

Syllabus

CS 3240B, Algorithm Design and Analysis, 3 credit hours

Instructor: Byung S. Lee; email: bslee@uvm.edu; office hours: 1:00 pm – 2:00 pm TTh until February 8 and 2:00 pm – 3:00 pm TTh from February 9, E429 Innovation (in person) or Microsoft Teams (live call or private chat; send a chat message to the instructor).

Teaching Assistants:

- Drew Jepsen, GTA; email: Christopher.Jepsen@uvm.edu; office hours: 5:00 pm – 6:30 pm MW online on Microsoft Teams. Email to the GTA if an in-person meeting is needed.
- Erik Arnold; email: Erik.Arnold@uvm.edu; office hours: none.
- Jeff Cooper; email: Jeff.Cooper@uvm.edu; office hours: none.
- Maddie Kosten; email: Madeline.Kosten@uvm.edu; office hours: none.
- Jai Veilleux; email: Jai.Veilleux@uvm.edu; office hours: none.

The graduate TA (GTA) is the lead TA of this class, holding office hours and coordinating grading within the teaching team. Grading will be done on a rotation basis so that different TAs will grade different students' assignments for different homework assignments.

Pre-requisite (required): Familiarity with data structures and elementary algorithms.

Course Description

The purpose of the course is to study how to design and analyze computer program algorithms to solve real-world problems. The course will begin with a review of the concept of algorithm complexity and basic graph algorithms; and then cover algorithm design approaches such as greedy, divide and conquer, and dynamic programming; then, a network flow problem will be introduced and algorithm design by reduction to a network flow problem will be discussed; then, the notion of problem reduction will be used to discuss and prove the computational intractability (i.e., hardness) of a problem; time permitting, approaches to handling intractable problems, such as approximation algorithms and local search algorithms, will be discussed as well.

Course Learning Objectives

After completing this course the student will be able to abstract a real-world problem to a computational problem and design an algorithm to solve the problem computationally and analyze its running time and storage space complexities.

Pedagogy

There will be balanced emphasis on both theory and practice. Theory requires rigorous thinking and practice requires intuition and experience. The level of difficulty is medium to high for a majority of students, and the course is designed mostly for upper class undergraduate students.

The course will be structured as a sequence of lectures accompanied by weekly written assignments. Additionally, there will be programming assignments, which are meant to give hands-on coding experiences of algorithms studied in class.

Required Course Materials

Textbook: Jon Kleinberg and Eva Tardos, Algorithm Design, Addison Wesley. Some of homework exercises will be based on textbook exercises. (*Reading:* Sections 2.1 – 2.2, 3.1 – 3.6, 4.1 – 4.2, 4.4 – 4.6, 5.1 – 5.4, 6.1 – 6.4, 6.6 – 6.9, 7.1 – 7.3, 7.5, 7.7-7.8, 7.10, 8.1 – 8.5, 8.9, 11.1 – 11.2, 11.4, 11.6, 11.8, 12.1 – 12.3, 13.1 – 13.3, subject to change as the course progresses.)

This textbook has been adopted for its coverage of intuitive and practical aspects of algorithm design. The authors made a good selection of problems in each topic, and in this course we will make further selection from those problems that are deemed more important than those not selected and are practically useful for students in their career.

Brightspace

Brightspace will be used for all written correspondences between the teaching team and the class students. Brightspace will also be used to post and collect all homework assignments – both written and programming. No email submission will be accepted, with no exception. Lecture slides used in class and video recording of lectures will be posted on Brightspace as well.

Attendance Expectations and Remote Teaching Accommodations

Full attendance of all lecture classes with full attention is expected. Frequent absences from class without prior excuse will be subject to an academic warning.

Grading Criteria/Policies

Components: weekly homework assignments (95%) and attendance (5%).

Late submission policy on homework: 10% grade deduction per day (i.e., 24 hours) after the deadline. Weekend days and holidays are counted as regular days.

One homework with the lowest grade will be dropped from consideration.

Grading scheme: an absolute grading system. Total points accumulated from all coursework components are translated to letter grades according to the following distributions.

- A+ ($\geq 95\%$), A ($\geq 90\%$), A- ($> 85\%$), B+ ($\geq 80\%$), B ($\geq 75\%$), B- ($\geq 70\%$), C+ ($\geq 65\%$), C ($\geq 60\%$), C- ($\geq 55\%$), D+ ($\geq 50\%$), D ($\geq 45\%$), D- ($\geq 40\%$), F ($< 40\%$).

Assessments (Graded Work)

Written homework: 13 written homework assignments, assigned weekly except the first week, the Spring break week and the last week of classes. Each written homework will typically contain

two exercises, where each exercise can address such aspects as concept, algorithm design, algorithm analysis (e.g., run time complexity), algorithm tracing, and theoretical proof (e.g., algorithm correctness); occasionally research exercises (wherein students are asked to study some topics on their own) may be included as well. Submission deadline will be typically 11:59 pm one class-week from the day of assignment. Answer keys are discussed or distributed after seven days from each assignment's deadline, and no submission is accepted after that.

Many resources can help you with the homework, including the internet, the instructor, and GTA (during office hours or by appointment), your textbook, and your classmates. That said, your program codes and written responses must be your own; write them yourself and cite the sources of the ideas you use. If you use the internet, be careful, as many sources are unreliable and provide incorrect information; you are responsible to judge the quality of the information there.

Programming homework: five programming assignments, about biweekly starting from the second week of the semester. Each programming homework will contain one exercise, the objective of which is to practice writing codes implementing algorithms studied in class. Submission deadline will be typically 11:59 pm one and a half class-week from the day of assignment. All programming must be done in Java, which is a pedagogical programming language expected of every student. All program codes must be formatted, organized, and commented for ease of reading; program code with no comment and hard to read will lose significant points. It is important for the program code to work exactly as specified in the assignment; code that is not working as specified will lose most of the points.

Attendance: there will be 1% of semester grade deducted for each absence without a prior excuse (so five unexcused absences will result in zero attendance grade); this deduction will be waived up to two absences without prior excuse; any more absence beyond the two will require an official letter (emails accepted) from a recognized university office, such as the student services, health services, athletic coach/director, and dean's office.

Course Evaluation

All students are expected to complete an evaluation of the course at its conclusion. The evaluations will be anonymous and confidential, and the information collected, including constructive criticisms, will be used to improve the course.

Tips for Success

Homework grades collectively constitute the entire semester grade in this course, so work diligently every week to meet the deadline; start early – the best time will be as soon as the homework is posted on Brightspace.

Lectures will make much use of slides for the sake of timely course pace. Copies of lecture slides will be posted after the class, not before, especially when there are slides animated for in-class discussion or exercise.

Students are encouraged to form a study group to discuss homework exercises within the boundary of academic honesty, that is, no copying from others' work. It is understood that group

discussions may take place virtually with screen sharing. Please honor the academic integrity code (below) and never share screen showing your or someone else's answers.

Student Learning Accommodations

In keeping with the University policy, any student with a documented disability interested in utilizing accommodations should contact SAS, the office of Disability Services on campus. SAS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated to faculty in an accommodation letter. All students are strongly encouraged to meet with their faculty to discuss the accommodations they plan to use in each course. A student's accommodation letter lists those accommodations that will not be implemented until the student meets with their faculty to create a plan.

SAS contact: A170 Living/Learning Center; 802-656-7753; access@uvm.edu; www.uvm.edu/access

Religious Holidays

Students have the right to practice the religion of their choice. If you need to miss class to observe a religious holiday, please email the dates of your absence to the instructor by the end of the second week of classes. You will be permitted to make up work within a mutually agreed-upon time. <https://www.uvm.edu/registrar/religious-holidays>

Academic Integrity

Refer to the University policy addresses collusion, cheating, plagiarism, and fabrication. <https://www.uvm.edu/policies/student/acadintegrity.pdf>. In particular, all work submitted for credit must be your own. You may discuss your homework assignments with your classmates, GTA, and the instructor. However, you should write up solutions on your own and should not read or copy the solutions written by others in this or previous terms.

The UVM policy on sources also applies to this course, which means that all sources must be acknowledged, whether allowed by the instructor or not. For example, software given to you by others must be acknowledged when incorporated into your work, and discussions with classmates should be acknowledged. In addition, do not leave your assignments, written documents or codes or anything else, in a public domain. If you want to use online repositories, UVM gitlab (<https://gitlab.uvm.edu/>) is recommended for better privacy protection. Protect all files in the repository with password.

Using online sources on the internet that allegedly provide "solutions to problems", such as Chegg.com, is allowed only within a strict restriction of using the solutions as study material. Specifically, the following actions are subject to academic sanction as violation of academic integrity.

- Posting homework exercise or exam problem obtained from your class to the Internet site is an act of collusion.
- Asking for a solution on the Internet site is an act of cheating.

- Copying part or all of an answer found on the Internet site without accurate citation is an act of plagiarism.

Using an AI-content generator (such as ChatGPT) to complete coursework without proper attribution or authorization is a form of academic dishonesty.

Grade Appeals

For grade appeals of homework assignments, send an email to the head TA and copy it to the instructor. If necessary, the head TA will forward the email to the grading TA and have it resolved; in case of difficulty in resolving the issue, the instructor will help to have it resolved in a timely manner. Refer to the grading guidelines document (posted on Brightspace) before submitting a grade appeal.

If you would like to contest a semester course grade, please follow the procedures outlined in this policy: <https://www.uvm.edu/policies/student/gradeappeals.pdf>

Grading

For information on grading and GPA calculation, go to <https://www.uvm.edu/registrar/grades>

Code of Student Conduct

<http://www.uvm.edu/policies/student/studentcode.pdf>

FERPA Rights Disclosure

The purpose of this policy is to communicate the rights of students regarding access to, and privacy of their student educational records as provided for in the Family Educational Rights and Privacy Act (FERPA) of 1974.

<http://catalogue.uvm.edu/undergraduate/academicinfo/ferparightsdisclosure/>

Promoting Health & Safety

The University of Vermont's number one priority is to support a healthy and safe community:

- Center for Health and Wellbeing: <https://www.uvm.edu/health>
- Counseling & Psychiatry Services (CAPS): <https://www.uvm.edu/health/CAPS>
- C.A.R.E. If you are concerned about a UVM community member or are concerned about a specific event, we encourage you to contact the Dean of Students Office (802-656-3380). If you would like to remain anonymous, you can report your concerns online by visiting the Dean of Students website at <https://www.uvm.edu/studentaffairs>

Statement on Alcohol and Cannabis in the Academic Environment

As a faculty member, I want you to get the most you can out of this course. You play a crucial role in your education and in your readiness to learn and fully engage with the course material. It is important to note that alcohol and cannabis have no place in an academic environment. They can seriously impair your ability to learn and retain information not only in the moment you may be using, but up to 48 hours or more afterwards. In addition, alcohol and cannabis can:

- Cause issues with attention, memory and concentration
- Negatively impact the quality of how information is processed and ultimately stored
- Affect sleep patterns, which interferes with long-term memory formation

It is my expectation that you will do everything you can to optimize your learning and to fully participate in this course.