

UC Berkeley Extension
Course Outline: Introduction to Databases (X-409.1)

Instructor: Andy Oppel **Email:** aoppel@berkeley.edu (questions, assignments, etc.)

Day: Tuesdays **Time:** 6:30-9:30 p.m.

Location: SF Downtown Center, Room 711

Course Web Site: <http://www.andyoppel.com/X4091>

Course Objectives: At the completion of the course, the student will be able to do the following:

1. Define the primary components of relational, hierarchical, network, object-oriented, object-relational, dimensional, and NoSQL databases, along with the fundamental differences between them.
2. Use forms-based tools and SQL statements to define, maintain and retrieve data from DBMS products.
3. Create normalized database designs for databases intended to support business transaction processing.
4. Create star schema designs for databases intended to support historical reporting and analytics (i.e. business intelligence applications).
5. Create data models, including the ability to recognize and use common data structure patterns.
6. Translate logical database designs into physical implementations, including specifications for network-connecting the database, indexing, deployment on a cluster server, and accessing the database using various programming languages.
7. Understand the security ramifications when implementing databases and implement security and data access controls.
8. Design data warehouse and data mart schemas for use in business intelligence applications.

Course Prerequisites: A programming course in any language or equivalent experience is recommended but not essential.

Texts: Required: *Databases: A Beginner's Guide*
Andy Oppel
First Edition, 2009, McGraw-Hill Education, ISBN 978-0-07-160846-6

Optional: *NoSql Distilled: A Brief Guide to the Emerging World of Polyglot Persistence*
Pramong J. Sadalage and Martin Fowler
First Edition, 2013, Addison-Wesley

Software Requirements: Assignment 2 requires access to a Database Management System (DBMS) such as Access, MySQL, Oracle, Sybase and Microsoft SQL Server. Many of these have editions that can be used without payment of a license fee. The data required for the assignment is available on the web site for the course.

Grading:	Assignment 1	10%	
	Assignment 2	10%	
	Assignment 3	10%	
	Assignment 4	15%	
	Assignment 5	15%	
	Assignment 6	5%	
	Assignment 7	10%	
	Assignment 8	10%	
	Final Exam	15%	%

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<u>Schedule of Assignments & Topics</u>	<u>Date</u>
1. Database Fundamentals Relational Database Components	06/06/17
Reading Assignments: Oppel: Chapter 1: Database Fundamentals Chapter 2: Exploring Relational Database Components	
2. The Motivation for Using Databases NoSQL Databases	06/13/17
Reading Assignments: Sadalage and Fowler: Chapter 1: Why NoSQL? Chapter 2: Aggregate Data Models Chapter 3: More Details on Data Models	
3. Forms-based Queries (Including a Demonstration) SQL Fundamentals (Including a Demonstration) Additional SQL Statements and Features	06/20/17
Reading Assignments: Oppel: Chapter 3: Forms-based Database Queries Chapter 4: Introduction to SQL	
Assignment 1 (choosing database architectures) due	
4. The Database Life Cycle The Normalization Process Class Exercise on Normalization (#1) Star Schema Design	06/27/17
Reading Assignments: Oppel: Chapter 5: The Database Life Cycle Chapter 6: Database Design Using Normalization	
Assignment 2 (database queries) due	
5. Data Modeling Process Modeling Data Structure Patterns Class Exercise on Normalization (#2)	07/11/17
Reading Assignments: Oppel: Chapter 7: Data and Process Modeling	
Assignment 3 (star schema design) due	

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6. Physical Design of Relational Databases
How Indexes Work 07/18/17

Reading Assignments:

Oppel: Chapter 8: Physical Database Design

Assignment 4 (data model using common patterns) due

7. Deploying Databases on Cluster Servers
Understanding NoSQL Database Implementations 07/25/17

Reading Assignments:

Sadalage and Fowler: Chapter 7: Map-Reduce
Chapter 8: Key-Value Databases
Chapter 9: Document Databases
Chapter 10: Column-Family Databases
Chapter 11: Graph Databases

Assignment 5 (physical data model) due

8. Connecting Databases to the Outside World
Securing Databases
Data Encryption 08/01/17

Reading Assignments:

Oppel: Chapter 9: Connecting Databases to the Outside World
Chapter 10: Database Security

Assignment 6 (NoSQL Implementations) due

9. SQL Cursor Processing
Transaction Management
Incorporating Alternative Data Structures
Object Oriented Database Management 08/08/17

Reading Assignments:

Oppel: Chapter 11: Deploying Databases
Chapter 13: Incorporating XML Documents and Objects into Databases

Assignment 7 (database security) due

10. Data Warehouses
Data Marts
Final Exam (Multiple Choice) 08/15/17

Reading Assignments:

Oppel: Chapter 12: Databases for Online Analytical Processing

Assignment 8 (cursor processing, transactions, alternative data structures) due