Introduction to DBMS

IS240 – DBMS

Lecture #2 – 2010-01-20

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Topics

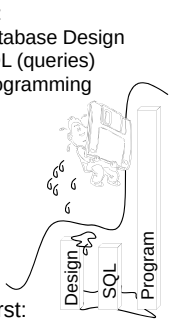
- **DBMS: Database Management System**
- **DBMS Features/Components**
- **Advantages of Database Approach**
- **Hierarchical Database**
- **Network Database**
- **Relational Database**
- **Object-Oriented DBMS**
- **Examples of Commercial DBMS**
- **REQUIRED HOMEWORK**

DBMS: Database Management System

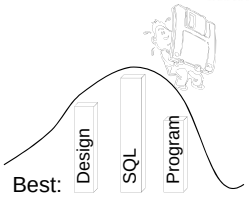
- **Database**
  - **A collection of data**
  - **stored in a standardized format,**
  - **designed to be shared by multiple users and**
  - **accessed through a standardized software interface**
  - **capable of managing multiple files as a single integrated entity.**
- **Database Management System**
  - **Software that defines a database,**
  - **stores the data,**
  - **supports a query language,**
  - **produces reports, and**
  - **creates data entry screens.**

Goal: Build a Business Application

Tools:
Database Design
SQL (queries)
Programming

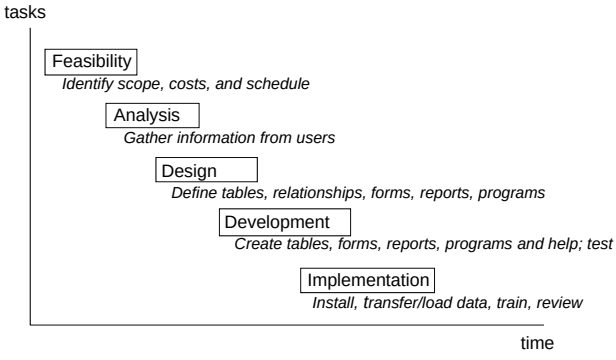


Worst:
Compensate for poor design
and limited SQL with programming.



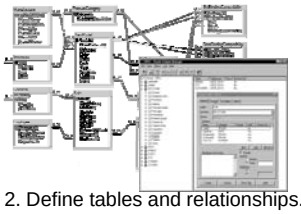
Best:
Spend your time
on design and SQL.

Application Development



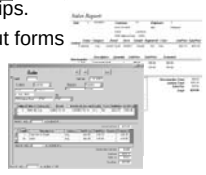
DBMS Application Design

1. Identify business rules.



2. Define tables and relationships.

3. Create input forms and reports.

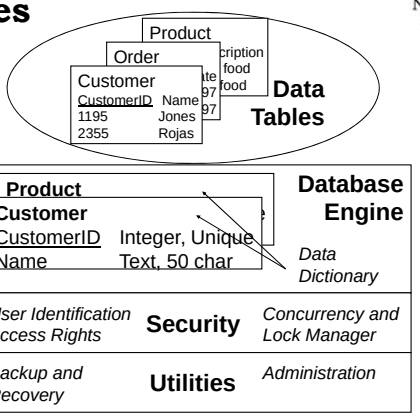


4. Combine as applications for users.

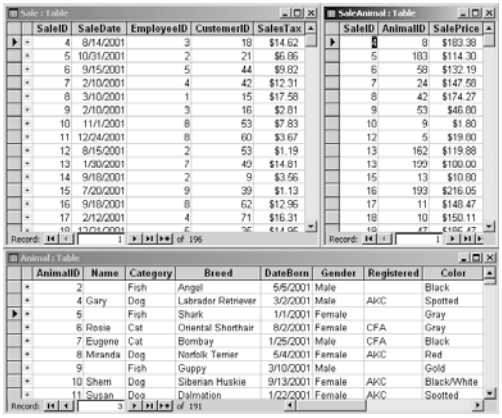
DBMS Features/Components

- Database engine
  - Storage
  - Retrieval
  - Update
- Query Processor
- Data dictionary
- Utilities
- Security
- Report writer
- Forms generator (input screens)
- Application generator
- Communications
- 3GL Interface

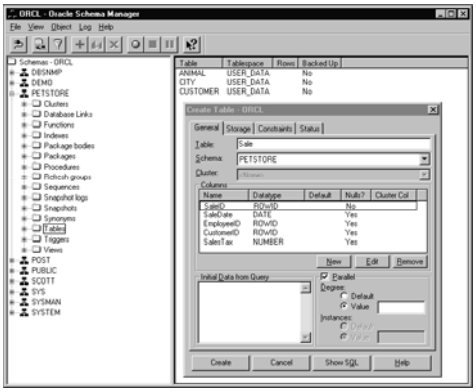
DBMS Engine, Security, Utilities



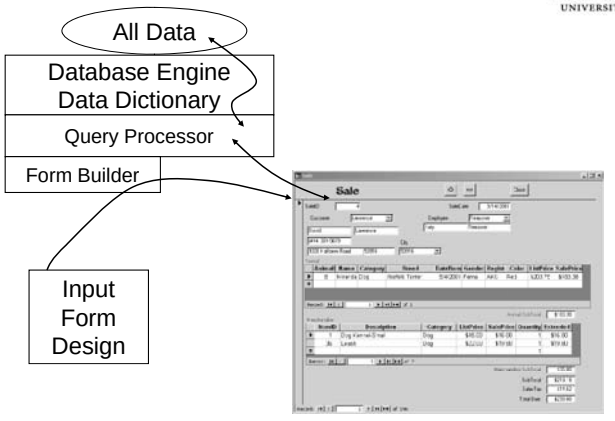
Database Tables (Access)



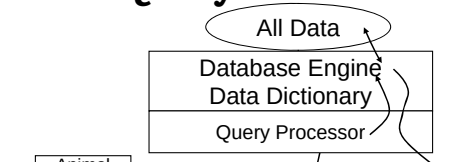
Database Tables (Oracle)



DBMS Input Forms



DBMS Query Processor

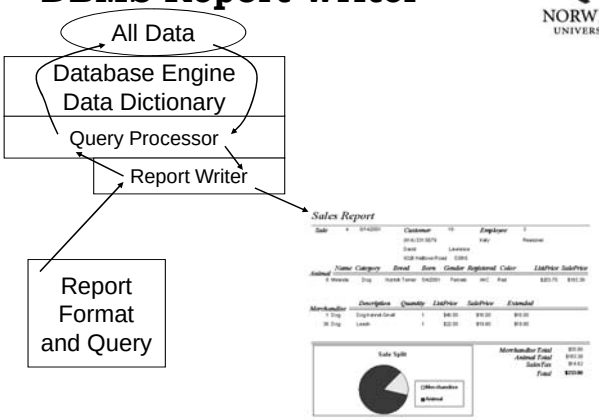


Animal
AnimalID
Name
Category
Breed

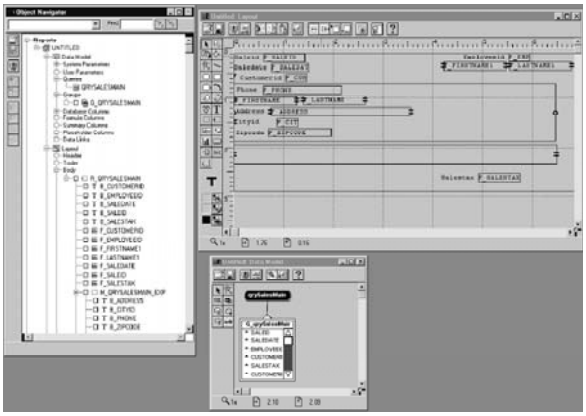
Field	Category	AnimalID
Table	Animal	Animal
Totals	Group By	Count
Sort		Descending

Category	CountOfAnimalID
Dog	100
Cat	47
Bird	15
Fish	14
Reptile	6
Mammal	6
Spider	3

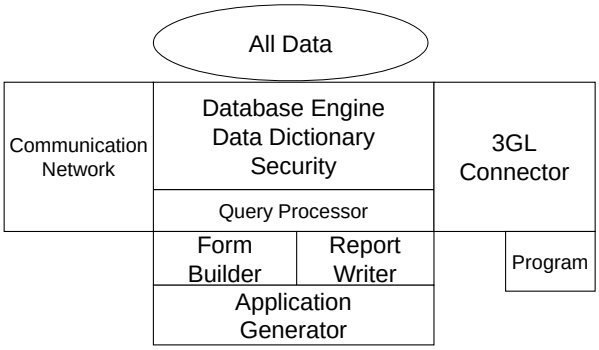
DBMS Report Writer



Report Writer (Oracle)



DBMS Components

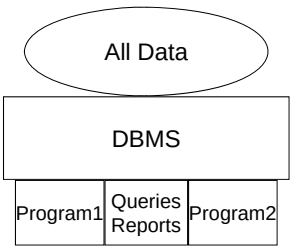


Advantages of Database Approach

- **Minimal data redundancy.**
- **Data consistency.**
- **Integration of data.**
- **Sharing of data.**
- **Enforcement of standards.**
- **Ease of application development.**
- **Uniform security, privacy and integrity.**
- **Data independence.**

Database Management Approach

- **Data are most important**
  - **Data defined first**
  - **Standard format**
- **Access through DBMS**
  - **Queries, Reports, Forms**
  - **Application Programs**
  - **3GL Interface**
- **Data independence**
  - **Change data definition without changing code**
  - **Alter code without changing data**
  - **Move/split data without changing code**



Modifying Data with DBMS

- **Add cell number to employee table**
  - **Open table definition**
  - **Add data element**
  - **If desired, modify reports**
    - **Use report writer**
    - **No programming**
- **Existing reports, queries, code will all run as before with no changes.**

Field Name	Data Type	Description
EmployeeID	Number	Autonumber..
TaxpayerID	Text	Federal ID
LastName	Text	
FirstName	Text	
. . .		
Phone	Text	
. . .		
CellPhone	Text	Cellular . . .

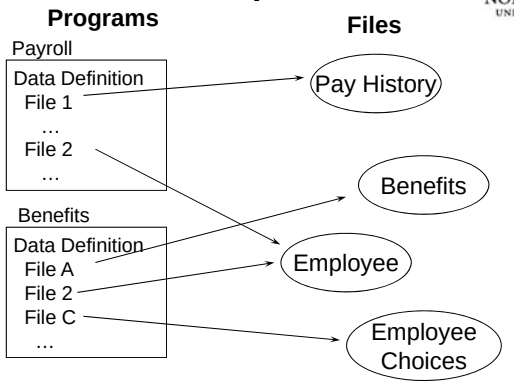
Drawbacks of Old File Methods

- Uncontrolled Duplication of Data
  - Wastes space
  - Hard to update all files
- Inconsistent data
- Inflexibility
  - Hard to change data
  - Hard to change programs
- Limited data sharing
- Poor enforcement of standards
- Poor programmer productivity
- Excessive program maintenance

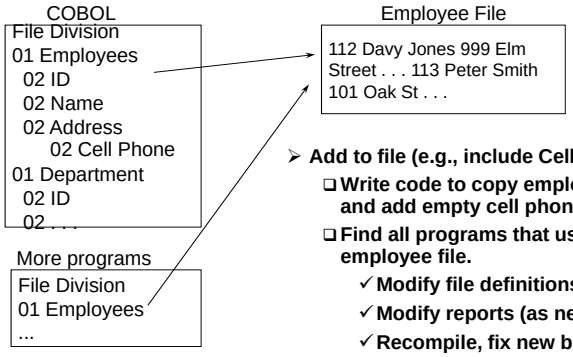
File Method Problems

- Files defined in program
  - Cannot read file without definition
  - Hard to find definition
  - Every time you alter file, you must rewrite code
  - Change in a program/file will crash other code
  - Cannot tell which programs use each file
- Multiuser problems
  - Concurrency
  - Security
    - ✓Access
    - ✓Backup & Restore
  - Efficiency
    - ✓Indexes
    - ✓Programmer talent
      - System
      - Application

Old File Method/3GL

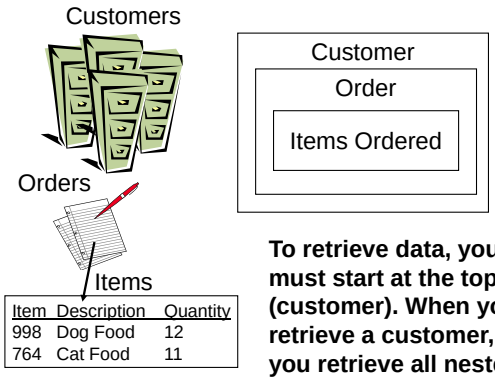


Example of File Method v DBMS



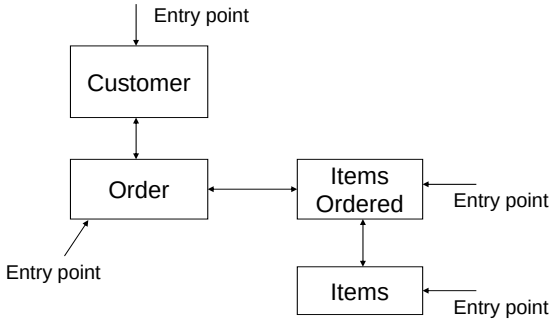
- Add to file (e.g., include Cell phone)
  - Write code to copy employee file and add empty cell phone slot.
  - Find all programs that use employee file.
    - ✓Modify file definitions.
    - ✓Modify reports (as needed)
    - ✓Recompile, fix new bugs.
- Easier: Keep two employee files?
  - BUT….

Hierarchical Database



To retrieve data, you must start at the top (customer). When you retrieve a customer, you retrieve all nested data.

Network Database



Relational Database

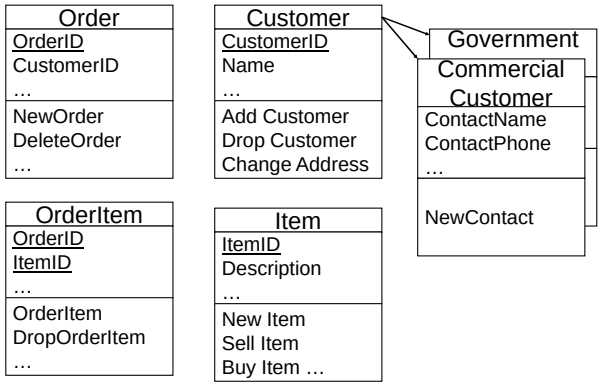
Customer(CustomerID, Name, …

Order(OrderID, CustomerID, OrderDate, …

ItemsOrdered(OrderID, ItemID, Quantity, …

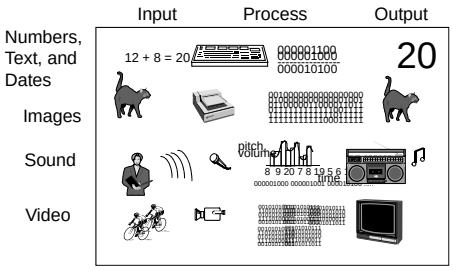
Items(ItemID, Description, Price, …

Object-Oriented DBMS



Base Data Types for OODBMS

- **Numbers**
  - **Integers**
  - **Reals**
- **Text**
  - **Length**
  - **International**
- **Date/Time**
- **Images**
  - **Bitmap**
  - **Vector**
- **Sound**
  - **Samples**
  - **MIDI**
- **Video**



Examples of Commercial DBMS

- **Oracle**
- **Informix (Unix)**
- **DB2, SQL/DS (IBM)**
- **Access (Microsoft)**
- **SQL Server (Microsoft +)**
- **Many older (Focus, IMS, ...)**
- **mySQL**
- **ProgresSQL**

HOMEWORK GUIDELINES (1)

- **All homework must be prepared using a computer**
  - **No handwritten work accepted**
  - **All diagrams must be created using computer programs (e.g., PowerPoint, other drawing tools)**
- **Top right corner of first page:**
  - **Student Name**
  - **IS240**
  - **Chapter #**
  - **Due date**
- **All other pages have student name at top right**

HOMEWORK GUIDELINES (2)

- **Group work is helpful**
  - **Discuss problems**
  - **Help each other understand issues**
  - **Not a substitute for individual learning**
- **Plagiarism is forbidden**
  - **Do not copy each other's specific solutions**
  - **After discussion, write out your answers yourselves, independently, in your own words**
  - **Do not copy/paste words or diagrams from other students**
  - **Plagiarism will be reported to the Committee on Academic Integrity and may result in expulsion from the University**

REQUIRED HOMEWORK

- Study Chapter 1 of your textbook in detail
- EXERCISES TO HAND IN USING E-MAIL TO MKABAY@NORWICH.EDU
  - Deadline: before Sunday 30th January at 23:59
  - #1, 2, 7, 8, 11, 12, 13, 15, 16, 17, 18
  - You must hand in written answers to specific questions
  - You can use PDF files for reports
  - Or JPG screen shots pasted in a WORD or PowerPoint file (as you prefer) showing how you are responding to operational demands
- NOT HOMEWORK:
  - Review Questions (next) help you learn

Review /Study Questions

1. A manager asks you why you are using a DBMS as part of the design of a new inventory system. Explain the major advantages of the DBMS over older methods of data organization in a paragraph of simple language suitable for a non-technical manager. (5 pts)
2. Which part of the DBMS is responsible for
   a. Managing user data-entry?
   b. Returning sets of records in response to selection criteria?
   c. Formatting output for written display?
   d. Storing information about all the other components of the DBMS including characteristics of the data?
3. What is the most important functional difference between a hierarchical database and a network database?
4. What is the most widely-used DBMS model today?
5. Go online to the WWW and locate *product descriptions* for Oracle, DB2, Access, and mySQL. Find out how much it costs to license each product for a single computer (any type will do) and provide the URL for your information.

DISCUSSION