

# Syllabus

Hi there 🙌 and welcome to CS106B!

## Course Overview

A nonprofit needs to assign tasks to its volunteers so they get completed as fast as possible. A political scientist wants to determine how to allocate city council seats based on a popular vote. A climatologist wants to estimate how many trees are in a forest. A city planner wants to see whether a proposed development will be underwater as sea levels rise. A physicist wants to know why perturbations to a system cause cascading effects.

How can we use computing power to answer these questions?

This course is about transitioning from “I know how to write programs” to “I know how to solve problems with computers.” Over the course of ten weeks, we’ll explore an array of techniques, tools, and perspectives useful for modeling and solving problems. We’ll explore recursion and see how it can be used both to model the intricacies of nature and to optimally allocate resources. We’ll develop a rich vocabulary of structures that can both capture the position of a dancer in space and compress a data file. And we’ll see how to put these techniques to use in problems drawn from a range of disciplines. By the time you’ve completed this course, you’ll learn how to look at problems in fundamentally different ways and how to use those perspectives to create clean and elegant computational solutions.

## Teaching Team



Keith



Neel

Our wonderful undergraduate [section leaders](#) lead [sections](#) and staff [LaIR](#) starting Week 2.

## Websites and Technology

The main CS106B website is where you are right now, [cs106b.stanford.edu](https://cs106b.stanford.edu). We have links to a bunch of other tools here. Here's the quick rundown:

- Our main course website [cs106b.stanford.edu](https://cs106b.stanford.edu) is the main hub for course information. It contains links to everything you’ll need.
- We use [Canvas](#) to host lecture videos.
- We use [Ed](#) as our Q&A forum.
- You will need to download and install [Qt Creator](#) to complete the coding assignments.
- You'll submit your work online through [Paperless](#).
- We will handle lecture participation through [PollEV](#) and [Gradescope](#).

## Prerequisites

CS106B assumes that you have a familiarity with programming at the level of CS106A or the AP Computer Science exam. Check out [our course placement page](#) for more information about deciding whether CS106B is right for you. As always, feel free to get in touch with us if you have any questions.

A note: although this class uses C++, this class is primarily designed to teach abstraction, recursion, and algorithmic analysis. If you already know those topics and just want to learn C++, you may want to opt to take CS106L instead of CS106B.

## Lectures

CS106B meets Monday, Wednesday, and Friday from 1:30PM - 2:30PM in Bishop Auditorium. (Axess lists us as running from 1:30PM - 2:50PM. We'll only use an hour of that block and will let you out twenty minutes early.) Throughout the quarter, lectures will

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be recorded and made available on Canvas.

It's important to keep pace with the lectures rather than to batch them up and watch them all in one go. (That model works great for Netflix shows that really hook you in, but it's not great for learning.) To give you an incentive to stay on top of lectures, we've reserved 5% of your grade for lecture participation in a way that can only help and not hurt your grade. Here's the details:

- Starting on Wednesday, January 18th, we'll ask a small number of practice questions through the PollEV polling system. If you attend lecture in person and answer those questions, you'll earn participation credit for the day regardless of whether your answers are correct.
- If you aren't able to make it, simply watch the video on Canvas and answer a few questions on Gradescope so we know you're up to speed. Unlike practice questions we do in class, you do need to answer these correctly to earn that day's credit. But Gradescope will give you the chance to retry questions you miss. These make-up questions need to be completed before the start of the next lecture (i.e., Monday lecture questions submitted before the start of Wednesday's lecture) to earn credit.

At the end of the quarter, we will calculate your total course grade including the 5% participation, and also not including it (and putting that 5% on the final exam instead). Whichever formula ends up more favorable to you is the formula we will apply for you. So if you'd rather not attend lecture or watch videos, because you are confident in other methods of learning the material, you can do what works for you without it damaging your grade.

To allow for some flexibility, you're allowed to miss the credit opportunity (i.e. not completing PollEV or Gradescope quiz) for two lectures over the course of the quarter and still earn the full 5%.

## Discussion Sections

In addition to lecture, you must also sign up for a weekly discussion section. Section signups are handled online and run from Thursday, January 12th at 5:00PM Pacific time to Sunday, January 15th at 5:00PM Pacific time. After a matching process, your section assignment will be emailed by Tuesday, January 17th at 5:00PM Pacific time. Sections begin the second week of classes. This link is also available on the CS106B web page.

Although Axess lists discussion sections for this course, we don't look at Axess section enrollments when assigning sections. Even if you're enrolled in a section through Axess, you need to sign up through our system as well to make sure that someone will be grading your assignments.

## Getting Help

Learning to program is like learning any skill – it takes practice, and it's normal to need some help from time to time.

You can get one-on-one help from our staff through “LaIR Hours.” LaIR hours run from 7:00PM - 11:00PM Pacific time, Sundays through Thursdays. We'll release details about how LaIR will run this quarter once LaIR hours begin.

In addition to the LaIR, you can get help asynchronously on our online EdStem forum. This is a Q&A site that we're constantly monitoring, and we're happy to take conceptual questions there. Visit Canvas to get a link to the EdStem page. Our EdStem forum is primarily for conceptual questions. If you have a coding question, please post it privately so you don't share your code with everyone else in the class.

And finally, you're welcome to visit Neel or Keith's office hours each week. We're looking forward to meeting you and are happy to help out!

## Units

If you are an undergraduate or a non-matriculated graduate student, you need to enroll in CS106B for five units (these are department and university policies, respectively). If you are a matriculated graduate student, you may enroll for anywhere between three and five units,

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depending on what best fits into your schedule. Regardless of how many units you are enrolled for, the course content and requirements will be the same. The unit flexibility is simply to make scheduling easier for matriculated graduate students.

Five-unit courses at Stanford vary greatly in their difficulty. Based on past student experiences, you should expect that this course probably will require a time investment proportional to its unit load. Expect to put in around 10 – 15 hours each week working on CS106B. We'll offer a lot of support through office hours, extra practice problems, and the like, and if you're willing to put in the effort to learn the material, the course staff will be behind you every step of the way.

## Readings

The required reading for this course is Eric Roberts' *Programming Abstractions in C++*. You can purchase a copy at the bookstore using this link:

<https://www.bkstr.com/stanfordstore/search/keyword/programming%2520abstractions>

You can also use this online version, which is a 2012 draft version of the book.

[https://web.stanford.edu/dept/cs\\_edu/resources/textbook/](https://web.stanford.edu/dept/cs_edu/resources/textbook/)

We assume that the majority of you have no prior programming experience in C++, and this textbook is a great resource to use at the start of the quarter as you're transitioning into the language.

A helpful note from the School of Engineering:

*“All students should retain receipts for books and other course-related expenses, as these may be qualified educational expenses for tax purposes. If you are an undergraduate receiving financial aid, you may be eligible for additional financial aid for required books and course materials if these expenses exceed the aid amount in your award letter. For more information, review your award letter or visit the [Student Budget website](#).”*

## Assignments

There are nine total assignments this quarter - one at the start of the quarter to help you get your computer set up to write C++ programs, then eight programming assignments. Assignments are due on Fridays at 1:00PM Pacific time. Check out our [page on assignments](#) for more details.

## Working in Pairs

A few of the assignments in this course must be completed on an individual basis, but the majority allow you to optionally work in a pair with a partner. Each assignment will specify if it is to be done individually or allows working in pairs. Note that you are not required to work with a partner on assignments that allow it, but you are encouraged to do so. Working in pairs can improve your learning by giving you someone to talk to when you are stuck, or by letting you see a different way of approaching the same problem. You can also change partners between assignments. In other words, you don't have to keep the same partner for every assignment that allows pairs (and you can even choose to do some in pairs and other individually).

If you choose to work with a partner, you must pair with another student who is **currently taking the course** and is in your discussion section. If you have a friend you want to work with, request the same section or request a section swap if necessary. Students auditing or sitting in on the course may not work in a pair with a student who is taking the course. No one who is not currently enrolled in the course may be part of any pair.

If you submit an assignment as a pair, each of you are expected to make a significant contribution toward solving that assignment. You should not claim to be part of a pair submission if you did not contribute significantly to the submission.

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If you submit an assignment as a pair, you should make *one* submission and make sure that the names of both members of the pair are listed in the comments of the solution. Both members of a pair will receive the same grade and do their interactive grading session together.

It goes without saying that regardless of pairs, every student is still responsible for learning all course material. All exams are completed individually. More details about working in pairs will be discussed in class and additional information will be posted on the class web site. Please make sure that you follow its guidelines.

## Late Policy

Each of the assignments is due at the start of class on the dates specified in the syllabus. All assignments are due at 1:00PM sharp on the dates indicated on the assignment handout. Anything that comes in after 1:00PM will be considered late.

Because each of you will probably come upon some time during the quarter where so much work piles up that you need a little extra time, every student begins the quarter with four free late days. A “late day” is a free 24-hour extension on an assignment. ***No assignments may be submitted more than 48 hours late***, even using late days, without prior approval by the head TA. In other words, you cannot use more than two late days on a single assignment. If you submit an assignment late and have used your late days, we will cap your score on both functionality and style at  $\checkmark$ - for the purposes of grading (though in your interactive grading session you’ll still receive the scores you would have otherwise received on the assignment so that you get more detailed feedback). You should think of these free “late days” as extensions you have been granted ahead of time, and use them when you might have otherwise tried to ask for an extension. As a result, extensions beyond these four free “late days” will generally not be granted.

If you are working with a partner, each of you will be charged a late day if you submit beyond the deadline. If you have late days remaining and your partner does not, then your partner will be subject to the above score cap while you will receive the normal grade on the assignment.

In very special circumstances (primarily extended medical problems or other emergencies), extensions may be granted beyond the late periods. All extension requests must be directed to the head TA, Neel Kishani ([neelk@stanford.edu](mailto:neelk@stanford.edu)), at least 24 hours before the normal assignment deadline. ***Only Neel can approve extensions***. In particular, please do not ask your section leader for an extension, since they don't have the authority to grant you one.

Note that late days may not be used on the last assignment, as it comes due during the finals period normally reserved for this course. More specifically, we will not accept any late submissions for the final assignment, even if you have remaining late periods, since university policy prevents us from having assignments come due then.

## Access and Accommodations

Stanford is committed to providing equal educational opportunities for disabled students. Disabled students are a valued and essential part of the Stanford community. We welcome you to our class.

If you experience disability, please register with the Office of Accessible Education (OAE). Professional staff will evaluate your needs, support appropriate and reasonable accommodations, and prepare an Academic Accommodation Letter for faculty. To get started, or to re-initiate services, please visit [oe.stanford.edu](http://oe.stanford.edu).

If you already have an Academic Accommodation Letter, we invite you to share your letter with us. Academic Accommodation Letters should be shared at the earliest possible opportunity so we may partner with you and OAE to identify any barriers to access and inclusion that might be encountered in your experience of this course. Please send any letters to Neel ([neelk@stanford.edu](mailto:neelk@stanford.edu)).

## Honor Code Policy

Please see our [Honor Code](#) page for more information.

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# Exams

There will be two exams in CS106B, one midterm exam and a final exam. Both exams are traditional in-person pencil-and-paper exams.

- The midterm exam will be held from 7:00PM - 10:00PM Pacific time on Monday, February 13th.
- The final exam will be held from 8:30AM - 11:30AM Pacific time on Monday, March 20th.

SCPD students: you are welcome to join us for the exams in-person if you are in the area. Otherwise, we will send a copy of the exam to your designated exam monitor. You will then be able to start the exam any time in the 24 hours leading up to the regular exam start time. So, for example, you could start the midterm exam any time between 7:00PM on Sunday, February 12th, Pacific time, and 7:00PM on Monday, February 13th, Pacific time.

If you have a conflict with the midterm exam time, please contact the course staff at least two weeks before the exam start date. We will not offer alternate final exams except for students with documented OAE accommodations.

## Withdraw / Incomplete Policy

If a serious emergency arises and you cannot complete the work in this course, you may contact Keith – not the TA and not your section leader – to request an incomplete. We reserve incompletes for emergencies, so we do not grant incomplete grades for poor performance on the assignments or exams, nor do we offer incompletes for busy work schedules. Withdrawing is the appropriate option in those circumstances.

In order to be eligible for an Incomplete, University policy says you must have completed a “substantial” part of the course work in “satisfactory” fashion. This means that incompletes are appropriate for serious medical or family emergencies that occur late in the quarter, which prevent you from completing the course despite having done well up to that point.

## Grading

Overall, your grade for this course will be determined as follows. We will compute a raw score in two ways:

- **Option 1:** Use Lecture Participation Scores
  - 40% Programming Assignments
  - 20% Midterm Exam
  - 30% Final Exam
  - 5% Section Participation
  - 5% Lecture Participation
- **Option 2:** Shift Lecture Participation to Final
  - 40% Programming Assignments
  - 20% Midterm Exam
  - 35% Final Exam
  - 5% Section Participation

We will then take whichever of these scores is higher and use that as your raw score for the course.

We will then assign letter grades as follows. We first determine a grading curve over raw scores to assign initial grades. We never assign grades that are lower than the decile of your raw score; for example, a 90% will never map to anything lower than an A-. Assuming that both your assignment score and your composite exam score represent passing work, you will receive the letter grade assigned by the grading curve. Otherwise, you will receive a non-passing grade. (The numbers denoting “passing work” are set at the discretion of the instructor. We will likely use 60% as a cutoff for passing work for programming assignments and 50% as a cutoff for passing work for exams, subject to change.) Your final grade will be determined solely as mentioned above. We do not offer any make-up work.

As an exception to the above rule, A+ grades are given rarely in CS106B and are awarded at the discretion of the instructor. There is no minimum raw score that guarantees an A+ grade.

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