ACS-1803
Introduction to Information Systems

Instructor: Kerry Augustine

# Data Management

Lecture Outline 2, Part 2

## Data Entities, Attributes, and Items

- Entity:
  - Things we store information about. (i.e. **persons, places, objects, events**, etc.)
  - Have **relationships** to **other entities** (i.e. the entity *Student* has a relationship to the entity *Grades* in a University Student database
  - General class of people, places, or things (objects) for which data is collected, stored, and maintained
- Attribute:
  - These are pieces of information (characteristics) about an entity (i.e. Student ID, Name, etc. for the entity *Student*)
- Data item:
  - Specific value of an attribute





## Data Entities, Attributes, and Items

| Employee # | Last name | First name | Hire date | Dept. number |
|---|---|---|---|---|
| 005-10-6321 | Johns | Francine | 10-07-1997 | 257 |
| 549-77-1001 | Buckley | Bill | 02-17-1979 | 632 |
| 098-40-1370 | Fiske | Steven | 01-05-1985 | 598 |

ENTITIES (records)

KEY FIELD

ATTRIBUTES (fields)

The key field is the employee number. The attributes include last name, first name, hire date, and department number.

## Data Entities, Attributes, and Items

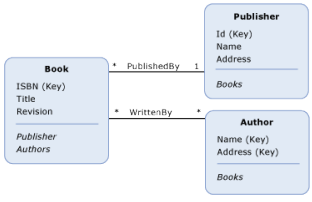
- Normalization
  - Process of streamlining complex groups of data to:
    - Minimize redundant data elements.
    - Minimize awkward many-to-many relationships.
    - Increase stability and flexibility.
- Data Integrity Rules
  - Used by relational databases to ensure that relationships between coupled tables remain consistent.
  - For example: when one table has a foreign key that points to another table, you may not add a record to the table with foreign key unless there is a corresponding record in the linked table.





## Designing Databases – Data Model

Data Model
- A map or diagram that represents entities and their relationships
- Used by Database Administrators to design tables with their corresponding associations

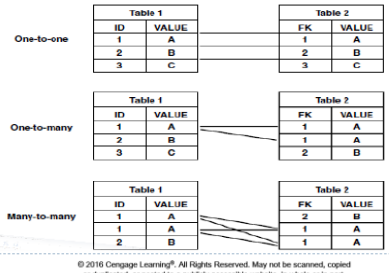







## Designing Databases – Associations

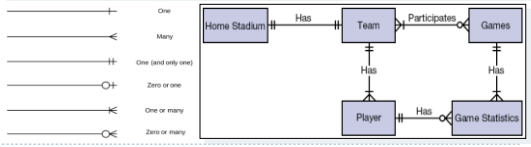
- Define the relationships one entity has to another
- Determine necessary key structures to access data
- Come in three relationship types:



## Designing Databases - Associations

Entity Relationship Diagram (ERD)
- Diagramming tool used to express entity relationships
- Very useful in developing complex databases

Example
- Each Home Stadium has a Team (One-to-One)
- Each Team has Players (One-to-Many)
- Each Team participates in Games
- For each Player and Game there are Game Statistics

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## Relational Database

- Data set up as a centralized collection of tables
- Tables are linked by common columns of data
- Tables are designed together to minimize repetition
- This is the most common database structure
- This is the one used in microcomputer databases and many larger ones too



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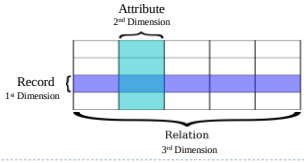
## The Relational Model

- The most common type of database model used today in organizations
- Is a three-dimensional model compared to the traditional two-dimensional database models
  - Rows (first-dimension)
  - Columns (second-dimension)
  - Relationships (third-dimension)
- The third-dimension makes this model so powerful because any row of data can be related to any other row or rows of data



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## Relational Model – Example 1

| *customer-name* | *social-security* | *customer-street* | *customer-city* | *account-number* |
|---|---|---|---|---|
| Johnson | 192-83-7465 | Alma | Palo Alto | A-101 |
| Smith | 019-28-3746 | North | Rye | A-215 |
| Johnson | 192-83-7465 | Alma | Palo Alto | A-201 |
| Jones | 321-12-3123 | Main | Harrison | A-217 |
| Smith | 019-28-3746 | North | Rye | A-201 |

| *account-number* | *balance* |
|---|---|
| A-101 | 500 |
| A-201 | 900 |
| A-215 | 700 |
| A-217 | 750 |

One-to-One



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## Relational Model – Example 2

**Department Records**

| Department No | Dept Name | Location | Dean |
|---|---|---|---|
| Dept A | | | |
| Dept B | | | |
| Dept C | | | |

One-to-Many

**Instructor Records**

| Instructor No | Inst Name | Title | Salary | Dept No |
|---|---|---|---|---|
| Inst 1 | | | | Dept A |
| Inst 2 | | | | Dept B |
| Inst 3 | | | | Dept C |
| Inst 4 | | | | Dept A |

**Figure 3.12** With the relational model, we represent these two entities, department and instructor, as two separate tables and capture the relationship between them with a common column in each table.



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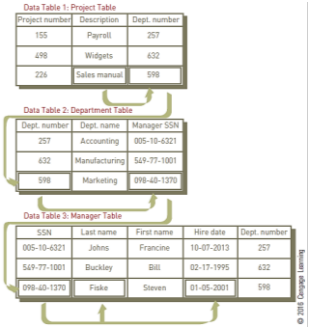
## Linking Data Tables to Answer an Inquiry

To find the name and hire date of the manager working on the sales manual project, the president needs three tables: Project, Department, and Manager.

The project description (Sales manual) leads to the department number (598) in the Project table, which leads to the manager's SSN (098-40-1370) in the Department table, which leads to the manager's name (Fiske) and hire date (01-05-2001) in the Manager table.

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## Data Modeling and Database Characteristics

- When building a database, an organization must consider:
  - ***Content***: What data should be collected and at what cost?
  - ***Access***: What data should be provided to which users and when?
  - ***Logical structure***: How should data be arranged so that it makes sense to a given user?
  - ***Physical organization***: Where should data be physically located?




## Data Modeling

- Building a database requires two types of designs:
  - Logical design:
    - Abstract model of how data should be structured and arranged to meet an organization's information needs
  - Physical design:
    - Starts from the logical database design and fine-tunes it for performance and cost considerations
- Planned data redundancy:
  - Done to improve system performance so that user reports or queries can be created more quickly




## Data Modeling (continued)

- Data model:
  - Diagram of data entities and their relationships
- Enterprise data modeling:
  - Starts by investigating the general data and information needs of the organization at the strategic level
- Entity-relationship (ER) diagrams:
  - Data models that use basic graphical symbols to show the organization of and relationships between data

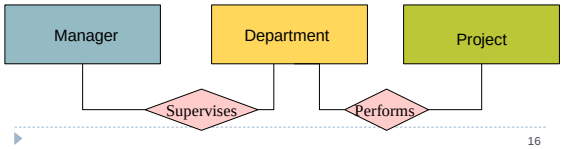
## Data Modeling Illustration

**First, list data fields**

- SSN
- Last Name
- First name
- Hire Date
- Dept. Number
- Dept. name
- Project Number
- Description

**Next, identify the relationships and design the tables**

| Manager | Dept | Project |
|---|---|---|
| • SSN<br>•L_Name<br>•F_Name<br>•Hire Date<br>•Dept. Number | •DeptNumber<br>•DeptName | •ProjNumber<br>•ProjDescript |

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## DBMS | DB Application System | MIS

- The information system needs raw data which is stored on disk as a relational database.
- The relational database is managed by Database Management System (DBMS) software. The system calls the DBMS (behind the scenes) and the DBMS extracts data from the database.
- DBMS is a group of programs used as interface between a database and application programs, or a database and the user
- Database (Application) System is the combination of the database, the DBMS, and the application programs that access the database
- Management Information System (MIS) is the **database system** coupled with a set of hardware, software, telecommunications, people, and procedures. Programs which are part of the information system then transform the raw data to useful information



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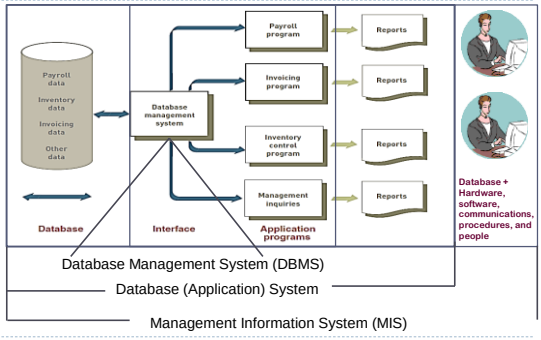
## DBMS | DB Application System | MIS

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## Using MS Access as a DBMS to Develop an MIS

- MS Access can be used **as an information system developer tool.**
- We use it to build a customized Management Information System (MIS) for some specific purpose.
- When setting up the database as part of the DBMS, the database design schema (Table Structures, Primary Keys, Relationships) are defined before data is entered.
- The system will utilize application interface screens that serve as an interface to the DBMS and database tables.
- The system will have its own menus, input screens, output (query) screens, and reports.
- In the background, it will have a database with related tables, and programs that take the raw data from the database and convert it to the required queries and reports.
- It will also have controls, i.e. mechanisms to ensure that the output is correct and that the data is safe from accidental or deliberate destruction.
- The information system will be set up on computers and a network and will provide an effective method for users to interface with the database without ever knowing they are utilizing MS Access.
- See Supplement Notes *"Using Access Screens"* for detail example.





## Database Management System (DBMS)

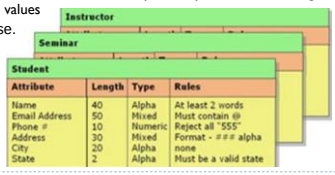
- System software that sets up the database structure ('skeleton' on disk according to a certain model, fills the structure with data and retrieves the data to provide meaningful information )
- Parts of DBMS:
  - **Data Dictionary**: defines each field and record, explains what each field means and who is authorized to update it
  - **Query language**: used to extract data that satisfy certain criteria from a database. Used to develop query retrieval commands and reports – which are the two main forms of output from a DBMS





## Data Dictionary

- Is a document that database designers prepare to help individuals enter data
- Provides several pieces of information about each attribute in the database including:
  - Name
  - Key (is it a key or part of a key?)
  - Data Type (date, alphanumeric, numeric, etc.)
  - Valid Value (the format or numbers allowed)
- Can be used to enforce Business Rules which are captured by the database designer to prevent illegal or illogical values from entering the database. (e.g. who has authority to enter certain kinds of data in specific files)



Instructor

Seminar

Student

| Attribute | Length | Type | Rules |
|---|---|---|---|
| Name | 40 | Alpha | At least 2 words |
| Email Address | 50 | Mixed | Must contain @ |
| Phone # | 10 | Numeric | Reject all "555" |
| Address | 30 | Mixed | Format - ### alpha |
| City | 20 | Alpha | none |
| State | 2 | Alpha | Must be a valid state |

## DBMS Functions

- A DBMS enables interactions with the database through activities such as:
  - Data Dictionary Management
  - Data Transformation and Presentation
  - Security Management
  - Backup and Recovery Management
  - Data Integrity Management
  - Database Access Languages and Application Programming Interfaces
  - Database Communication Interfaces
  - Transaction Management
  - Data entry, queries, etc.



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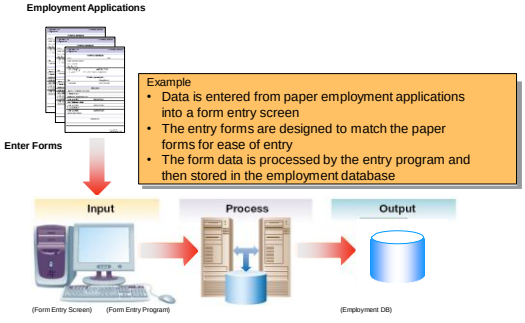
## DBMS – Data Entry



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## DBMS - Queries

- Query - A way to extract data from the database
  - Focuses on providing appropriate parameters to select the information required
- SQL (Structured Query Language)
  - A language to select and extract data from a database
  - The industry standard language for relational databases
- QBE (Query by Example)
  - A technique that allows a user to design a query on a screen by dragging and placing the query field in the desired locations




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## DBMS – Query Language

- e.g., SQL: Structured Query Language:
  - Popular language for making requests to a relational dbms

```
SELECT LAST_NAME, FIRST_NAME, CITY
FROM APPLICANT
WHERE APPLICATION_DATE >= 'August 19, 2012'

SELECT LAST_NAME, FIRST_NAME, CITY SALARY
FROM EMPLOYEE WHERE DEPARTMENT = '4530' AND
SALARY > 25000
```





## DBMS – Example of Query Results

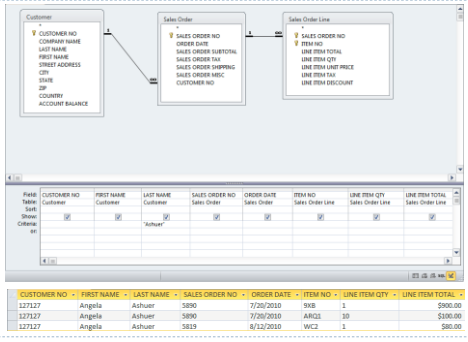
WORKERS Query

| wnum | wname | brith_date | rate | skill | certified |
|---|---|---|---|---|---|
| 100 | James Langdor | 2/22/1953 | $12.00 | Painter | ☑ |
| 200 | Rekha Hindoch | 1/8/1960 | $30.00 | Engineer | ☑ |
| 246 | Pierre Garceau | 7/19/1947 | $18.50 | Electrician | ☑ |
| 300 | Mary Clutterha | 12/30/1950 | $12.50 | Painter | ☑ |
| 395 | Donna Graham | 9/27/1956 | $21.00 | Plumber | ☑ |
| 452 | Isabella Fong | 5/12/1957 | $15.00 | Electrician | ☐ |
| 453 | Rosita Cordeirc | 8/22/1955 | $12.50 | Painter | ☐ |
| 565 | Ernest Schneid | 10/31/1957 | $18.00 | Electrician | ☑ |
| 664 | Maurice Favrea | 5/17/1962 | $12.00 | Plumber | ☐ |
| 743 | Oleh Markiw | 1/1/1959 | $15.00 | Carpenter | ☑ |
| 754 | Emil Juliano | 9/9/1949 | $15.00 | Carpenter | ☑ |
| 887 | Salim Agarwal | 11/20/1964 | $17.00 | Carpenter | ☑ |
| 0 | | | $0.00 | | ■ |





## DBMS – Example of Query Results




| CUSTOMER NO | FIRST NAME | LAST NAME | SALES ORDER NO | ORDER DATE | ITEM NO | LINE ITEM QTY | LINE ITEM TOTAL |
|---|---|---|---|---|---|---|---|
| 127127 | Angela | Ashuer | 5890 | 7/20/2010 | 9XB | 1 | $900.00 |
| 127127 | Angela | Ashuer | 5890 | 7/20/2010 | AR21 | 10 | $100.00 |
| 127127 | Angela | Ashuer | 5819 | 8/12/2010 | WC2 | 1 | $80.00 |

## DBMS – Report

Report – A database function that extracts and formats information from a database for printing and presentation

Report Generator
- A specialized program that uses SQL to retrieve and manipulate data (aggregate, transform, or group)
- Reports are designed using standard templates or can be custom generated to meet informational needs

Example – Report on applicants entered in the last 30 days
- Report parameters are selected in the report request screen
- The database program uses SQL to query and present the result


(Query Request) (Query Program) (Employment Report)





## DBMS – Designing a Report

- To create reports, the developer must first select the table(s) or queries(s) upon which the report will be based.
- All fields will then become available to the developer to include on the report:
- *The developer formats and enters the report header, detail, and footer.The required fields are placed in the desired location on the report layout.*

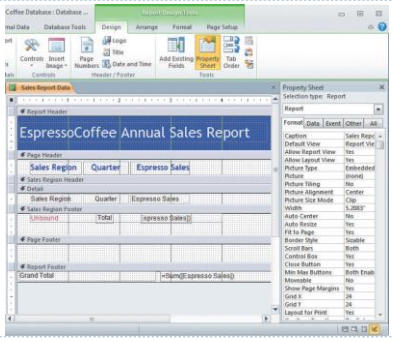
1. On the **Create** tab, click **Report Design**.

2. Click on the **Add Existing Fields** button, on the **Design** tab, to see a list of tables/fields.





## DBMS – Structured Report Design



## DBMS – Structured Report Results







## Setting Up a Relational Database in a Computer






## Implementing the Concepts

- After having reviewed all the basic database models in the last section, the following section will focus on a practical process to set up a database
  1) Complete Your Data Requirements Analysis

## Steps to set up a Database

- First: Speak to people who will use the information system
  - go to every person that will need any kind of output from the computer when doing his / her job
  - Find out from them what data fields do they need for different reports that they will use
  - List those fields (data items), and write them all down
- The database is going to be set up as a relational database (most likely)
- Always think of the relationships between fields




## Complete Your Data Requirements Analysis

- Example: School information System
- Three different users tell you their information needs:
  - Person 1.
    - A report displaying Student number, Student Name, Address, and City for all students
    - A report showing Student Name, Student phone, Student Major, ordered by student name
  - Person 2
    - Student Name, Course name and grade that each student took last term
    - Major ,St name and phone number for all students
  - Person 3
    - Course name, Course number, Student Name and Grade for each student
    - Course name, course number for each course offered in the term




## Complete Your Data Requirements Analysis

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  - Person 2
    - Student Name, Course name and grade that each student took last term
    - Major ,St name and phone number for all students
  - Person 3
    - Course name, Course number, Student Name and Grade for each student
    - Course name, course number for each course offered by enrolment date over the past three years

## Complete Your Data Requirements Analysis

- Example: School Information System
- The director of XYZ School would like to assess the initial design of the system using the following student, course, and grade information:
  - Student #: 1234; Student: A. Lam; Address: 491 Castle, Wpg; Phone: 204-258-6987; Major: Economics; Course: 1803, Computers, Grade: A; Course: 1901, Pascal, Grade: B; Course 2002, Finance, Grade A
  - Student #: 9876; Student: R. Kelly; Address: 22 Miller Cres, Wpg; Phone: 204-258-7563; Major: Biology; Course: 2002, Finance, Grade: B; Course: 3421, Entomology, Grade: B; Course 4523, Zoology, Grade: C
  - Student #: 4567; Student: J. Ng; Address: 399 High St.; Phone: 204-785-2145; Major: Business; Course: 1304, Accounting, Grade: C; Course: 2233, Marketing, Grade: A.



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## Store Meaningful Data About the Information

- In order to store data on disk meaningfully, we notice we must set it up first, at least **in a file** so that we can get a variety of useful information out
- Storing just characters alone in a computer won't do; we need to group them
- Storing just fields alone in a computer won't do; we need to group them.
- Storing just one record alone in a computer won't do; we need a group of several records that follow the same layout and are somehow related (say students of the same class)



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## Create Your Master Database File (Table)

- Data Items:
  - Student Number,
  - Student Name,
  - Student Street address,
  - Student City
  - Student Phone,
  - Student major area (only one),
  - for each course the student takes, the Course Number, Course Name, Enrolment Date, and Grade

| Field Name | STNUMBER | STNAME | STREET | CITY | STPHONE | MAJOR | CNO | CNAME | ENROL | GRADE |
|---|---|---|---|---|---|---|---|---|---|---|



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## Insert Data into Your Master File (Table)

- Insert all data records one by one:

| ST Number | St name | Street | City | Major | Phone Number | Course Name | Course Number | Enrolment | Grade |
|---|---|---|---|---|---|---|---|---|---|
| 1234 | Lam A | 491 Castle | Wpg | Economics | 208568974 | Computers | 1803 | | A |

- Ensure all of the data attributes have been identified and populated in the table. If there are no data elements for a specific attribute, then enter data

| St Number | St Name | Street | City | Major | Phone Number | Course Number | Course Name | Enrolment | Grade |
|---|---|---|---|---|---|---|---|---|---|
| 1234 | Lam A | 491 Castle | Wpg | Economics | 2042586987 | 1803 | Computers | 090912 | A |
| 9876 | Kelly R | 22 Miller Cr | Wpg | Biology | 2042587563 | 2002 | Finance | 050112 | B |
| 4567 | Ng J | 399 High St | Wpg | Business | 2047852145 | 1304 | Accounting | 050112 | C |



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## Analyze Data in Your Table

| STNumber | STName | Address | City | Major | StPhone | Cnumber | Cname | Enrolment | Grade |
|---|---|---|---|---|---|---|---|---|---|
| 1234 | Lam A | 491 Castle | Wpg | Economics | 2042586987 | 1803 | Computers | 090912 | A |
| 1234 | Lam A | 491 Castle | Wpg | Economics | 2042586987 | 1901 | Pascal | 080911 | B |
| 1234 | Lam A | 491 Castle | Wpg | Economics | 2042586987 | 2002 | Finance | 060111 | A |
| 9876 | Kelly R | 22 Miller Cr | Wpg | Biology | 2042587563 | 2002 | Finance | 050112 | B |
| 9876 | Kelly R | 22 Miller Cr | Wpg | Biology | 2042587563 | 3421 | Entomology | 080911 | B |
| 9876 | Kelly R | 22 Miller Cr | Wpg | Biology | 2042587563 | 4523 | Zoology | 070910 | C |
| 4567 | Ng J | 399 High St | Wpg | Business | 2047852145 | 1304 | Accounting | 050112 | C |
| 4567 | Ng J | 399 High St | Wpg | Business | 2047852145 | 2233 | Marketing | 080911 | A |



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## Determine the Data Relationships

- Determine the relationships when you have all the fields listed
- Group related fields into one table
  - Use logic, think about relationships
  - On this example, all fields with a one-to-one relationship go in one table, and all fields that have a one-to-many relationship in another table
- Determine what fields will be links between the tables
- Create your Data Model



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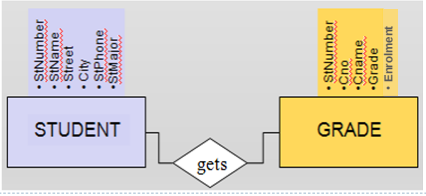
## Develop Your Entity Relationship (ER) Model

- When stored on Disk, *Student Number* is the common column linking data in the STUDENT table with data in the GRADES table
- An entity relationship (ER) diagram of this set up would be:








## Normalize the Tables (as per your ER Model)

| Student |
|---|
| StNumber |
| StName |
| Street |
| City |
| StPhone |
| StMajor |

| STNUMBER | STNAME | STREET | CITY | STPHONE | STMAJOR |
|---|---|---|---|---|---|
| 1234 | LAM A | 491 Castle | Wpg | 2042586987 | Economics |
| 9876 | KELLY R | 222 Miller Cr | Wpg | 2042587563 | Biology |
| 4567 | NG J | 399 HIGH ST | Wpg | 2047852145 | Business |

| Grade |
|---|
| Student |
| Course Number |
| Course Name |
| Enrolment |
| Grade |

| STNUMBER | COURSENUM | COURSENAME | ENROLMENT | GRADE |
|---|---|---|---|---|
| 1234 | 1803 | Computers | 090912 | A |
| 1234 | 1901 | Pascal | 080911 | B |
| 1234 | 2002 | Finance | 060111 | A |
| 4567 | 1304 | Accounting | 050112 | C |
| 4567 | 2233 | Marketing | 080911 | A |
| 9876 | 2002 | Finance | 050112 | B |
| 9876 | 3421 | Entomology | 080911 | B |
| 9876 | 4523 | Zoology | 070910 | C |

*This is an Unnormalized Database*

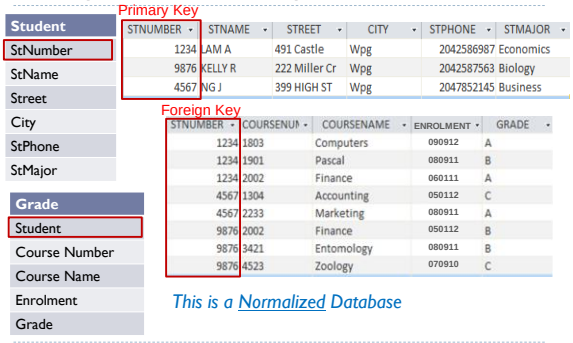




## Identify and Label Your Keys

- Primary Key – Student Table
  - Student Number
- Foreign Key – Grade Table
  - Student Number
- Compound Primary Key – Grade Table
  - Student Number + Course Number + Enrolment

## Identify and Label Your Keys

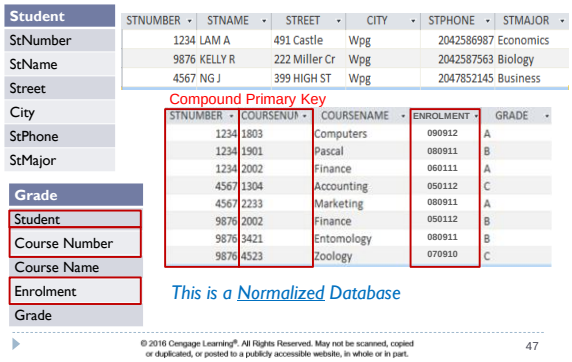



*This is a Normalized Database*





## Identify and Label Your Keys




*This is a Normalized Database*





## Define Your Report

- Example: School information System
- Three different users tell you their information needs:
  - Person 1.
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## Data Report – Courses by Enrolment

**Courses by Enrolment Date for XYZ School**

| Enrol Date | Course No | Course Name |
|---|---|---|
| 07-Sep-10 | 4523 | Zoology |
| Total Number of Courses: | | 1 |
| 06-Jan-11 | 2002 | Finance |
| Total Number of Courses: | | 1 |
| 08-Sep-11 | 1901 | Pascal |
| | 2233 | Marketing |
| | 3421 | Entomology |
| Total Number of Courses: | | 3 |
| 05-Jan-12 | 1304 | Accounting |
| Total Number of Courses: | | 1 |
| 09-Sep-12 | 1803 | Computers |
| Total Number of Courses: | | 1 |





## Define Your Queries

- Person 1
  - A report displaying Student number, Student Name, Address, and City for all students
  - A report showing Student Name, Student phone, Student Major, ordered by student name
- Person 2
  - Student Name, Course name and grade that each student took last term
  - Major ,St name and phone number for all students
- Person 3
  - Course name, Course number, Student Name and Grade for each student
  - Course name, course number for each course offered by enrolment date over the past three years





## Data Queries – Students/ Student Grades

- A report displaying Student number, Student Name, Address, and City for all students

| St Number | St Name | Street | City |
|---|---|---|---|
| 1234 | Lam A | 491 Castle | Wpg |
| 9876 | Kelly R | 22 Miller Cr | Wpg |
| 4567 | Ng J | 399 High St | Wpg |

- Student Name, Course name and grade that each student took last term

| ST Name | Cname | Enrolment | Grade |
|---|---|---|---|
| Lam A | Pascal | 080911 | B |
| Kelly R | Entomology | 080911 | B |
| Ng J | Marketing | 080911 | A |






## Big Data

- Extremely large and complex data collections acquired from either sensors or Social media
  - Traditional data management software, hardware, and analysis processes are incapable of dealing with them
- Three characteristics of big data
  - Volume – Estimated (2014) 4.4 zetabytes of data
  - Velocity – 5 trillion bits of data per seconds
  - Variety – structured vs unstructured data





## Sources of Big Data

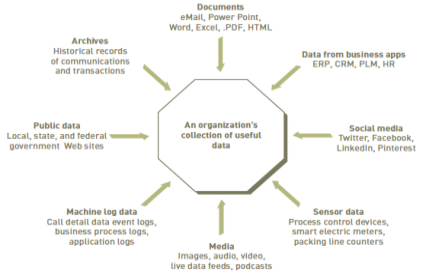



FIGURE 3.20
**Sources of an organization's useful data**
An organization has many sources of useful data.

## Big Data Uses

- Examples:
  - Retail organizations monitor social networks to engage brand advocates, identify brand adversaries
  - Advertising and marketing agencies track comments on social media
  - Hospitals analyze medical data and patient records
  - Consumer product companies monitor social networks to gain insight into consumer behavior
  - Financial service organizations use data to identify customers who are likely to be attracted to increasingly targeted and sophisticated offers




## Challenges of Big Data

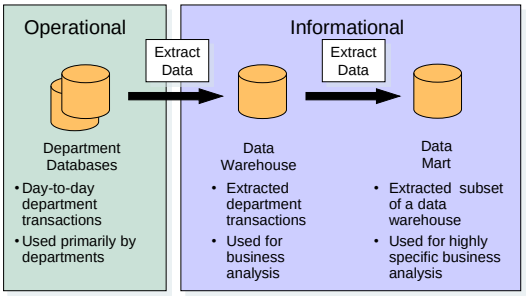
- How to choose what subset of the data to store
- Where and how to store the data
- How to find the nuggets of data that are relevant to the decision making at hand
- How to derive value from the relevant data
- How to identify which data needs to be protected from unauthorized access




## Data Management and Governance

- **Data management** purpose is to ensure that data remains accessible, reliable and timely to meet the needs of the users of an organization. It is driven by a variety of factors:
  - The need to meet external regulations designed to manage risk associated with financial misstatement
  - The need to avoid the inadvertent release of sensitive data
  - The need to ensure that high data quality is available for key decisions
- **Data governance** defines the roles, responsibilities, and processes for ensuring data can be trusted and used by the entire organization
  - Requires business leadership and active participation
  - Use of a cross-functional team is recommended
  - Team should consist of executives, project managers, line-of-business managers, and data stewards
  - A data steward is an individual responsible for management of critical data elements

## Data Warehouses and Data Marts






## Data Warehouses and Data Marts

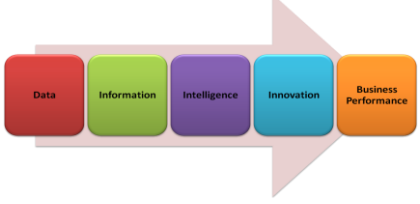
- Data warehouse:
  - Database that holds business information from many sources in the enterprise
- Data mart:
  - Subset of a data warehouse that is used by small- and medium-sized businesses and departments within large companies to support decision making
  - A specific area in the data mart might contain greater detailed data than the data warehouse





## Business Intelligence

- A broad range of technologies and applications
  - Enabling an organization to transform mostly structured data obtained from information systems to perform analysis, generate information, and improve the decision making of the organization

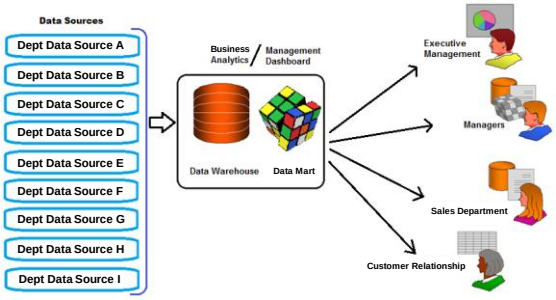


## Business Intelligence (cont'd.)

- Technologies include:
  - Data mining
    - An information-analysis tool that involves the automated discovery of patterns and relationships in a data warehouse
    - Provides bottom-up, discovery-driven analysis
  - Predictive analytics
    - A form of data mining that combines historical data with assumptions about future conditions to predict outcomes of events, e.g., future product sales or the probability that a customer will default on a loan
    - Example: Used by retailers to upgrade occasional customers into frequent purchasers.
    - Software can be used to analyze a company's customer list and a year's worth of sales data to find new market segments




## Data Mining and Predictive Analytics







## Data Warehouses, Data Marts, and Data Mining

- Predictive analysis:
  - Form of data mining that combines historical data with assumptions about future conditions to predict outcomes of events
  - Used by retailers to upgrade occasional customers into frequent purchasers
  - Software can be used to analyze a company's customer list and a year's worth of sales data to find new market segments

## Data Mining Applications

- Branding and positioning of products and services
  - Enable the strategist to visualize product behavior in different markets, while condensing the data in dimensions that are easily analyzed
- Customer Churn
  - Predict current customers who are likely to switch to a competitor
- Direct Marketing
  - Identify customer prospects most likely to respond to direct marketing practices
- Fraud detection
- Market Segmentation
- Trend analysis (sales, spending, promotions, etc.)