnson	Alice	K	502
106	Smithfield	William		504
125	Laurie	Robert	M	504

Data Items

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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

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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**

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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**

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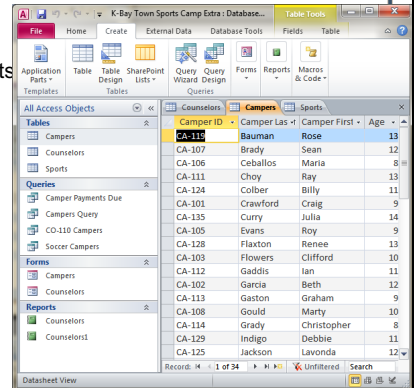
Designing Database Tables

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

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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
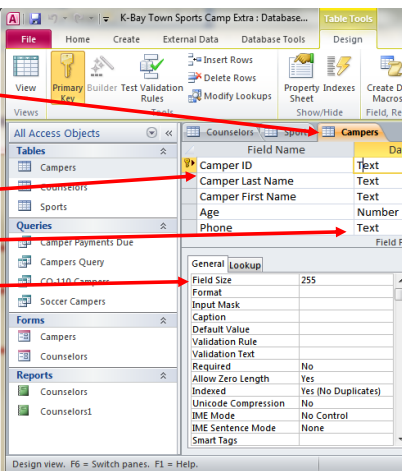
Table Name

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?**

Text	Numeric	AutoNumber
also called alphanumeric—letters, numbers, or special characters	numbers only Integer, floating point	unique number automatically assigned to each new record
Currency	**Date**	**Memo**
dollar and cent amounts or numbers containing decimal values	month, day, year, and sometimes time	lengthy text entries
Yes/No	**Hyperlink**	**Object**
(also called Boolean)—only the values Yes or No (or T/F)	Web address that links to document or Web page	(also called BLOB for binary large object)—photograph, audio, video, or document

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Slide 13: 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

Slide 14: Enter Data into Tables or Forms

Slide 15: 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

Slide 16: 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*

IFSM201: Slide Set 3 - Databases

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REPORTS: Information Output

Reports are for information output only

You cannot enter data or edit data using reports

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   ◆ <= Less Then or Equal To
  ◆ > Greater Then   ◆ >= Greater Then or Equal To
  ◆ = Equal To   ◆ <> Not Equal To

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";

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
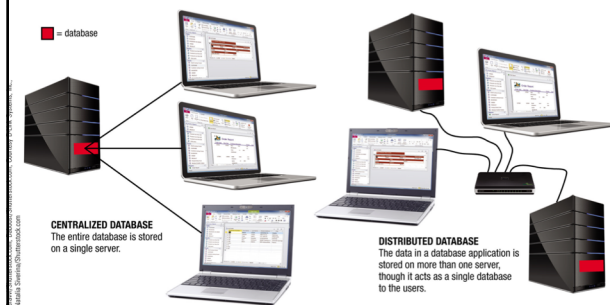
◆ Full-update privileges -user can view and change data

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)

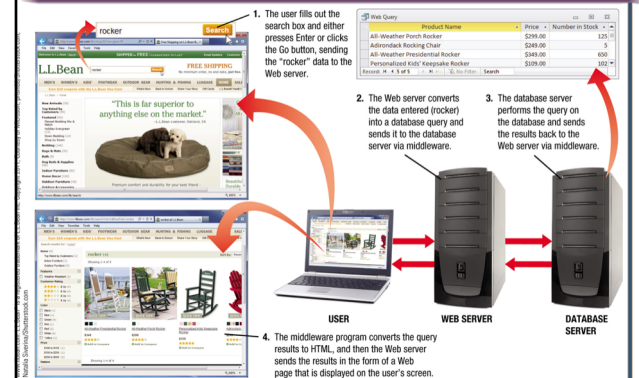## Centralized vs. Distributed DBMS

Databases and the Web