

(Graduate) Analysis of Algorithms

Computer Science 511

Winter 2025

Instructor

Kameron Decker Harris, PhD (prefers “Professor Harris” in class, he/him/his)

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office hours: Mon 3-3:45 pm, Fri 11-12 am

Overview

We will cover algorithm design techniques such as dynamic programming, greedy, and randomized algorithms. We will apply these techniques to various graph problems such as minimum spanning trees, shortest paths and network flows. As time permits we will cover complexity theory and approximation algorithms.

Class time: MTWF 1:00-1:50 pm in ES100

Prerequisites: CSCI 305

Text: “Introduction to Algorithms” (4th ed) by Cormen, Leiserson, Rivest and Stein

Course Outcomes

The outcomes listed below are the same as those for CSCI 405 but we will cover the topics at a greater depth. The outcomes listed below will be tested and measured via homework assignments, quizzes, and exam(s).

Upon completion of this course, students will demonstrate a:

- Thorough understanding of the mathematical techniques used to determine the time and space complexity of algorithms.
- Thorough understanding of dynamic programming and greedy algorithms and an ability to discern which technique to use for a given problem.
- Thorough understanding of graph algorithms for minimum spanning trees, shortest paths, and maximum network flows.
- Thorough understanding of randomized algorithms.
- Ability to formulate efficient, effective solutions for various problems and justify the correctness and complexity of those solutions.

Schedule

We aim to spend 1 – 2 weeks on each bullet point item:

- Dynamic Programming (Chapter 14)

- Greedy Algorithms (Chapter 15)
- Randomized Algorithms (see class notes, Chapter 5, Section 9.2)
- Basic Graph Algorithms and Minimum Spanning Trees (Chapters 20, 21)
- Shortest Paths (Chapters 22, 23)
- Network Flows (Chapter 24)
- String Matching (Chapter 32)
- NP-Completeness (Chapter 34) and Approximation Algorithms (Chapter 35)

Culture and Environment

All of you are becoming professional computer scientists. I want all students to succeed, regardless of race, gender, ethnicity, preconceptions, personality, or learning style. I use a variety of techniques to engage active learning. For this to work, your participation is necessary! You will be asked to think about questions on your own, write down answers, consult small groups, and share your answers with the class. Sometimes, you may be asked to come and write on the board. My goal is to give you each enough time to think through things before being put on the spot. Don't hesitate to provide feedback about the structure of the class, activities, or group dynamics.

Communication

The course website is on Canvas. There you will find all supplemental materials (handouts, lecture notes, and links to any uploaded recordings) and due dates for homework. I import the previous course offering at the start of the quarter; because of this, due dates may change.

I will use Canvas for class announcements, distributing assignments to you and collecting assignments from you. **Please do not message me through Canvas, instead send email to my university email kameron.harris@wwu.edu. I expect you to read email daily Monday to Friday, and I keep the same schedule.** I will be available in office hours and any time my door is open you are welcome to drop in. However, if my door is closed please do not interrupt.

Assessment and Grading

Homework	50%
Quizzes	15%
Midterm	15%
Final exam	15%
Participation	5%
Total	100%

To map your total score to a letter grade, I use the normal ranges 90-100% = A, 80-89% = B, ..., <60% = F. Use of +/- is at my discretion.

Assignments

The homework assignments are primarily written work of two types: problem sets and essays. Essays consist of expository writing and arguments about the applications of algorithms to society. The problem sets have you solve puzzles related to the concepts introduced during lectures and readings. You must turn in the work on Canvas at the specified due time. Your overall grade displayed in Canvas may be inaccurate; refer to the percentages above.

- No late submissions will be accepted without prior agreement except in cases of hardship.

- All work must be typed. You do not need to use LaTeX.
- Show your work when you answer questions. This applies to the answers you submit for participation, quizzes and exams as well. An answer alone will not get you full credit. Clarity and organization of presentation count. Illegible answers will lose points. **See the rubric.**
- You will be given ample time to work on your assignments.
- Please talk to me *in advance* if you need special accommodation. Emailing me the day the homework is due is not acceptable.
- Essays are graded on the quality of writing, both in the coherence of the argument and style.
- I reserve the right to assign work during the week before finals.

Group Work

Teamwork is allowed on the problem sets unless it is explicitly an individual assignment or problem. Working in groups is one of the best ways to learn from each other. An ideal group size is 3 people, since it's hard for everyone to contribute in large groups. Each student must write up and submit their own answers to the assignment, with all group members listed. That means you may discuss the steps in an algorithm or mathematical argument on a whiteboard, but write math or pseudocode yourself. Don't copy-paste from others, the internet, or discord.

Always list your group members or explicitly state "I worked alone," or you will lose points.

Participation

Showing up for class is expected. Lack of attendance will negatively affect your grade.

The following is a list of example activities that can count as participation:

- in-class activities and worksheet completion
- office hour visits
- reflection on your learning shared with me (self-assessment)
- suggestion to improve our teaching and learning

Quizzes

Quizzes will be given in class roughly every 2 weeks (3 total).

- You are allowed printed/handwritten notes, limit 3 pages front and back.
- No make-up quizzes will be given, so you must attend.
- Please talk to me in advance about any DAC accommodations or if you have other needs.

Exams

The midterm will be in-class and take an entire class period (50 minutes). The final exam will take place at the scheduled time in the classroom (2 hours). For both of these, you will be allowed 4 pages of printed/handwritten notes front and back.

Revisions and grade disputes

If you have any questions about a grade you received on homework or an exam, return the homework or exam to me (please do not contact the grader) with written questions within 48 hours of the time the graded work is returned to you. You will never lose points for disputing a grade. You are allowed to revise your work *at my discretion*. In general, revisions are not allowed, but if you are experiencing significant hardship, I will work with you to help you succeed.

Policies

Artificial Intelligence Policy

Use of any artificial intelligence (AI) tools including large language models or chatbots such as ChatGPT, Bard, etc. are allowed for problem-solving on problem sets. You do this at your own peril: If you rely heavily on these you will struggle in quizzes and exams. You are responsible for understanding the answers you give on assignment. You must still write your own answer in your own words.

AI tools are entirely forbidden for any essays. If you are an English language learner and find these very helpful, I may be willing to work with you on an exception.

Always indicate if you have used an AI tool; tell me which tool was used.

In-class Behavior, Norms, and University Policies

In this course, you should act professionally, respectfully, and maturely. Do not distribute any course materials outside the class. Do not sell or distribute in any way questions or answers to any assignment, quiz, or exams.

Please review the University policies outlined at <http://syllabi.wvu.edu> regarding:

- Accommodations (please contact me within the first 2 weeks of class about these)
- COVID-19
- Ethical Conduct with WWU Network and Computing Resources
- Equal Opportunity
- Medical Excuse Policy
- Student Conduct Code

Academic Honesty

All Western Washington University students have an obligation to fulfill their responsibilities as members of an academic community. Academic integrity is demanded; moreover, violations of the academic honesty policy at Western are serious infractions dealt with severely. No student shall claim as his or her own the achievements, work, or arguments of others, nor shall he or she be a party to such claims. It is the instructor's responsibility to confront a student and to take appropriate action if such academic dishonesty has occurred. See [Appendix D: Academic Honesty Policy & Procedure](#) of the catalog for examples, procedures, and methods of appeal and [Academic Honesty Resources for Students](#) for appeal rules and timeline.

Disruptive Behavior Clause and Classroom Conduct

I am committed to maintaining an inclusive, supportive, and professional environment in all academic settings including lectures, labs, and course-related online spaces. Students are expected to live up to the [ACM Code of Ethics and Professional Conduct](#). This is the ethical code adopted by nearly every software professional. A pattern of failure to follow the ACM Code of Ethics and Professional Conduct can negatively affect course grades up to and including a failing grade for the course. Conduct is also considered when determining admission to the major.