**Database Systems**

CISC 3500 | Spring 2025

|  |  |  |
| --- | --- | --- |
| **Professor:** | | **Sam Sultan** [[sam.sultan@fordham.edu](mailto:sam.sultan@fordham.edu)] |
| **Class website:** | | [[storm.cis.fordham.edu/~sultan/db](javascript:top.location.href='/~sultan/web')]   **(or)**   [[fordham.samsultan.com/db](http://fh.samsultan.com/web)] |
| **Course Days:** |  | Wednesdays 1/15 – 5/8 |  |
| **ourse Hours:** | | 2:30pm-5:15pm |
| **Location:** | | Rose Hill, room 330 |

**Course Description**

Structured Query Language (SQL) is the language used to manipulate data in relational databases. Learn to use SQL to select, update, insert, and delete data from database tables, and acquire hands-on experience with both Oracle and MySQL. Learn how to select data from multiple tables using both inner and outer joins and unions, understand how to create subqueries to develop more complex retrieval capabilities, and use DDL to create your own database and to populate tables. In addition, learn about database design, primary keys, foreign keys, indexes, table relationships, referential integrity, and normalization/denormalization techniques. This course prepares you to work with any relational database, such as Oracle, MySQL, PostgreSQL, SQL Server, and others.

### TEXTBOOKS - (Required / Suggested)

**Required Books**

* Database Systems – Design, Implementation & Management (13th Edition – 2018)
  + **Authors** – Carlos Coronel, Steven Morris
  + **Publisher** – Cengage
  + **ISBN** – 1337627909 **ISBN-13** - 978-1337627900
* Teach Yourself SQL in 24 Hours (7th Edition) 2021
  + **Authors** - Ryan Stephens
  + **Publisher** – Sams
  + **ISBN** – 0137543123 **ISBN-13 -** 978-0137543120

### GRADES AND GRADING POLICY

Your final grade will be based on the following:

* Midterm Exam - **30%**
* Final Exam - **30%**
* Homeworks - **30%** *(homeworks assigned later in semester have more % value)*
* Attendance & Class Participation - **10%**

**Details of Assignment and Evaluation**.

* **Homework:** Homeworks must be submitted on time by due date (often within 1 week after date assigned).
  + Late submission will severely impact your homework grade, or may not be accepted altogether, especially after discussion of solution.
  + All program code must be properly indented as shown in class. No exception.   
    If not properly indented, homework will not be accepted.
  + All program code and program output must be uploaded separately (do not zip).   
    If output is not provided, points will be deducted.
  + Homeworks assigned later in the semester have more point average weight than homeworks assigned early in the semester.
  + Homework will not be accepted via email unless preauthorized by Professor or TA.
  + Do not use the JavaScript\*Tester or PHP or Python\*Tester to submit your homework.
* **Midterm Exam:** There will be a midterm exam. The exam will be an open book, open notes/internet style exam. The exam will test the student's acquisition of topics, concepts and competencies learned by midterm.
* **Final Exam:** There will be a final exam. The exam will be an open book, open notes/internet style exam. The exam will test the student's acquisition of topics, concepts and competencies learned in this class. The final exam will not be cumulative. It will only include topics covered/discussed since the midterm exam.
* **Class Attendance and Participation:** To receive full credit for the course, you must attend all classes since much of the learning occurs during class presentation and discussions. Please contact the instructor ahead of time if you anticipate missing any part of the class. Grades will be based on:
  + Involvement in class discussions and activities
  + Student must ask at least one question and/or respond to Professor or other student inquiry during each session.
  + Quality/quantity of providing effective feedback and responses.

**Grades are FINAL**.

Please do not negotiate for a better grade. Instructor will compute grades to 2 decimal places. If you are expecting to receive a grade of an "**A**" at the end of the semester, then I expect you to attend all sessions, to participate in class, to turn in your homeworks on time, and to keep up with the class reading material. If you see yourself falling behind do not hesitate to ask for help. This will ensure that you stay current with the class, and will ensure that you get a good grade on your work.

**Please Note:** Professor will not entertain any request for assignment "redo" or extra credit assignment to improve grade. Professor will also not entertain a request for   
“re-evaluation” of class participation or negotiate for a better overall course grade

### Statement on Academic Integrity:

Fordham University is a high-level academic institution that takes academic integrity very seriously. Students must present their own original work. Students suspected of violating this policy including **cheating** and/or **plagiarism** and/or **copying** from others or published materials on assignments or exams will be severely penalized for their action.

**Course Outline**

**Week 1, Session 1, Introduction to Databases and SQL**

* introduction to databases and SQL
* The various database models
* Relational databases
* Creating tables
* Insert, update and delete rows
* Query data from a single table
* The JOIN command
* Inner vs. outer joins
* Query from multiple tables
* noSQL databases

**Reading:** Chapter 1 (Database Systems)

Chapter 1 (Teach Yourself SQL)

**Assignment:** Further reading on the internet regarding different database models

**Week 2, Session 2, Introduction to Databases**

* Introduction to databases
* What is a database?
* The History of databases
* The various database models
* Hierarchical databases
* Network databases
* Relational databases
* Object & Object relational databases
* NoSQL and Big Data databases

**Reading:** Chapter 2 (Database Systems)

Chapter 1 (Teach Yourself SQL)

**Assignment:** Further reading on the internet regarding different database models

**Week 3, Session 3, Introduction to the SQL Language**

* Introduction to SQL
* Flavors of SQL
* DDL - Data Definition Language
* DML - Data Manipulation Language
* The SELECT statement
* Choosing distinct values
* The WHERE clause
* Comparison operators
* Comparing with LIKE
* Logical operators, AND, OR, NOT
* Numeric operators
* Creating computational columns

**Reading:** Chapter 2, 3 (Teach Yourself SQL)

**Exercise/Assignment:** See online course session

**Week 4, Session 4, Selecting Data from Multiple Tables**

* Selecting data from multiple tables
* The join construct.
* Old vs. new join syntax
* Normal or Inner join
* Cross join - Cartesian product
* Outer join vs. Inner join
* What is a Self-Join
* Set operators, UNION, INTERSECT, MINUS
* Combining Join with UNION
* Performance considerations

**Reading:** Chapter 5 (Teach Yourself SQL)

**Exercise/Assignment:** See online course session

**Week 5, Session 5, SQL Built-in Functions**

* SQL built-in Functions
* Numeric functions - CEIL, FLOOR, ROUND, TRUNCATE, etc.
* String functions - CONCAT, LENGTH, SUBSTR, REPLACE, etc.
* The CASE expression, 2 flavors
* Date functions - MySQL and Oracle
* Current date, date manipulation, date formatting

**Reading:** Chapter 7 (Skip aggregate functions), chapter 12 (Teach Yourself SQL)

**Exercise/Assignment:** See online course session

**Week 6, Session 6, Aggregating and Grouping**

* Aggregating and Grouping
* Aggregate functions - SUM, COUNT, AVG, MIN, MAX
* The GROUP BY clause
* The HAVING clause
* Finding Duplicate Records
* GROUP BY with ROLLUP feature
* The ORDER BY clause Pivoting rows into columns

**Reading:** Chapter 7 (Aggregate functions), Chapter 4 (Teach Yourself SQL)

**Exercise/Assignment:** See online course session

**Week 7, Session 7, Select Sub-Queries**

* Using SELECT Sub-Queries
* Subqueries as filters
* Subqueries as inline views
* Subqueries as additional derived columns
* Correlated Subqueries
* Where [NOT} EXISTS in Subquery
* Finding the last record from a set
* Pivoting rows into columns

**Reading:** Chapter 6 (Teach Yourself SQL)

**Exercise/Assignment:** See online course session

**Week 8, Session 8, Midterm Exam**

* Midterm Exam

**Week 9, Session 9, Database Design**

* Database Design
* The Logical and Physical Model
* Understanding data normalization
* First normal form
* Second normal form
* Third normal form
* Pros & cons of data normalization
* De-normalizing data
* Entity relationships
* One-to-one relationship
* One-to-many relationship
* Many-to-many relationship
* Designing Self-join relationship
* Designing for an ODS (Reporting Database)
* Designing for a Data Warehouse

**Reading:** Chapter 3 ,6 (Database Systems)

**Reading:** Chapter 8 (Teach Yourself SQL)

**Exercise/Assignment:** See online course session

**Week 10, Session 10a, Creating Database Objects**

* Creating database objects
* What is a primary key?
* What is a foreign key?
* What is an index?
* Creating tables
* SQL data types
* Adding a primary key
* Adding constraints
* Creating Indexes
* Altering table definition
* Dropping tables
* MySql Auto Increment
* Oracle Sequences and Identity

**Reading:** Chapter 9, 10, 15

**Exercise/Assignment:** See online course session

**Week 10, Session 10b, Inserting, Updating and Deleting Data**

* Manipulating data in tables
* Adding data with the INSERT statement
* INSERT with a SELECT statement
* Changing data with the UPDATE statement
* UPDATE with a SELECT statement
* Removing data with the DELETE statement
* DELETE with a SELECT statement
* The TRUNCATE statement
* The REPLACE statement (MySql)
* The MERGE statement (Oracle)

**Reading:** Chapter 11

**Exercise/Assignment:** See online course session

**Week 11, Session 11, Advanced Topics**

* Advanced Topics
* Creating and using views
* Using the Data Dictionary – MySql
* Using the Data Dictionary – Oracle
* The show statement (MySql)
* Loading data from a file
* Unloading data into a file
* Importing a database or table(s)
* Exporting a database of table(s)

**Reading:** Chapter 13, 18

**Exercise/Assignment:** See online course session

**Week 12, Session 12, Advanced Topics**

* MySQL - Procedural Language
* Creating Stored Procedures
* Calling a Stored Procedure
* Creating Custom Functions
* Calling a Custom Function
* Creating database Triggers
* Activating a Trigger

**Reading:** Professor Notes

Further online/web reading

**Exercise/Assignment:** See online course session

**Week 13, Session 13, Advanced Topics**

* Accessing a DB from within a Programming Language
* Database Drivers
* Database Cursors
* Python DB insert/query examples
* PHP DB insert/query examples
* Java DB insert/query examples
* C DB insert/query examples
* C++ DB insert/query examples

**Reading:** Professor Notes

Further online/web reading

**Exercise/Assignment:** See online course session

**Week 14, Session 14, Final Exam**

* Final Exam

**Additional Topic If Time Permits**

* Non-Relational Databases
* NoSQL Databases various architectures
* MongoDB
* Mongo examples

**NOTE:** The syllabus may be modified to better meet the needs of students and to achieve the learning outcomes.

**New York University School of Professional Studies Policies**

1. Policies - You are responsible for reading, understanding, and complying with [University Policies and Guidelines](http://www.nyu.edu/about/policies-guidelines-compliance.html), [NYU SPS Policies and Procedures](http://sps.nyu.edu/academics/academic-policies-and-procedures.html), and [Student Affairs and Reporting](https://www.nyu.edu/about/policies-guidelines-compliance/policies-and-guidelines/student-services.html).

2. Learning/Academic Accommodations - New York University is committed to providing equal educational opportunity and participation for students who disclose their dis/ability to the [Moses Center for Student Accessibility](https://www.nyu.edu/students/communities-and-groups/student-accessibility.html). If you are interested in applying for academic accommodations, contact the [Moses Center](https://www.nyu.edu/students/communities-and-groups/student-accessibility/academic.html) as early as possible in the semester. If you already receive accommodations through the Moses Center, request your accommodation letters through the [Moses Center Portal](https://www.nyu.edu/students/communities-and-groups/student-accessibility.html) as soon as possible ([mosescsa@nyu.edu](mailto:mosescsa@nyu.edu) | 212-998-4980).

3. Religious Observance - As a nonsectarian, inclusive institution, NYU policy permits members of any religious group to absent themselves from classes without penalty when required for compliance with their religious obligations. Refer to the [University Calendar Policy on Religious Holidays](https://www.nyu.edu/about/policies-guidelines-compliance/policies-and-guidelines/university-calendar-policy-on-religious-holidays.html) for the complete policy.

4. Academic Integrity and Plagiarism - You are expected to be honest and ethical in all academic work. Moreover, you are expected to demonstrate how what you have learned incorporates an understanding of the research and expertise of scholars and other appropriate experts; and thus recognizing others' published work or teachings—whether that of authors, lecturers, or one's peers—is a required practice in all academic projects.

Plagiarism involves borrowing or using information from other sources without proper and full credit. You are subject to disciplinary actions for the following offenses which include but are not limited to cheating, plagiarism, forgery or unauthorized use of documents, and false form of identification

[Turnitin](https://www.nyu.edu/servicelink/KB0018471), an originality detection service in NYU Brightspace, may be used in this course to check your work for plagiarism.

Read more about academic integrity policies at the NYU School of Professional Studies on the [Academic Policies for NYU SPS Students](https://www.sps.nyu.edu/homepage/student-experience/policies-and-procedures.html) page.

5. Use of Third-Party Tools - During this class, you may be required to use non-NYU apps/platforms/software as a part of course studies, and thus, will be required to agree to the “Terms of Use” (TOU) associated with such apps/platforms/software.

These services may require you to create an account but you can use a pseudonym (which may not identify you to the public community, but which may still identify you by IP address to the company and companies with whom it shares data).

You should carefully read those terms of use regarding the impact on your privacy rights and intellectual property rights. If you have any questions regarding those terms of use or the impact on the class, you are encouraged to ask the instructor prior to the add/drop deadline.