Basic Concepts on Relational Databases

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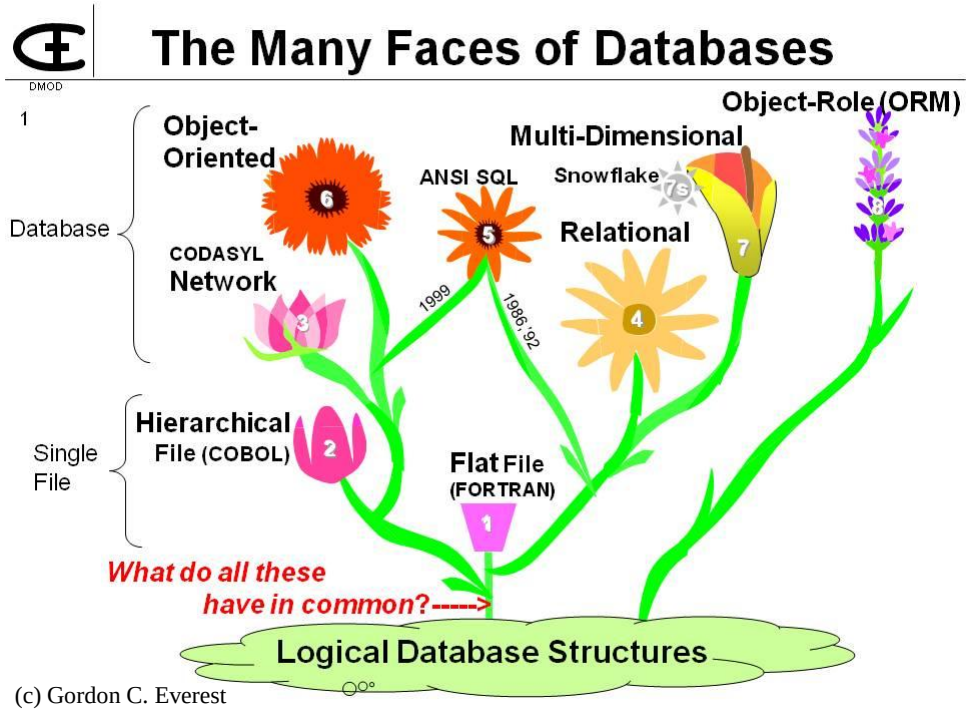
Data Models

- a set of concepts used to describe the database structure
  - data types
  - constraints
- Some existing database models
  - Hierarchical model
  - Network model
  - Relational model
  - Object-Oriented model

"More than 90% of current database applications are built on relational database systems which uses relational model as its underlying data model"*

* R. Elmasri and S. Navathe. Fundamentals of Database Systems



Relational Data Model

- introduced by C F Codd in 1970
- simple and uniform data model
- based on a firm mathematical foundation (set theory)
- Main aspects:
  - Data structure: n-ary two dimensional
    - Attributes, domain value
    - Tuples
    - Tables/relations
  - Integrity constraints
    - entity integrity
    - referential integrity

Student

Id	Name	Suburb
1108	Robert	Kew
3936	Glen	Bundoora
8507	Norman	Bundoora
8452	Mary	Balwyn

Example: University Database

Student

Id	Name	Suburb
1108	Robert	Kew
3936	Glen	Bundoora
8507	Norman	Bundoora
8452	Mary	Balwyn

Takes

SID	SNO
1108	21
1108	23
1108	29
8507	23
8507	29

Enrol

SID	Course
3936	101
1108	113
8507	101

Course

No	Name	Dept
113	BCS	CSCE
101	MCS	CSCE

Subject

No	Name	Dept
21	Systems	CSCE
23	Database	CSCE
29	VB	CSCE
18	Algebra	Maths

Attribute

- Definition
  - designated by a meaningful name
  - also called field or column
  - denoted A
  - ✓ Example
    - Id, name, suburb, dept, …
- Domain
  - define the original sets of data values used
  - denoted Domain(A)
  - √ Example
    - text, number, boolean, date/time, memo
    - Id: text(10)
    - Name: text(30)
    - birthday: date
    - …

Relation

- Definition
  - Defined as a set of attribute
  - also called table
  - Denoted R(A1,A2, … An)

    R(A1,A2, … An) $\subseteq$ Dom(A1) x … x Dom(An)
  - ✓ Example
    - STUDENT(Id, Name, Suburb)
    - SUBJECT (No, Name, Dept)
- A relation is composed of tuples

Tuple

- Definition
  - defined as a set of attribute value
  - also called record or row
  - Denoted t(a1,a2, … an)
  - t(a1,a2, … an) $\in$ Dom(A1) x … x Dom(An)
  - ✓ Example

    (1108, Robert, Kew)

    (3936, Glen, Bundoora)
- Each tuple must have a primary key which can uniquely identified the tuple.

Key

- Definition
  - A set of attribute in a relation
  - Used to identify each tuple
  - Given R(A1,A2, … An), K ⊆ {Ai},
    K is key if ∀t1, t2 ∈R, ∃Ai ∈K: t1.K≠t2.K
  - ✓ Example
    - STUDENT(**Id**, Name, Suburb)
    - TAKE(**SID, SNO**)
- Remark:
  - If K ⊆ {Ai} is key and K ⊆ K' ⊆ {Ai}
    → K' is super key
  - candidate key
    - a superkey without redundant attributes

Primary key

- Definition
  - a "smallest" key, i.e. with single attribute or smallest number of attributes allowing identify a unique tuple
  - A candidate key chosen to be the main key for the relation
- Entity constraint:
  - No attribute in the primary key can be NULL

✓ Example
- STUDENT(**Id** , Name, Suburb)
- SUBJECT (**No**, Name, Dept)

Foreign key

- Specified between two relations and maintain the correspondence between tuples in these relations
  - also called referential integrity
- A set of attributes FK in a relation R1 is foreign key if
  - The attributes in FK correspond to the attributes in the primary key of another relation R2
  - The value for FK in each tuple of R1 either occur as values of primary key of a tuple in R2 or is entirely NULL

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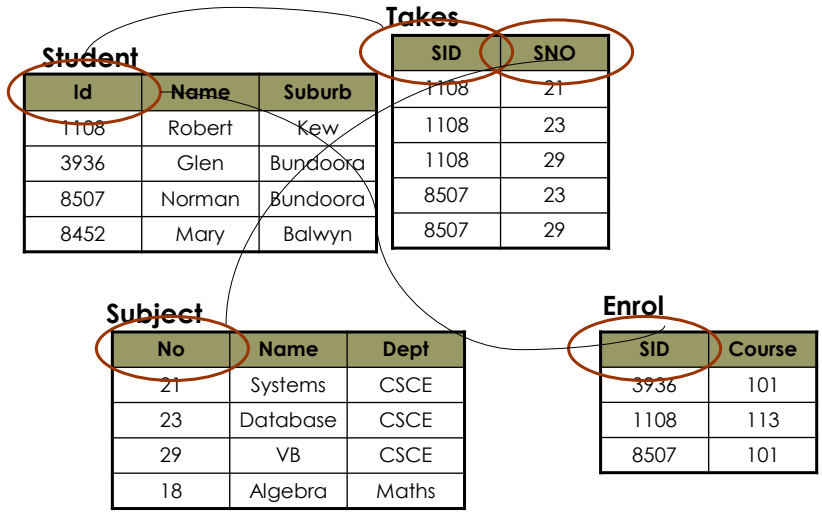

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Summary

- Main concepts
  - Relation / Table
  - Attribute / Column
  - Tuple / Record / Row
  - Key, Super-key, Candidate key, Primary key, Foreign key,