Database Management System – 4 (Data models, Schemas and Instances)

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Data abstraction

- Refers to the suppression of details of data organization and storage
- Highlighting of the essential features for an improved understanding of data
- Different users can perceive data at their preferred level

Data Model

- A collection of concepts that can be used to describe the **structure** of a database
- **Structure** - Data types, relationships, constraints that apply to the data
- To achieve **abstraction**
- Set of basic operations for specifying retrievals and updates on the database

Categories of Data Models

- **Conceptual (high-level, semantic) data models**
  - Provide concepts that are close to the way many users perceive data
  - Entity-relationship model data models
- **Physical (low-level, internal) data models:**
  - Provide concepts that describe details of how data is stored in the computer
  - record formats, record orderings, and access paths
- **Implementation (representational) data models:**
  - Provide concepts that fall between the above two
  - Used by many commercial DBMS implementations
  - e.g. relational data models

Database Schema, Schema diagram

- Database Schema
  - ***Description*** of a database
  - Includes descriptions of the database structure, data types, and the constraints on the database
- Schema Diagram
  - ***Illustrative*** display of a database schema
- Schema Construct
  - ***Component*** of the schema or an object within the schema
  - STUDENT, COURSE

Schema Diagram

STUDENT

Name	Student_number	Class	Major

COURSE

Course_name	Course_number	Credit_hours	Department

PREREQUISITE

Course_number	Prerequisite_number

SECTION

Section_identifier	Course_number	Semester	Year	Instructor

GRADE_REPORT

Student_number	Section_identifier	Grade

Database State

- Database State
  - Actual data stored in a database at a ***particular moment in time***.
  - Collection of all the data in the database
  - Also called **database instance** (or **occurrence** or **snapshot**)
- Initial Database State
  - database state when it is initially loaded
- Valid State
  - A state that satisfies the structure and constraints of the database

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

Database Schema vs. Database State

- Distinction
  - ***Database schema*** changes very infrequently.
  - ***Database state*** changes every time the database is updated
- **Schema** is also called **intension**
- **State** is also called **extension**

Reference

- Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education 6th edition and 7th edition

Thank you