

# CS345: DBMS

CS 345: Database Management Systems Design

Luby Liao

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## I Textbook

*Database Systems: An Application-Oriented Approach, Introductory Version (2nd Edition)*,  
by Michael Kifer, et al

## II. Topics

- System matters such as Emacs commands, Shell commands, PATH, PYTHONPATH, CLASSPATH, etc are taken up as needed.
- Why a database system is organized as a client-server application. Use of Postgresql database server for instruction and production. Different clients: language library (DB API-compliant python library `psycopg2` and Java JDBC drivers), sql monitor `psql`, GUI clients Navicat, dump tools `pg_dump`.  
[3 hours]
- Database access from a Python and a Java program using DBAPI and JDBC.  
[3 hours]
- Design of a Gradebook database: `student`, `work`, `score`. This provides an example for the discussion of more abstract ideas that follow.  
[1.5 hours]
- Three layer DBMS architecture: view, conceptual and physical layers. Data Models for conceptual layer: object, operations and constraints.  
[1.5 hours]
- Relational Data Model. Describing relational data model using relational algebra.  
[6 hours]
- Declarative *simple query language* SQL as the interface language to a RDBMS. Query processing using relational algebra. Query optimization.  
[3 hours]
- How to write complex queries.  
[4.5 hours]
- Constraints: keys, foreign keys, DOMAIN, CHECK and ASSERTION. Triggers.  
[3 hours]
- Many-to-many relationships and the use of Object-relation-mapper (ORM) using Django as example. Related issues of schema evolution.  
[1.5 hours]
- Server-side objects: Views, Functions (stored procedures) and Triggers. Aggregate functions and grouping. Triggers are executed in a transaction.  
[4.5 hours]
- Performance: indexes, B-trees, Materialized view, Clustering.  
[2 hours]

- Database design: decomposing a universal table losslessly into tables of BCNF (Boyce-Codd Normal Form) if possible, 3NF (Third Normal Form) otherwise to avoid redundancies and anomalies.  
[8 hours]

### III. Grading System

Your grade consists of 4 components:

1. **15%** Notes, Quizzes, and Short homework problems due in a day or 2
2. **35%** More substantial homework assignments and Term Project
3. **20%** Midterm exam
4. **30%** Comprehensive Final