

Database Systems

Overview and Issues

Database System

- **large** repository of data
- **shared**
- at the **centre** of an information system

Examples

- commercial sector
 - supermarket
- financial sector
 - bank
- academia
 - university
- health sector
 - hospital

Discussion

- what is data?
- what is it meant by large? is 'large' a necessary requirement?
- is shared a necessary requirement?
- at the centre of an information system → data comes first, functionality follows
 - however, data is inferred from functionality
 - discuss

Database Management System

- a software that assists the management of data
- in-house developed
 - e.g., in the financial sector
- off-the-shelf
 - e.g., Oracle

Database Management Systems

- can a database be implemented without a (n off the shelf) database management system?

Database Management System

- "communication"
 - language for human users
 - command line
 - graphical
 - interfaces for application programmes
- features
 - easy data manipulation (creation of structures, updates of actual data items)
 - catalogue, security, concurrency, recovery, ...

ANSI/SPARC Architecture

- separation of three levels
 - external level
 - conceptual level
 - internal level
- data independence
 - when working at one level, one does not need to be concerned with the details of the underlying levels

Data Model

- a set of generic structures in which data can be organised
 - this term may also mean the actual structure of a specific database (as represented in a generic data model)
- level of formality
 - informal – not rigorously (mathematically/locally) defined; e.g. *ER model*
 - formal – 'sound' mathematical/logical model; e.g., *relational model*

DBMS ad Data Models

- each DBMS implements a certain data model
- most popular data model: relational model
- recent requirements → Object relational, OO, semi-structured

Relational Model

- tables
- operations – relational algebra
 - restriction, projection, join, union, intersection, difference, division
 - another formalism: relational calculus
- most commercial DBMSs are based on the relational model
 - SQL – standard language founded on the relational model

Design

- find the best (data) structures that can be used to model an information/data space

Database Development

- methodology
 - requirements specification
 - data and transactions
 - conceptual/logical design
 - ER
 - relational
 - physical design
 - efficiency
 - maintenance

Requirements Specification

- requirements
 - what information/data needs to be stored
 - what operations need to be done with it
- specified in English

Conceptual/Logical Design

- recall from a previous slide
 - find the best (data) structures that can be used to model an information/data space
 - to avoid redundancies, which could cause inconsistencies
 - recommended steps
 - ER modelling
 - normalisation

Physical Design

- make the database efficient
 - denormalisation
 - file organisation structures (including indexes)
 - based on transaction analysis
- use other features of DBMS
 - e.g.: rules (active database); Procedural SQL

Maintenance

- a database system is a 'living thing' continuously evolving, according to newly identified needs
 - some parts of the database may become obsolete
 - the initial good design may be lost
 - ...

Databases and Application Programmes

- application programmes implement some functionality, on the basis of the data stored in the database
- communication technologies
 - SQL embedded in programming languages
 - Java
 - PHP, Cold Fusion, ...
 - ...
 - ...