## CSC715 Fall 2025 Database Theory Syllabus (revised August 26, 2025)

CSC715 is a hybrid course meeting every Wednesday at 6:30pm. Attendance is required and will be taken at every class.

For the first few weeks classes will be on Zoom. The 1st class meets on Zoom on August 27.

You are required to attend all classes and also spend at least 6 hours per week on the assigned readings, videos & problem sets.

CSC715 information can be found here: [Professor Chi's Web site](https://www.cs.csi.cuny.edu/~chi/)

## Course Prerequisites:

## Good programming skills, familiarity with basics of operating systems (including file systems, caching, locking and concurrency), and knowledge of basic algorithms and data structures (including sorting, heaps, search trees, and hashing). You should have taken a course on data structures, algorithms, and operating systems, at the graduate or undergraduate level.

## Course Description:

* Database management systems
* Programming in SQL using MySQL software
* The relational model of data & relational database management systems
* Theory of normal forms of relations & database design
  + Boyce-Codd Normal Form & 4th Normal Form
* The Entity-Relationship model of data
* Transactions, Concurrency & Security of databases
* Very Large databases
* Natural language Databases using Large Language Modes

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## Course Objectives:

## Acquire the skill to program in the SQL database language

## Learn how to develop and design a modern database system.

## Learn the mathematical theory behind database

## Develop an understanding of the security required for database systems

## Learn how to manage big data systems & data analytics.

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**Course Tools**

**Required Textbook:** **Database System Concepts** by Silberschatz, Korth & Sudarshan; Seventh Edition: <https://www.db-book.com/>

List price of this book is $195.00

Buy it here for $41.27: <https://www.amazon.com/Database-Concepts-Sudarshan-Abraham-Silberschatz/dp/B0B8528T3H/ref=pd_lpo_sccl_2/136-2693111-5420419?pd_rd_w=2x3gd&content-id=amzn1.sym.116f529c-aa4d-4763-b2b6-4d614ec7dc00&pf_rd_p=116f529c-aa4d-4763-b2b6-4d614ec7dc00&pf_rd_r=35GMRZ5RNJPKCDWD8657&pd_rd_wg=9lztU&pd_rd_r=ac9aff88-8234-41a0-b33c-baa514f18481&pd_rd_i=B0B8528T3H&psc=1>

Reference Books – supposedly available in the CSI Library:

* **First Course in Database Systems** by Ullman & Widom, ISBN-10: 97800136006374 | ISBN-13: 978-0136006374 | 3rdEdition  
  **PHP and MySQL Web Development** by Luke Welling & Mary Z. Laura Thomson,Addison Wesley, 2009, ISBN # 978-0-672-329166-6
* **Concepts of Database Management,** by Philip J. Pratt & Joseph J. Adamski, 6th Edition, Course Technology, 2008, ISBN-10: 1423901479

**Required Software:**        MySQL.  This open source software is free.  Setup of MySQL is not difficult and you can easily do it on your own. Instructions for the Windows setup are in [MySQL Install Instructions](file:///C:\Users\emile\Documents\CSI\Courses\CSC715\MySQL\MYSQL%20install%20Fall%202025-1.docx) If you have any questions or problems with this please ask me in class. It is essential to have MySQL running by the 2tnd week of classes or you will not be able to do the 1st problem set.

**Course Requirements**

* 0% Problem sets
  + Please try to do them by yourself. Solutions to all of the problems can be found in any chatbot. I encourage you to not look at these except to check your work.
* 50% Project Design and implement a database
  + Sample projects will be shown in class
* 50% Final Exam  A written exam in class on December 17

**Course Outline**

* Programming in SQL using open source MySQL software
* Database management systems
* The relational model of data
* Theory of normal forms of relations & database design
* Embedded MySQL in Python (optional)
* Recursive SQL
* The Entity-Relationship (E-R) model of data
* Recovery, Concurrency & Security of databases
* A.I. Databases

**Schedule** (subject to revision)

**Part I: SQL**

August 27 **Course Introduction** [CSC715 Introduction](https://www.cs.csi.cuny.edu/~chi/)

[Databases & A.I.](https://www.nytimes.com/2025/07/23/science/ai-history-ancient-rome-google-deepmind.html?unlocked_article_code=1.Y08.8ZVB.qTkOY0ik7VNT&smid=url-share)

**Module 1: Introduction to Database & SQL, Elementary**

* Read Silberschatz:
  + Chapter 1: Introduction all
* Read Silberschatz Chapter 3 Sections 3.1-3.4
  + Exercises 3.1a,b,c,d, 3.3a,b,c ,3.6
    - [script to create the Silberschatz University database](http://163.238.35.144/~chi/CSC715/Databases/SilberUniv/DDL.txt)
    - [script to load the Silberschatz University database](http://163.238.35.144/~chi/CSC715/Databases/SilberUniv/smallRelationsInsertFile..txt)

September 3 **Module 2: Introduction to SQL**

* Read Silberschatz:
  + Chapter 2: Introduction to the Relational Model Sections 2.1-2.5
  + Exercises 3.8 a,b,c [script to create the Bank database](http://163.238.35.144/~chi/CSC715/Databases/Bank2023/Create%20Bank%202023.sql)
  + For 3.8b change “Smith” to “Saul”
  + For 3.8c change "Harrison” to “Staten Island”

September 10 **Module 2: Introduction to SQL**

* Read Silberschatz Chapter 3 Sections 3.5-3.7
  + Exercises 3.11 a,b (change 2017 to 2018), c,d

September 17 **Module 2 Introduction to SQL**

* Read Silberschatz Chapter 3 Sections 3.8-3.10
  + Exercises 3.15, 3.24, 3.25, 3.28
  + Discuss project assigment

**Part II: Database Design**

October 8 **Module 3: Database design using the E-R Model**

* Read Silberschatz Chapter 6 Sections 6.1-6.5
  + Exercises 6.1, 6.2a,b

October15 **Module 3:** **Relational Database Design**

* Read Silberschatz Chapter 7 Sections 7.1-7.10
  + Exercises 7.2, 7.6, 7.11a, Exercises on BCNF, More Exercises on BCNF & 4NF
  + 7.30a,c; 7.31; 7.32
  + 7.33 & 7.34 (use the BCNF algorithm for both)
  + 7.42
* [Lecture notes on Relational Design by Decomposition](http://163.238.35.144/~chi/CSC715/Theory/Database%20Design.docx)

October 22 **Module 4: Intermediate SQL**

* Read Silberschatz Chapter 4 Sections 4.1-4.2
  + Exercises 4.1, write correct SQL for 4.1, 4.2a,b,c,d

October 29 **Module 4: Intermediate SQL**

* Red Silberschatz Chapter 4 Sections 4.3-4.8

November 5 **Module 5: Advanced SQL Embedded SQL**

* Read Silberschatz Chapter 5 Sections 5.1-5.2

November 12 **Module 5: Advanced SQL Triggers & Recursive Queries**

* Read Silberschatz Chapter 5 Sections 5.3-5.4

November 19 **Module 6: Database Integrity, Concurrency, Transactions**

* Read Silberschatz Chapter 17 Sections 17.1-17.18

November 26 **Module 7: Big Data & Large Language Models**

* Read Silberschatz Chapter 10 Sections 10.1-10.33

December 3 **Module 8: A.I. Databases**

* Read **TBA**
* Project due

December 10 **Module 8: A.I. Databases**

* Project deadline

December 17

* **Final Exam**