1. Introduction to databases
   
   Covered in:
   - Lecture set 1
   - Chapter 1

   Sub-topics:
   a. Database Management Systems benefits

2. Data Modeling with the Entity-Relationship Model
   
   Covered in:
   - Set 2, 3
   - Chapter 5

   Sub-topics:
   a. Entities
      • Identifiers /Composite identifiers
      • Attributes
      • Strong entities
      • Weak entities
      • Id-dependent entities
   b. Relationships
      • Has-A relationships
        Maximum and minimum cardinality
        Identifying/non-identifying relationships
      • Is-A relationships (supertype/subtype)
        Inclusive/Exclusive
3. The Relational Model

Covered in:
- Set 4
- Chapter 3, pages 69-74, 79-81

Sub-topics:
a. Relation/Table
   - Attributes
b. Integrity Constraints
c. Keys
d. Primary key
e. Candidate key
f. Surrogate key
g. Foreign key
   - Referential integrity constraint

4. Transforming ER diagrams to Relational Model

Covered in:
- Set 5
- Chapter 6

Sub-topics:
a. Transform entities
   - Specify primary key
   - Specify candidate (alternate keys)
   - Specify properties for each column
     1. data type
     2. null/not null
     3. default values
     4. other constraints
b. Transform relationships (foreign keys used here)
   - 1:1 relationships, 1:N relationships
     - identifying relationships
     - non-identifying relationships
   - N:M relationships
   - Supertype/subtype relationships
c. Specify logic to enforce minimum cardinalities
5. SQL

Covered in:
- Set 6, 7
- Chapter 7, pg 220-234 and Chapter 2

Sub-topics:
a. CREATE
b. DROP
c. ALTER
d. INSERT
e. DELETE
f. UPDATE
g. SELECT…FROM… WHERE… framework
h. Conceptual evaluation of queries
i. DISTINCT keyword
j. ORDER BY
k. Aggregate operators: COUNT, MIN, MAX, AVG, SUM
l. GROUP BY… HAVING
m. Subqueries
n. Join

6. Normalization

Covered in:
- Set 8
- Chapter 3, pages 74-99
- Chapter 4

Sub-topics:
- Purpose
- Insert /delete/update anomalies
- Functional dependencies
  - Definition of key based on functional dependencies
d. Normal forms
  - First normal form
  - Boyce-Codd Normal Form
  - Decomposition into relations that are in Boyce-Codd Normal Form
e. Multivalued dependencies
  - Fourth Normal Form

7. PHP and MySQL
a. variables, constants, arrays (numerically indexed arrays and associative arrays)
b. control statements (if, for, foreach, while, …)
c. files
d. functions
e. objects/classes, inheritance
f. Work with MySQL using PHP
   • Connect to a database
   • Query
   • process results
   • close connection
g. authentication and sessions
   • Passwords
   • Session variables

8. SQL VIEWS
   a. SQL View is a virtual table that is constructed from other tables or views.
b. Syntax: CREATE VIEW viewname AS viewquery
c. Order By clause cannot be used in the Create View query.
d. A view can be queried as if it is a table.
e. Uses for views
f. Updating views

9. Triggers
   a. A trigger is a stored program that is attached to a table or view.
b. Type of triggers
c. Uses for triggers
d. Writing a trigger

10. Stored Procedures
    a. A stored procedure is a program that performs some common action on database data and is stored in the database.
b. Advantages of stored procedures
c. How to write a stored procedure
d. Differences between triggers and stored procedures
11. Database security
   a. Create users
   b. Grant/revoke permissions
   c. Changing passwords
   d. General security guidelines

12. Concurrent processing
   a. Transactions
   b. Concurrent transaction processing
      • Lost Updates
      • Inconsistent read
         1. Dirty read
         2. Unrepeatable read
         3. Phantom read
   c. Resource locking
      • Implicit/explicit locks
      • Lock gradularity
      • Exclusive/ shared locks
      • Serializable trasactions
      • Two-phase locking, String two-phase locking
      • Deadlocks
         1. preventing deadlocks
         2. breaking deadlocks
      • Optimistic / pessimistic locking
      • Using implicit locks/ declaring transaction boundaries
      • ACID transactions
         1. Atomic
         2. Consistent
            a. statement level
            b. transaction level
         3. Isolation
            a. read uncommitted
            b. read commited
            c. repeatable read
            d. serializable
         4. Durable

13. Storage and indexing
   a. Disk components
   b. Time to access a disk block
   c. ‘Next’ concept
   d. Hash index
   e. B+Tree index
   f. Clustered / unclustered index
   g. **How to choose indexes to improve performance**