

CIS 303 Algorithm Analysis and Design

Dr. Laura Grabowski

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Contact Information:

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Office Hours (Dunn 303):

MWF 11-11:50 AM

Tue 9-10:30 AM

and by appointment, or drop in

Class Meeting Information:

MWF 10:00 AM — 10:50 AM, Dunn 206

Catalog Description

Analysis and design of algorithms on data structures, including algorithms for processing graphs, trees and strings. Introduction to the theory of algorithm complexity. Prerequisites: CIS 205 and 300.

Learning Outcomes

The Computer Science department has adopted five Program Student Learning Outcomes for students completing an undergraduate major or minor in the department. These learning outcomes map to the undergraduate computer science curricula outlined by the Association for Computing Machinery (ACM) and the Computing Accreditation Commission (CAC) of the Accreditation Board for Engineering and Technology (ABET). Each course in the curriculum is designed to address particular outcomes so that the overall curriculum fulfills our goal of producing capable computer scientists. The outcomes serve as a rubric for evaluating the learning that happens in this class.

Student Learning Outcomes for CIS 303

Student Learning Outcomes are the knowledges, concepts, and skills that will be tested to assess what you learned in the course.

1. Explain the meaning and importance of the upper bound (O), lower bound (Ω), and tight bound (Θ) with respect to the runtime behavior of algorithms. (Understanding)
2. Derive and provide mathematical analysis of the bounds for the algorithm implemented by specified source code, for both recursive and non-recursive algorithms. (Applying)

3. Given specific constraints, students will select appropriate data structures for a given application and justify their choices. (Evaluating)
4. Students will analyze and explain results of experiments that test the behavior of algorithms or data structures. (Evaluating)

Program Student Learning Outcomes

The above course objectives integrate with the following Computer Science Program Student Learning Outcomes.

- Solve problems through analysis and implementation of tested programs that use data structures and algorithms.
- Apply logic and mathematical proof techniques to computing problems, including computability, formal languages, and complexity of algorithms.

Required Materials

- Textbook: Shaffer, C. (2013). *A Practical Introduction to Data Structures and Algorithm Analysis in Java*, 3rd Edition. Dover Publications. Available free online here: <https://people.cs.vt.edu/shaffer/Book/> and in Brightspace.
- Supplementary videos, slides, assignment materials, and other helpful materials are available in Brightspace.
- Software: You do not need to install any software on your own computer in order to do the assignments for this course. All necessary software is installed in the CS Lab (Dunn 302). If you wish to work on your own machine, you will need access to the following software.
 - Browser
 - Java 17 (JDK 19.0.2), <https://www.oracle.com/java/technologies/javase/jdk19-archive-downloads.html>
 - Git version control, <https://www.git-scm.com/downloads>
 - L^AT_EX client, or use an online tool such as <https://www.overleaf.com/>
 - Plain text editor (for README files)
 - A spreadsheet program for data analysis and plotting, or an online tool such as Google Sheets

General Course Information

- Midterm Exams Dates
 1. Midterm 1: Wednesday, February 21
 2. Midterm 2: Friday, March 29
- Final Exam Date: Monday, May 13, 10:15 AM – 12:15 PM, Dunn 206

- I will NOT allow you to take the final at a different time, except in exceedingly extenuating circumstances and as dictated by university policy. Please note, in particular, the following: “No student will be required to take more than two examinations in one day. If a student has more than two examinations scheduled in one day, the middle examination(s) must be rescheduled if the student requests. **A student must request rescheduling two weeks before the last day of classes**” [emphasis mine]. Please refer to <https://www.potsdam.edu/about/offices/registrar/final-exam-schedule> for more information. Please note that it may not be possible to find an alternate time for the final exam if the request is made less than 2 weeks before the scheduled exam date/time.
- Lecture topics, activities, and assignment due dates: See the Tentative Schedule (posted in Brightspace) for lecture topics, activities, and assignments. Please note that this schedule is tentative and is subject to change. Students will be informed of schedule changes in lecture and through Brightspace.
- Other important dates
 1. Last day to withdraw or elect S/U/P: Friday, March 29.
 2. See the university website for additional calendar information, <http://www.potsdam.edu/academics/calendar>.

Course Requirements and Grading Procedure

Course Requirements

- Distribution of your grade: I will grade your course work using the distribution shown below.
 - 35% — Assignments: Problems and Programming/Empirical assignments
 - 15% — Quizzes and In-class Assignments
 - 25% — Midterm Exams (2)
 - 25% — Comprehensive Final Examination
 - Grades will be visible to you in the grades tool in Brightspace. Please be aware that Brightspace shows only the grade based on completed work and so can be somewhat misleading about your ultimate performance in the course.
- Reading: Each week, you are assigned reading from the textbook. Reading the chapter material ahead of class discussion will help you understand the concepts and examples and will prepare you for class. There may also be videos that you are assigned to watch before class, which will be treated as reading.
- Brief explanation of graded assessments:
 - **Assignments: Problems.** Problems assignments will be similar to example problems from lecture and in the textbook. Problems assignments provide practice applying the algorithm analysis tools in a directed, focused context and will prepare you for the midterm and final exams.
Problems and analyses must be typeset using L^AT_EX. I will provide some templates and other resources to help you get started. I will NOT accept word-processed assignments in place of assignments done in L^AT_EX.

* IMPORTANT NOTES ON PROBLEMS SUBMITTED FOR GRADING:

- As noted above, problems must be typeset using L^AT_EX. I will not accept hand-written or word-processed assignments.
 - You are permitted to draw figures by hand, but they **MUST** appear inline in the printed document. That is to say, take a photo of your hand-drawn figure and insert it in the document as a figure.
 - **You are expressly forbidden from submitting solutions downloaded from the Internet as a solution for homework problems..** This will be considered cheating and will be cause for initiating a case with Student Conduct.
- **Assignments: Programming/Empirical.** Developing skills for empirical testing and analysis for Computer Science is an important aspect of this course. The empirical assignments will involve running experiments, analyzing results, and writing a formal lab report. Some assignments will include programs that you write, some will use code that I give you, some will use a mix of code that I provide and code that you write. Any code that you turn in for a grade must be your own and must adhere to the notes given below as well as constraints or restrictions within the assignment. Lab reports must be typeset using L^AT_EX; I will give you a template for lab reports. You must also turn in data and analysis files, as per current best practices in Computer Science research, and a README file. Details of files to submit and the README requirements are provided elsewhere.

* IMPORTANT NOTES ON PROGRAM CODE SUBMITTED FOR GRADING:

- Assignment source code will be submitted through Brightspace.
 - Code **MUST** be properly commented (see the handouts, “Coding Standards” available in Brightspace).
 - If assignments appear to have arisen from the same source (including online sources) or from excessive collaboration, the code will be subject to a code review that includes examination by the instructor, other Computer Science Faculty, and anti-plagiarism software. For more information, please see “Academic Integrity,” below.
 - **You are expressly forbidden from submitting code downloaded from the Internet as a solution for homework problems. All code you submit must be of your own design and implementation.** The only exception to this rule is code that I have given you to use for an assignment.
 - **Code that does not compile will receive a grade of 0 and no additional evaluation.** It does not matter why your code does not compile. It is your responsibility to submit the code you intend to submit. Code must compile on the CS Lab machines using Java 17, the current Department standard. If you are developing on your own machine, you must ensure that you are using the specified Java version.
 - **Code that has no comments will receive a grade of 0 and no additional evaluation.**
- **Use of AI in the Computer Science Classroom.** Please see the separate document, “Appropriate use of AI in the Computer Science Classroom”, for the current Computer Science Department policy regarding use of AI tools in CS classes and assignments. This policy applies to all graded work in this course.

- **Midterm Exams (2).** There will be two (2) midterm exams, each covering approximately 4 – 5 weeks of course material. The dates for the midterms are listed above (see “Midterm Exams Dates”), in the tentative course calendar, and on the course Brightspace page.
- **Comprehensive Final Examination.** There will be a comprehensive/cumulative Final Exam administered during the final exam time assigned by the university. The exam will include all material covered in the course. The date and time for the final are listed above (see “Final Exam Date”), in the tentative course calendar, and on the course Brightspace page.

Grading Procedure

Within each grading area shown in the breakdown above, the overall grade for that area will be computed as the “simple mean” in Brightspace. That means that the relative weight of an assignment is determined by the point value of the assignment. Generally speaking, an assignment worth 25 points carries less weight than one worth 35 points in the same grading area. Point values for assignments are intended to reflect the relative difficulty, importance, or effort of an assignment.

Your course-grade average (on a scale of 0 — 100%) will be then calculated as the weighted average of your averages on each area using the weight distribution that is listed above. Final grades are determined according to the scale shown following, subject to scaling at the discretion of the professor.

4.0: 95 — 100%	2.7: 77 — 79%	1.7: 67 — 69%
3.7: 90 — 94%	2.3: 73 — 76%	1.3: 63 — 66%
3.3: 85 — 89%	2.0: 70 — 72%	1.0: 60 — 62%
3.0: 80 — 84%		0.0: < 60%

NOTE: The actual scale used may be adjusted according to the performance of the class as a whole, again at the professor’s discretion. In borderline cases, attendance, class participation, and completion of assigned work will be used to make a decision on the course grade.

Grades will be visible to you in the Gradebook tool in Brightspace. Please be aware that Brightspace shows only the grade based on completed work and so can be somewhat misleading about your ultimate performance in the course.

Course Policies

Attendance

My expectation is that you will prepare for and attend class. I am generally flexible when circumstances dictate that you must miss class (illness, emergency). Should such a circumstance arise, you need to contact me as soon as possible. Please note that class absence does not automatically change any due date, nor does it automatically ensure a makeup for in-class work that is missed. This course is being delivered *in person*; there is not a virtual delivery option for this course. I will not “Zoom you in” if you cannot attend class. It is your responsibility to get class notes from another student.

More on class engagement

We are in a professional community of computer scientists. As professionals, we are expected to:

- show up on time;
- be prepared for our collective work;
- be appropriately attired; and
- limit distractions during class (please see especially the following section, “Electronics in Class”).

As members of a community, please consider the effects of your actions on your colleagues. Please see details about our department Code of Conduct later in this document.

Electronics in Class

Unless you have a documented accommodation from the Accommodation office, you may not use electronics during class. This includes your phone, laptop, tablet, and headphones. While I am aware that some students take electronic notes, there is a high risk that devices may be used for non-class activity during class. In addition, there is an abundance of cognitive science and learning research that show that taking notes by hand enhances memory, recall, and overall learning. Typing notes does not have these effects. If you are using a device during class without permission, I will ask you to put it away. Please ensure that you can store your devices appropriately during class.

Accommodation of Religious Observances

I will make reasonable accommodation for a student’s religious beliefs. Please notify me within the first week of classes about any scheduled class date that conflicts with a religious observance.

Course Withdrawal

The last day to drop a semester course without receiving a grade or to elect S/U/P is Friday, March 29. For other important dates, see the Academic Calendar, <http://www.potsdam.edu/academics/calendar>.

Brightspace Page and Gitea

All the information and content for the course will be distributed through the course Brightspace page or the class Gitea organization. I expect that you will check Brightspace daily for updates and announcements. Announcements posted in the Announcements in Brightspace will automatically be sent to your Potsdam email, so you must also check your email daily. If you have schedule questions, please look in Brightspace first, before you send me an email. Brightspace is where all class materials, assignment grades, *etc.* will be posted. Programming assignment materials will be distributed and turned in through Gitea.

Grading Policies

Extra Credit

There is none. No special arrangements will be made for extra credit for improving grades.

Exam Make-ups

You must give me prior notice if you must miss an exam. No make-ups will be granted unless satisfactory documentation is produced to show an extenuating circumstance.

Grading Questions

If you have a question about a grade, you must (1) wait 24 hours after receiving the grade before contacting me, and (2) send me an email with the request and your rationale for requesting the regrade within one week of the day the graded work is returned to you. You lose the right to regrading after that time. Arithmetic errors in scoring are exceptions to the regrading policy, since they are simple errors of fact. You may bring arithmetic errors in scores to my attention at any time before/after class or in office hours. I will then make the appropriate correction.

Missed Assignments

Completing all assignments is critical to your understanding and success in this course. Failure to submit assignments will both hamper your performance on midterms and the final and have a severe negative impact on your course grade.

Late Assignments

Assignments have a due date: a date and a time. Assignments turned in at or before that time are considered *on time*. Assignments turned in after that time (by any amount of time) are considered *late*. Late assignments will be accepted according to the following policy. You will be allowed to turn in no more than 2 assignments up to 72 hours late, with a 20% grade penalty. To qualify for a late submission, you must:

1. Notify me through email of your intention to turn in a late assignment **before** the assignment deadline.
2. Push all assignment files to Gitea within 72 hours of the posted due date/time of the assignment. The submission time and date will be the Gitea time stamp.

No additional late assignments will be accepted. Please note that these are NOT extensions (see section below).

Brightspace may shut down submission at the time the project is due. Brightspace might not keep exact time with your local timepiece. Brightspace's clock is considered correct. (Don't cut it too close.)

Notes on assignment deadlines:

- I strongly encourage you to avoid missing assignments. There is an assignment due nearly every week (except weeks when there is an exam). Falling behind in the assignments will have a highly deleterious effect on your learning and success in the course.
- **Extensions:** In the general case, I do not give individual extensions for assignments. The late assignment policy described above is intended to remove the need for individual extensions on assignments. Please note that poor time management is not a valid reason to request an extension. I will consider extensions only in exceptional circumstances.

Incomplete Grades

Incomplete grades (Inc) are granted rarely. Incompletes are not to be used as a shelter from potentially low grades. An incomplete grade may be reported for you only when the following conditions are satisfied (SUNY Potsdam Undergraduate Catalog):

1. The student has requested an incomplete.
2. Course requirements have not been completed for reasons beyond the student's control (e.g., illness or family emergency).
3. The student has completed the majority of the work for the class, and the student can accomplish the remaining requirements without further registration.

Please note also that you must be passing the course in order to request an Incomplete.

Academic Integrity and Honesty

You are expected to follow the "SUNY Potsdam Academic Honor Code" (SUNY Potsdam Undergraduate Catalog) by doing your own work on all required work for the course unless specifically directed otherwise by the professor. Copying is strictly forbidden. Students caught cheating will receive a grade of 0 for that evaluation and the initiation of a case with Student Conduct. Such a case may result in disciplinary sanctions by the university. Academic Misconduct definitions, procedures, due process, and student rights are described in the SUNY Potsdam Undergraduate Catalog.

Please see the separate document, "Appropriate use of AI in the Computer Science Classroom", for the current Computer Science Department policy regarding use of AI tools in CS classes and assignments. This policy applies to all graded work in this course.

You are expressly forbidden from submitting any solutions you find online for credit in assignments. This includes code (as mentioned above), proofs, AI-generated documents and code (as outlined in the above-mentioned policy document), and other problem solutions. All empirical analysis must be based on data that you collected yourself. Any violation will be considered cheating and dealt with as described in the first paragraph of this section.

Accommodative Services

If you have special needs that must be accommodated to fulfill the course requirements, you must notify the professor and Accommodative Services, 111 Sisson Hall, 267-3267 (more information at <https://www.potsdam.edu/studentlife/support/accommodative-services>). The university has resources available to assist qualified students with their academic studies. Please note that the professor is not able or qualified to determine what accommodations are necessary and appropriate. That task must be accomplished by the Accommodative Services staff. **It is up to the student to initiate the process with Accommodative Services.**

Course Schedule

The schedule shown below is tentative and subject to change. Changes will be announced in class and through the course Brightspace page.

CIS 303 Tentative Schedule:

Week starting	Week	Topics	Reading**	Assignment due
22-Jan	1	Course Intro; Ch. 1 Data structures and algorithms Review of basic algorithm analysis	Ch. 1 Ch. 2.1 – 2.3; 2.6	Problems 1: Review of Big-O and ADTs
29-Jan	2	Representation and stored program concept Ch. 2. Mathematical Prelims. (2.4 – 2.5)	Ch. 2.4 – 2.5	Program 1: Review of Lists and basic algorithm analysis
5-Feb	3	Recurrence relations Ch. 3 Alg. Analysis (3.1 – 3.4)	Ch. 3.1 – 3.4	Problems 2: Math-y Things and Representation
12-Feb	4	Ch. 3 Alg. Analysis (3.5 – 3.11)	Ch. 3.5 – 3.11	Problems 3: Algorithm analysis
19-Feb	5	Ch. 3 Alg. Analysis Midterm 1, Ch. 1, 2, 3 – Wed Feb 21 Winter Recess: No classes Thu-Fri Feb 22-23		Midterm prep
26-Feb	6	Ch. 4 Lists, Stacks, Queues	Ch. 4.1 – 4.4	Problems 4: Lists and related structures
4-Mar	7	Ch. 5 Binary Trees (5.1 – 5.3)	Ch. 5.1 – 5.3	Program 2: Lists, Stacks, and Queues
11-Mar	8	Ch. 5 Binary Trees (5.4 – 5.5)	Ch. 5.4 – 5.5	Problems 5: Binary Trees 1
18-Mar	9	Ch. 5 Binary Trees Ch. 13.2.1 AVL Trees	Ch. 13.2.1	Problems 6: Binary Trees 2
25-Mar	10	Ch. 7 Internal Sorting Midterm 2, Ch. 4, 5, 7 – Fri Mar 29	Ch. 7.1 – 7.3	Midterm prep
		Spring Break		
8-Apr	11	Ch. 7 Internal Sorting	Ch. 7.4 – 7.9	Program 3: Trees
15-Apr	12	Ch. 9 Searching	Ch. 9.1 – 9.4	Program 4: Sorting with Lists
22-Apr	13	Ch. 9 Searching Ch. 11 Graphs (11.2 – 11.3)	Ch. 11.1 – 11.3	Problems 7: Sorting and Searching
29-Apr	14	Ch. 11 Graphs (11.4 – 11.5)	Ch. 11.4 – 11.5	Problems 8: Graphs
6-May	15	Ch. 17 Limits to Computation	Ch. 17.1 – 17.2	Program 5: Graphs
13-May		Final Exam (Comprehensive/Cumulative): Mon May 13, 10:15 AM – 12:15 PM		

** Some sections of the textbook will be skipped in lecture, and others omitted entirely. In addition, some topics are not covered by the textbook. I will provide lecture slides and additional resources for those topics. I may assign additional readings and videos from other sources as appropriate.

See <https://www.potsdam.edu/academics/calendar> for important dates for Spring 2024.

SUNY Potsdam Department of Computer Science Code of Professional Conduct

All members of the Potsdam Computer Science community are governed by the ACM Code of Ethics and Professional Conduct, <https://www.acm.org/about-acm/acm-code-of-ethics-and-professional-conduct>, which we have distilled into our SUNY Potsdam Department of Computer Science Code of Professional Conduct (see below). The department faculty are committed to modeling and promoting ethical and professional behavior for all our students.

1 Preamble

All members of the ACM, including the Computer Science faculty of SUNY Potsdam, are committed to ethical professional conduct as specified in the ACM Code of Ethics and Professional Conduct. Students, taking courses from the faculty, are bound by our commitment.

All members of the Department are obliged to remind one another to behave professionally. Violations should be reported promptly; however, capricious or malicious reporting of violations is, itself, a violation. When reporting, bring all relevant aspects of the incident to the faculty's attention.

2 Moral Imperatives

As a Computer Science student I will...

2.1 Respect all members of the Department.

1. Be professional in face-to-face and electronic interactions.
2. Be fair so everyone is free to work and learn.
3. Be active in preventing discrimination in physical and electronic spaces frequented by Department members.

2.2 Accept and provide appropriate feedback.

1. Avoid starting or spreading rumors.
2. Respect confidentiality.

2.3 Be honest, trustworthy, and respect intellectual property.

1. Only take credit for my own work.
2. Respect the privacy of others.
3. Access computing resources only when authorized and report any access risks discovered.

2.4 Contribute to society and human well-being.

1. Improve public understanding of computing and its consequences.
2. Consider both the direct and indirect impacts of my actions.

Student Support

Caring Community

I recognize that many factors within and outside our university community continue to be stressful for you, your peers, and our community. Please know that there are resources available to you, both on and off campus, to support you during these very uncertain times. Our excellent Counseling Center staff are available to meet with you; more information can be found on their FAQ page accessed at: <https://www.potsdam.edu/studentlife/wellness/counseling-center/coping-covid-19-pandemic/counseling-center-faqs>. In addition, information on a variety of on- and off-campus resources can be found on our Bear Care site: <https://www.potsdam.edu/studentlife/wellness/bear-care>. You are an incredibly important member of our Potsdam community; please take care of yourself, and each other.

More information about various Student Support services may be found at: <https://www.potsdam.edu/studentlife/support>.

Professor's Note: The Provost has requested that the following information be included in course

syllabi. The following information is presented without modification except to format it for L^AT_EX.

Every student in this class is a valued individual. If you are struggling with issues outside of the classroom, please know that there are professionals both on and off campus who can assist you. If you need immediate assistance, please contact our campus Counseling Center (with free counseling) at (315) 267-2330 or visit their website. Links to other resources are provided below:

Andrea Waters, Title IX Support Staff & Title IX Core Team

- Sisson 244. (315) 267-2350
- <http://www.potsdam.edu/offices/hr/titleix>

Bias Incident Reporting

- <http://www.potsdam.edu/about/diversity/biasincident>

Center for Diversity

- 223 Sisson Hall
- (315) 267-2184
- <http://www.potsdam.edu/studentlife/diversity>

University Police

- Van Housen Extension
- (315) 267-2222 (number for non-emergencies; for an emergency please dial 911)

Student Conduct and Community Standards

- 208 Barrington Student Union
- <http://www.potsdam.edu/studentlife/studentconduct/codeofconduct>

Reachout (24-hour crisis hotline)

- (315) 265-2422

Renewal House (for victims of domestic violence)

- SUNY Potsdam Campus Office: Sisson 217 (open Wednesdays, 9-5:00)
- (315) 379-9845 (24-hour crisis hotline)
- Email: renewalhouse@verizon.net

And please: if you see something, say something. If you see that someone that you care about is struggling, please encourage them to seek help. If they are unwilling to do so, Care Enough to Call has guidelines on whom to contact. Everyone has the responsibility of creating a college climate of compassion.