

SYLLABUS

MATH 4343. Introduction to Scientific Computing
SPRING 2022

Instructor: Dr. Tulin Kaman

Email: tkaman@uark.edu

Office Hours: MWF 08:30am - 09:20am or by appointment (Zoom)

Lectures: MWF 12:55pm-1:45pm in Mech Engr Classroom 0216 (1/18 to 5/5)

Textbook: Rouben Rostamian: Programming Projects in C for students of Engineering, Science, and Mathematics, SIAM 2014. <http://www.siam.org/books/cs13> redicts to the book's website

<https://userpages.umbc.edu/~rostamia/cbook/> that contains notes, comments and known errata.

Learning Objectives: Provides an understanding of a diverse set of problems, as well as algorithms for solving them and implementing the algorithms using high performance computing resources and environments. The emphasis is on problem solving and offers multiple projects concerning applications in science and engineering.

Prerequisite: MATH 3083 (Linear Algebra) or MATH 3093 (Abstract Linear Algebra)

Tentative Course Outline: The detailed weekly schedule will be posted on Blackboard.

Chapters 1-6	A common background
Chapter 7	Allocating memory
Chapter 8	Dynamic memory allocation for vectors and matrices
Chapter 18	The Nelder-Mead downhill simplex
Chapter 20	Finite difference schemes for the heat equation in one dimension
Chapter 21	The porous medium equation
Chapter 11	Storing sparse matrices
Chapter 12	The UMFPACK library
Chapter 23	Triangulation with the Triangle Library
<i>Appendix A</i>	<i>An introduction to barycentric coordinates</i>
Chapter 24	Integration on triangles
Chapter 25	FEM-1: A finite element method for solving the Poisson equation with zero Dirichlet boundary conditions
Chapter 22	Gaussian quadrature
Chapter 26	FEM-2: second order elliptic partial differential equation with arbitrary Dirichlet and Neumann boundary conditions

Plan: We will use Blackboard as the portal for the delivery of course materials and UARK email for communications. Please check both of these areas regularly for guidance and directions from me.

Things to Know About Using Zoom for Class Meetings: Zoom sessions are set up and available in Blackboard. To find and join the sessions, click the “Zoom” link in the left course menu in Blackboard. The Zoom sessions are recorded automatically. Click the “Class Recording” link in order to find the course videos. You can contact the Help Desk at help.uark.edu or 479-575-2905 if you have any technical issues accessing Zoom.

Grading: The performance assessments will be based on

Projects	60 %
Final project	40 %

Grades are assigned according to the percentage scale $A \geq 90$, $B \geq 80$, $C \geq 70$, $D \geq 60$, $F < 60$.

Projects: The programming language C will be used for solving the set of problems called projects. The projects with due dates will be posted in Blackboard. Late submission will not be accepted. You are encouraged to talk to other students on problems, but you must submit your own solutions.

Final Project: The final project will be on the use of the algorithms for solving a specific problem in your area.

- At the beginning of the semester, each student will give a short presentation to outline his/her research interest.
- At the middle of the semester, you will submit a 2-pg written report and give a short presentation to show your progress.
- At the end of the semester, you will submit your final report outlining the results you have achieved and give a final presentation.

Technical writing is easy with LaTeX. LaTeX is a high-quality typesetting system for the production of technical and scientific documentation. I expect you to write your project reports using LaTeX. *How to get LaTeX?*

LaTeX is an open source software; it may be obtained freely and installed on any computer platform.

- Linux: All Linux distributions come with LaTeX. If you have your own Linux machine, you may install/activate LaTeX with a few mouse clicks.
- Mac: Download and install MacTeX.
- Windows Download and install MiKTeX.
- Overleaf: LaTeX in a web browser—the easy way With Overleaf you don't need to install LaTeX on your machine! Go to <https://www.overleaf.com> and register for a free personal account. Then you will be able to access their fully functioning LaTeX remotely through your web browser which works on all operating systems. Your files will be on Overleaf's cloud servers by default but you can download them to your local computer in order to email them to me.

Important Dates:

Presentation #1	Wednesday, February 16, 2022
Presentation #2	Wednesday, March 16, 2022
Final Presentation	May 9 -13, 2022

Expectations for Participation: As remote learners, students must be proactive in their studies, able to balance academic responsibilities with life events, and able to dedicate an appropriate amount of time to a course. The most crucial skills are communication, time management, and staying organized. Log in to the course in Blackboard to check for class materials and announcements. Check university email for course communications daily. Attend scheduled (synchronous) class sessions in Blackboard, arriving on time and leaving at the end of the class session. Start the video camera and mute your microphone when not speaking. Make sure you are in a quiet location and unmute your microphone when speaking. Participate in synchronous conversations and activities. Complete assigned work/learning activities by indicated due dates.

Technology/Software Requirements: Access to a reliable Internet connection is required for this course. If you experience problems with your Internet connection while working on this course, it is your responsibility to find an alternative Internet access point, such as a public library or Wi-Fi hotspot.

Recording of Class Lectures: By attending this class, the student understands the course is being recorded and consents to being recorded for official university educational purposes. Be aware that incidental recording may also occur before and after official class times. Recordings may include personally-identifiable comments submitted to the chat stream during class.

Unauthorized Use and Distribution of Class Notes. These recordings may be used by students only for the purposes of the class. Students may not download, store, copy, alter, post, share, or distribute in any manner all or any portion of the class recording, (e.g. a 5-second clip of a class recording sent as a private message to one person is a violation of this provision). This provision may protect the following interests (as well as other interests not listed): faculty and university copyright; FERPA rights; and other privacy interests protected under state and/or federal law. Unauthorized recording, or transmission of a recording, of all or any portion of a class is prohibited unless the recording is necessary for educational accommodation as expressly authorized and documented through the Center for Educational Access with proper advance notice to the instructor. Unauthorized recordings may violate federal law, state law, and university policies. Student-made recordings are subject to the same restrictions as instructor-made recordings. Failure to comply with this provision will result in a referral to the Office of Student Standards and Conduct for potential charges under the Code of Student Life. In situations where the recordings are used to gain an academic advantage, it may also be considered a violation of the University of Arkansas' academic integrity policy.

Academic Integrity Resources for Remote Teaching: There are many websites claiming to offer study aids to students, but in using such websites, students could find themselves in violation of our University's Academic Integrity and Code of Student Life policies. These websites include (but are not limited to) Quizlet, Bartleby, Course Hero, Chegg, and Clutch Prep. The U of A does not endorse the use of these products in an unethical manner. These websites may encourage students to upload course materials, such as test questions, individual assignments, and examples of graded material. Such materials are the intellectual property of instructors, the university, or publishers and may not be distributed without prior authorization. Furthermore, paying for academic work to be completed on your behalf and submitting it for academic credit is considered 'contract cheating' per the Academic Integrity Policy. Students found responsible for this type of violation face a grading penalty of 'XF' and a minimum one-semester academic suspension per the University of Arkansas Sanction Rubric. Please let me know if you are uncertain about the use of a website.