UNIVERSITAS INDONESIA

FAKULTAS ILMU KOMPUTER

Slide 1

Introduction to Databases

CSF2600700 - BASIS DATA

SEMESTER GENAP 2018/2019

This slide is a modification to supplementary slide of "Database System", 6th edition, Elmasri/Navathe, 2011:
Chapter 1 Introduction to Databases

Outline

Introduction

An Example

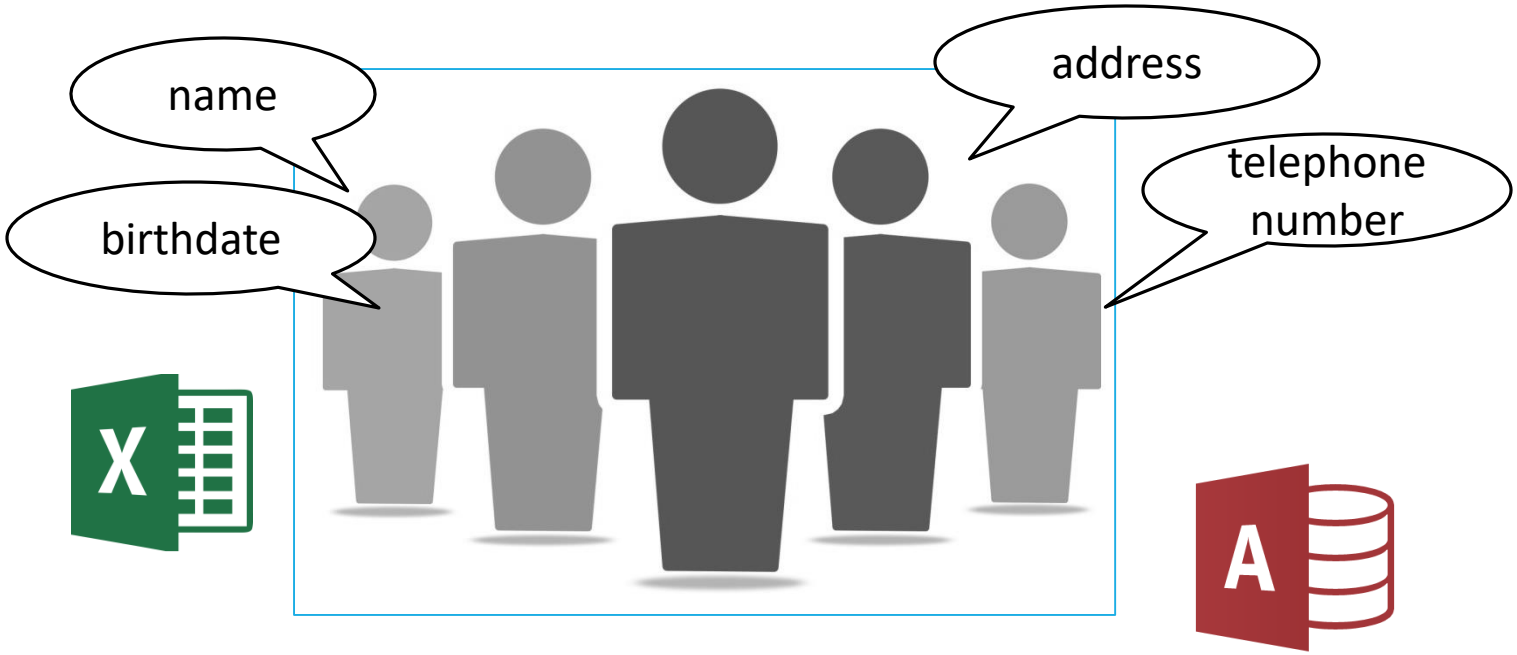
Actors on the Scene

Workers behind the Scene

When to Use the Database?

Database - Definition

- Collection of related data
- Known facts that can be recorded and that have implicit meaning



Database Properties

- **Miniworld** or **universe of discourse (UoD)**
- Represents some aspect of the real world
- Logically coherent collection of data with inherent meaning
- Built for a specific purpose

Database Management System (DBMS)

- Collection of programs
- Enables users to create and maintain a database
- Examples:

Database System

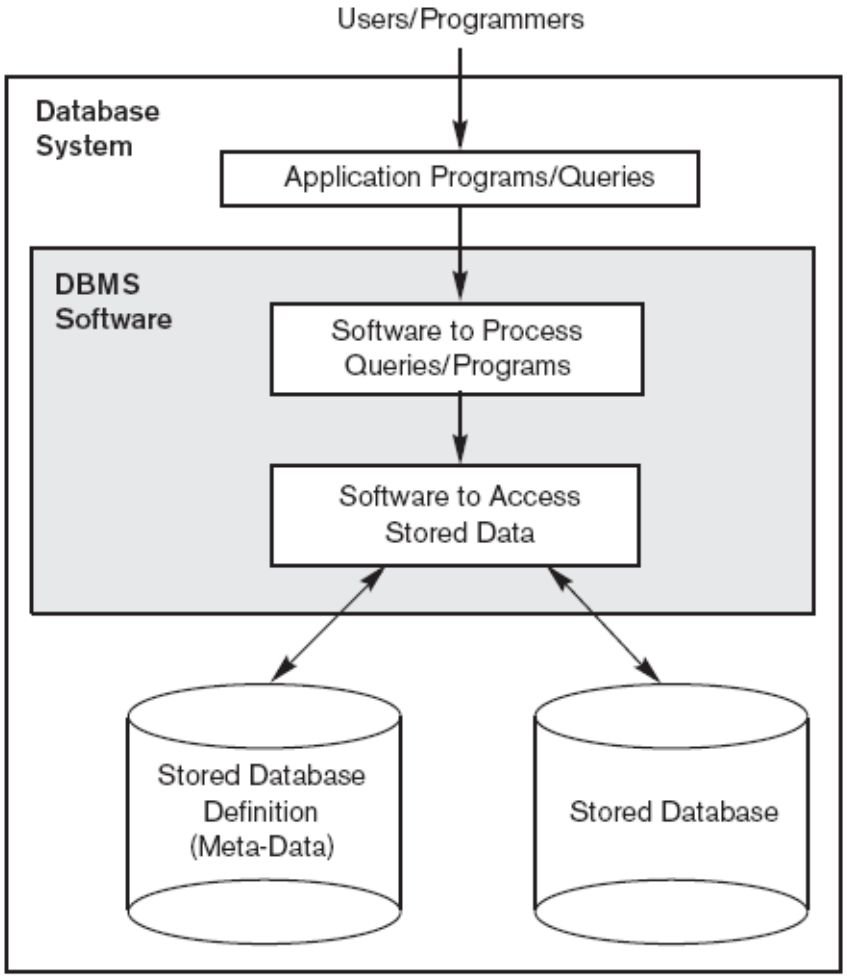


Figure 1.1
A simplified database system environment.

Examples

Traditional database applications

- Store textual or numeric information

Multimedia databases

- Store images, audio clips, and video streams digitally

Geographic information systems (GIS)

- Store and analyze maps, weather data, and satellite images

Examples (cont'd.)

Data warehouses and online analytical processing (OLAP) systems

- Extract and analyze useful business information from very large databases
- Support decision making

Real-time and active database technology

- Control industrial and manufacturing processes

Defining a database

Specify the data types, structures, and constraints of the data to be stored

Meta-data

- Database definition or descriptive information
- Stored by the DBMS in the form of a database catalog or dictionary

RELATIONS

Relation_name	No_of_columns
STUDENT	4
COURSE	4
SECTION	5
GRADE_REPORT	3
PREREQUISITE	2

COLUMNS

Column_name	Data_type	Belongs_to_relation
Name	Character (30)	STUDENT
Student_number	Character (4)	STUDENT
Class	Integer (1)	STUDENT
Major	Major_type	STUDENT
Course_name	Character (10)	COURSE
Course_number	XXXXNNNN	COURSE
….	….	…..
….	….	…..
….	….	…..
Prerequisite_number	XXXXNNNN	PREREQUISITE

Note: Major_type is defined as an enumerated type with all known majors.
XXXXNNNN is used to define a type with four alpha characters followed by four digits.

Figure 1.3
An example of a database catalog for the database in Figure 1.2.

Other terms

Manipulating a database
- Query and update the database miniworld
- Generate reports

Sharing a database
- Allow multiple users and programs to access the database simultaneously

Application program
- Accesses database by sending queries to DBMS

Query
- Causes some data to be retrieved

Other terms (cont'd.)

Transaction

- May cause some data to be read and some data to be written into the database

Protection includes:

- System protection
- Security protection

Maintain the database system

- Allow the system to evolve as requirements change over time

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An Example

UNIVERSITY database

- Information concerning students, courses, and grades in a university environment

Data records

- STUDENT
- COURSE
- SECTION
- GRADE_REPORT
- PREREQUISITE

An Example (cont'd.)

Specify structure of records of each file by specifying **data type** for each **data element**

- String of alphabetic characters
- Integer
- Etc.

An Example (cont'd.)

Construct UNIVERSITY database

- Store data to represent each student, course, section, grade report, and prerequisite as a record in appropriate file

Relationships among the records

Manipulation involves querying and updating

STUDENT

Name	Student_number	Class	Major
Smith	17	1	CS
Brown	8	2	CS

COURSE

Course_name	Course_number	Credit_hours	Department
Intro to Computer Science	CS1310	4	CS
Data Structures	CS3320	4	CS
Discrete Mathematics	MATH2410	3	MATH
Database	CS3380	3	CS

SECTION

Section_identifier	Course_number	Semester	Year	Instructor
85	MATH2410	Fall	07	King
92	CS1310	Fall	07	Anderson
102	CS3320	Spring	08	Knuth
112	MATH2410	Fall	08	Chang
119	CS1310	Fall	08	Anderson
135	CS3380	Fall	08	Stone

GRADE_REPORT

Student_number	Section_identifier	Grade
17	112	B
17	119	C
8	85	A
8	92	A
8	102	B
8	135	A

PREREQUISITE

Course_number	Prerequisite_number
CS3380	CS3320
CS3380	MATH2410
CS3320	CS1310

Figure 1.2
A database that stores student and course information.

An Example (cont'd.)

Examples of queries:

- Retrieve the transcript
- List the names of students who took the section of the 'Database' course offered in fall 2008 and their grades in that section
- List the prerequisites of the 'Database' course

An Example (cont'd.)

Examples of updates:

- Change the class of ‘Smith’ to sophomore
- Create a new section for the ‘Database’ course for this semester
- Enter a grade of ‘A’ for ‘Smith’ in the ‘Database’ section of last semester

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When to Use the Database?

Actors on the Scene

Database administrators (DBA) are responsible for:

- Authorizing access to the database
- Coordinating and monitoring its use
- Acquiring software and hardware resources

Database designers are responsible for:

- Identifying the data to be stored
- Choosing appropriate structures to represent and store this data

Actors on the Scene (cont'd.)

End users

- People whose jobs require access to the database
- Types
  - **Naive** or **parametric end users**
  - **Casual end users**
  - **Sophisticated end users**
  - **Standalone users**

Actors on the Scene (cont'd.)

System analysts

- Determine requirements of end users

Application programmers

- Implement these specifications as programs

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When to Use the Database?

Workers behind the Scene

DBMS system designers and implementers

- Design and implement the DBMS modules and interfaces as a software package

Tool developers

- Design and implement **tools**

Operators and maintenance personnel

- Responsible for running and maintenance of hardware and software environment for database system

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When to Use the Database?

When we need to use database

- The data is 'business' data: large and need to be updated.
- Consist of a lot of similar data (homogeneous).
- The data is relevant for a long time.
- Simultaneous usage by user.

When we don't need to use database

- Simple, well-defined database applications not expected to change at all
- Stringent, real-time requirements that may not be met because of DBMS overhead
- Embedded systems with limited storage capacity
- No multiple-user access to data

When database can not to be used

- If the database system can not handle the complexity of data because of the limitations of requirement modeling.
- If users need special operations which can not be met by the DBMS

Inside a Google Data Center

https://www.youtube.com/watch?v=XZmGGAbHqa0