Introduction to Database Systems: CS312
SQL Queries, SELECT and WHERE

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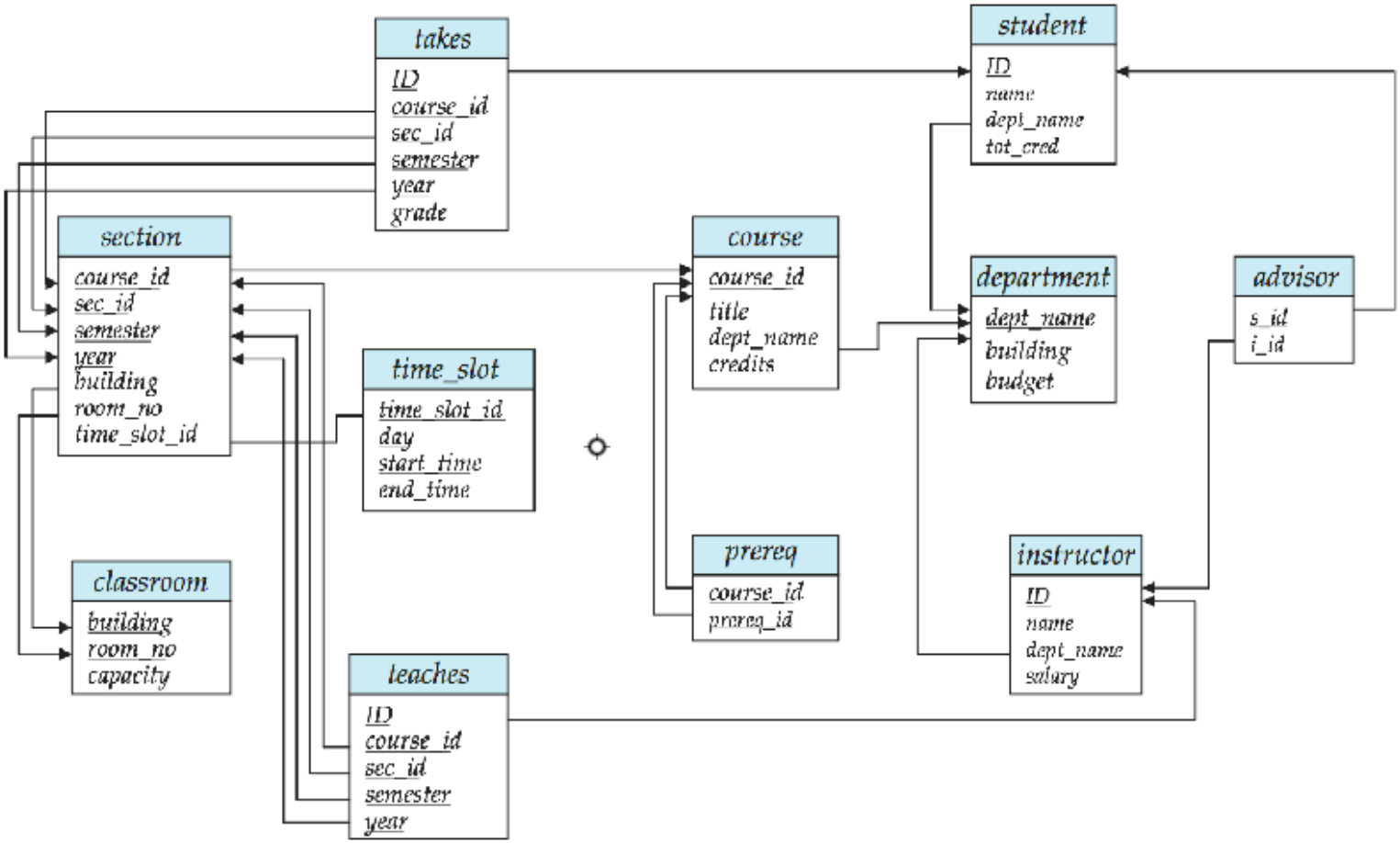
How to connect all this information?



The Basic Query Structure

The SQL data-manipulation language (DML) provides the ability to query information, and insert, delete and update tuples

A typical SQL pseudo code query has the form:

```
SELECT A1, A2, ..., An
FROM r1, r2, ..., rm
WHERE P;
```

- A_i represents an attribute
- R_i represents a relation
- P is a predicate
- The result of an SQL query is a relation

The **SELECT** Clause

The SELECT clause filters out particular data from a table.

- SQL allows duplicates in relations as well as in query results.
- The SELECT statement has many optional clauses:
  - WHERE specifies which rows to retrieve.
  - GROUP BY groups rows sharing a property so that an aggregate function can be applied to each group.
  - HAVING selects among the groups defined by the GROUP BY clause.
  - ORDER BY specifies an order in which to return the rows.
  - AS provides an alias which can be used to temporarily rename tables or columns..

Given table 'T'

Table "T"	Query	Result
C1 C2 1 a 2 b	`SELECT * FROM T;`	C1 C2 1 a 2 b
C1 C2 1 a 2 b	`SELECT C1 FROM T;`	C1 1 2
C1 C2 1 a 2 b	`SELECT * FROM T WHERE C1 = 1;`	C1 C2 1 a
C1 C2 1 a 2 b	`SELECT * FROM T ORDER BY C1 DESC;`	C1 C2 2 b 1 a

New Database Tables!

TeaDB

Build file: `sandbox/teaDB/teaDB_Build.txt`

```
cat builder_teaDB.txt | sqlite3 teaDB.sqlite3
```

The **SELECT** Clause

TeaDB

- Find everything in the `Department` table.
- SELECT * FROM Department;
- Find all entries for *dept*'s of the `Department` table
- SELECT dept from Department;
- Count entries of *dept*'s in `Department` table,
- SELECT COUNT(dept) FROM department;

The **SELECT** Clause

TeaDB

- Find all unique entries for *depts* in `Department` table,
- SELECT DISTINCT(dept) FROM department;
- Count unique entries of *depts* in `Department` table,
- SELECT COUNT(DISTINCT(dept)) FROM Department; /*count unique occurrences*/
- Return the exhaustive set of sandwiches that are being ordered.
- SELECT DISTINCT(sandwich) FROM Tea; /*Everyone gets one type of this sandwich from this set */

The **WHERE** clause

TeaDB

The **WHERE** clause: **conditions** that the result must satisfy

- Corresponds to the selection predicate of the relational algebra
- Comparison results can be combined using the logical connectives and, or, and not
- Comparisons can be applied to results of arithmetic expressions

The **WHERE** clause

TeaDB

- Find out who is ordering a sandwich less than $15 (from the new cost column)

- SELECT * FROM tea where cost $<$ 15;

- Find department, Session material, sandwich type for orders of sandwiches less than $15.

- SELECT Department.id, Session.session, tea.sandwich, tea.cost FROM Tea, Department, Session WHERE cost ¡ 15 AND Department.id == Session.id AND Department.id == Tea.id;

- Find out what kinds of *sandwich*es are going to each *dept*

- SELECT department.dept, tea.sandwich FROM department, tea where department.id == tea.id;

The **WHERE** clause

TeaDB

- Find out which professors are presenting posters

- SELECT * FROM session WHERE material == “poster”; /* show all*/
- SELECT ID, material FROM session WHERE material == “poster”; /*which professor is doing what?*/

- Find how who is presenting a poster, having what kind of sandwich which costs over $10

- SELECT session.ID, session.material, tea.sandwich, tea.cost FROM session, tea WHERE session.material == “poster” AND tea.cost > 10 AND session.id == tea.id;

New Database Tables!

CampusDB

Build file: `sandbox/campusDB_Build.txt`

```
cat campusDB_build.txt | sqlite3 CampusDB.sqlite3
```

Abbreviations in queries

CampusDB

Find which students are working with what instructors.

- SELECT Instructor.ID, Instructor.name, Instructor.studentId, Student.name, Student.Id FROM Instructor, Student WHERE Instructor.studentId == Student.ID;

Shorter way to write query by using abbreviations

- SELECT **i**.ID, **i**.name, **i**.studentId, s.name, s.Id FROM Instructor **i**, Student s WHERE i.studentId == s.ID;

- The "**Instructor**" table name can be replaced with an **i**.
- The "Student" table name can be replaced by an "s".

Aggregate Functions
CampusDB

These functions operate on the multiset of values of a column of a relation, and return a value

- **avg**: average value
- **min**: minimum value
- **max**: maximum value
- **sum**: sum of values
- **count**: number of values

Mathematical Functions

CampusDB

To find all instructors in Comp. Sci. dept with salary > 80000

- SELECT name FROM instructor WHERE deptName = "CompSci" AND salary > 80000;

Using functions

- SELECT AVG (salary) FROM instructor WHERE deptName = "CompSci";
- SELECT MIN (salary) FROM instructor WHERE deptName = "CompSci";
- SELECT MAX (salary) FROM instructor WHERE deptName = "CompSci";
- SELECT SUM (salary) FROM instructor WHERE deptName = "CompSci";
- SELECT COUNT (salary) FROM instructor WHERE deptName = CompSci";

Logical Queries
CampusDB

- Find the ID, name and total credit students who are taking a course where the total credit is 3 or 4 hours.

- SELECT ID, name, totCred FROM student WHERE totCred == "3" OR totCred == "4";

Watch out for cross products that give no usable information!!

- SELECT s.name, i.name from student s, instructor i WHERE s.deptName == i.deptName and s.deptName == "CompSci";
- Use two queries instead:
  - SELECT s.name from student s WHERE s.deptName == "CompSci";
  - SELECT i.name from instructor i WHERE i.deptName == "CompSci";

Using Count and Count(Distinct())

CampusDB

Find the number of tuples in the course relation

- SELECT COUNT(credits) FROM course;
- SELECT COUNT(distinct(credits)) FROM course;
- SELECT COUNT (*) FROM course;
- SELECT COUNT (distinct(*)) FROM course;
- Question: Why will the above *distinct* line **not** work?

Removing Tables or Data

CampusDB: Adding data to Student table

- DROP TABLE student
  - Deletes the table and its contents
- DELETE FROM student
  - Deletes all contents of table, but retains table

Changing Table Contents

- ALTER TABLE
  - Alter table r add AD
  - where A is the name of the attribute to be added to relation r and D is the domain of A.
  - All tuples in the relation are assigned null as the value for the new attribute.
  - Change name of table:
    - `ALTER TABLE department RENAME TO newDept;`

- Add a column to a table
  - `ALTER table course ADD COLUMN courseTag char(1);`
  - `Check your additional column:`
    - `.schema course`