

**COURSE TITLE: CSCI 4055, 43119, Theory of Database Management Systems****I. CONTACT INFORMATION**

Instructor:	Dr. Lon Smith
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Office Hours:	Monday, Wednesday: 10:00-11:00, 13:00-15:30 Tuesday, Thursday: 10:30-12:00 Friday: By Appointment

**II. COURSE DESCRIPTION**

Logical and physical data and file organization; relational data models; data normalization; query facilities; current literature in the database area.

**III. COURSE PREREQUISITES/COREQUISITES**

Grade of C or better in CSCI 2073

**IV. COURSE OBJECTIVES**

- Compare and contrast information with data and knowledge.
- Show uses of explicitly stored metadata/schema associated with data
- Identify issues of data persistence to an organization.
- Explain the characteristics that distinguish the database approach from the traditional approach of programming with data files.
- Cite the basic goals, functions, models, components, and applications of database systems.
- Describe the components of a database system and give examples of their use.
- Identify major DBMS functions and describe their role in a database system.
- Explain the concept of data independence and its importance in a database system.
- Use a declarative query language to elicit information from a database.
- Categorize data models based on the types of concepts that they provide to describe the database structure—that is, conceptual data model, physical data model, and representational data model.
- Describe the modeling concepts and notation of the entity-relationship model and UML, including their use in data modeling.
- Define the fundamental terminology used in the relational data model.
- Describe the basic principles of the relational data model.
- Illustrate the modeling concepts and notation of the relational data model.
- Identify appropriate indices for given relational schema and query set
- Estimate time to retrieve information, when indices are used compared to when they are not used.
- Prepare a relational schema from a conceptual model developed using the entity-relationship model
- Explain and demonstrate the concepts of entity integrity constraint and referential integrity constraint (including definition of the concept of a foreign key).

- Create a relational database schema in SQL that incorporates key, entity integrity, and referential integrity constraints.
- Demonstrate data definition in SQL and retrieving information from a database using the SQL SELECT statement.
- Evaluate a set of query processing strategies and select the optimal strategy.
- Create a non-procedural query by filling in templates of relations to construct an example of the desired query result.
- Embed queries into a stand-alone language such as C++ or Java
- Determine the functional dependency between two or more attributes that are a subset of a relation.
- Connect constraints expressed as primary key and foreign key, with functional dependencies
- Compute the closure of a set of attributes under given functional dependencies
- Determine whether or not a set of attributes form a superkey and/or candidate key for a relation with given functional dependencies
- Evaluate a proposed decomposition, to say whether or not it has lossless-join and dependency-preservation
- Describe what is meant by 1NF, 2NF, 3NF, and BCNF.
- Identify whether a relation is in 1NF, 2NF, 3NF, or BCNF.
- Normalize a 1NF relation into a set of 3NF (or BCNF) relations and denormalize a relational schema.
- Explain the concepts of records, record types, and files, as well as the different techniques for placing file records on disk.
- Give examples of the application of primary, secondary, and clustering indexes.
- Distinguish between a non-dense index and a dense index.
- Implement dynamic multilevel indexes using B-trees.
- Explain the theory and application of internal and external hashing techniques.
- Use hashing to facilitate dynamic file expansion.
- Describe the relationships among hashing, and efficient database searches.
- Evaluate costs and benefits of various hashing schemes.
- Explain how physical database design affects database transaction efficiency.

## V. COURSE TOPICS

- Information storage and retrieval (IS&R)
- Information management applications
- Information capture and representation
- Metadata/schema association with data
- Analysis and indexing
- Search, retrieval, linking, navigation
- Declarative and navigational queries
- Information integrity and security.
- Scalability, efficiency, and effectiveness
- History and motivation for database systems
- Components of database systems

- DBMS functions
- Database architecture and data independence
- Use of a declarative query language
- Data modeling
- Conceptual models (such as entity-relationship or UML)
- Object-oriented model
- Relational data model
- Semi-structured data model (expressed using XMLSchema)
- The massive impact of indexes on query performance
- The basic structure of an index.
- Keeping a buffer of data in memory;
- Creating indexes with SQL.
- Mapping conceptual schema to a relational schema
- Entity and referential integrity
- Relational algebra and relational calculus
- Overview of database languages
- SQL (data definition, query formulation, update sublanguage, constraints, integrity)
- Embedding non-procedural queries in a procedural language
- Database design
- Functional dependency
- Decomposition of a schema; lossless-join and dependency-preservation properties of a decomposition
- Candidate keys, super keys, and closure of a set of attributes
- Normal forms (1NF, 2NF, 3NF, BCNF)
- Storage and file structure
- Indexed files
- B-trees
- Files with dense index
- Files with variable length records
- Database efficiency

## VI. INSTRUCTIONAL METHODS AND ACTIVITIES

- This course will consist of a traditional interactive lectures presentation of topic material with periodic programming and design assignments to reinforce major points of discussion. There will also be various assignments again to reinforce lecture topics.
- The Internet is used extensively as a communications tool in this class. Announcements, copies of assignments, copies projects, a copy of this syllabus, and various examples and data files will be available on the class page on MOODLE. Students are expected to print their own copies of assignments and lab handouts from the class website, should they need hard copy. Announcements of a time critical nature may be emailed to class members. Class discussions and questions may be pursued on a class MOODLE discussion forum.
- There will be 4 tests to assess individual understanding of the material presented. These tests will be spaced throughout the semester, with the last test being the final exam.
- Reading assignments are indicated in the course outline. Students should be aware that they will be tested over the contents of their reading, as well as lecture topics and labs. Some things will

be in the text but not in the lecture, others will be in the lecture but not in the book. Both parts are necessary for success in this class. Some assignments may also be drawn from the text.

- All students must have access to ULM's Moodle system. There is a Moodle account generated for all students once all student fees are paid. If you have problems accessing Moodle contact the help desk at 342-3333.

## VII. EVALUATION AND GRADE ASSIGNMENT

- **GRADES:** Final grades will be determined as follows:

	Points	Percentage	Grade	Point Range
Test # 1	100	22.2%	A	450 - 405 (90%)
Test # 2	100	22.2%	B	404 - 360 (80%)
Assignments/HW/Quiz	100	22.2%	C	359 - 315 (70%)
Final Exam	150	33.3%	D	314 - 270 (60%)
	450	100%	F	269 - 0

## VIII. CLASS POLICIES AND PROCEDURES

At a minimum, all policies stated in the current ULM *Student Policy Manual & Organizational Handbook* should be followed (see <http://www.ulm.edu/studentpolicy/>). Additional class policies include:

### A. Textbook(s) and Materials:

*Fundamentals of Database Systems* (7<sup>th</sup> Edition) by Elmasri and Navathe  
ISBN-13: 978-0-13-397077-7 ISBN-10: 0-13-397077-9

### B. Attendance Policy:

***The course will be administered using the Hybrid-Zoom model. Whenever a student is not physically present in the classroom, the student is expected to connect and actively participate via a synchronous Zoom session.*** Regular attendance and class participation –whether remote or physical-- is expected. Physical attendance for unit tests and final exams is required. The student is responsible for any information, material, and announcements given by the instructor during any missed class period(s). The student will be allowed to make up graded work only if the absence is excused and documented. Any student who is not present for at least 75% of the scheduled class sessions in any course may receive a grade of W if this condition occurs prior to the last day to drop a course or a grade of F after that date.

### C. Make-up Tests:

You are expected to arrange your schedule around the dates indicated in this syllabus as much as is possible. Make-up tests arranged at least one full week prior to the test date can be obtained:

- to avoid direct conflict with participation in an unavoidable official school-sponsored activity, such as playing in an intercollegiate sporting event (documentation from the sponsor is required)
- in the event that a test occurs on a day other than those given in this syllabus, for an unavoidable personal conflict (this is at my discretion, but I try to be reasonable)

Make-up tests will be arranged after the test date only:

- in the event of an unexpected and professionally documented medical condition which prevented attendance. If you are experiencing a long-term illness, please keep me informed each week of your status.
- in the event of a personal tragedy (I may need for you to provide some documentation)

### D. Late Assignments:

Unless specified otherwise, program assignments are due at the beginning of class on the date due. Late penalties are 10% per day (including weekends and holidays). Program assignments will be submitted through the electronic submission system, and that timestamp will be used for determining appropriate penalties. Physical portions of late assignments must be given directly to

the instructor. Do **not** just slip them under the door. No assignments of any sort will be accepted after 2:00 p.m. on the last official day of classes, even if this would result in a failing grade. Minor assignments and homework may only be done and turn-in by permission of the instructor, generally, University acceptable excuses must be provided.

**E. Academic Integrity:**

Students must observe the ULM published policy on Cheating and Plagiarism (see ULM *Student Policy Manual* -- <http://catalog.ulm.edu/content.php?catoid=21&navoid=2516>). All classwork turned in by student for any assignment or test in any form (hardcopy, electronic, etc...) is assumed to be the work done by the student and will, therefore, be considered academic plagiarism if it is deemed to be from any source other than the student. Punishment for any instance of cheating or plagiarism will be severe. Penalties may be a grade of 0 on the item, expulsion from the class, expulsion from the University, etc. and placement of the infraction in the student's permanent academic record.

**F. Cell Phone Policy:**

Cell phone will be placed in a silent mode and put away during class. This means that the cell phone should not be visible during class at any point. Don't expect to charge your phone during class whether on the desk or in the corner. If an exceptional reason requires that you be able to monitor incoming classes communicate with me before class and instruction will be given on how and if you will be able to monitor your phone. Student who will not follow this policy may receive a penalty on exams and/or assignments and may also be told to leave the class or their phone may be confiscated during class period.

**G. Course Evaluation Policy:**

Students are expected to complete the on-line course evaluation.

**H. Student Services:**

Information about ULM student services, such as Student Success Center (<http://www.ulm.edu/cass/>), Counseling Center (<http://www.ulm.edu/counselingcenter/>), Special Needs (<http://www.ulm.edu/counselingcenter/special.htm>), and Student Health Services, is available at the following Student Services web site <http://www.ulm.edu/studentaffairs/>.

**I. Emergency Procedures:**

In addition to all University stated safety and emergency policies, the students are expected to become familiar with emergency exits nearest the classroom. Should an emergency arise, students should proceed cautiously to the nearest exit.

**J. Discipline/Course Specific Policies:**

The use of University computer equipment for purposes not related to class is prohibited. A student found in violation of this policy may lose the privilege of computer access during class. Details of acceptable computer usage are specified in the Department Acceptable Use Policy. The use of mobile phones, pagers, and other electronic equipment not related to class is also prohibited and may result to penalties including class expulsion, course expulsion, and/or grade reduction.

**K. Schedule & Syllabus**

This instructor reserves the right to change the content and schedule of the course due to the needs of the students and content coverage. As instructor all possible measure will be taken to communicate any needed changes to the students.

**IX. Health and Safety Requirements**

To safeguard the health and safety of the ULM Community during the COVID-19 pandemic, the University has instituted a variety of protocols in response to State and University of Louisiana System mandates for the different phases of reopening. All students are expected to be in compliance with these required policies and procedures as well as to practice proper hand washing, follow appropriate sneeze etiquette, and stay at home when sick. Students are required to wear face masks, practice social distancing, and follow other requirements inside all campus buildings (including classrooms) until such time as State and University authorities no longer mandate them.

**COVID-19 Symptoms and Testing**

Testing and contact tracing for those individuals who develop symptoms of COVID-19 is paramount to the safety of our community. Information on what you are required to do should you develop symptoms or test positive for COVID-19 can be found at:

[https://www.ulm.edu/safety/student\\_positive\\_test/index.html](https://www.ulm.edu/safety/student_positive_test/index.html)

In the event that one or more individuals in a course are diagnosed with COVID-19, contact tracing will be completed to determine the potential exposure to other individuals in the class. One potential outcome of this tracing might be a recommendation that the members of the class quarantine for a period of time. If this happens, the course will go into temporary remote instruction during that time period.

**Temporary Remote Instruction**

During the semester, campus operations might be disrupted by an emergency, such as a tornado, fire, or pandemic. If in-person instruction becomes impossible for a period of time, the class will enter a phase of temporary remote instruction (TRI). During this phase, instruction will take place via virtual means, either synchronously or asynchronously. Your instructor will alert you when this happens via e-mail and will include a description of how the course will proceed.

During a period of temporary remote instruction, the need for the course to continue in a virtual manner means that you will be required to have appropriate equipment, software, and telecommunication access to allow you to participate. This course will require that you have the following, should we have to go into TRI:

- Internet access
- Computer with video camera (capable of running all class required software)
- Respondus Lockdown Browser
- Cell phone with camera

**Office Hours**

Office hours have been set aside as time your instructor will be available for remote consultations. Students should **email** the instructor with requested conference time and a remote session will be set up. If student needs consultation outside of office hours this will be purely on an appointment basis. All efforts will be taken to communicate to students as promptly as possible.

Student services:

The University of Louisiana at Monroe strives to serve students with special needs through compliance with Sections 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act. These laws mandate that postsecondary institutions provide equal access to programs and services for students with disabilities without creating changes to the essential elements of the curriculum. While students with special needs are expected to meet our institution's academic standards, they are given the opportunity to fulfill learner outcomes in alternative ways. Examples of accommodations may include, but are not limited to, testing accommodations (oral testing, extended time for exams), interpreters, relocation of inaccessible classrooms, permission to audiotape lectures, note-taking assistance, and course substitutions.

*Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds, including federal loans and grants. Furthermore, Title IX prohibits sex discrimination to include sexual misconduct, sexual violence, sexual harassment and retaliation. If you encounter unlawful sexual harassment or gender-based discrimination, please contact Student Services at 318-342-5230 or to file a complaint, visit [www.ulm.edu/titleix](http://www.ulm.edu/titleix).*

## Information about ULM student services

- Student Success Center: <http://www.ulm.edu/studentsuccess/>
- Counseling Center <http://www.ulm.edu/counselingcenter/>
- Special Needs at <http://www.ulm.edu/counselingcenter/special.html>
- Library <http://www.ulm.edu/library/>
- Computing Center Help Desk <http://www.ulm.edu/computingcenter/helpdesk>

Current college's policies on serving students with disabilities can be obtained at for the ULM website: <http://www.ulm.edu/counselingcenter/special.html>

- If you need accommodation because of a known or suspected disability, you should contact the director for disabled student services at:
- Voice phone: 318-342-5220
- Fax: 318-342-5228
- Walk In: ULM Counseling Center, 1140 University Avenue (this building and room are handicapped accessible).

## Mental Wellness on the ULM Campus

If you are having any emotional, behavioral, or social problems, and would like to talk with a caring, concerned professional please call one of the following numbers:

- The ULM Counseling Center 342-5220
- The Marriage and Family Therapy Clinic 342-9797
- The Community Counseling Center 342-1263

Remember that all services are offered free to students, and all are strictly confidential.

**If you have special needs that I need to be made aware you should contact me within the first two days of class.**

**Schedule:****CSCI 4055 - Fall 2021**

Day	Topic	
Monday, August 16, 2021	Syllabus	1
Wednesday, August 18, 2021	Intro	2
Monday, August 23, 2021	Three Schema Arc.	2
Wednesday, August 25, 2021	ER, EER	3,4
Monday, August 30, 2021	ER to Relational	9
Wednesday, September 1, 2021	Basic SQL	5
Monday, September 6, 2021	Labor Day	
Wednesday, September 8, 2021	More SQL	6
Monday, September 13, 2021		
Wednesday, September 15, 2021	Exam 1	
Monday, September 20, 2021	Queries, Triggers	7
Wednesday, September 22, 2021	Indexes, Views	7
Monday, September 27, 2021	Advanced SQL	7
Wednesday, September 29, 2021	Not Queries	24
Monday, October 4, 2021	Programming SQL	10
Wednesday, October 6, 2021	Embedded SQL	10
Monday, October 11, 2021		
Wednesday, October 13, 2021		
Monday, October 18, 2021	Exam 2	
Wednesday, October 20, 2021	Disk Shape	16
Monday, October 25, 2021	Files and Indexes	17
Wednesday, October 27, 2021	Multilevel index, B+	17
Monday, November 1, 2021	Fall Break	
Wednesday, November 3, 2021	Functional Dep	14
Monday, November 8, 2021	Normal Forms	15
Wednesday, November 10, 2021		
Monday, November 15, 2021		
Wednesday, November 17, 2021		
Monday, November 22, 2021		
Wednesday, November 24, 2021	Thanksgiving	
Monday, November 29, 2021		
Tuesday, December 7, 2021	Final 8:00am - 9:50am	

**Final Note:**

The instructor reserves the right to change any part of the syllabus, class policy or schedule.