MET CS 779 Advanced Database Management
2026 Spring A1 On-Campus Course Syllabus

Instructor

Jack Polnar, jpolnar@bu.edu

Course Duration

Start: January 22, 2026
End: May 7, 2026

Course Credits

4 credits

Course Description

This course covers advanced aspects of database management including normalization and denormalization, query optimization, distributed databases, data warehousing, and big data. There is extensive coverage and hands on work with SQL, and database instance tuning. Course covers various modern database architectures including relational, key value, object relational and document store models as well as various approaches to scale out, integrate and implement database systems through replication and cloud-based instances. Students learn about unstructured "big data" architectures and databases and gain hands-on experience with Spark and MongoDB.

The topics covered in the course include:

- Advanced normalization & denormalization
- SQL techniques focusing on subqueries, window functions, CTE, inline views, etc
- Programming triggers and stored procedures in PL/SQL
- Transaction Management
- Database architecture and administration
- Database and query performance tuning
- Distributed database architecture and design
- Data warehouse architecture including dimensional database design, ETL and ELT
- NoSQL data models such as key value, document stores and graph
- Big Data DBMS approaches (Spark, MongoDB)
- Streaming Data (Kafka)

Prerequisites: CS 579, CS 669, or instructor’s consent

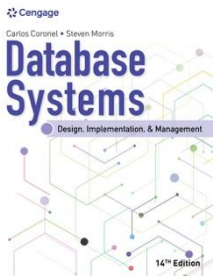
Course Learning Objectives

By successfully completing this course, you will be able to:

- Identify and correct Boyce-Codd and 4th normal form normalization problems.
- Identify and correct over-normalization problems.
- Design correct denormalizations that improve performance.
- Develop and use stored procedures, functions, and triggers with SQL.
- Explain the factors that influence query performance and the different techniques for query optimization.
- Design distributed databases, including those that perform replication; vertical, horizontal, and mixed partitioning; and data allocation.
- Explain the fusion of relational and NoSQL data models including document stores and key value stores.
- Explain the concepts of consistency, availability and partition tolerance (CAP) in distributed databases.
- Explain the scaling limitations of relational databases and when it could be desirable to move to non-relational (NoSQL) solutions.
- Describe the design models of non-relational databases.
- Describe the main features of common non-relational databases, such as Spark, MongoDB, Neo4j.
- Explain the roles of decision support databases in enterprises.
- Design, develop, and use star and constellation dimensional data mart and data warehouse databases.
- Explain the relationships between data, information, and knowledge.
- Explain the roles of data, databases, and database management in an organization.
- Perform common database administration functions.

Course Materials

Required Books



Coronel, C., & Morris, S. (2023). Database Systems: Design, Implementation, & Management (14th ed.). Cengage Learning.
ISBN: 9780357673034.

Welcome To First Day™ Delivery For Your Course

To enhance your learning experience and simplify access to the right materials for your class, your course materials have been integrated directly into your course.

Benefits of The Program

- Exclusive preferred pricing
- Guaranteed the right materials
- Single Sign-On
- Ready to go on day one
- Course materials charge will be placed on your student account
- Option to Opt-Out on the first day of class.

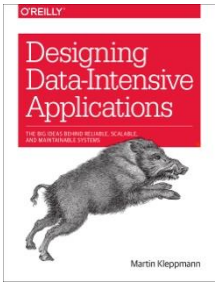
Accessing Your Materials

To access the required materials for your course, click on *Course Materials (Barnes & Noble)* in the left-hand menu in Blackboard. To navigate back to the course, click on the course title at the top left of your Blackboard screen.

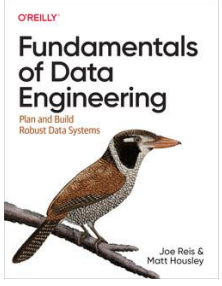
Boston University will bill you at the discounted price as a course charge for this course. Please be advised it is NOT recommended that you Opt-Out, as these materials are required by your professor to complete the course. You can choose to Opt-Out on the first day of class, but you will be responsible for purchasing your course materials at the Opt-Out price.

For more information and FAQs visit Barnes and Noble at Boston University customer care page.

Recommended Books



Kleppmann, M. (2017). Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems. O'Reilly Media. ISBN 9781449373320.



Reis, J., & Housley, M. (2022). Fundamentals of Data Engineering: Plan and Build Robust Data Systems. O'Reilly Media. ISBN 9781098108304.

Purchasing Recommended Textbooks

The optional recommended textbooks can be purchased from Barnes and Noble at Boston University. Be aware that some of our students have experienced month-long delays when ordering texts from deep discount web-based vendors. The BU Bookstore stocks the texts, can get them to you quickly, and often has used copies of these texts for a reduced rate.
Online Materials

Required Software

This course supports Oracle, Microsoft SQL Server (MSSQL), and we are building capacity for PostgreSQL. Detailed step-by-step instructions for downloading and installing Oracle, SQL Server, and PostgreSQL are provided in the "Resources" section below. If you choose to use a cloud-based DBMS platform from Oracle, SQL Server (Azure), or for postgreSQL, please note that there may be certain limitations and costs, however an advantage is fast deployment and cloud-based experience.

Oracle Resources

- Oracle Installation Guide

Microsoft SQL Server Resources

- Microsoft SQL Server 2019 Installation Guide

PostgreSQL Resources

- PostgreSQL Installation Guide

Microsoft Azure Dev Tools or Teaching

Microsoft Azure Dev Tools for Teaching is a Microsoft program that supports technical education by providing access to Microsoft software for learning, teaching, and research purposes. Our membership allows faculty and students currently enrolled in MET courses to obtain certain Microsoft products free of charge. All MET students are granted access to download the software for the duration of their study at MET College.

FAQ and basic information are at Microsoft Azure Dev Tools for Teaching, (You may have to enter your personal BU login credentials to access this page.)

Course schedule

Live office - Every Sunday at 7 PM

	Date	Topic	What's Due
1	01/22/2026	Course Intro, Term Project, Intro to Normalization Module 1	
2	01/29/2026	Normalization continued - In-Class work and presentations Module 1	Have diagramming tool ready for the class (Draw.io, lucidchart) Crediting Sources Assessment
3	02/05/2026	SQL Programming DML, DDL Review Module 1	Have DBMS installed Assignment 1.0
4	02/12/2026	SQL Programming DML, DDL Review Advanced SQL Programming: ROLAP, Stored Procs and Triggers Module 1	Term Project Update #1
5	02/19/2026	Advanced SQL Programming: ROLAP, Stored Procs and Triggers Module 1 Intro to Transaction management and concurrency Module 2	SQL Programming Part 1
6	02/26/2026	Transaction management and concurrency Module 2	
7	03/05/2026	Relational DB Performance and Tuning	SQL Programming Part 2

		Module 2	
	03/12/2026	Spring Break	
8	03/19/2026	Relational DB Performance and Tuning Module 2	• Assignment 2.1 Term Project Update # 2
9	03/26/2026	Distributed DB concepts Module 3	Assignment 2
10	04/02/2026	Data Warehousing & Semi Structured Data/Integration Module 4	Assignment 3.0
11	04/09/2026	Data Warehousing & Semi Structured Data/Integration Module 4 Database Architecture and Administration (Module 2) Term Project Presentation sign-up link (to be available at start of class for sign-ups)	Term Project Update # 3
12	04/16/2026	Big Data & Streaming Data (Module 5)	Assignment 4
13	04/23/2026	Term Projects & Final Exam Review	Assignment 5 & Assignment 5.1 (one of these is extra credit)
	04/25-04/30	Online Term Project presentations	
14	04/30/2026	Online Term Project presentations	Assignment 6 (extra credit)
	05/01/2026	Study Period	**Term Project Delta Report & source code hand-in due 05/01 end of day**
FE	05/07/2026	Final Exam	

Module 0.1 Study Guide and Deliverables

Readings:

In this module we review SQL, traditional normalization, and the basics of database programming. The readings cover additional database programming, to prepare you for the more advanced database programming in Module 1

Coronel, C., & Morris, S. (2023). Database Systems: Design, Implementation, & Management (14th ed.). Cengage Learning.

- Chapters 1-12, 14, and 16-18 for review.

Module 0.2 Study Guide and Deliverables

Readings:

In this module we review some of the important facets of executive writing. You may view several videos and access slides to use as a checklist for your assignment submissions for this course.

Module 1 Study Guide and Deliverables

Readings:

Coronel, C., & Morris, S. (2023). Database Systems: Design, Implementation, & Management (14th ed.). Cengage Learning.

- Background Concepts on Relational Modeling and Normalization: Chapter 4 – Entity Relational Modeling, Chapter 5 section 3 on Primary Keys, Chapter 6 – Normalization
- Background concepts on SQL: Chapter 7 and Chapter 8
- Background concepts on OLAP Chapter 13-6, 13-8 on Analytic Functions
- Appendix A – Using Lucidchart

Term Project:

During this first module you should begin to think about what you will be doing for your term project and discuss your ideas with your instructor. Your term project can be based on any advanced database topic, including but not limited to XML and databases, database performance measurement or tuning, advanced non-relational databases, decision support databases, data mining, distributed databases, object-oriented databases, object-relational databases, tiered databases, very large databases, or advanced database architectures

Module 2 Study Guide and Deliverables

Readings:

Coronel, C., & Morris, S. (2023). Database Systems: Design, Implementation, & Management (14th ed.). Cengage Learning.

- Background Concepts on Transaction Management: Chapter 10
- Background Concepts on Performance Tuning: Chapter 11
- Background Concepts on Backup and Recovery Chapter 9-3d, 9-3f on maintenance

Term Project:

During this module you should finalize the definition of your project, working with your instructor. You should develop a project definition document with a project plan and should obtain approval for this project. Your updated term project concept can be different than the concept submitted for the Module 1 Term Project Proposal. Still, it is risky to change your term project concept after this module, because you may not have sufficient time to complete your project.

Module 3 Study Guide and Deliverables

Readings:

Coronel, C., & Morris, S. (2023). Database Systems: Design, Implementation, & Management (14th ed.). Cengage Learning.

- Background Concepts on Distributed Databases: Chapter 12
- Background Concepts on Cloud Computing Services: Chapter 15 -4

Term Project:

This term project deliverable may include an update of your project plan or any other portions of your term project. The purpose of this deliverable is to provide your instructor with an opportunity to guide you midway in your term project.

Live Classrooms:

Module 4 Study Guide and Deliverables

Readings:

Coronel, C., & Morris, S. (2023). Database Systems: Design, Implementation, & Management (14th ed.). Cengage Learning.

- Background Concepts on BI and Data Warehousing Chapter 13 sections 1 through 5, 13-9, 13-10
- Background Concepts on XML 15-3

Term Project:

During this module you should complete much of the implementation of your project, including writing most of your research paper. You should provide evidence of progress to your instructor, who will review it and provide guidance.

Module 5 Study Guide and Deliverables

Readings:

Coronel, C., & Morris, S. (2023). Database Systems: Design, Implementation, & Management (14th ed.). Cengage Learning.

- Background Concepts on Big Data Chapter 14
- Background Concepts on Appendix P Working with MongoDB (Appendix P) and Jeo4G (Appendix Q)

Term Project:

During this module you should be finishing the technical implementation of your term project and completing the term paper and presentation.

You are encouraged to present your partially completed project products to your facilitator for feedback before the final delivery.

Module 6 Study Guide and Deliverables

Readings:

None

Term Project:

If you have not already done so, during the last module you should submit your term project presentation, and any related documents through the Blackboard submission link (including source code, if applicable). The report should be in Microsoft Word or Adobe PDF format. Please indicate clearly in your report any content that is proprietary or otherwise sensitive, so that we can protect the information appropriately.

There is considerable flexibility in the particular deliverables, depending on the design of your term project, so your approved project proposal and plan may not have all of these deliverables.

Live Classrooms:

Course Evaluation:

Please complete the course evaluation once you receive an email or Blackboard notification indicating the evaluation is open. Your feedback is important to MET, as it helps us make improvements to the program and the course for future students.

Final Exam

The Final Exam is a proctored exam available from **Thursda**.

The Computer Science department requires that all final exams be administered using an online proctoring service, which you will access via your course in Blackboard. In order to take the exam, you are required to have a working computer, webcam, speakers, and microphone that meet the proctoring service's system requirements. A detailed list of those requirements can be found in the Proctored Exam Information module located on the course home page. Additional information regarding your proctored exam will be forthcoming from the Assessment Administrator. You will be responsible for scheduling your proctored exam session within the defined exam window.

Course Grading Information

The course is conducted by means of a sequence of readings from the textbooks, lectures in text and graphic form, exercises, and quizzes. There are one or more lectures per module.

Graded Items:

- **Assignments**: There are assignments due each module. You submit the assignment in the "Assignments" area.
- **Term Project**: There is a term project that you will define and develop with the help of your facilitators and myself. There are weekly milestones to help you stay on schedule and to help your facilitator and professor guide you as you work on your project. You submit each piece of the term project in the "Assignments" area.
- **Final Exam**: There will be a proctored Final Exam in this course using an online proctoring service. Detailed instructions regarding your proctored exam will be forthcoming from the Assessment Administrator. You will be responsible for scheduling your own appointment.

Ungraded Items:

- **Quizzes**: There is a quiz ("Review Questions") in each module covering the module materials. They are not graded. You are encouraged to take the Questions as often as you wish to help you practice your skills.
- **Ungraded Discussion Forums:** There are ungraded discussion forums throughout the course. You are encouraged to share your knowledge and learn from your peers.
- **Live classroom sessions:** Live classroom sessions will be offered during this course. Days/times will be posted in the announcements area. Students are not required to attend (recordings will be provided when possible).

Grading Policy

All students will be expected to demonstrate database knowledge and techniques. Your professor may in exceptional circumstances, such as disabilities, modify these distributions to more accurately reflect a student's performance in the course.

Grading Structure and Distribution

The course grade will be computed from the following:

- Assignments 34%
- Term Project 33%
- Final Exam 33%

Grade Computations

Grade	Numeric Grade Range	Grade Points
A	≥ 95	4.0
A–	≥ 90 < 95	3.7
B+	≥ 87 < 90	3.3
B	≥ 83 < 87	3.0
B–	≥ 80 < 83	2.7
C+	≥ 77 < 80	2.3
C	≥ 73 < 77	2.0
C–	≥ 70 < 73	1.7
D	≥ 60 < 70	1.0
F	< 60	0

Expectations

We recognize that emergencies occur in professional and personal lives. If one occurs that prevents your completion of homework by a deadline, please make this plan to your facilitator. This must be done in advance of the deadline (unless the emergency makes this impossible, of course) and should be accompanied by particulars that back it up. Additional documentation may be requested.

Penalties for Late Work

Assignments

- 3 days late 10% grade reduction (72 hours past the original due date)
- 5 days or more late 50% grade reduction (120 hours past the original due date)

Project Updates

- **Term Project Updates:** No credit past 1 day late (24 hours past the original due date) - however, feedback will be provided.
- **Presentation**: 20% deduction for not presenting on your scheduled date and time of presentation unless arrangements have been made 3 days ahead of time.
- **Term Project completion:** 100% deduction if term project is not presented. No credit can be awarded for a project that is not presented.

Use of Artificial Intelligence (AI) Tools

Students may use AI tools (such as ChatGPT or similar systems) as support for learning and development, including assistance with understanding concepts, refining logic, or improving code and presentation. Any use of AI must be clearly disclosed in the submission, in plain language, explaining how the tool was used and how the student's own thinking, decisions, or modifications are reflected in the final work. Formal citation styles are not required.

AI use is explicitly evaluated as part of the course rubric. Strong work demonstrates that AI tools enhance the student's original reasoning, clarity, and technical understanding, while weak work relies on AI output with little evidence of independent thought or comprehension. Students are fully responsible for the accuracy and correctness of all submitted work. Undisclosed AI use, or overreliance on AI that replaces rather than supports learning, will negatively impact evaluation and may constitute an academic integrity violation.

Academic Conduct Code

Academic Integrity: Plagiarism is the passing off of another's words or ideas as your own, and it is a serious academic offense. Plagiarism and cheating also defeat the purpose of getting an education. Plagiarism and cheating cases will be handled in accordance with the disciplinary procedures described in the College of Arts and Sciences Academic Conduct Code. You are expected to know and abide by the code, which can be read online: Academic Conduct Code. Penalties range from failing an assignment or course (first offense) to suspension or expulsion from BU. If in doubt, cite your source. If you have any questions about academic integrity, please ask your instructor.

Incidents of academic misconduct will be reported to the Academic Conduct Committee (ACC). The ACC may suspend/expel students found guilty of misconduct.

Important Message on Final Exams

Dear Boston University Computer Science Online Student,

As part of our ongoing efforts to maintain the high academic standard of all Boston University programs, including our online MSCIS degree program, the Computer Science Department at Boston University's Metropolitan College requires that each of the online courses includes a proctored final examination.

By requiring proctored finals, we are ensuring the excellence and fairness of our program. The final exam is administered online.

Specific information regarding final-exam scheduling will be provided approximately two weeks into the course. This early notification is being given so that you will have enough time to plan for where you will take the final exam.

I know that you recognize the value of your Boston University degree and that you will support the efforts of the University to maintain the highest standards in our online degree program.

Thank you very much for your support with this important issue.

Regards,

Professor Lou Chitkushev, Ph.D.

Associate Dean for Academic Affairs

Boston University Metropolitan College

Disability and Access Services

In accordance with university policy, every effort will be made to accommodate students with respect to speech, hearing, vision, or other disabilities. Any student who may need an accommodation for a documented disability should contact Disability and Access Services at 617-353-3658 or at access@bu.edu for review and approval of accommodation requests.

Once a student receives their accommodation letter, they must send it to their instructor and/or facilitator each semester. They must also send a copy to their Faculty & Student Support Administrator, who may need to update the course settings to ensure accommodation is in place. Accommodation cannot be implemented if the students do not send their letters.