CS143: Basic SQL Query (1)

Book Chapters

(5th) Chapter 3.1, 3.3-4
(6th) Chapter 3.1, 3.3-5
(7th) Chapter 3.1, 3.3-5

Things to Learn

- Basic SELECT query
- SQL set operator

SQL

- Structured Query Language
- The standard language for all commericial RDBMS
- SQL has many aspects
  - DDL: schema definition, constraints, index, ...
  - DML: query, update, ...
  - triggers, transaction, authorization, ...
- In this lecture, we cover the DML aspect of SQL
  - How to query and modify exsiting databases
- SQL and DBMS
  - SQL is high-level description of user's query
    - No concrete procedure for query execution is given
  - The beauty and success of DBMS
    - The system understands the query and find the best way possible to execute it *automatically*

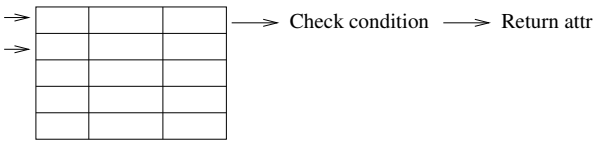
Example to Use in the Class

- School information
  - Student(sid, name, age, GPA, address, ...)
  - Class(dept, cnum, sec, unit, title, instructor, ...)
  - Enroll(sid, dept, cnum, sec)

Basic SELECT statement

- **Query 1:** Find the titles and instructors of all CS courses

- **Semantics**
  - Interpret and write FROM → WHERE → SELECT
    - FROM: the list of tables to look up
    - WHERE: conditions to meet
    - SELECT: the attributes to return
  - *Conceptual* execution (table cursor diagram)



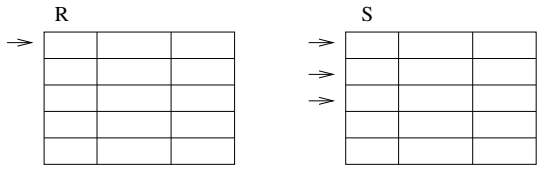
General SQL statement

- `SELECT A1, ..., An`
  `FROM R1, ..., Rm`
  `WHERE C`
  $\equiv \pi_{A_1,\ldots,A_n}(\sigma_C(R_1 \times \cdots \times R_m))$
- `SELECT *`: all attributes
- `SELECT` is "projection" not "selection": can be confusing
- SQL does not remove duplicates: Major difference between SQL and relational algebra
  - More examples will follow

SQL join

- **Query 2:** Find the names and GPAs of all students taking CS classes

  - Conceptually `WHERE R, S`
    (Table join diagram)



- For every pair of tuples from R and S, we check condition and produce output

Notes:

- S, E: tutple variable
  - renaming operator
  - We can consider that S and E are variables that bind to every pair of tuples
- Attribues can also be renamed
  - `GPA (AS) grade`
- `DISTINCT`: remove duplicates in the results

WHERE conditions

- **Query 3:** All student names and GPAs who live on Wilshire

  - `%`: any length (0–∞) string
    _: one character
    `'%Wilshire%'`: Any string containing Wilshire

  Q: What does `'___%'` mean?

- Other useful string functions: `UPPER(), LOWER(), CONCAT(), ...`

Set operators

- $\cap$: `INTERSECT`, $\cup$: `UNION`, $-$: `EXCEPT`
- Can be applied to the result of SELECT statements or to relations
- **Query 4:** All names of students and instructors

- **Important points to note**
  - Set operators should have the same schema for operands
    - In practice, it is okay to have just compatible types
  - Set operators follow *set* semantics and remove duplicates
    - Set semantics is well understood for set operations. Not many people know bag semantics.
    - Efficiency
  - To keep duplicates, use `UNION ALL, INSERSECT ALL, EXCEPT ALL`
- **Query 5:** Find ids of all students who are not taking any CS courses.

- MySQL support:
  - Standard MySQL does not support `INTERSECT` or `EXCEPT`.
  - MariaDB v10.3 introduced supports for `INTERSECT` and `EXCEPT`.