CS 340 - Analysis of Algorithms
Spring 2025

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MW 11:40am - 1:00pm

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 T 11:40am - 1:00pm
- Office hours
- TAs:
  - Yue Chen TBA
  - Julia Rieger TBA
- Check the class Moodle often for updates. Deadlines will also be listed there.

Remote Learning Resources

- Class website: `www.cs.brynmawr.edu/cs340`
- Moodle: assignments, assignment submissions, and lecture notes
- CS server: project data and other handouts
- Slack: you will receive an invitation to join a class channel.

Learning Goals

Students who 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
2. CS 231

Schedule of Topics

This schedule is *tentative*. Homework is due (with few exceptions) **every Monday before class**. **Electronic copies are required** - consult the course website links for sample writeups and LaTeXtemplate. Any assignments missing by the 11:40am deadline will not be accepted. Students should expect ***at least*** **10 hours of work each week.**

Week 1. Introduction

- Reading: Chapters 1 and 2

Week 2. Basics of Algorithms Analysis, Graphs

- Homework 1
- Reading: Chapters 2 and 3

Week 3. Greedy Algorithms

- Homework 2
- Project assigned
- Reading: Chapter 4

Week 4. Greedy Algorithms

- Homework 3
- Reading: Chapters 4

Week 5. Divide and Conquer

- Homework 4
- Reading: Chapter 5

Week 6. Dynamic Programming

- Homework 5
- Reading: Chapter 6
- Project checkpoint 1

Week 7. Midterm

- Homework 6 (due the following Wednesday)
- Review
- Midterm in class

Week 8. Spring Break

Week 9. DP and Network Flow

- Homework 7
- Reading: Chapter 7
- Project checkpoint 2

Week 10. Network Flow

- Reading: Chapter 7

Week 11. Intro to NPC, Intractability

- Homework 8
- Reading: Chatper 8

Week 12. Reductions, NP-Complete, Approximation Algorithms

- Homework 9
- Reading: Chapter 11.1 - 11.5

Week 13. Project

- Project presentations
- Project due

Week 14. Approximation Algorithms

- Homework 10
- Reading: Chapter 11.6 - 11.8

Week 15. Randomized Algorithms and Review

- Reading: Chaper 13

Week 16. Final exam week

Total grade breakdown

Grades will be awarded based on the number of points earned and according to the percentage breakdowns shown.

Homework	20%
Group Project	15%
Midterm	25%
Final exam	40%

Late work policy

Because of the weekly problem sets, late submissions inevitably "eat" into the next set. You are better off turning in what you have already done (incomplete as it may be) by the deadline and focusing your efforts on the next set. Late begets later and thus the class has a general "no late work" policy, except for circumtsances beyond your control.

All extensions must be requested **at least 24 hours in advance** of the deadline. Extensions will be granted based on individual circumstances. Extensions are meant to give you more time to work, NOT to delay starting. If you want to stay on top of the workload in this class, your best strategy is to start every problem set as soon as it is assigned. **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 class sessions is expected of all students. Participation will be taken into account in awarding of 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+.

Collaboration

It is your responsibility to understand and follow the collaboration policy in this class. The goal of the policy is to encourage collaboration while ensuring that you and your classmates really engage in earning how to solve the challenging problems you'll see in this course. If you are ever uncertain if collaboration or certain sources are allowed, you should ask the professor.

You are encouraged to discuss the lecture material and the labs and problems with other students, subject to the following restriction: the only "product" of your discussion should be your memory/understanding of it - you may not write up solutions together, or 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 and you may freely work closely with students within your group. Collaboration is not allowed on examinations or quizzes.

You should not use outside sources (the internet, AI tools, other textbooks, students not in this class, etc.) to look for specific solutions to any assigned problems. 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 are encouraged to meet with me privately early in the semester with a verification letter. Students not yet approved to receive accomodations should contact Access Services in Guild Hall, as soon as possible, to verify their eligibility for reasonable accommodations. Early contact will help avoid unneccessary inconvenience and delays.