

**Database Design, CSCI 340, Spring 2015**  
**Review for Exam 2, April 1, S&E 308**

Introduction to Databases

Chapter 1, Introduction

Know what is meant by meta data

Know that Entity-Relationship Diagram (ERD) show:

- Entity – distinct object or concept to be represented in the database
- Attribute – property of an object
- Relationship – association between two entities

Know what views are and that they can be used to provide:

- Security
- Ways to customize the look of a database
- Consistent picture of the database, even when the database changes

Chapter 2, Database Environment (Skip 2.3), pages 3-45 & 49-55

3-Level Architecture (Figure 2.1, page 37) - know what is meant by external schemas or sub schemas, conceptual schemas and internal schemas

Know the importance of both logical and physical data independence

Know the difference between the intension and extension of a db

Know what a logical record is

Be able to describe the following and know why they are needed in a DBMS.

1. Data storage, retrieval and update
2. User-accessible catalog
3. Transaction support
4. Concurrency control
5. Recovery
6. Authorization
7. Support for data communications
8. Integrity
9. Data independence
10. Utilities – importing, monitoring

(I will not ask you to list these services)

## Relational Model and Languages

### Chapter 4, Relational Model

Know the vocabulary of the relational model

- Relation
- Attribute
- Tuple
- Degree of a relation (# attributes)
- Cardinality of a relationship (# records)
- Degree of a relationship (# relations which participate)
- Cardinality of a relationship (the minimum and maximum records that participate in the relationship)

Know the vocabulary of keys:

- Composite key
- Candidate key
- Primary key
- Foreign key

Know the vocabulary of constraints:

- Entity constraint (no value in the key can be null)
- Referential constraint
- General constraint

Base relations – those relations given in the conceptual schema

View – relations derived from base relations (also call these virtual relations)

### Chapter 5, Relational Algebra

Know the difference between imperative and declarative languages

Know that SQL is declarative while relational algebra is imperative

Be able to write queries involving:

Projection ( $\Pi$ ), Select ( $\sigma$ ), Natural Join ( $\bowtie$ ), Theta join -  $\bowtie_{\theta}$ , Equijoin join -  $\bowtie_{\theta}$ , aggregation ( $\mathcal{A}_{ag}$ ), grouping ( $gr_{\mathcal{A}}$ ), rename ( $\rho$ ), Cartesian product ( $\times$ ), union ( $\cup$ ), intersection ( $\cap$ ), set difference ( $-$ )

Be able to translate simple SQL statement into an equivalent relational algebra statement, and vice versa

## Chapter 6, SQL Data Manipulation

Know that SQL includes a DDL and a DML and the purpose of each

Be able to write queries involving:

SELECT, FROM, WHERE, GROUP BY, ORDER BY  
LIKE

aggregate functions

sub queries with equality

INSERT, UPDATE, DELETE

HAVING

sub queries with IN, ANY, ALL, SOME, EXISTS, NOT EXISTS

UNION, INTERSECT, EXCEPT

Joins – outer, LEFT, RIGHT, FULL

## Chapter 7, SQL Data Definition, Sections 7.1 & 7.3

Be able to write queries involving:

CREATE TABLE enforcing referential integrity

CREATE VIEW

## Chapter 12, Entity-Relationship Modeling

Know the difference between intentional and extension of a database.

Know the vocabulary (some of this was introduced in Chapter 4): entity, relationship, degree, binary relationship, recursive relationships, composite attributes, derived attributes, candidate key, primary key and composite key, id-dependent entities, multiplicity of relationships (cardinalities), minimum cardinality, maximum cardinality, Know to recommend that relationships of degree greater than two be split into multiple binary relationships.

Know to recommend that 1-1 relationships be combined.

## Chapter 14, Normalization, pages 378-389

Know the purpose of normalization

Know the meaning of a functional dependency and be able to identify likely functional dependencies within a relation.

Know the definition of BCNF

Be able to recognize when a relation is not in BCNF and to decompose the relation into a set of relations which are in BCNF

## Methodology

Chapter 17, Methodology-Logical Database Design for the Relational Model, pages 439-448

Be able to develop a logical data model which corresponds to a given conceptual data model

Chapter 19, Denormalization, pages 495-508

Know and be able to describe how sometimes tables storing addresses are not fully normalized (due to zip codes)

Know the idea “normalization is about design, denormalization is about optimization”

Know that one reason not to normalize is that joins are expensive

Know that denormalization speed up reads but slows down writes

Chapter 21, Professional, Legal, and Ethical Issues in Data Management

Be able to discuss the consequences of data retention policies on privacy

Know

- FERPA – Family Educational Rights and Privacy Act, 1974
  - As first enacted, FERPA provided parents with the right to inspect and review "any and all official records, files, and data directly related to their children"
- European Union (EU) Directive 95/46/EC (1995)
  - Protection of individuals with regard to the processing of personal data and on the free movement of such data
- Health Insurance Portability and Accountability Act (HIPAA, 1996)
  - Standards for the security of patient data and transactions involving this data
- United Kingdom's Data Protection Act of 1998
  - Personal data processed for any purpose or purposes shall not be kept for longer than is necessary for that purpose or those purposes.