Announcements

- Quiz canceled for this week

Announcements

- Quick Write this week on Privacy
  - (First half of chapter 13 in *Fluency*)

A Table with a View

Data Storage and Transfer with XML and Databases

Differences Between Tables and Databases

- When we think of databases, we often think of tables of information
- Comparing Tables
  - Database tables
    - Metadata tag identifying each of the data fields
  - Spreadsheet tables
    - Rely on position to keep the integrity of their data
  - HTML tables
    - Data as table entries with no unique identity at all
    - Concerned only with how to display the data, not with its meaning

The Database Advantage

- Metadata is key advantage of databases over other systems recording data as tables
- Two of the most important roles in defining metadata
  - Identify the type of data with a unique tag
  - Define the relationships of the data

XML: A Language for Metadata Tags

- Extensible Markup Language
  - Tagging scheme similar to XHTML
  - No standard tags to learn
    - Self-describing, think up the tags you need
  - Works well with browsers and Web-based applications
  - Use a simple text editor
  - XML tag names cannot contain spaces

Extensible **M**arkup **L**anguage

XML

An Example from Tahiti

- Area in km^2 for Tahiti & neighboring islands

```
<?xml version = "1.0" encoding="ISO-8859-1" ?>
<archipelago>
<island><iName>Tahiti</iName>    <area>1048</area></island>
<island><iName>Moorea</iName>    <area>130</area></island>
<island><iName>Maiao</iName>     <area>9.5</area></island>
<island><iName>Mehetia</iName>   <area>2.3</area></island>
<island><iName>Tetiaroa</iName>  <area>12.8</area></island>
</archipelago>
```

Figure 16.1 XML file encoding data for the Windward Islands database. The first line states that the file contains XML tags.

An Example from Tahiti (cont'd)

- First line

  <?xml version="1.0" encoding="ISO-8859-1" ?>

- File should be ASCII text
- File extension should be `.xml`

Table 16.1 Rules for writing XML.

Required first line	`<?xml version="1.0" encoding="ISO-8859-1"?>` must appear on the first line, starting in the first position.
First tag	The first tag encountered is the *root* element, and it must enclose all of the file's content; it appears on the second or possibly third line.
Closing tags	All tags must be closed.
Element naming	Observe these rules: • Names can contain letters, numbers, and underscore characters. • Names must not start with a number or punctuation character. • Names must not start with the letters xml (or XML, or Xml, etc.). • Names cannot contain spaces.
Case sensitivity	Tags and attributes are case sensitive.
Proper nesting	All tags must be well-nested.
Attribute quoting	All attribute values must be quoted; paired single quotes (apostrophes) or paired double quotes are okay; use "dumb" quotes only; choose 'opposite' quotes to enclose quoted values.
White space	White space is preserved and converted to a single space.
Comments	XML comments have the form `<!-- This is a comment. -->`.

Expanding Use of XML

- Combine encodings of two archipelagos – the Windward and the Galapagos Islands
- Root element is the tag that encloses all of the content of the XML file
  - <archipelago> in Fig. 16.1
  - <geo_feature> in Fig. 16.2
- Indenting for readability and structure

```
<?xml version = "1.0"
      encoding="ISO-8859-1" ?>
<geo_feature>
   <archipelago>
      <a_name>Windward Islands
      </a_name>
      <island>
         <iName>Tahiti</iName>
         <area>1048</area>
      </island>
      <island>
         <iName>Moorea</iName>
         <area>130</area>
      </island>
      <island>
         <iName>Maiao</iName>
         <area>9.5</area>
      </island>
      <island>
         <iName>Mehetia</iName>
         <area>2.3</area>
      </island>
      <island>
         <iName>Tetiaroa</iName>
         <area>12.8</area>
      </island>
   </archipelago>
   <archipelago>
      <a_name>Galapagos Islands
      </a_name>
      <island>
         <iName>Isabella</iName>
         <area>4588</area>
         <elevation>1707</elevation>
      </island>
      <island>
         <iName>Fernandina</iName>
         <area>642</area>
         <elevation>1494</elevation>
      </island>
      <island>
         <iName>Tower</iName>
         <area>14</area>
         <elevation>76</elevation>
      </island>
      <island>
         <iName>Santa Cruz</iName>
         <area>986</area>
         <elevation>846</elevation>
      </island>
   </archipelago>
</geo_feature>
```


Figure 16.2 XML file for the Geographic Features database. XML ignores white space, so the text in the file has been indented for easier reading.

Attributes in XML

- Use attributes for additional metadata, not for additional content
  - Not good, name is content:

    <archipelago name="Galapagos">

  - Better to give alternate form of the data

    <a_name accents="Galápagos">Galapagos</a_name>

Effective Design with XML Tags

- Identification Rule: Label Data with Tags Consistently
  - You can choose whatever tag names you with to name data, but once you've decided on a tag for a particular kind of data, you must always surround it with that tag.

Effective Design with XML Tags (cont'd)

- Affinity Rule: Group Related Data
  - Enclose in a pair of tags all tagged data referring to the same entity. Grouping it keeps it all together, but the idea is much more fundamental: Grouping makes an association of the tagged data items as being related to each other, properties of the same thing.
  - Groups together data for a single thing – an island
    - Association is among properties of an object

Effective Design with XML Tags (cont'd)

- Collection Rule: Group Related Instances
  - When you have several instances of the same kind of data, enclose them in tags; again, it keeps them together and implies that they are related by being instances of the same type.
  - Groups together data of several instance of the same thing – islands
    - Association is among the objects themselves (entities)

The XML Tree

- XML encodings of information produce hierarchical descriptions that can be thought of as trees
  - Hierarchy a consequence of how tags enclose one another and the data

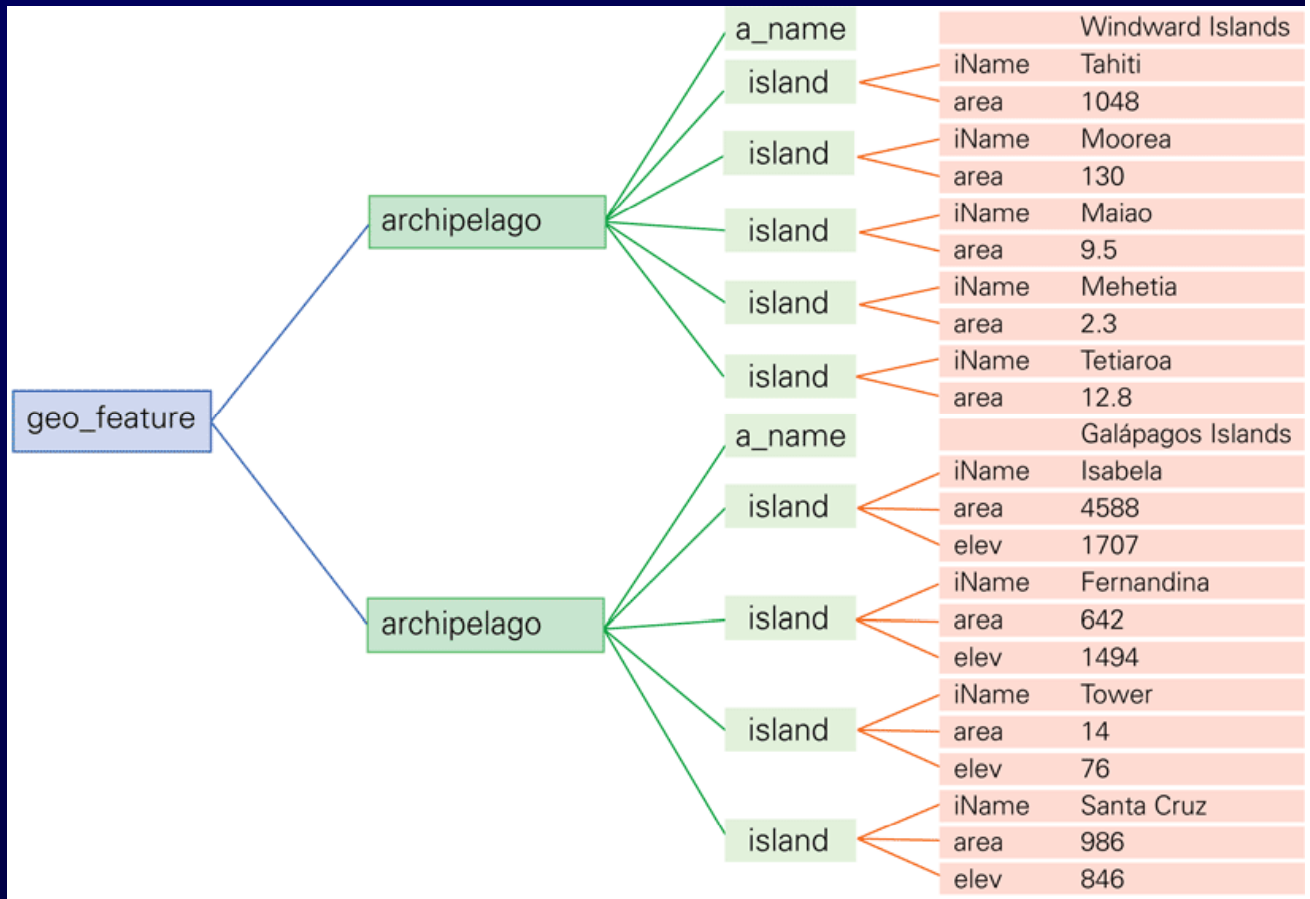


Figure 16.3 The XML displayed as a tree. The encoding from Figure 16.2 is shown with the root element (`geo_feature`) to the left and the leaves (content) shown to the right.

DATABASES

What is a Database

- Any organized collection of data
- A collection of similar data
- Examples of databases:
  - Telephone book white pages
  - T.V. Guide
  - Airline reservation system
  - Motor vehicle registration records
  - Papers in your filing cabinet
  - Files on your computer hard drive

Data | Information | Knowledge

- Data
  - Can be defined in many ways
  - IS defines data as unprocessed information
- Information
  - Data that have been organized and communicated in a coherent and meaningful manner
- Knowledge
  - Knowledge—information evaluated and organized so that it can be used purposefully

Data is converted into information, and information is converted into knowledge

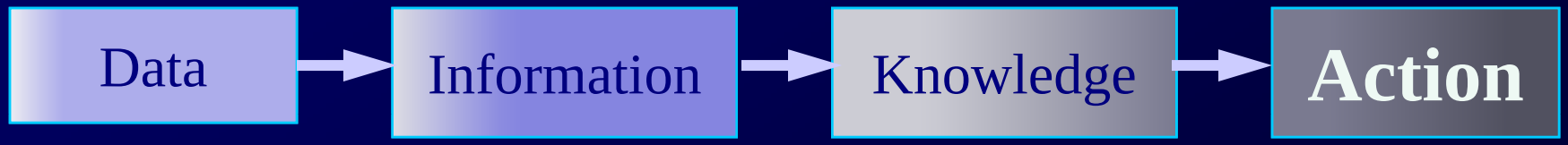
Data vs. Information

- We collect data
- Information is harvested from data

- Many companies are good at collecting data
- Fewer are good at harvesting information

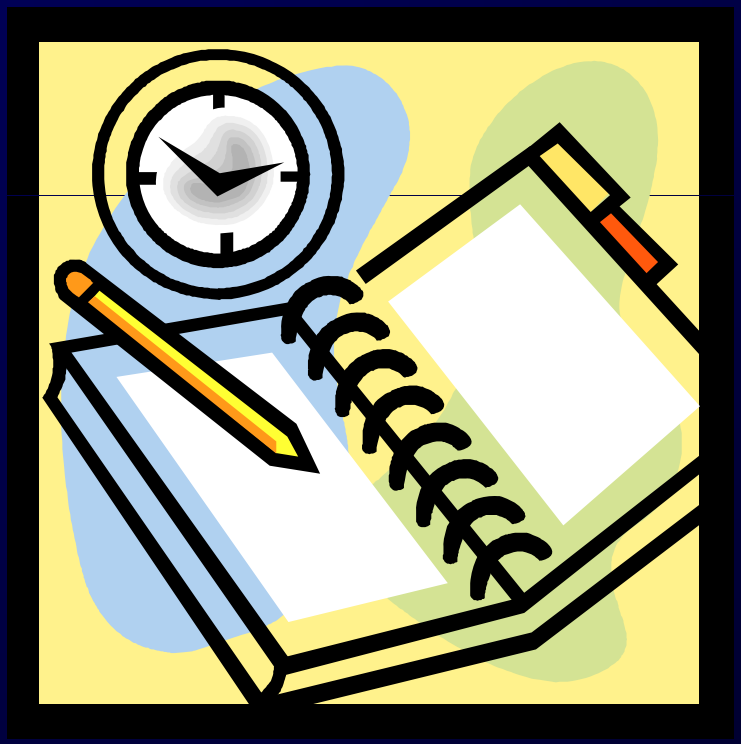
Ultimate Purpose of a Database Management System (DBMS)

To transform



Why do we need a database?

- Keep records of our:
  - Clients
  - Staff
  - Volunteers
- To keep a record of activities and interventions
- Keep sales records
- Develop reports
- Perform research



Database Terminology

Phone book:

Fields (columns)

Records (rows)

Anderson	Thomas	A	123 Marine View Dr.	237-1234
Benson	Karen	C	1300 California Ave	237-1098
Casserly	Rick	W	12492 Rd 19	342-0502
Drummond	Lynn	M	12059 30th Ave W	931-1105

Table

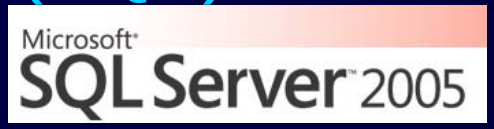
Field (the columns in a table)	• Smallest unit of information in a table • Sometime called "attributes"	• First name • Last name • Middle initial • Street address • Phone number(s)
Record (the rows in a table)	• All related fields are collectively called a record	• All fields for one person are a record
Table	• A collection of records is a data table	• Collection of everyone's records
Database Management System (DBMS)	• All the related tables, queries, data entry and edit forms, reports, macros and VBA modules constitute a database	

Database Management System (DBMS)

- Software tools for working with data
- Designed to:
  - Store (tables)
  - Organize (sort)
  - Add, modify or delete
  - Ask questions (queries)
  - Produce forms and reports
    - Summarizing
    - Displaying details
- Toolbox is a good analogy

DBMS Examples

- Microsoft Access
- Structured Query Language (SQL)
  - Microsoft SQL Server
  - Oracle
  - MySQL
- FileMaker Pro
- Lotus Notes
- Open Office Base



Flat-File vs. Relational Database

- Flat-File Database
  - All relevant data in a single table, or series of unrelated tables
  - Work best for small quantities of data; where viewing and sorting the data in a single list does not create a time-consuming task
  - Typically a person's first databases
  - Example: Excel spreadsheet or Word data list file
- Relational Database
  - Provide a solution to data entry redundancy problems
  - Linked through common fields (columns) with exactly the same data
  - Tables linked together can be queried as if one table

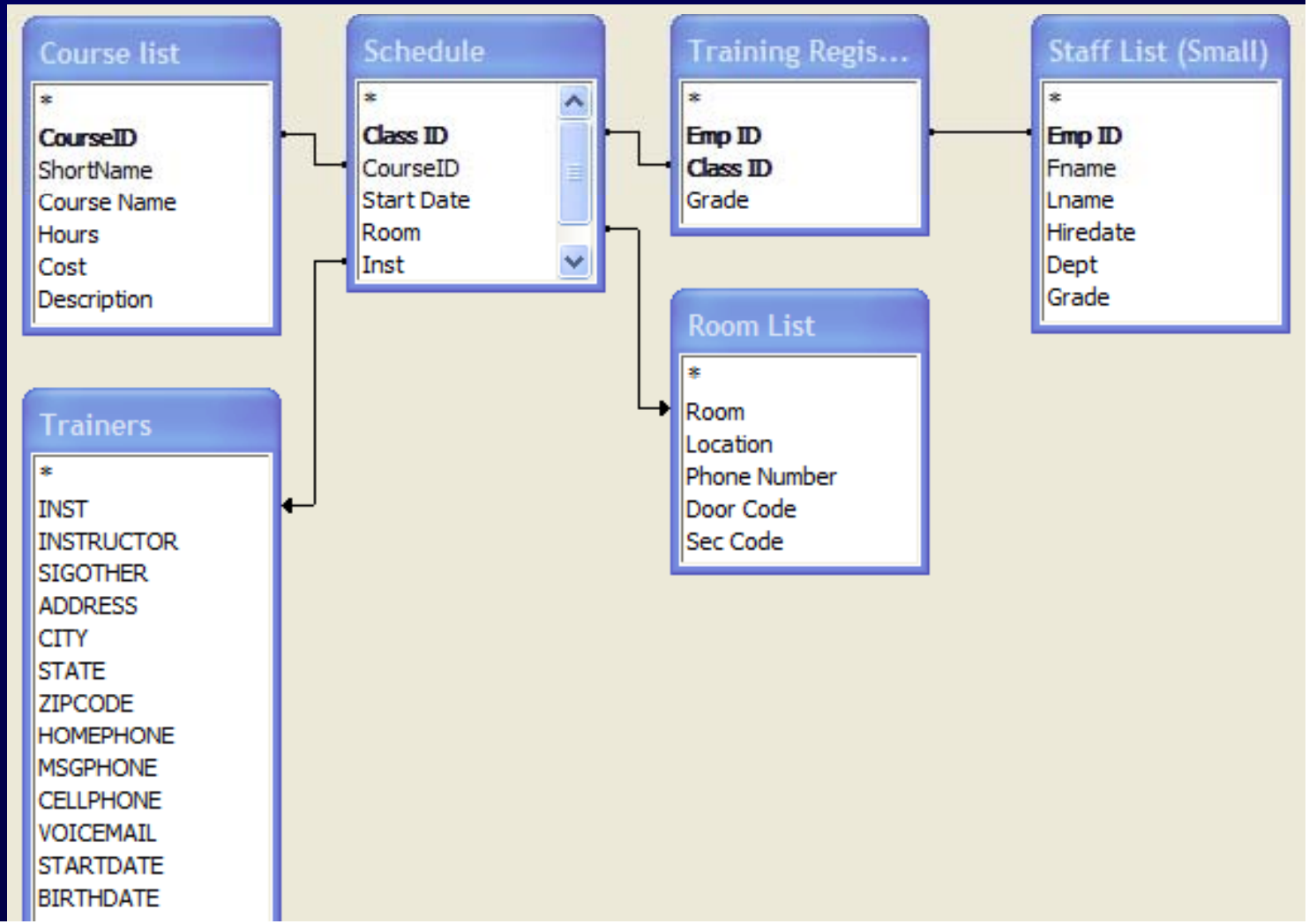
Flat-File Example

Staff Telephone List

Last Name	First Name	Emp ID	Dept	Location	Work Phone	M/S	Supervisor Name	Supr Phone
Adams	Wes	19589	PROD	Seattle	(206) 221-1958	QR-07	Susan Buckle	(206) 221-2241
Alberts	George	21533	PROD	Seattle	(206) 221-2153	QR-35	Marsha Mosley	(206) 221-1975
Allen	Susan	20256	PROD	Renton	(206) 393-2025	PB-18	Frank Sullivan	(206) 393-1000
Allert	Maria	10544	PROD	Seattle	(206) 221-1054	QR-27	Lynn Jarret	(206) 221-1366
Andrews	Mike	22113	PROD	Seattle	(206) 221-2211	QR-12	Harry Hillis	(206) 221-2179
Apperly	Ward	12244	PROD	Renton	(206) 393-1224	PB-14	Molly Goldberg	(206) 393-1513
Arthur	Diane	12370	MKTG	Bellevue	(206) 882-1237	RL-27	Wes Adams	(206) 221-1958
Asher	Jane	11222	ACCT	Seattle	(206) 221-1122	BX-45	Val Johnson	(206) 221-1958
Astor	Lawrence	20286	PROD	Seattle	(206) 221-2028	QR-10	Peggy Kramer	(206) 221-2083
Ayres	William	22263	PROD	Seattle	(206) 221-2226	QR-10	P. Kramer	(206) 221-2083
Baker	Gerald	19042	ACCT	Seattle	(206) 221-1904	BX-45	Valerie Johnson	(206) 221-1958

- Weaknesses common to flat-file systems
  - Duplicate information in the table
  - Inconsistencies in the way Supervisor Names are entered

Relational Database Example



Database Tables

Microsoft Access - [Training2003 : Database (Access 2002 - 2003 file format)]

File Edit View Insert Tools Window Help Adobe PDF

Type a question for help

Open Design New

Objects

- Tables
- Queries
- Forms
- Reports
- Pages
- Macros
- Modules

Groups

- Favorites

- Create table in Design view
- Create table by using wizard
- Create table by entering data
- Course List
- Room List
- Schedule
- Staff List
- Staff List (Small)
- Staff Salary Data
- Trainers
- Training Register
- xtblCourseManuals
- xtblDeptCodes

Staff List (Small) : Table

Emp ID	Fname	Lname	Hiredate	Dept	Grade
19589	Wes	Adams	0/23/1997	PROD	22
21533	George	Alberts	2/18/2003	PROD	4
20256	Susan	Allen	8/21/1999	PROD	14
10544	Maria	Allert	1/17/1973	PROD	2
22184	Kim	Ally	1/30/2004	PROD	3
22113	Mike	Andrews	9/20/2004	PROD	13
12244	Ward	Apperly	9/13/1977	PROD	15
12370	Diane	Arthur	1/17/1978	MKTG	20
11222	Jane	Asher	1/26/1974	ACCT	18
20286	Lawrence	Astor	9/20/1999	PROD	5
22263	William	Ayres	2/17/2005	PROD	1
19042	Gerald	Baker	4/24/1996	ACCT	6
17996	William	Barker	6/13/1993	PROD	9

Record: 1 of 321

Ready

Query from Two Tables

qryStaffListSmallSortedByName : Select Query

Emp ID	Lname	Fname	Hiredate	Dept	Grade	Salary
19589	Adams	Wes	0/23/1997	PROD	22	$3,812.55
21533	Alberts	George	2/18/2003	PROD	4	$1,611.05
20256	Allen	Susan	8/21/1999	PROD	14	$2,761.80
10544	Allert	Maria	1/17/1973	PROD	2	$1,380.90
22184	Ally	Kim	1/30/2004	PROD	3	$1,495.98
22113	Andrews	Mike	9/20/2004	PROD	13	$2,646.72
12244	Apperly	Ward	9/13/1977	PROD	15	$2,876.88
12370	Arthur	Diane	1/17/1978	MKTG	20	$3,452.25
11222	Asher	Jane	1/26/1974	ACCT	18	$3,222.10
20286	Astor	Lawrence	9/20/1999	PROD	5	$1,726.12
22263	Ayres	William	2/17/2005	PROD	1	$1,265.83
19042	Baker	Gerald	4/24/1996	ACCT	6	$1,841.20
17996	Barker	William	6/13/1993	PROD	9	$2,186.42

Record: 1 of 321

qryStaffListSmallSortedByName : Select Query

Staff List (Small)
- *
- **Emp ID**
- Fname
- Lname
- Hiredate
- Dept
- Grade

Staff Salary Data
- *
- **Grade**
- Salary

Field:	Emp ID	Lname	Fname	Hiredate	Dept	Grade	Salary
Table:	Staff List (Small)	Staff List (Small)	Staff List (Small)	Staff List (Small)	Staff List (Small)	Staff List (Small)	Staff Salary Data
Sort:		Ascending	Ascending				
Show:	☑	☑	☑	☑	☑	☑	☑
Criteria:							
or:							

Forms

Staff Data Entry Form

XYZ Company

Employee Salary Data

Emp ID: 19589 Dept: PROD

Last Name: Adams First Name: Wes

Hire Date: 10/23/1997 Years: 9.2

Grade: 22 Monthly Salary: $3,812.55

Annual Salary: $45,750.60

Hourly Rate: $21.91

Close Form Find Employee: Adams, Wes

Record: 1 of 321

xtblDeptCodes

XYZ Department Summary Dept: Accounting & Finance

Dept Code: ACCT Building: A

Number of Employees:	28
Total Monthly Salaries:	$59,048.53
Average Monthly Salary:	$2,108.88
Largest Monthly Salary:	$3,812.55
Smallest Monthly Salary:	$1,265.83
Average Pay Grade:	8

Close Form | Staff Form | Staff Report

Valerie Smith

Vice President

Reports

Training Records by Employee

Emp ID	Last Name	First Name	Course Name	Start Date	Grade	Room	Instructor	Dept	Hours	Cost
19589	Adams	Wes	Microsoft Access, Level 1	2/12/2006	3.4	G218	Terrie Urbas	PROD	7	$145.00
			Microsoft Access, Level 2	2/13/2006	3.4	G218	Terrie Urbas	PROD	7	$145.00
			Microsoft Access, Level 3	2/14/2006	3.4	G218	Terrie Urbas	PROD	7	$145.00
			Microsoft Access, Level 4	4/9/2006	3.6	G218	Terrie Urbas	PROD	7	$145.00
			Microsoft Access, Level 5	4/10/2006	3.6	G218	Terrie Urbas	PROD	7	$145.00
			Microsoft Windows 95, Level 1	9/2/2006	3.1	R121	Bob Larson	PROD	7	$145.00
21533	Alberts	George	Microsoft Excel, Level 4	4/29/2005	2.7	G218	Andrea Forster	PROD	7	$145.00
			Introduction to Computers	6/5/2005	3.7	G219	Dan Mclalwain	PROD	7	$145.00
			Microsoft Excel, Level 1	7/2/2005	2.6	G218	Bob Larson	PROD	7	$145.00
			Microsoft Excel, Level 2	7/3/2005	2.6	G218	Bob Larson	PROD	7	$145.00
			Microsoft Excel, Level 3	7/4/2005	2.6	G218	Bob Larson	PROD	7	$145.00
			Microsoft Access, Level 1	6/18/2006	3.4	G218	Bob Larson	PROD	7	$145.00
			Microsoft Access, Level 2	6/19/2006	3.4	G218	Bob Larson	PROD	7	$145.00
			Microsoft Access, Level 3	6/20/2006	3.4	G218	Bob Larson	PROD	7	$145.00
			Microsoft Access, Level 4	8/13/2006	3.6	G218	Bob Larson	PROD	7	$145.00
			Microsoft Access, Level 5	8/14/2006	3.6	G218	Bob Larson	PROD	7	$145.00
			Microsoft Windows 95, Level 1	11/2/2006	3.1	R121	Doug Hitchman	PROD	7	$145.00
20256	Allen	Susan	Microsoft Word, Level 1	6/2/2006	4.0	R123	Sally Larson	PROD	7	$145.00
			Microsoft Word, Level 2	6/3/2006	4.0	R123	Sally Larson	PROD	7	$145.00
			Microsoft Word, Level 3	6/4/2006	4.0	R123	Sally Larson	PROD	7	$145.00
			Microsoft PowerPoint, Level 1	7/31/2006	3.9	G107	Bob Larson	PROD	7	$145.00
			Microsoft Excel, Level 1	3/29/2007				PROD	7	$145.00
			Microsoft Excel, Level 2	3/30/2007				PROD	7	$145.00
			Microsoft Excel, Level 3	3/31/2007				PROD	7	$145.00
10544	Allert	Maria	Microsoft Windows 95, Level 1	8/26/2005	3.0	R121	Doug Hitchman	PROD	7	$145.00
			Microsoft Windows 95, Level 2	12/16/2005	3.2	R121	Doug Hitchman	PROD	7	$145.00

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Dept: Accounting & Finance *Vice President:* Valerie Smith

Number of Employees:	28
Total Monthly Salaries:	$59,048.53
Average Monthly Salary:	$2,108.88
Largest Monthly Salary:	$3,812.55
Lowest Monthly Salary:	$1,265.83
Average Pay Grade:	8

Employee	Emp ID	Location	Work Phone	Mail Stop	Budget
Asher, Jane	11222	Seattle	(206) 221-1122	BX-45	A-1834
Baker, Gerald	19042	Seattle	(206) 221-1904	BX-45	A-1834
Carrera, Barbara	20002	Renton	(425) 393-2000	BB-27	A-1834
Ewing, Robert	12672	Seattle	(206) 221-1267	BX-45	A-1834
Fairchild, Earl	16332	Renton	(425) 393-1633	BB-27	A-1834
Farmer, Lou	14082	Seattle	(206) 221-1408	BX-45	A-1834
Giles, Peter	12752	Seattle	(206) 221-1275	BX-45	A-1834
Graham, Margaret	21902	Seattle	(206) 221-2190	BX-45	A-1834
Graves, Bert	10702	Seattle	(206) 221-1070	BX-45	A-1834
Henderson, Peter	18572	Seattle	(206) 221-1857	BX-45	A-1834
Hickok, Joe	21752	Renton	(425) 393-2175	BB-27	A-1834
Hoover, Toni	22062	Seattle	(206) 221-2206	BX-45	A-1834
Isaacs, Rick	18412	Renton	(425) 393-1841	BB-27	A-1834
Lautenbach, Duane	21932	Seattle	(206) 221-2193	BX-45	A-1834
McGinnis, Gerald	21592	Renton	(425) 393-2159	BB-27	A-1834
Murray, Beverly	19932	Renton	(425) 393-1993	BB-27	A-1834
Perkins, Leslie	15602	Seattle	(206) 221-1560	BX-45	A-1834
Randall, Maxine	20742	Renton	(425) 393-2074	BB-27	A-1834
Roberts, Dick	19622	Seattle	(206) 221-1962	BX-45	A-1834
Robertson, Georgia	11582	Seattle	(206) 221-1158	BX-45	A-1834
Sample, Roger	21942	Renton	(425) 393-2194	BB-27	A-1834
Selleck, Shirley	21962	Renton	(425) 393-2196	BB-27	A-1834
Smith, Steve	12002	Renton	(425) 393-1200	BB-27	A-1834
Smith, Valerie	15002	Seattle	(206) 221-1500	BX-45	A-1834
Strassberger, Tom	22503	Seattle	(206) 221-2279	BX-45	A-1834
Thompson, Tom	15992	Seattle	(206) 221-1599	BX-45	A-1834
Wentworth, Cathy	11972	Renton	(425) 393-1197	BB-27	A-1834
Zoom, Zelda	22517	Renton	(425) 393-2326	BB-27	A-1834

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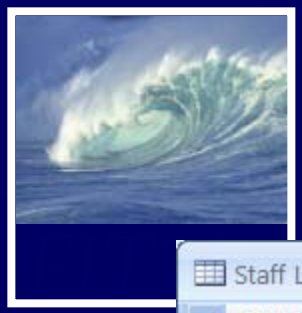
RELATIONAL DATABASES

Video

- Relational databases and tables

Relational Database Model

- Introduced by E. F. Codd in 1970
- A Logical View of Data
  - Enables developer to view data logically rather than physically
  - Greater logical simplicity tends to yield simpler and more effective database design methodologies



Tables

Staff List

Emp ID	Last Name	First Name	Address	City	State	Zip	Telephone
19589	Adams	Wes	3132 C N. E.	Auburn	WA	98002	(253) 833-1958
21533	Alberts	George	1819 Westlake Ave. N.	Seattle	WA	98109	(206) 452-2153
20256	Allen	Susan	17314 140th Ave S. E.	Renton	WA	98058	(425) 226-2025
10544	Allert	Maria	865 Lind S. W.	Renton	WA	98055	(425) 227-1054
22184	Ally	Kim	2904 A St. S. E.	Auburn	WA	98002	(253) 833-2218
22113	Andrews	Mike	23605 - 156th S.E.	Kent	WA	98042	(253) 872-2211

Record: 14 of 321 Unfiltered Search

- Cornerstone of Relational DBMS
- Advantages – structural and data independence
- Conceptually Resembles a file
  - Note a file is actually a physical structure
- Easier to understand than its hierarchical and network database predecessors

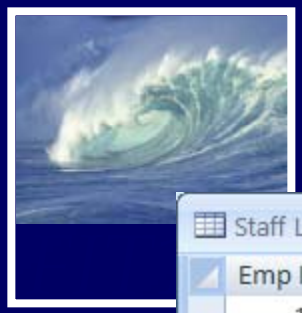


Table Characteristics

Staff List

Emp ID	Last Name	First Name	Address	City	State	Zip	Telephone
19589	Adams	Wes	3132 C N. E.	Auburn	WA	98002	(253) 833-1958
21533	Alberts	George	1819 Westlake Ave. N.	Seattle	WA	98109	(206) 452-2153
20256	Allen	Susan	17314 140th Ave S. E.	Renton	WA	98058	(425) 226-2025
10544	Allert	Maria	865 Lind S. W.	Renton	WA	98055	(425) 227-1054
22184	Ally	Kim	2904 A St. S. E.	Auburn	WA	98002	(253) 833-2218
22113	Andrews	Mike	23605 - 156th S.E.	Kent	WA	98042	(253) 872-2211

Record: 14 of 321 | Unfiltered | Search

1	A table is perceived as a two-dimensional structure composed of rows and columns.
2	Each table row (**tuple**) represents a single entity occurrence within the entity set.
3	Each table column represents an attribute, and each column has a distinct name.
4	Each row/column intersection represents a single data value.
5	All values in a column must conform to the same data format. For example, if the attribute is assigned an integer data format, all values in the column representing that attribute must be integers.
6	Each column has a specific range of values known as the **attribute domain**.
7	The order of the rows and columns is immaterial to the DBMS.
8	Each table must have an attribute or a combination of attributes that uniquely identifies each row.