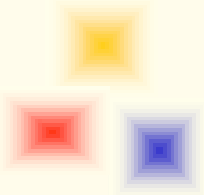
2.6 Other Data Models

- Logic-based data model (Deductive DBMS)
  - Extend the query function of DBMS (especially recursive query function)
  - Promote the deductive ability of DBMS
- Temporal data model
- Spatial data model
- XML data model
  - Store data on internet
  - Common data exchange standard
  - Information systems integration
  - Expression of semi-structured data
  - … …
- Others

2.7 Summary

- Data model is the core of a DBMS
- A data model is a methodology to simulate real world in database
- In fact, every kind of DBMS has implemented a data model

☹ If there will be a data model which can substitute relational model and become popular data model, just as relational model substituted hierarchical and network model 30 years ago **???**



3. User Interfaces and SQL Language*

User interface of DBMS

- A DBMS must offer some interfaces to support user to access database, including:
  - Query Languages
  - Interface and maintaining tools (GUI)
  - APIs
  - Class Library
- Query Languages
  - Formal Query Language
  - Tabular Query Language
  - Graphic Query Language
  - Limited Natural Language Query Language

Example of TQL & GQL

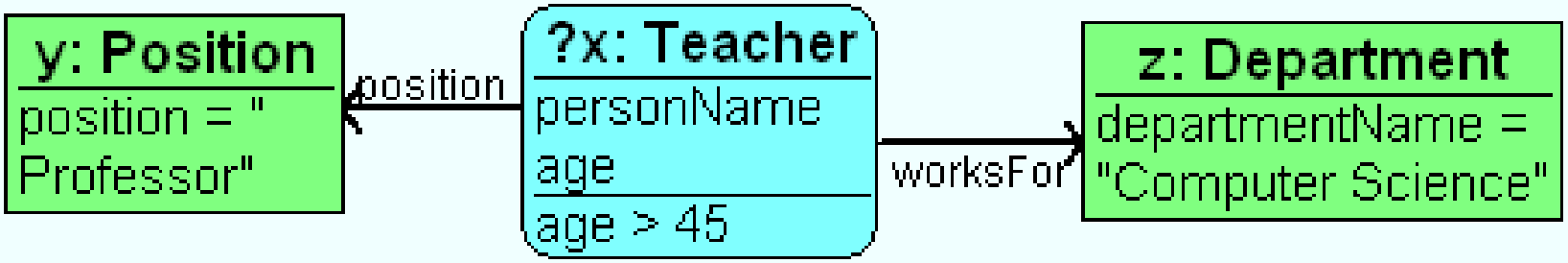
Find the names of all students in the department of Info. Science

Student	Sno	Sname	Ssex	Sage	Sdept
		P.T			IS

操作符，表示打印（print）
实际是显示

示例元素，域变量

条件



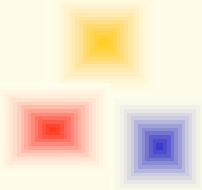
Find all Teachers, which have position=”Professor” and which have age>”45” and which work for department=”Computer Science”

Relational Query Languages

- Query languages: Allow manipulation and retrieval of data from a database.
- Relational model supports simple, powerful QLs:
  - Strong formal foundation based on logic.
  - Allows for much optimization.
- Query Languages **!=** programming languages!
  - QLs not expected to be "Turing complete".
  - QLs not intended to be used for complex calculations.
  - QLs support easy, efficient access to large data sets.

Formal Relational Query Languages

- Two mathematical Query Languages form the basis for "real" languages (e.g. SQL), and for implementation:
  - *Relational Algebra*: More operational, very useful for representing execution plans.
  - *Relational Calculus*: Lets users describe what they want, rather than how to compute it. (Non-operational, *declarative*.)
- The most successful relational database language --- SQL (Structured Query Language, Standard Query Language(1986))



SQL Language

- It can be divided into four parts according to functions.
  - Data Definition Language (DDL), used to define, delete, or alter data schema.
  - Query Language (QL), used to retrieve data
  - Data Manipulation Language (DML), used to insert, delete, or update data.
  - Data Control Language (DCL), used to control user's access authority to data.
- QL and DML are introduced in detail in this chapter.