Course Syllabus - Summer C 2022
CSE 511: Data Processing at Scale

Contact Information

Instructor:	Andrew Boateng
Teaching Assistants:	Prerak Jaimin Shah
	Rithvik Chokkam
Content Questions:	Ed Discussion for CSE 511 (pilot course discussion platform)
Graded Assessments Questions:	Ed Discussion for CSE 511 (pilot course discussion platform)
Ed Discussion Join Link	https://edstem.org/us/join/43Dxy6
Note:	You will only be able to join/access Ed Discussion with your @asu.edu email address.
Slack Workspace:	https://asu-2224-cse511-44221.slack.com
Note:	You must join/access this workspace using your ASURITE credentials.
Content Issues:	Course "Report an Issue" tool (clickable link on every content page)
Technical Support:	Coursera Learner Help Center
Note:	Please make sure you are logged in so that support personnel recognize you as an ASU learner.
General Support:	mcsonline@asu.edu
Note:	When sending an email about this class, please include the prefix "CSE 511" in the subject line of your message.
	Please use this email address for questions that are private in nature. If it is a question that would benefit your classmates, and is not private in nature, please post in the discussion forums.

Course Description

Database systems are used to provide convenient access to disk-resident data through efficient query processing, indexing structures, concurrency control, and recovery. This course delves into new frameworks for processing and generating large-scale datasets with parallel and distributed algorithms, covering the design, deployment and use of state-of-the-art data processing systems, which provide scalable access to data.

Specific topics covered include:

- Efficient query processing
- Indexing structures
- Distributed database design
- Parallel query execution
- Concurrency control in distributed parallel database systems
- Data management in cloud computing environments
- Data management in Map/Reduce-based
- NoSQL database systems

Technologies covered include:
- Python
- Java
- PostgreSQL
- Scala
- Apache Spark
- Hadoop
- Amazon AWS
- MongoDB
- Neo4j

Learning Outcomes

Learners completing this course will be able to:

- Differentiate among major data models such as relational, spatial, and NoSQL
- Perform queries (e.g., SQL) and analytics tasks in state-of-the-art database systems
- Apply leading-edge techniques to design/tune distributed and parallel database systems
- Utilize existing NoSQL database systems as appropriate for specified cases
- Perform database operations (e.g., selection, projection, join, and group by) in state-of-the-art cluster computing systems such as Hadoop/Spark
- Perform scalable data processing operations (e.g., selection, projection, join, and group by) in cloud computing environments, including Amazon AWS

Estimated Workload/ Time Commitment Per Week
Average of 18 - 20 hours per week

Required Prior Knowledge and Skills

This course will be very challenging, so learners are expected to learn the necessary technologies on their own time if they do not already possess the necessary skills.

Proficient Mathematical Skills and Theoretical Understanding

- Basic statistics and computer science knowledge including computer organization and architecture, discrete mathematics, data structures, and algorithms
- Knowledge of high-level programming languages (e.g., C++, Java) and scripting language (e.g., Python)

Strong Application Skills

- Ability to effectively read/write Java, Python, C++ code.
- Confidence executing in these technologies:
    - PostgreSQL
    - Scala
    - Apache Spark
    - Hadoop

Note: The course project will be completed using the language that the learner chooses; however, the course team will not be able to help the learner if they choose any language that is not Python or Java.

Proficient Experience
- For the course to be effective, course participants should already have acquired basic database systems knowledge:
    - SQL query language
    - Query Processing and Optimization
    - Data Storage and Indexing
    - Transaction Management
- Course participants should also have programming experience with a high level programming language (e.g., C++, Java)
- Scripting language programming (e.g., Python)

Technology Requirements

Hardware

- Personal computer with a major operating system and 8 GB RAM or higher and an

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x86-64 CPU.
- *Must be able to install virtual machines on this computer. Computers with ARM processors (or any other architecture) will not work.*
- Reliable, strong Internet connection with unrestricted access to key websites that are commonly used in software development activities (e.g., GitHub and StackOverflow)
- Webcam
- Microphone

Software/Other

- To complete course projects, some of the following resources may be required: Amazon AWS, Cloud, Hadoop/Spark, GitHub, PostgreSQL, MongoDB, Neo4j.

Textbook and Readings

At the graduate level, inquiry, research, and critical reading are part of the learning experience; however, this course does not have a required textbook. Any required readings are provided within or are accessible through the course.

Course Content

Information about the course's instructional and assessment content follows.

Instructional

- Video lectures
- Readings
- Course discussion on Ed Discussion (**Join Link:** https://edstem.org/us/join/43Dxy6)
- Virtual office hours hosted by course team members
- Live sessions hosted by the instructor

Assessment

Coursera Feedback Descriptions

- Limited: you will be able to see your Total Score, which includes the overall total percent (%) and the number (#) of points
- Partial: you will be able to see your Question Score, which includes the correct or incorrect status and the total points for each question
- Full: you will be able to see your Options and Feedback, which includes any itemized additional feedback

CSE 511 Assessment Types

- Knowledge check quizzes: ungraded, full auto-feedback, untimed, unlimited attempts
- Practice weekly quizzes: ungraded, full auto-feedback, untimed, unlimited attempts
- Graded weekly quizzes: auto-graded, partial auto-feedback, untimed, 1 (one) attempt
- Graded individual assignments: auto-graded, full auto-grader feedback, untimed, unlimited attempts
- Graded individual projects: auto-graded, full auto-grader feedback, untimed, unlimited attempts
- Midterm Exam: auto- & staff-graded, 120 minutes timed, 1 (one) attempt, proctored (practice exam questions are provided)

Details of the main instructional and assessment elements in this course:

Each course in the MCS program is uniquely designed by expert faculty so that learners can best master the desired learning outcomes. As a result, course features and experiences are not the same across all MCS courses. Learners are expected to plan accordingly to accommodate for these differences.

Lecture videos: The concepts you need to know are presented through a collection of video lectures. You may play these videos within the browser or download the files to watch the videos offline. To further support learning, all of the videos include transcripts and most include PDF lecture slides. Transcript files appear under each video's "Download" tool and PDFs of lecture slides, when available, appear in the same place.

Note: If presented, weekly overview videos, assignment videos, and project-related videos do not have PDF lecture slides because they are not lectures and instead have associated documents specific to them.

Readings: Suggested readings may accompany topics. They are supplementary materials for you to further understand the course topics. Required reading citations accompany topics and are accessible through ASU's Library.

Discussion forums: Although Cousera provides built-in weekly discussion forums, **we will *not* be using those forums** for the Summer C 2022 session of this course. We will instead be using Ed Discussion, as this course is participating in a pilot of alternative discussion forum platforms for MCS Online courses. Although the course team will be engaged in discussions on Ed Discussion, the discussions there are also spaces to support and enrich learner-to-learner communication and learning. For more information, please review the course communication-related readings in the "Welcome - Start Here!" section of Week 1, including this introduction to Ed Discussion.

Knowledge Check quizzes: Designed to support your learning, these are short, ungraded quizzes to test your knowledge of the concepts presented in the lecture videos. You may take

your time, review your notes, and learn at your own pace because knowledge checks are untimed. With unlimited attempts, you may retake these as often as you would like at any point in the course. You are encouraged to read the feedback provided, review your answer choices, and compare them to the correct answers. With the feedback as your guide, you may use these quizzes as opportunities to study for other assessments and tasks in the course. *There are no late penalties. Knowledge check quizzes are not counted towards your overall course grade.*

Practice quizzes: There is a practice quiz to help prepare you for each graded quiz. You may retake these quizzes as often as you like at any point in the course. You are encouraged to read the full feedback, review your answer choices, and compare them to the correct answers. With the feedback as your guide, you may use these quizzes as opportunities to study for other assessments and tasks in the course. *There are no late penalties. These quizzes are not counted toward your final grade in the class.*

Graded quizzes: Each week includes one (1) graded quiz. Each graded quiz comprises a relatively small number (approximately ten (10)) single- or multiple-select multiple choice questions. These quizzes are untimed, but you will be allowed only one (1) attempt for each quiz. Graded quizzes in this course include partial feedback. For academic integrity purposes, once grades are made available, learners will see their overall total scores. Correct and incorrect answers and feedback to each question will **not** be provided. Read the Graded Quiz and Exam Policy for more information. *An automatic late penalty of 25% will be applied each day a quiz is submitted after the scheduled due date and time. These quizzes count toward your final grade in the class.*

Graded Assignments: This course includes four (4) individual graded programming assignments. Assignments are introduced in the first week of the course in the "Welcome - Start Here!" section, so you can preview what is expected and design your own learning schedules to complete these on time. *An automatic late penalty of 25% for each day late is applied to projects submitted after the scheduled due date and time. These assignments count toward your final grade in the class.*

- Assignment 1: Movie Recommendation Database - due at the end of Week 1 on Sunday, May 22, 2022 at 11:59 PM Phoenix Time
- Assignment 2: SQL Query for Movie Recommendation - due at the end of Week 2 on Sunday, May 29, 2022 at 11:59 PM Phoenix Time
- Assignment 3: Data Fragmentation - due at the end of Week 4 on Sunday, June 12, 2022 at 11:59 PM Phoenix Time
- Assignment 4: Query Processing - due at the end of Week 5 on Sunday, June 19, 2022 at 11:59 PM Phoenix Time

Projects: This course includes two (2) individual graded projects, which are based on programming assignments. Projects are introduced in the first week of the course in the "Welcome - Start Here!" section, so you can preview what is expected and prepare your own learning schedule to complete the projects on time. Projects' programming assignments apprear at the end of the week each is due (Project 1 includes an ungraded Jupyter Notebook lab). You

will also use a staff-graded assignment at the end of each week a project is due to submit your project report. *An automatic late penalty of 25% for each day late is applied to projects submitted after the scheduled due date and time. These projects count toward your final grade in the class.*

- Project 1: NoSQL - due at the end of Week 6 on Sunday, June 26, 2022 at 11:59PM Phoenix Time
- Project 2: Hot Spot Analysis - due at the end of Week 8 on Sunday, July 8, 2022 at 11:59PM Phoenix Time

Note: As a set of two (2), this course's projects may be included in the Request for Review: MCS Project Portfolio Inclusion Report submission, which is optional.

Request for Review: MCS Project Portfolio Inclusion Report: This is an **optional task** for degree students wanting to use this course's projects as part of their portfolio degree requirement/specialization requirements. Review your onboarding course for more information. Requests are submitted using a staff-graded assignment located near the end of Week 8 in the course. *Although there are no late penalties, these requests must be submitted by the designated deadline. The Request for Review: MCS Project Portfolio Inclusion Report does not count toward your final grade in the class.*

- Address both projects listed in the Projects section above in your Request for Review: MCS Project Portfolio Inclusion Report.
  - Request for Review: MCS Project Portfolio Inclusion Report - due by Friday, July 22, 2022 at 11:59PM Phoenix Time.
  - Faculty/instructor feedback should be received by August 5, 2022.

Practice exam questions: To help you prepare for your proctored exam, a set of practice exam questions is provided. The questions may be discussed during live events. *Practice exam questions are not counted toward your final grade in the class.*

Proctored exam: You have one (1) proctored, timed exam, a Midterm Exam. Proctored exams provide limited feedback. For academic integrity purposes, once grades are made available, learners will see their overall total scores. Correct and incorrect answers and feedback to each question will *not* be provided. Read the Graded Quiz and Exam Policy for more information. *An automatic late penalty of 100% is applied to exams after the scheduled due date and time. No late exams will be permitted or accepted and will result in a score of zero points (0). This penalty does not apply to established accommodations for learners with disabilities. Proctored exams count toward your final grade in the class.*

Midterm Exam

Details

- **Content covered:** Weeks 1 - 3
- **Question type(s):** single- and multiple-answer multiple choice questions

- **Number of questions:** 22 content questions + 1 academic integrity question = 23 total questions
- **Availability:** Wednesday, June 1 at 12:15 AM Phoenix time and must be completed by Sunday, June 5 at 11:45 PM Phoenix time
    - **Note:** The last available ProctorU appointment will be on Sunday, June 5, 2022 at 9:15 PM Phoenix time.
- **Duration:** Plan for 15 minutes of proctoring start up and 1-1/2 hours (90 minutes) for the exam - 105 minutes total

Exam Allowances

- **Hardcopy and/or digital books and/or reference materials**: none
- **Calculators**: none
- **Notes**: Two (2) sheets (both sides) of 8.5x11/A4 paper of hand-written notes *OR* one (1) sheet (both sides) of 8.5x11/A4 paper of typed/printed notes (printouts of lecture slides are NOT allowed)
- **Websites**: none
- **Software**: none
- **Other technologies, devices, and means of communication**: none
- **Whiteboard, scratch paper, writing utensils, erasing resources**: Learners are *strongly* encouraged to use the whiteboard option instead of scratch paper.
    - If using a whiteboard, learners may have erasable whiteboard markers and what is needed to erase writing on the whiteboard; please have extra whiteboard markers and eraser resources in your testing area.
    - If using scratch paper, learners may have two (2) sheets (both sides) of 8.5x11/A4 blank paper and writing utensils (e.g., pens, pencils, markers, and/or highlighters) and erasers; please have extra writing supplies in your testing area should you run out of ink, the pencil breaks, etc.
    - Before the exam concludes and the proctoring session ends, all scratch paper must be destroyed and all whiteboard markings must be erased. The last question in the exam will be a confirmation of learners executing these ASU academic integrity actions.
- **Other**: Learners are to independently take the exam in a single session without leaving the testing space (e.g., no bathroom, water, etc. breaks) to ensure proctoring of the entire session. Once you open the exam, your testing session begins. You will be allowed one (1) attempt to take and complete the exam. Learners are to stay within a clear view of the proctor and not speak outloud throughout the duration of the proctored exam session.

Note: You will be unable to open the exam until the ProctorU exam proctor enters the password into the password quiz that precedes it *during* your scheduled appointment to take your exam.
- **Note**: All virtual machines must be closed *prior* to starting proctoring.

Proctoring

ProctorU is an online proctoring service that allows learners to take exams online while ensuring the integrity of the exam for the institution.

- You are expected to scan your testing space using your webcam for the proctor. Proctoring also requires you to have sound and a microphone. Please plan accordingly.
- You are strongly encouraged to schedule your exam(s) within the first two weeks of the course to ensure you find a day and time that works best for your schedule. Time slots can fill up quickly, especially during high volume time periods.
    - You *must* schedule your proctoring at least 72 hours prior to the exam to avoid possible late scheduling fees.
- **The exam proctor will input the exam password**.
- **When you are scheduling your exam, you *must* pick "Coursera" as your institution.**
- Your ID needs to be in English. See your MCS Onboarding Course for more information.
- Conduct a ProctorU system test PRIOR to your exam.
- Additional information and instructions are provided in the "Welcome - Start Here!" section of the course.

Note: Learners with exam accommodations through Student Accessibility and Inclusive Learning Services (SAILS) should not schedule exams until they receive an invitation specifically for them from ProctorU.

Course Grade Breakdown

Course Work	Quantity	Team or Individual	Percentage of Grade
Graded quizzes	7	Individual	20%
Graded programming assignments	4	Individual	30%
Course projects	2	Individual	*see below*
	Project 1 (NoSQL) - programming & code	Individual	10%

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	Project 1 (NoSQL) - report	Individual	5%
	Project 2 (Hot Spot Analysis) - programming & code	Individual	10%
	Project 2 (Hot Spot Analysis) - report	Individual	5%
	[Optional] Portfolio Inclusion Request	Individual	*approval request only*
			Projects Total = 30%
Midterm exam **NOTE:** This course does not have a second or final exam.	1	Individual	20%

*To request approval to include this course's projects in your final MCS Portfolio, you must include both of the projects, which together will account for at least 30% of your grade, which is the threshold for a project's eligibility for inclusion as ONE project in the final portfolio.

Note: See the MCS Graduate Handbook for more information about the portfolio requirement if you are a degree student.

Grade Scale

You must earn a cumulative grade of 70% to earn a "C" in this course. You must earn at least a "C" to receive graduate credit. Final course grades will *not* include pluses and minuses.

The instructor reserves the right to adjust individual grades based on, but not limited to, violations of academic integrity.

A	90% - 100%
B	80% - 89%
C	70% - 79%
D	60% - 69%
E	<60%

Note: For more information about grading, visit ASU's Grades & Records webpage.

Course Schedule and Important Dates

Course teams will not be working on ASU's days off* and those are listed by name in the Course Schedule. Please review the ASU Days Off for more details.

Week	Main Topic - Graded work due	Begins (12:01 AM Phx Time)	Ends (11:59 PM Phx Time)
0	Welcome - Start Here!	May 13, 2022	May 16, 2022
1	Basic Data Processing Concepts - Week 1 Graded Quiz - Graded Assignment #1 (Movie Recommendation Database)	May 16, 2022	May 22, 2022
2	Data Storage and Indexing - Week 2 Graded Quiz - Graded Assignment #2 (SQL Query for Movie Recommendation)	May 23, 2022	May 29, 2022
3	Virtual Networks - Week 3 Graded Quiz	May 30, 2022	Jun 5, 2022
3	- Midterm Exam **Note:** Last available ProctorU appointment will start at 9:15 PM Sunday, June 5, 2022.	Jun 1, 2022 12:15 AM	Jun 5, 2022 11:45 PM
4	Principles of Distributed and Parallel - Week 4 Graded Quiz - Graded Assignment #3 (Data Fragmentation)	Jun 6, 2022	Jun 12, 2022
5	NoSQL Database Systems - Week 5 Graded Quiz - Graded Assignment #4 (Query Processing)	Jun 13, 2022	Jun 19, 2022
6	Big Data Tools - Week 6 Graded Quiz	Jun 20, 2022	Jun 26, 2022

	- Project 1 (NoSQL)		
7	Data Management in the Cloud - Week 7 Graded Quiz	Jun 27, 2022	Jul 3, 2022
8	Course Wrap-up - Project 2 (Hot Spot Analysis)	Jul 4, 2022	Jul 8, 2022
n/a	Request for Instructor Review: MCS Project Portfolio Inclusion Request submission (optional)	n/a	Jul 22, 2022
n/a	Instructor Feedback for the Review: MCS Project Portfolio Inclusion Request submission (optional)	n/a	Aug 5, 2022

Grades are due July 10, 2022. Please see the ASU Academic Calendar for additional information.

Live Events

This course has two types of live events: **live sessions** and **virtual office hours**. Check the Live Events page in your course for your local time and access details. Although we try to be consistent for our learners' planning purposes, the Live Event schedule is subject to change throughout the course, so stay up-to-date on Live Event details by checking your Course Announcements and the Live Events page in your course.

Read about the specific policies related to Live Events in the Policy section of this syllabus: Live Events, Policy Regarding Expected Classroom Behavior, and the Student Code of Conduct for more detailed information.

Live Sessions - Weekly
Live Sessions are a valuable part of the learning experience because learners can meet with the course instructor and fellow classmates to learn more about course topics, special topics within the field, and discuss coursework. If you are able to attend these Live Sessions, you are strongly encouraged to do so. If you have specific questions or topics of interest to be discussed during the live events, please indicate your request in your discussion forum post. Although it may not be possible to address all requests live, the instructor is interested in tailoring the live events to your questions and interests. The instructor will be following a set agenda, so please be mindful of that when engaging in the live session.

Live Sessions hosted by the instructor will be recorded and uploaded to the course.

CSE 511 Summer C 2022 Live Sessions will be [day and time to be added]

Virtual Office Hours - Weekly

Virtual Office Hours offer a chance for learners to get their questions answered from the course team. Although the course team is responsive to trends in the discussion forums and mcsonline@asu.edu emails, virtual office hours focus on addressing learners' specific questions related to content: clarifications, reteaching, assessment review, etc. These sessions are not intended to address program or course design questions or feedback. Assistants do not have the authority to weigh in or make decisions regarding those items, so please do not include those at this time. These sessions are specific to helping learners learn materials and understand various course assessments. Feedback of that nature is best addressed in the communication channel: mcsonline@asu.edu and please include it in your course survey.

Virtual office hours are recorded, but not uploaded into the course.

CSE 511 Summer C 2022 virtual office hours will be [day and time to be added]

Assignment Deadlines and Late Penalties

Unless otherwise noted, all graded work is due on **Sundays at 11:59 PM Phoenix (Phx) time**. A **25% late penalty** will be added **each day** for graded work, and a **one-time 100% late penalty** will be applied for exams, submitted after the scheduled due date and time unless prior accommodations have been agreed to for SAILS allowances or extraordinary circumstances.

- Week 1 graded quiz - due at the end of Week 1 on Sunday, May 22, 2022 at 11:59PM Phoenix Time
- Assignment 1: Movie Recommendation Database - due at the end of Week 1 on Sunday, May 22, 2022 at 11:59PM Phoenix Time
- Week 2 graded quiz - due at the end of Week 2 on Sunday, May 29, 2022 at 11:59PM Phoenix Time
- Assignment 2: SQL Query for Movie Recommendation - due at the end of Week 2 on Sunday, May 29, 2022 at 11:59PM Phoenix Time
- Week 3 graded quiz - due at the end of Week 3 on Sunday, June 5, 2022 at 11:59PM Phoenix Time
- Midterm exam - due at the end of Week 3 on Sunday, June 5, 2022 at 11:45PM Phoenix Time
- Week 4 graded quiz - due at the end of Week 4 on Sunday, June 12, 2022 at 11:59PM Phoenix Time
- Assignment 3: Data Fragmentation - due at the end of Week 4 on Sunday, June 12, 2022 at 11:59PM Phoenix Time
- Week 5 graded quiz - due at the end of Week 5 on Sunday, June 19, 2022 at 11:59PM Phoenix Time
- Assignment 4: Query Processing - due at the end of Week 5 on Sunday, June 19, 2022 at 11:59PM Phoenix Time

- Week 6 graded quiz - due at the end of Week 6 on Sunday, June 26, 2022 at 11:59PM Phoenix Time
- Project 1: NoSQL - due at the end of Week 6 on Sunday, June 26, 2022 at 11:59PM Phoenix Time
- Week 7 graded quiz - due at the end of Week 7 on Sunday, July 3, 2022 at 11:59PM Phoenix Time
- Project 2: Hot Spot Analysis - due at the end of Week 8 on Sunday, July 8, 2022 at 11:59PM Phoenix Time

Course Outline with Assignments

Please review the ASU Days Off for more details. Course teams will not be working on ASU's days off.

Week 1: Getting Started and Basic Data Processing Concepts (May 16 - 22, 2022)

Learning Objectives
1.1 Explain Data Models and Data Processing Concepts
1.2 Utilize Relational Model and Relational Algebra
1.3 Utilize SQL Query Language
1.4 Describe the major components of Database Management Systems
1.5 Define spatial data.
1.6 Explain how SQL is used to support spatial data.

Topics
- ☐ Getting Started
- ☐ Big Data and Data Processing
- ☐ Basic Data Concepts
- ☐ Database Design: Entity Relationship Model to Relational Model
- ☐ Relational Model and Relational Algebra
- ☐ Introduction to SQL Query Language
- ☐ Spatial Database

Graded Coursework
- ☐ Getting Started Quiz
- ☐ Week 1 Graded Quiz
- ☐ Assignment 1: Create Movie Recommendation Database

Other Tasks
- ☐ Go to Ed Discussion to "Introduce Yourself and Get to Know Your Classmates"
- ☐ Attend and/or watch the recorded instructor's Live Session
- ☐ Create your ProctorU account (if you do not already have one) and schedule your final exam proctoring appointment with ProctorU

☐ For learners needing accommodations, submit requests through Connect and review the ASU Student Accessibility and Inclusive Learning Services website. Note: Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.

Week 2: Data Storage and Indexing (May 23 - 29, 2022)

Learning Objectives

2.1 Recognize major data storage layouts
2.2 Identify major indexing schemes in Database Systems

Topics

☐ Major Storage Layouts
☐ Major Indexing Schemes in Database Systems

Graded Coursework

☐ Week 2 Graded Quiz
☐ Assignment 2: SQL Query for Movie Recommendation

Other Tasks

☐ Attend and/or watch the recorded instructor's Live Session
☐ If you have not done so already, schedule your final exam proctoring appointment with ProctorU
☐ For learners needing accommodations, submit requests through Connect and review the ASU Student Accessibility and Inclusive Learning Services website. Note: Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.

Week 3: Transactions and Recovery (May 30 - June 5, 2022)*

*Monday, May 30th is Memorial Day; the University is closed.

Learning Objectives

3.1 Examine the ACID properties
3.2 Explain Transactions and Concurrency Control concepts
3.3 Describe how recovery from failures happens in database systems

Topics

☐ Transactions/ACID Properties
☐ Concurrency ControlConcepts
☐ Lock-based Concurrency Control and Recovery from Failures

Graded Coursework

☐ Week 3 Graded Quiz
☐ Midterm exam (see below)

Other Tasks
- ☐ Attend and/or watch the recorded instructor's Live Session
- ☐ If you have not done so already, schedule your final exam proctoring appointment with ProctorU.
- ☐ For learners needing accommodations, submit requests through Connect and review the ASU Student Accessibility and Inclusive Learning Services website. Note: Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.

Midterm Exam (June 1 - 5, 2022)

Reminders
- ☐ Schedule your proctoring appointment with ProctorU *at least* 72 hours prior to your desired exam date and within the availability window to avoid late scheduling fees
- ☐ Review the Midterm Exam details and allowances information for this exam
- ☐ Prepare for the exam (practice exam questions are available)
- ☐ Conduct a ProctorU system test PRIOR to your exam

Week 4: Principles of Distributed and Parallel Database Systems (June 6 - 12, 2022)

Learning Objectives
4.1 Describe data fragmentation and replication models
4.2 Describe the components of a distributed database
4.3. Apply skills learned to complete an assignment using data partitioning
4.4 Illustrate how query processing is achieved in distributed databases.
4.5 Explain the total cost of query execution plans in distributed data processing systems.

Topics
- ☐ Distributed Databases: Why, What?
- ☐ Data Fragmentation and Replication Model
- ☐ Advanced Distributed Database Systems
- ☐ Parallel Database Systems

Graded Coursework
- ☐ Week 4 Graded Quiz
- ☐ Assignment 3: Data Fragmentation

Other Tasks
- ☐ Attend and/or watch the recorded instructor's Live Session
- ☐ If you have not done so already, schedule your final exam proctoring appointment with ProctorU.

□ For learners needing accommodations, submit requests through Connect and review the ASU Student Accessibility and Inclusive Learning Services website. Note: Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.

Week 5: NoSQL Database Systems (June 13 - 19, 2022)

Learning Objectives
5.1 Describe NoSQL Database Systems
5.2 Define scalability
5.3 Recognize the importance of the CAP Theorem in NoSQL databases
5.4 Differentiate between classifications of NoSQL Databases
5.5 Describe components of Key-Value Stores
5.6 Describe components of Graph Databases
5.7 Describe components of Document Databases

Topics
□ What is NoSQL?
□ Classifications of NoSQL Databases

Graded Coursework
□ Week 5 Graded Quiz
□ Assignment 4: Query Processing

Other Tasks
□ Attend and/or watch the recorded instructor's Live Session
□ If you have not done so already, schedule your final exam proctoring appointment with ProctorU.
□ For learners needing accommodations, submit requests through Connect and review the ASU Student Accessibility and Inclusive Learning Services website. Note: Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.

Week 6: Big Data Tools (June 20 - 26, 2022)

Learning Objectives
6.1 Describe how data in managed in MapReduce Systems
6.2 Outline Hadoop file structures
6.3 Explain MapReduce programming Model
6.4 Diagram MapReduce Systems
6.5 Identify how execution is handled in MapReduce
6.6 Describe how common operators are handled in MapReduce
6.7 Describe Apache Spark data system
6.8 Explain RDD data processing system

6.9 Describe several common components that are part of the Apache Hadoop Ecosystem

6.10 Explain the techniques used to optimize query processing and indexing/storage layers from spatial data.

Topics
☐ Data Management in MapReduce Systems

☐ Data Management in Apache Spark and Apache Hadoop

Graded Coursework
☐ Week 6 Graded Quiz

☐ Project 1 - NoSQL programming assignment, source code, and project report

Other Tasks
☐ Attend and/or watch the recorded instructor's Live Session

☐ If you have not done so already, schedule your final exam proctoring appointment with ProctorU.

☐ For learners needing accommodations, submit requests through Connect and review the ASU Student Accessibility and Inclusive Learning Services website. Note: Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.

☐ Check the course evaluation survey's **availability dates** (see the "Schedule" area near the top of the page and check the "Survey open" and "Survey close" dates for the **current session**) and complete the survey within the availability window.

Week 7: Data Management in the Cloud (June 27 - July 3, 2022)

Learning Objectives
7.1 Explain data processing in the cloud

7.2 Evaluate service models

7.3 Evaluate deployment models

Topics
☐ Introduction to Cloud Computing

☐ Cloud-Based Data Management

☐ Amazon Web Services

Graded Coursework
☐ Week 7 Graded Quiz

Other Tasks
☐ Attend and/or watch the recorded instructor's Live Session

☐ If you have not done so already, schedule your final exam proctoring appointment with ProctorU.

☐ For learners needing accommodations, submit requests through Connect and review the ASU Student Accessibility and Inclusive Learning Services website. Note: Learners with exam accommodations through SAILS should not schedule exams until they receive an invitation specifically for them from ProctorU.

☐ Complete the course evaluation survey if it is still available (check availability dates)

Week 8: Course Wrap-up (July 4 - 8, 2022)

*Monday, July 4th is Independence Day; the University is closed.

Learning Objectives
n/a

Topic

☐ n/a

Graded Coursework

☐ Project 2 - Hotspot Analysis programming assignment, source code, and project report

Other Tasks

☐ Attend and/or watch the recorded instructor's Live Session
☐ [Optional] Request for Review: MCS Portfolio Inclusion Report

Policies

All ASU and Coursera policies will be enforced during this course. For policy details, please consult the MCS Graduate Handbook and the MCS Onboarding Course.

Slack

This course will have a unique Slack workspace where you can communicate with your classmates.

Note: You must join/access this workspace using your ASURITE credentials.

While your instructors have access to the Slack workspace, it is intended to provide a space to create community with your classmates. Please remember to follow the communication protocol pinned in your Slack channel to ensure that any questions or concerns you have are addressed in a timely manner. Also, please remember ASU's Academic Integrity policy, and refrain from sharing assessment questions, answers or solutions.

Graded Quiz and Exam Policy

Each course in the MCS program is uniquely designed by expert faculty so that learners can best master the learning outcomes specific to each course. By design, course features and experiences are different across all MCS courses.

In the MCS program, we strive to provide learners with exercises and applied practice beyond quizzes and exams that align with the hands-on nature of the computer science industry. Ungraded practice opportunities *may* include, but are not limited to: in-video-questions (IVQs), knowledge check quizzes (KCs), weekly (i.e., unit) practice quizzes, practice exams, and other assignments or exercises. For all these learning activities, the questions and correct answers are provided to learners. When available, auto-generated typed feedback is built into the course to further help learners learn in real-time. Please thoroughly review your course to ensure that you are aware of the types of practice opportunities available to you.

For academic integrity purposes, once grades are made available, learners will see their overall total scores. Like other standardized tests, such as the GRE and SAT, learners will receive a singular grade for the graded quizzes and exams, but the questions, correct and incorrect answers, and feedback to each question will ***not*** be provided.

If learners desire 1:1 feedback for their questions on graded assessments, please submit questions to mcsonline@asu.edu. Rather than receiving the exact questions learners had correct and incorrect and the answers to those questions, learners will likely receive the concepts that were covered in the assessment questions so they will know what they need to review prior to other assessments and how to apply this information in their professional environments.

Absence Policies

There are no required or mandatory attendance events in this online course. Live Events, both Live Sessions hosted by the instructor and Virtual Office Hours hosted by the course team do not take attendance.

Learners are to complete all graded coursework (e.g., projects and exams). If exceptions for graded coursework deadlines need to be made for excused absences, please reach out to the course team by the end of the second week of the course using the mcsonline@asu.edu email address. Review the exam availability windows and schedule accordingly. The exam availability windows allow for your own flexibility and you are expected to plan ahead. Personal travel does not qualify as an excused absence and does not guarantee an exception.

Review the resources for what qualifies as an excused absence and review the late penalties in the Assignment Deadlines and Late Penalties section of the syllabus and the course:

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a. Excused absences related to religious observances/practices that are in accord with ACD 304–04, "Accommodation for Religious Practices" (please see Religious Holidays and Observances)
b. Excused absences related to university sanctioned events/activities that are in accord with ACD 304–02, "Missed Classes Due to University-Sanctioned Activities"
c. Excused absences related to missed class due to military line-of-duty activities that are in accord with ACD 304–11, "Missed Class Due to Military Line-of-Duty Activities," and SSM 201–18, "Accommodating Active Duty Military"

Live Event Expectations

The environment should remain professional at all times. Inappropriate content/visuals, language, tone, feedback, etc. will not be tolerated, reported and subject to disciplinary action. Review the Policy Regarding Expected Classroom Behavior section of the syllabus and the Student Code of Conduct for more detailed information.

Policy Regarding Expected Classroom Behavior

The aim of education is the intellectual, personal, social, and ethical development of the individual. The educational process is ideally conducted in an environment that encourages reasoned discourse, intellectual honesty, openness to constructive change, and respect for the rights of all individuals. Self-discipline and a respect for the rights of others in the university community are necessary for the fulfillment of such goals. An instructor may withdraw a student from a course with a mark of "W" or "E" or employ other interventions when the student's behavior disrupts the educational process. For more information, review SSM 201–10.

If you identify something as unacceptable classroom behavior on the class platform (e.g., Coursera discussion forum) or communication channels (e.g., Zoom, virtual live session, virtual office hours, Slack, etc.), please notify the course team using the mcsonline@asu.edu email. In the discussion forums, you can also flag the post for our attention. For more specifics on appropriate participation, please review our Netiquette infographic.

Our classroom community rules are to:
● Be professional
● Be positive
● Be polite
● Be proactive

Academic Integrity

Students in this class must adhere to ASU's academic integrity policy, which can be found at https://provost.asu.edu/academic-integrity/policy). Students are responsible for reviewing this policy and understanding each of the areas in which academic dishonesty can occur. In

addition, all engineering students are expected to adhere to both the ASU Academic Integrity Honor Code and the Fulton Schools of Engineering Honor Code. All academic integrity violations will be reported to the Fulton Schools of Engineering Academic Integrity Office (AIO). The AIO maintains a record of all violations and has access to academic integrity violations committed in all other ASU colleges/schools.

Copyright

The contents of this course, including lectures (Zoom recorded lectures included) and other instructional materials, are copyrighted materials. Students may not share outside the class, including uploading, selling or distributing course content or notes taken during the conduct of the course. Any recording of class sessions is authorized only for the use of students enrolled in this course during their enrollment in this course. Recordings and excerpts of recordings may not be distributed to others. (see ACD 304–06, "Commercial Note Taking Services" and ABOR Policy 5-308 F.14 for more information).

You must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's/learner's original work, unless the student/learner first complies with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement.

Policy Against Threatening Behavior, per the Student Services Manual, (SSM 104-02)

Students, faculty, staff, and other individuals do not have an unqualified right of access to university grounds, property, or services (see SSM 104-02). Interfering with the peaceful conduct of university-related business or activities or remaining on campus grounds after a request to leave may be considered a crime. All incidents and allegations of violent or threatening conduct by an ASU student (whether on- or off-campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students.

Disability Accommodations

Suitable accommodations will be made for students having disabilities. Students needing accommodations must register with ASU Student Accessibility and Inclusive Learning Services. Students should communicate the need for an accommodation at the beginning of each course so there is sufficient time for it to be properly arranged. These requests should be submitted through the online portal. See ACD 304-08 Classroom and Testing Accommodations for Students with Disabilities. ASU Student Accessibility and Inclusive Learning Services will send the instructor of record a notification of approved accommodations and students are copied on

these letters. It is recommended that students reply to the faculty notification letters, introduce themselves to their instructor, and share anything they might want to disclose.

Harassment and Sexual Discrimination

Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information.

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at https://sexualviolenceprevention.asu.edu/faqs.

Mandated sexual harassment reporter: As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, https://eoss.asu.edu/counseling, is available if you wish to discuss any concerns confidentially and privately.

Disclaimer

The information in this syllabus may be subject to change without advance notice. Stay informed by checking course announcements and the syllabus section of your course.

Course Creator

The following faculty members created this course.

Dr. Mohamed Sarwat

Mohamed Sarwat is an Assistant Professor of Computer Science and the director of the Data Systems (DataSys) lab at Arizona State University (ASU). He is also an affiliate member of the Center for Assured and Scalable Data Engineering (CASCADE). Before joining ASU, Mohamed obtained his MSc and PhD degrees in computer science from the University of Minnesota. His research interest lies in the broad area of data management systems.
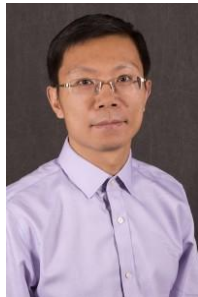
Dr. Ming Zhao

Ming Zhao is an associate professor of the ASU School of Computing, Informatics, and Decision Systems Engineering. Before joining ASU, he was an associate professor of the School of Computing and Information Sciences (SCIS) at Florida International University. He directs the Research Laboratory for Virtualized Infrastructure, Systems, and Applications (VISA). His research interests are in distributed/cloud computing, big data, high-performance computing, autonomic computing, virtualization, storage systems and operating systems.