CS1555/2055

Intro to Relational Technologies

Database Vs. File Systems Approaches

- Abstraction
  - Data
  - Execution
- Reliability
- Efficiency/Performance

Data Abstraction

- Data are structured in a way meaningful to applications
- **Data Model:**
  - A collection of high-level data description constructs that hide low-level storage details
- **The Relational / Object-Relational Model:**
  - Is the most widely used data model today
  - Main construct is a ***relation***: table of records
  - Every relation has a ***schema***:
    - Relation name
    - Names of fields
    - Types of fields

Example

Attribute or Field

Schema

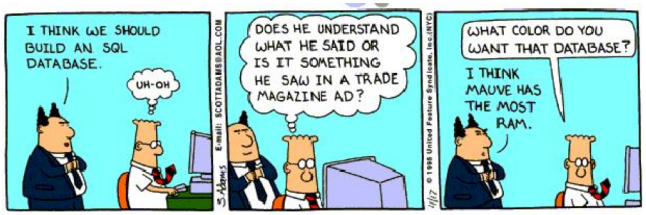
Record or Tuple

SID	*Name*	*Age*	*GPA*
546007	Peter	18	3.8
546100	Bob	19	3.65
546500	Bill	20	3.7

- Schema:
  - Students (*sid:* `string`, *name*: `string`, *age*: `integer`, *gpa*: `real`)
- State: Actual data at a given point in time

Database Languages

- **Data Definition Language (*DDL*):**
  - Define schemas
  - Define **Integrity Constraints**
    - Example: unique *SID*s
  - More…
- **Data Manipulation Language (*DML*):**
  - To ask questions = ***Query***
    - Example: Which students have GPA > 3.75?
  - To create and modify data
- ***SQL:*** Most widely used database language



Relation Schema

STUDENTS

SID	*LName*	*Name*	*Class*	*Major*
123	Smith	John	3	CS
395	Aiken	Mary	4	CS

⇦ Schema

- ***What is the meaning?***
- A relation schema R specifies
  - The name of the relation
  - the attribute names A_i of R
  - the domain D_i (data type + format) for each attribute A_i
- data type is a set of **atomic data** values:
  - no attribute is a set-valued (1st Normal Form, 1-NF)
  - no attribute is composite
- format specify the representation of a data value

DDL Example: SQL Table Schema

Schema of STUDENTS(SID, Name, Major, GPA)

```
CREATE TABLE  STUDENTS
(    SID      INTEGER,
     Name   CHAR(20),
     Class    INTEGER,
     Major   CHAR(4),
     CONSTRAINT STUDENT_PK
        PRIMARY KEY (SID)
);
```

SQL Insert

INSERT INTO Students
VALUES (123, 'John', 3, 'CS');

INSERT INTO Students
VALUES (124, 'Mary', 3, 'CS');

Students

SID	*Name*	*Class*	*Major*
123	John	3	CS
124	Mary	3	CS
999	Newman	1	CS

DML: SQL Select Statement

- Complete form:

```
SELECT [DISTINCT | ALL] attribute-list
FROM   table-list
WHERE selection-condition
GROUP BY grouping-attribute(s)
HAVING grouping-condition
ORDER BY {attribute ASC | DESC} pairs
```


Sample SQL Queries

Q1

```
SELECT *
FROM   STUDENTS
WHERE  Class = 3;
```

Q2

```
SELECT SID, Name, Major
FROM   STUDENTS
WHERE  Class = 1;
```

Q1 RESULT

SID	*Name*	*Class*	*Major*
123	John	3	CS
124	Mary	3	CS

Q2 RESULT

SID	*Name*	*Major*
999	Newman	CS

Class DB Technologies

- PostgreSQL (Personal Installation)
- Oracle Server (class3.cs.pitt.edu)
- DataGrip (SQL IDE)
- Install PostgreSQL & DataGrip following the instructions on the handout & test them by creating the STUDENTS table and running the sample SQL queries.

Agenda for 1st Recitation

- When & Where
  - Aug 30th, Friday, 11:00 - 11:50 am
  - Aug 30th, Friday, 2:00 - 2:50 pm
  - @ 6110 Sennott Square Building
- What
  - Helping with installation of PostgreSQL and DataGrip on your local machine