

CSCE 4123, Programming Challenges (3 credits), Selected Elective

Catalog Description: This course studies the principal methods used in the solution of programming contest problems, e.g., data structures, strings, sorting, machine arithmetic and algebra, Combinatorics, number theory, backtracking, graph traversal, graph algorithms, dynamic programming, grids, and computational geometry.

Prerequisites: CSCE 2014 Programming Foundations II with C or better

Corequisites: None

Textbook/required material: *Programming Challenges: The Programming Contest Training Manual*, Steven S. Skiena and Miguel A. Revilla, Springer, 2003, ISBN 978-0387001630

Recommended Reference:

- *Introduction to Algorithms*, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, The MIT Press, 3rd edition, 2009, ISBN 978-0262033848
- *Algorithms*, Robert Sedgewick and Kevin Wayne, Addison-Wesley Professional, 4th edition, 2010, ISBN 978-0321573513
- *The Art of Computer Programming*, Vol. 1: Fundamental Algorithms, Donald E. Knuth, Addison-Wesley Professional; 3rd edition, 1997, ISBN 978-0201896831

Goals: Ability to rapidly develop efficient solutions to standard computer science problems, such that an online judge accepts the developed solutions as correct and efficient.

Student Learning Outcomes. By the end of this course, students will be able to:

- Choose appropriate data structures to represent a given problem.
- Devise appropriate algorithms to solve a given problem.
- Implement the devised algorithms in either C, C++, or Java.
- Debug the correctness and efficiency of the developed program based on the limited feedback from an online judge.
- Improve the performance of answering job interviewing problems related to data structures and algorithms.

Topics covered:

- Programming competition or contest
- Data structures
- Strings
- Sorting
- Machine arithmetic and algebra
- Combinatorics
- Number theory
- Backtracking
- Graph traversal
- Graph algorithms
- Dynamic Programming

- Grid related problems
- Geometry
- Computational Geometry

Grading

The grading in this course will be distributed as follows

- Attendance: 10%
- Programming assignments: 70%
- Final Programming Exam 20%

There will be about 2-3 programming assignment per each chapter.

Class attendance and online participation will be used for attendance grading. Excused absence (sickness, family emergency, conference/business trip) must be approved by submitting request on the course website with valid proof.

We will use the following scale to assign final grades:

A: [90, 100] B: [80, 90), C: [70, 80), D: [60, 70), F: below 60%

Academic Honesty:

As a core part of its mission, the University of Arkansas provides students with the opportunity to further their educational goals through programs of study and research in an environment that promotes freedom of inquiry and academic responsibility. Accomplishing this mission is only possible when intellectual honesty and individual integrity prevail.

Each University of Arkansas student is required to be familiar with and abide by the University's 'Academic Integrity Policy' which may be found at honesty.uark.edu/policy. Students with questions about how these policies apply to a particular course or assignment should immediately contact their instructor.

Attendance Policy and COVID Considerations

The University of Arkansas will primarily offer in-person instruction. Most of the university's academic programs have essential in-person components. Class attendance is the responsibility of each student and expected. If you are absent, it is your responsibility to obtain assignments, notes, and any class information given.

For any valid excused absence request, you must obtain a written proof before the class as soon as possible. If you have COVID-19 symptoms, DO NOT COME TO CLASS. You can get a COVID test report within three days and use it as a proof for absence request. If you must quarantine, self-isolate, or miss more than one class during the semester because of COVID-19 or other illness, obtain a doctor's note or any proof record after you recover to avoid attendance penalties.

Class information (lecture slides, recordings) will be provided to students who must miss class due to COVID-19 or other excused absences on a short-term basis. Contact the CEA Center to determine if you think that you have a disability that prevents you from participating in person. Accommodations will be made accordingly.

All students are expected to take the exams in the classroom or CEA facilities. If a student cannot do so, permission to take the exam online or skip one midterm can be granted on a case-by-case basis with written proof. All students must take the final to complete the course with no exception.

Mask Policy

The Board of Trustees for the U of A System reinstated its requirement for all campuses that masks be worn indoors where 6-feet of distance cannot be assured in response to the high number of cases of the very contagious COVID-19 variant in Arkansas. The U of A is one of nine SEC schools with mask requirements at this time. This requirement is in place until further notice. You must wear a mask while in class for your protection and for the protection of those around you. If you do not have a mask, please let your instructor know, and a mask will be provided for you; there are also disposable masks available in most classrooms across campus. Students who do not comply with the mask requirement will be reported to the office of the Dean of Students.

Vaccinations

The UA strongly encourages everyone who is eligible and able, to become fully vaccinated. A vaccination incentive program has been implemented on the Fayetteville campus. We fully understand that there are students who do not wish to receive a vaccination at this time, can't receive a vaccination for medical or other reasons, and others who simply do not want to participate. While state law prohibits requiring it, COVID-19 vaccination is encouraged as our primary means of mitigating the spread of the virus. Those who receive vaccination protect themselves from serious illness, hospitalization, and in some cases even death, while protecting those around them, supporting our plans to have a more traditional in-person fall semester and hopefully avoid interruptions in the school year.

Technology/Software Requirements

Students must own or rent a personal computing device (laptop or desktop) for this course. Access to a reliable Internet connection is required for this course. A problem with your Internet access may not be used as an excuse for late, missing, or incomplete coursework. 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, student understands the course may be 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.

Unauthorized Use and Distribution of Class Materials

Third parties may attempt to connect with you to buy your notes and other course information from this class. Instructors may record the class and make the class available to students through Blackboard. These recordings may be used by students ONLY for the purposes of the class.

I will consider distributing course materials to a third party without my authorization a violation of my intellectual property rights and/or copyright law as well as a violation of the University of Arkansas' academic integrity policy. Students may not download, store, copy, alter, post, share, or distribute in any manner all or any portion of the class recording, e.g. sharing a clip of a class recording to one person is a violation of this provision.

Continued enrollment in this class signifies your intent to abide by the policy. In situations where class materials are used to gain an academic advantage, it may also be considered a violation of the University of Arkansas' academic integrity policy.

Emergency Preparedness:

Many types of emergencies can occur on campus; instructions for specific emergencies such as severe weather, active shooter, or fire can be found at emergency.uark.edu. The University of Arkansas has a campus-wide alert system for any hazardous conditions that may arise on campus. To learn more and to sign up: <http://safety.uark.edu/emergency-preparedness/emergency-notification-system/>

Inclement Weather:

If the university is officially closed, class will not be held. When the university is open, you are expected to make a reasonable effort to attend class, but not if you do not feel that you can get to campus safely. Any changes to due dates or the class schedule will be communicated via email to your uark email address.

Academic Support:

University of Arkansas [Academic Policy Series 1520.10](#) requires that students with disabilities are provided reasonable accommodations to ensure their equal access to course content. If you have a documented disability and require accommodations, please contact me privately at the beginning of the semester to make arrangements for necessary classroom adjustments. Please note, you must first verify your eligibility for these through the Center for Educational Access (contact 479-575-3104 or visit <http://cea.uark.edu> for more information on registration procedures).

Class/laboratory schedule: Meets either 3 times a week for 50 minutes or 2 times a week for 1 hour 15 minutes for 15 weeks.

Relationship of course to ABET Computer Science Student Outcomes:

- CS1. An ability to analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
- CS2. An ability to design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
- CS6. An ability to apply computer science theory and software development fundamentals to produce computing-based solutions.

Relationship of course to ABET Computer Science Topics:

- T1. Techniques, skills, and tools necessary for computing practice.
- T4. Substantial coverage of algorithms and complexity, computer science theory, concepts of programming languages, and software development.

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Date: January 2023