# IST659 Data Administration Concepts and Database Management

Syracuse University Graduate Course Syllabus

## Course Information

### Description

Definition, development, and management of databases for information systems. Data analysis techniques, data modeling, and schema design. Query languages and search specifications. Overview of file organization for databases. Data administration concepts and skills.

### Additional Course Description

This is an introductory course in database management systems. It examines data structures, file organizations, concepts, and principles of database management systems(DBMS); as well as, data analysis, database design, data modeling, database management and database implementation. There is a specific emphasis on data analytics and learning to query data with Structured Query Language (SQL), query performance, data normalization; and database migration. This course provides hands-on experience in database design and implementation through assignments, lab exercises and course projects. This course also introduces advanced database concepts such as transaction management and concurrency control, distributed databases, multi-tier client/server architectures, database applications, improving query performance through indexing, and advanced data query patterns for extract-transform-load.

### Prerequisite/Co-requisite:

None

### Audience:

This is an introductory course and requires no prior knowledge in the subject area.

### Credits:

3

### Learning Objectives

Upon completing this course, the learner should be able to:

* Describe fundamental data and database concepts, including various storage models.
* Explain and use the database development life-cycle and data models.
* Analyze business problems and design and implement appropriate data-oriented solutions using the relational data storage model.
* Solve problems by constructing database objects and queries using SQL.
* Identify performance and data integrity improvements of existing database designs and implementations.
* Evaluate and select approaches for data migrations, temporal data, and data normalization.
* Critique the effectiveness of DBMS in computer information systems.

### Course Fees and/or Costs

* None

### Required Textbooks and Supplies

* **Applied Database Management**, By Michael Fudge. ISBN 9781644965900. The book is an online text available within Blackboard, and at https://www.grlcontent.com/. At your instructor’s discretion you may take quizzes through the textbook. The textbook is very closely aligned with the course content and and labs.
* Students are expected to have a laptop computer to participate in the class sessions, run the lab software, and complete the problem sets. Requirements are any Mac OSX, Windows 10, or Chromebook with 8GB RAM and 8GB free disk space.
* NOTE: In Lieu of installing the software on your laptop, your instructor may opt to use the cloud-based Azure Lab Services.

### Understanding the Approach Used in This Course

To instill good habits and routine, the approach used in this course is the same each week. It is designed to allow you to progress as a learner, ask questions, and grow comfortable with the material throughout the week. There are three phases to the approach:

* **Coursework before class** consists of a chapter reading from the textbook and a video lecture. Both are active learning tools, and you will be asked questions as you read and watch. Your responses are not graded but will be reviewed by your instructor to prepare for the in-class session. As part of your engagement with the learning process, it is expected that you will review your own answers and prepare any questions or doubts you have about the coursework. You will also be issued a quiz that reinforces basic concepts from the textbook and asynchronous content. Your learning outcomes at this stage are to recall key terms and understand the concepts presented to you.
* The **live session** allows you to reinforce what you have learned and to begin to apply it to new problems and situations. We begin each class with students posting their coursework questions to the community board. Your questions should be based on concepts that remain unclear to you. These questions will guide our class discussions and activities. We then review the previous week’s homework problem set, discussing strategies, and sharing answers to them.
* **After class** you will complete a lab and Homework Problem Set. The lab contains a walk-through to guide you through the application of the problem-solving approaches relevant to this week’s material. The Homework Problem Set is your opportunity to self-measure your knowledge of the material and application of it to new situations and scenarios. Included with your Homework Problem Set is a metacognitive activity where you are asked to reflect on your experiences as a learner that week and asses your comfort level with the material.

### Tools We May Use in This Course

It is suggested that you install and configure these tools on your laptop before the course begins.

* **Zoom.** Zoom is a video conferencing tool we will use for our scheduled online and hybrid face-to-face sessions. Download the Zoom client at <https://zoom.us>
* **Microsoft Teams.** Teams is collaboration tool. Integrating with email and calendar, Teams offers presence awareness and chat/messaging. These chats can be elevated into a video conference. We will use teams for class discussions, homework questions, and office hours. You are welcome to contact me whenever my status says I am available. Your Office 365 account is linked to your NetID. Log on to teams by visiting <https://portal.office.com>, entering your SU email [netid@syr.edu](mailto:netid@syr.edu) and then your NetID password. One you are signed into Office 365, click the Teams icon.
* **Google Docs**. We will use Google Docs as a collaborative note-taking tool to work in class on problems and breakout activities. Log in with your SU Google account: <https://g.syr.edu>.
* **Docker**. Docker is a containerization platform, allowing you to run applications in isolation from your host computer. In this course, we use it to run the DBMS itself and supporting tools. You can download and install Docker by following the instructions here: <https://docs.docker.com/get-docker/>
* **Azure Data Studio**. Azure Data Studio (ADS) is a SQL database client. While you can get away with using the web tools provided with the Learn Databases setup, the ADS experience is better. To install, follow the instructions here: <https://docs.microsoft.com/en-us/sql/azure-data-studio/download-azure-data-studio>
* **Learn Databases.** Learn Databases is a suite of Docker containers that create a database lab environment on your computer. There are containers for the SQL Server database management system itself and three web tools for provisioning sample databases, database administration, and writing SQL scripts. After you have installed Docker, follow the instructions at <https://github.com/mafudge/learn-databases#walkthrough> to set it up. Do not create any sample databases at this time—you will do this as part of the first Homework Problem Set.

## Special Considerations

### Class Materials and Recordings

Please be aware that all class sessions will be recorded. Original class materials (handouts, code samples, assignments, quizzes, textbook chapters, etc.) and recordings of class sessions are the intellectual property of the course instructor. You may download these materials for your use in this class. However, you may not provide these materials to other parties (e.g., websites, social media, other students) without permission. Doing so is a violation of intellectual property law and of the student code of conduct.

## Academic Expectations

### Requirements

As an enrolled student in this course, it is expected that you will:

1. **Complete asynchronous coursework.** It is expected you will complete the assigned textbook readings, quizzes, and video coursework as prescribed.
   * Participation in the assigned reading and video coursework is required and will be measured.
   * Attendance in online or face-to-face sessions is required, and there are no excused absences other than medical illness documented by the university.
   * While in attendance, you are expected to be engaged, an active participant in class. You should be prepared to ask and answer questions to the best of your ability when called upon.
   * It is expected that you will have your microphone muted until you need to speak, and your video camera on at all times.
   * In some classes, an ungraded pop quiz or other type of diagnostic instrument will measure your comprehension of coursework and passing will count as your participation grade for that week.
   * **Reading, participation, and coursework are not graded but do impact your grade.**
     + **unprepared for 2 units of the course: decrease your final grade by one Registrar Grade. (For example, A to A-)**
     + **For 4 or more units of the course: decrease your final grade one complete letter: B+ to C+ for example.**
     + **You will be notified when you reach these thresholds.**
2. **Complete quizzes**. The intention of the quiz is to ensure that you are keeping pace with the coursework and to measure your understanding of the class material. Quizzes should be completed by 11:59 PM Eastern the day before our live session.
   * Quizzes are delivered through the online LMS.
   * You will get one attempt at the quiz, and your attempt must be complete before your class meeting.
   * Quizzes are open book.
   * Quizzes consist of multiple-choice and/or short answer questions.
   * Quizzes measure only individual effort.
   * You must complete the quiz on your own time, outside class.
   * Quizzes are due 11:59 PM Eastern the day before our live session. This provides your instructor ample time to review student answers and prepare for the live session.
3. **Complete** **homework problem sets**. Homework Problem Sets are technical activities that enforce key concepts learned in the lesson through problem solving and practice. You start them after the live session and complete them by the 11:59 PM Eastern the day before our next live session. It is important to remember that the homework is practice; if you do not have the right answers, it is expected you will have questions. Save those questions for our discussions. You are expected to reflect on your learning. Each homework problem set is assigned a grade of:
   * High Pass (10 points)—the assignment is complete and correct, with very minor errors, and the student contributes to homework discussion in class and reflects on your learning for that week.
   * Pass (7 points)—the assignment is complete and mostly correct, or the student has few to no contributions to homework discussions in class or little to no reflection on your learning for the week.
   * Needs Improvement (3 points)—the assignment is incomplete or has several errors or is late, with no reflection.
   * Fail (0 points)—the assignment was not turned in after 1 week.
4. **Complete a** **team project**, which demonstrates your ability to work in a team to design and implement a functional system with a database, based on what you have learned in the course. Guidelines for this are:
   * Work in self-assembled teams of two to three students.
   * Devise your own database to design and implement. The project idea must be preapproved, prior to beginning work.

Required artifacts for team project submission are as follows:

1. Document with team name, group members, and which project you will work on. If the project is your own idea, a requirements document must be submitted and approved.
2. Data analysis of the facts listing entities, attributes, and relationships in the data model.
3. Conceptual data model diagram.
4. Logical data model diagram.
5. Identification of your external data model and data logic.
6. Basic layout of all application screens.
7. Diagram of each screen used in the application.
8. SQL up/down script to implement the internal model with initial data.
9. SQL up/down Script to load/migrate in existing data.
10. SQL up/down script of data logic for the external data model.
11. Implementation of the application itself.
12. A team log recording individual and group contributions to the project, including when and by whom.
13. A slide deck of your presentation.
14. A video recording of your team presentation.
15. A video reflection of what you learned from the experience, what you would do better if you had the time, etc.

The rubric is as follows:

1. Quality of artifacts (slides, code, video, documents, etc.)
2. Completeness of project—does it work?
3. Purpose of project—does it do something of value?
4. What was learned from the experience?
5. Does the project demonstrate what the team has learned pertinent to the course?

### Grading:

| **Type of Activity** | **Quantity** | **Points Each** | **Notes** | **Total Points** |
| --- | --- | --- | --- | --- |
| 1. Problem Sets | 10 | 10 | 13 Total. Lowest Dropped. | 100 |
| 2. Quizzes | 10 | 10 | 13 Total. Lowest dropped. | 100 |
| 3. Team Project | 1 | 50 | Refer to team project guidelines. | 50 |
| **Total POints** |  |  |  | 250 |

### Grading Scale:

----------------------------------------------------------------  
Student Points Grade Registrar  
Achievement Points Grade  
-------------------- --------------- ------------- -------------  
Mastery 238--250 4.0 A  
 225--237 3.667 A-  
  
Satisfactory 213--224 3.333 B+  
 200--212 3.0 B  
  
Low Passing 188--199 2.667 B-  
 175--187 2.333 C+  
  
Unsatisfactory 163--174 2.0 C  
 150--162 1.667 C-  
 0--149 0.0 F  
----------------------------------------------------------------

## Other Course Policies

* All work is due on the dates provided. No late work is accepted, unless explicitly noted. The reasoning is the grading is participation / effort-based and most of the content time-sensitive.
* Final grades will not be rounded up. 94/100 is an A-, please don’t ask.

### Academic Integrity

* We take academic integrity seriously, and so should you.
* It is our expectation that your work will be 100% representative of your academic abilities.
* Cheating, including assistance from others or use of non-sanctioned academic materials on quizzes or homework is prohibited.
* Do not work together unless the instructions state explicitly you are permitted to do so.
* When in doubt as to whether you can use a resource outside those provided in the course, **ask your instructor**.
* All violations of academic integrity will be reported to the AIO office. Proposed grade sanction is F in the course.

## Course Calendar

### Course Schedule

+----+-----------------------------+----------------------------------+  
| WK | Topic for That Week | Due 11:59PM Eastern 1 day before |  
| | | live session |  
+====+=============================+==================================+  
| 0 | Make sure you have the text | |  
| | and that your lab | |  
| | environment works. | |  
+----+-----------------------------+----------------------------------+  
| 1 | 1. Introduction to | - Video coursework for Week 1 |  
| | Databases | |  
| | | - Read Unit 1; Unit 1 quiz |  
| | \*Data, information, | |  
| | metadata and data | |  
| | management\* | |  
+----+-----------------------------+----------------------------------+  
| 2 | 2. The Relational Data | - Complete \*\*Homework Problem |  
| | Model\ | Set 1\*\* |  
| | \*relational concepts in | |  
| | depth, keys, constraints, | - Video coursework for Week 2 |  
| | tables and relations.\* | |  
| | | - Read Unit 2; Unit 2 quiz |  
+----+-----------------------------+----------------------------------+  
| 3 | 3. Introduction to SQL | - Complete \*\*Homework Problem |  
| | \*DDL, DML, migration | Set 2\*\* |  
| | scripts\* | |  
| | | - Video coursework for Week 3 |  
| | | |  
| | | - Read Unit 3; Unit 3 quiz |  
+----+-----------------------------+----------------------------------+  
| 4 | 4. SQL Select, Part I | - Complete \*\*Homework Problem |  
| | \*Projections, filters, | Set 3\*\* |  
| | joins, table / column | |  
| | aliases, case\* | - Video coursework for Week 4 |  
| | | |  
| | | - Read Unit 4; Unit 4 quiz |  
+----+-----------------------------+----------------------------------+  
| 5 | 5. SQL Select, Part II | - Complete \*\*Homework Problem |  
| | \*Aggregates, group | Set 4\*\* |  
| | by/having, common table | |  
| | expressions, window | - Video coursework for Week 5 |  
| | functions, set operations\* | |  
| | | - Read Unit 5; Unit 5 quiz |  
+----+-----------------------------+----------------------------------+  
| 6 | 6. Data Modeling | - Complete \*\*Homework Problem |  
| | \*ER-Models, Conceptual ER | Set 5\*\* |  
| | Diagramming\ | |  
| | Logical Models, Mapping, | - Video coursework for Week 6 |  
| | Relational Notation\* | |  
| | | - Read Units 7 and 8; Unit 7 |  
| | | and 8 quizzes |  
| | | |  
| | | - The average of the two |  
| | | quiz scores will be your |  
| | | quiz grade for this |  
| | | week. |  
+----+-----------------------------+----------------------------------+  
| 7 | 7. Database Applications | - Complete \*\*Homework Problem |  
| | and Programming | Set 6\*\* |  
| | \*CRUD applications, stored | |  
| | procedures, functions, | - Video coursework for Week 7 |  
| | views, triggers, data logic | |  
| | vs business logic\* | - Read Units 9 and 10; Unit 9 |  
| | | and 10 quizzes |  
| | | |  
| | | - The average of the two |  
| | | quiz scores will be your |  
| | | quiz grade for this |  
| | | week. |  
+----+-----------------------------+----------------------------------+  
| 8 | 8. Transactions and | - Complete \*\*Homework Problem |  
| | Concurrency Control | Set 7\*\* |  
| | \*transaction management, | |  
| | commit / rollback, | - Video coursework for Week 8 |  
| | transaction safety, locks, | |  
| | versioning, deadlocks\* | - Read Unit 11; Unit 11 quiz |  
+----+-----------------------------+----------------------------------+  
| 9 | 9. Performance and | - Complete \*\*Homework Problem |  
| | Indexing\ | Set 8\*\* |  
| | \*Reading query plans, scans | |  
| | vs seeks, clustered non | - Video coursework for Week 9 |  
| | cluster index, tuning for | |  
| | performance.\* | - Read Unit 12; Unit 12 quiz |  
+----+-----------------------------+----------------------------------+  
| 10 | 10 . Data Normalization | - Complete \*\*Homework Problem |  
| | \*1st, 2nd and 3rd | Set 9\*\* |  
| | normal forms. Table | |  
| | redesigns for normal forms, | - Video coursework for Week 10 |  
| | migration of data to new | |  
| | tables\* | - Read Unit 13; Unit 13 quiz |  
+----+-----------------------------+----------------------------------+  
| 11 | Final Team Project | - Complete \*\*Homework Problem |  
| | | Set 10\*\* |  
| | | |  
| | | - Complete Final Team Project |  
+----+-----------------------------+----------------------------------+