

CS 340 - Analysis of Algorithms

Fall 2026

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This course will cover qualitative and quantitative analysis of algorithms and their corresponding data structures from a precise mathematical point of view. Topics include: performance bounds, asymptotic analysis, correctness and complexity. Particular classes of algorithms will be studied in detail, including greedy, divide-and-conquer, dynamic programming, networkflow, NPC and approximation algorithms.

Textbook

Required: Algorithm Design by Jon Kleinberg and Eva Tardos

Class Time and Office Hours

- Class meets MW 11:40am - 1:00pm
- Lab meets W 1:10pm - 2:30pm
- Office hours TBA
- TA
 - Fatma Ayad TBA

Remote Learning Resources

- Class website: www.cs.brynmawr.edu/cs340
- Moodle: lecture notes, handouts, lab worksheets and practice problems.
- CS server: project data and other code handouts
- Slack: you will receive an invitation to join a class workspace, used for discussions and one-on-one Q/A

Learning Goals

Students who successfully complete the course will have demonstrated the ability to do the following:

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms (Greedy, Divide-and-Conquer, Dynamic Programming, major graph algorithms and approximation algorithms) and methods of analysis.
- Synthesize efficient algorithms in common design situations.

Prerequisites

The following courses (or their equivalents at Haverford or Swarthmore) are required with a grade of 2.0 or better (or permission of the instructor).

1. CS 151 Data Structures
2. CS 231 Discrete Mathematics

Schedule of Topics

This schedule is *tentative*. Students should expect *at least* 10 hours of work each week.

Week 1. Introduction, Basics of Algorithms Analysis

- Reading: Chapters 1 and 2

Week 2. Graphs and Graph Algorithms

- Reading: Chapters 2 and 3

Week 3. Greedy Algorithms

- Quiz 1 in lab (Wed 9/16)
- Project assigned
- Reading: Chapter 4

Week 4. Greedy Algorithms

- Reading: Chapters 4

Week 5. Divide and Conquer

- Quiz 2 in lab (Wed 9/30)
- Project checkpoint 1 (Sun 10/4)
- Reading: Chapter 5

Week 6. Dynamic Programming

- Quiz 3 in lab (Wed 10/7)
- Reading: Chapter 6

Week 7. October break

Week 8. DP and Review

- Midterm review

Week 9. Midterm and Network Flow

- Midterm in-class (Mon 10/26)
- Reading: Chapter 7

Week 10. Network Flow, DP on Graphs

- Project checkpoint 2 (Sun 10/25)
- Reading: Chapter 7

Week 11. NPC and Reductions

- Quiz 4 in lab (Wed 11/11)
- Reading: Chapter 8

Week 12. NPC and Approximation Algorithms

- Reading: Chapter 11.1 - 11.5

Week 13. Project

- Project presentations (Monday 11/23)
- Project due (Wed 11/25)
- Thanksgiving!

Week 14. Approximation Algorithms

- Quiz 5 in lab (Wed 12/2)
- Reading: Chapter 11.6 - 11.8

Week 15. Approximation Algorithms, Randomized Algorithms and Review

- Reading: Chapter 13

Week 16. Scheduled 3-hour final, 12/16 9:30am-12:30pm

Important Dates

- Quizzes: in lab on Wednesdays
 1. 9/16
 2. 9/30
 3. 10/7
 4. 11/11
 5. 12/2
- Project:
 1. cp1: 10/4 (Electronic submission, Sunday midnight)
 2. cp2: 10/25 (Electronic submission, Sunday midnight)
 3. Presentation: 11/23 (Monday in class)
 4. Final submission: 11/25 (Electronic submission, Wednesday midnight)
- Midterm: 10/26 (Monday in class)
- Final: 12/16 9:30am-12:30pm

Assessment

There is a practice problem set assigned roughly every week. These problem sets are not collected or graded, however, students are strongly encouraged to complete them to the extent possible. There will be 5 quizzes given in lab throughout the semester, in addition to the midterm and final exams. Practice problems are intended as practice for the quizzes and exams. To encourage completion, solutions to these problems are only given if a student presents a written solution to the problem first (your solution doesn't have to be correct, however, we need to see a real attempt first). In addition, students can request orals on the practice problems (where you will be quizzed on any of the practice problems) for extra credit. Grades will be assigned according to the percentage breakdowns shown below.

Group Project	15%
Quizzes	25%
Midterm	25%
Final exam	35%

Late work policy

Algorithm design is an iterative process. The challenging problems you will encounter in this course require long germination and the best approach is to start thinking about the problems as soon as possible, discuss with your groupmates, get stuck (you will), come to me or the TA to get unstuck, then rinse and repeat. This process of trial-and-error is the only way to develop the instincts and critical thinking skills to come up with the answers when it counts (exams, interviews, etc). You have heard about the workload in this course, but 10-hours over the weekend isn't the same thing as 2 hours a day every week day, and having the initiative and time management skills to do the latter is the key to success.

Extensions are intended to give you more time to work, not to delay the start. Before requesting an extension, make sure you have a good answer to when you started and how much work you have already done. All extensions must be requested at least 24 hours in advance of the deadline. **Time-management related problems are not valid reasons for extensions.** Work handed in late without a previously granted extension may not be accepted.

Attendance and Participation

Attendance at and active participation in all lectures and labs are expected of all students. Participation will be taken into account when awarding final grades for students who are "on the edge" between two grades. For example, a student with a B+/A- average and a strong attendance and participation record would receive an A-, while a student with a weak record would receive a B+.

Missing a quiz or exam without prior approval will result in a 0. Conflicts with scheduled quizzes and exams for reasons such as religious observances, athletic events and other planned absences must be reported to the instructor during the first two weeks of classes (or as soon as such events are announced), with documentation so that makeup dates may be arranged. Medical, family or other emergencies must be reported as soon as possible, with accompanying documentation from a doctor or your dean.

Collaboration/AI

Grades in this class are largely based on in-person quizzes and exams, thus improper collaboration or AI use is not of serious concern. However, my goal is not to catch you at exam times, but to encourage you to establish good learning habits before that.

You are encouraged to discuss the lecture material, worksheets, handouts and problem sets with other students. Study groups are highly recommended and very productive by all previous student reports. However, the only "product" of your discussion should be your memory/understanding - you should write up solutions individually. You may not exchange written work or computer files. The group project is the only exception to this - in this case, these collaboration rules apply to students outside of your group.

You are permitted to use AI-tools or the internet in general, to clarify concepts, to get guidance on assignments, as long as you do so in an ethical and responsible manner. The bottom line is you should not use ANY tool to replace your own thinking or analysis. Showing me the correct answer is never the goal (I know the answers), being able to come up with them yourself is. Beware however, that it is easy to underestimate the effort it takes. Understanding a solution given is very far away from being able to come up with one yourself. This is the real danger in using AI-tools as "learning tools". **Beware of the shortcuts you are taking.**

Code should not be copied without permission from the author. If permission is given, code should be cited at the location it is used with a comment. If your solution is inspired by any outside resources (I understand that sometimes it is hard to not see things), you **MUST** cite.

Learning Accommodations

Students requesting accommodations in this course because of the impact of disability are encouraged to meet with me privately early in the semester with a verification letter. Students not yet approved to receive accommodations should get in touch with Access Services in Guild Hall, as soon as possible, to verify their eligibility for reasonable accommodations. Early contact will help avoid unnecessary inconvenience and delays.