CS 321: Algorithms

Term: Fall 2021
Credits: 3
Meets: MW 1:50 PM – 3:20 PM in HS 202
Prerequisites: CS 212 and CS 271, all with a grade of C or better.

Classroom mask requirement

All students are required to wear an appropriate mask that covers their mouth and nose when they're in the classroom. They must also adhere to additional expectations communicated by the instructor or posted in the classroom. Note: UWO procedure dictates that, during the COVID-19 pandemic, an instructor cannot begin class until all students are wearing a mask properly. If a student is non-compliant with the masking policy and refuses to leave the classroom promptly when requested, the instructor is required to cancel class. Students responsible for class cancellation for these reasons will be referred to the Dean of Students office, and the student will be unable to attend class until they meet with the Dean of Students. The student may be dropped from the class by the Dean of Students. After each violation, the student's final letter grade will be lowered to the next lower grade level, e.g., an A to an A-, a C+ to a C-, and so on.

Instructor

Instructor: Scott Summers
Email: summerss@uwosh.edu
Phone: 920-424-1324
Office: Halsey 220
Office hours: Indicated by the cells shaded in gray in the following table and subject to change.

	Mon	Tues	Wed	Thu	Fri
9:10 AM					
10:20					
11:30					
12:40 PM					
1:20					
3:20					

To avoid confusion: I have office hours on Tuesdays and Thursdays at 1:20 – 3:20 PM and on Fridays at 9:10 AM – 10:10 AM.

I will hold my office hours virtually, unless specified otherwise. To meet with me, simply send me an email during office hours and I'll respond with a corresponding link to a private video meeting.

Course description

An introduction to the design and analysis of algorithms. Algorithm analysis topics include asymptotic analysis, recurrence relations, loop invariants and amortized analysis. Algorithm design techniques include divide and conquer, the greedy method, and dynamic programming. Additional topics include graph algorithms and NP-completeness.

Course Website

The course website is Canvas: `https://uwosh.edu/canvas/`. You should check Canvas on a regular basis, perhaps two or three times per day.

Course Objectives

At the conclusion of the course:

1. The student will be able to prove the correctness of an algorithm using loop invariants and mathematical induction.
2. Given a recursive algorithm, the student will be able to examine its recursive structure, determine and mathematically solve the corresponding recurrence relation, and infer the asymptotic runtime of the algorithm using big-O notation.
3. The student will be able to use appropriate asymptotic notations for bounding algorithm running times from above and below.
4. Given a data structure with an occasional high-cost operation, the student will be able to select an appropriate potential function and use amortized analysis techniques to determine the amortized cost of the operations on the data structure.
5. The student will be able to identify problems amenable to divide-and-conquer solutions, derive the details of a solution to such a problem, and analyze the run-time behavior of the corresponding solution.
6. Given a problem amenable to a dynamic programming solution, the student will be able to determine the underlying recursion that solves the problem, determine why this recursion is suited to dynamic programming, implement the algorithm using dynamic programming to cache sub-problem solutions, and determine the efficiency of the resulting algorithm.
7. The student will be able to identify problems amenable to greedy solutions, derive the details of a solution to such a problem, and analyze the run-time behavior of the corresponding solution.
8. The student will be able to identify problems that can be modeled as a graph, select the appropriate graph algorithm to solve the problem and analyze the efficiency of the resulting algorithm.
9. The student will be able to identify, from a list of tractable and NP-complete problems, those that are tractable and those that are NP-complete, provide, for each tractable problem, a polynomial-time algorithm that solves it and provide, for each NP-complete problem, a proof that it is NP-complete.

Recommended Textbook

Introduction to Algorithms 3rd edition by Cormen, Leiserson, Rivest and Stein. ISBN 9780262033848.

Course Grade

Your final course grade will be based on the following components as well as adhering to the classroom mask requirement (see above).

25% HOMEWORK ASSIGNMENTS

There will be a homework assignment due toward the beginning of each week. All assignments must be written in LaTeXand the resulting PDF file must be submitted electronically via Canvas. Some assignments may involve writing Java programs. All assignments will be equally-weighted. You may work with a partner on some homework assignments.

75% EXAMS
There will be three equally-weighted, in-class exams. Exam material will come from the lecture notes, and homework assignments. There will be more information about each exam as it approaches. The actual exam dates will be announced in class at least one week before the exam.

If you are unable to take a scheduled exam, it may be possible to take a make-up exam provided that you do both of the following, which are then subject to my approval:

1. Make arrangements prior to the scheduled exam (for last minute emergencies, call me at 920-424-1324 or leave a message at the Computer Science office, 920-424-2068. **No after-the-fact notifications will be accepted**.

2. Have a written medical excuse signed by the attending physician OR have a note of justification from the Dean of Students Office.

If allowed, only one make-up exam will be given. It will be a comprehensive exam given at an arranged time during the last week of the semester.

Grading Scale

Grading will be on a plus/minus system. Grading may be done on a curve depending on the overall performance of the class. If no curve is used, then your grade will be computed based on the following:

Percentage	Grade
> 91	A
> 89 and ≤ 91	A-
> 87 and ≤ 89	B+
> 81 and ≤ 87	B
> 79 and ≤ 81	B-
> 77 and ≤ 79	C+
> 71 and ≤ 77	C
> 69 and ≤ 71	C-
> 67 and ≤ 69	D+
> 61 and ≤ 67	D
> 55 and ≤ 61	D-
≤ 55	F

Re-grading

If you believe an assignment or an exam was graded incorrectly and would like to have it re-graded, then you must let me know about it in writing within one day of receiving the assignment or exam back. I will re-grade the entire assignment or exam and you may gain or lose points.

Late Work

Late work will NOT be accepted. Late work is worth 0 points. Extensions may be granted at the discretion of the instructor if you provide a valid justification (in the form of a written excuse from a medical doctor or the Dean of Students Office) before the due date.

University Policy on Academic Integrity

The University of Wisconsin Oshkosh is committed to a standard of academic integrity for all students. The system guidelines state:"Students are responsible for the honest completion and representation of their work, for the appropriate citation of source, and for respect of others' academic endeavors" (UWS 14.01, Wisconsin

Administrative Code).

Often, students are not aware of the ways to identify and avoid plagiarism. Therefore, it is important to educate yourself about how to give proper credit to sources that you use in your assignments. For writing assignments, you can consult the Purdue Owl website on how to identify and avoid plagiarism: `https://owl.english.purdue.edu/owl/resource/589/02/` and `https://owl.english.purdue.edu/owl/resource/589/03/`. This website outlines the strategies for avoiding plagiarism in this course. However, other courses may demand knowing other ways to identify and avoid plagiarism. Therefore, I encourage you to consult with me if it is unclear to you how you give proper credit to your sources of information.

In sum, all material turned in for this course must be original. In this course, you may not re-use papers or projects from other sections of this course, from other courses you have completed, or other courses you are currently completing. This class is a specific event in your learning process. To learn, you must engage in the material and complete the work. Thus, work from other experiences is not acceptable. All work turned in that is plagiarized will receive a "0" in the course.

Students' Rights and Responsibilities: Course Policies

WELCOME STUDENTS!

As a University of Wisconsin–Oshkosh student, you have rights and responsibilities regarding your relationship with both the classroom and university community. The policies in the course specifically as well as at UW–Oshkosh generally are in place to foster an equitable and safe classroom and campus climate. The primary goal of all policies is to create a classroom and campus community in which all students can access learning, achieve success and reach their goals. Your rights and responsibilities are important to know both so that you can enhance your learning experience and contribute positively to the campus climate. Specific policies and procedures can be accessed through the Student Affairs Policies and Procedures webpage (`https://www.uwosh.edu/stuaff/policies-procedures`).

INCLUSION STATEMENT

Building relationships and community is one of the most important goals of the course. The only way to build community in this course is to honor each person in terms of their identity. Each student in the course will conceive of their identity in different ways; aspects of identity important to students in the course may include race, ethnicity, ability, sex, sexuality, gender, gender expression, gender identity, religious beliefs, political affiliations, and/or class. Thus, each of us, myself included, must honor each students' identity in all its complexity. We need to work on taking up perspectives unlike our own, challenging our assumptions and finding a route toward understanding the similarities and differences between ourselves and others.

STUDENTS WITH DISABILITIES

Most importantly, students with disabilities are welcome in this course! If you need alternative/additional instructional structure for this class due to specific individual learning needs, please talk to me and we can work together. I am committed to creating an environment conducive to learning for all students.

UNIVERSITY POLICY ON TYPES OF EXCUSED ABSENCES

There are several forms of absences that are excused under University policy: "Students are excused from class for participation in all-University events [GEN 4.B.10 (1)(b)] and for circumstances beyond the students' control including, but not limited to medical or family emergencies (medical care for pregnancy, illness, child care issues, death or serious health problem of family member), court appearance, required military

service not to exceed two (2) weeks unless special permission is granted by the instructor or chair, jury duty, etc." Student responsibility: "Students are responsible for notifying the instructor. . . as far in advance as possible and may not be penalized for such absences as long as appropriate documentation is provided in a timely fashion to the instructor to verify the reason for the absence." Instructor responsibility: "Instructors are responsible for providing reasonable accommodation or opportunities to make up course obligations that have an impact on the course grade."

RELIGIOUS ACCOMMODATION FOR STUDENTS

Both University policy and state policy requires that instructors honor students sincerely held religious and faith traditions by making accommodations for religious holidays or other days of special religious significance. If there is a scheduling conflict for you between attending a course session and/or completing coursework on a day of religious observance, then, it is necessary to "notify the instructor within the first three weeks of the beginning of classes of the specific days or dates on which you will request relief from an examination or academic requirement."

CREATING A SPACE FREE FROM SEXUAL HARASSMENT

The University policy on sexual harassment is very clear: it will not be tolerated anywhere on campus, including the classroom. Sexual harassment is defined by the University of Wisconsin Oshkosh as follows: "Sexual harassment is a form of sex discrimination. It [is] . . . the inappropriate introduction of sexual activities or comments into the work, learning, or living situation. Such behavior is not acceptable at the UW–Oshkosh and will result in disciplinary action."

ATTENDANCE

I am dedicated to your success and know that attendance is crucial to achieving improvement in your skills and abilities and, thus, your success in the course. Therefore, I may keep track of attendance weekly. Missing two weeks or more of the course may result in a failing final course grade. In turn, if I receive no communication from you for two weeks, I reserve the right to withdraw you from the course.

If you experience difficulties such as illness or death in the family or other significant disruptions in your life as discussed in the section on excused absences above, then, please communicate with me about your situation and we will forge a plan on how to best catch you up in the course.

DROPBOX

Odd things happen in cyberspace-emails get lost, servers disconnect temporarily, and logins fail. Due to this challenge, you should anticipate possible mishaps and complete your work with enough time to meet the deadline. In turn, timely communication aids success: reply to emails received and check for replies to your sent emails. With these strategies, you will be able to meet my expectations of getting work in on time.