CS 161 TA Manual

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November 2, 2017

1 Introduction

Welcome to the CS 161 course staff!

1.1 Your impact as a TA

CS 161 is the most important class in the CS core curriculum. It plays a crucial role in helping students find engineering jobs and setting them up for success, both in academia and industry. CS 161 is a required class, and a bad experience in CS 161 can turn students off of computer science forever.

As a TA, you will have the most direct interaction with students. Your attitude and the way you interact with students can have a huge impact on students' view of algorithms, and computer science in general. Since the problem and solution sets in this class are primarily written by TAs, it is safe to say that students spend more time wrestling with TA-created content than instructor-created content. As a CS 161 TA, your actions directly affect the career outcomes of hundreds of students. One bad problem set can permanently turn a student away from computer science.

1.2 Rewards for TAs

CS 161 is a very personally rewarding class to TA, in that being a TA for this class will make you much better at programming interviews. However, this will not happen if you do the minimum amount of work – the greatest benefits go to the TAs who engage with the class the whole way through, coming to lecture and taking an active role in designing the problem sets.

All TAs are evaluated by the instructor at the end of the quarter, and these evaluations may impact your ability to get future TAships. In addition, some TAs receive student evaluations on Axess, which are visible to all members of the Stanford community. For TAs who truly go above and beyond, performing in the top 5% of TAs in the CS department, there is an outstanding TA bonus in the amount of $1000.

1.3   Knowing your audience

CS is one of the best career paths these days, and students know that. Students also know that CS 161 is the magic key to unlocking technical interviews. Therefore, you should expect CS 161 students to have a wide range of backgrounds.

There are several broad groups of people who take CS 161.

- CS majors at Stanford, who need this class to graduate (and also to pass interviews).

- CS masters students at Stanford, who need this class to graduate (and also to pass interviews).

- CS PhD students (these people need at least an A- in the class for it to count, so you might see them in office hours a lot).

- Students in other fields, who want to switch to CS. Often the strongest CS 161 students are in this category, since math and physics majors have strong backgrounds in math.

- SCPD students who need it for a certificate or masters degree. These tend to be on the stronger side, since they have industry experience and have seen the material before. In addition, CS 161 is often their only class, and sometimes they have to get a minimum grade in the class for their employer to pay for it.

- Visiting students (mostly specific to summer quarter). Some are very motivated but many are very distracted.

- Auditors

1.4   Math background

Your prior math background is the strongest indicator of how well you will perform in CS 161. As a TA, you may have breezed through CS 161 yourself. However, students without a rigorous mathematical background struggle a lot with this class.

It is important to make this struggle as painless as possible for them (without sacrificing rigor), and make sure they know that poor performance in CS 161 does not mean they have no future in computer science. (People may assume that they will fail technical interviews just because they do poorly on correctness proofs, which only marginally relate to software engineering skill.)

About 35% of incoming CS 161 students cannot write a solid proof by induction, which is one of the most critical skills needed to do well in this class. A smaller, but still substantial fraction of CS 161 students have trouble with concepts from high school algebra, such as logarithms and geometric series. You cannot expect students to remember calculus, and many of them will have trouble with randomized algorithms and probabilistic analysis.

When holding sections, designing problem sets, or running office hours, you should remember that steps that are trivial to you will not be easy for a large fraction of students.

1.5 SCPD students

SCPD students frequently feel alone at Stanford, and do not have access to the same social networks and resources that traditional students do. Often they cannot come to in-person office hours because they live far away, or the office hours are during work hours. It is important to be mindful of this, and allow SCPD students to fully participate in the class by

- Holding some office hours during non-working hours.

- Logging onto Google Hangouts during office hours, and allowing SCPD students to participate as normal students would.

- Making sure SCPD students have access to all of the same resources that traditional students do. Anything that traditional students have that SCPD students don't will be considered highly unfair by SCPD students, even if it doesn't provide a real advantage.

1.6 Our values

Do no harm.

Reach every student in the class.

Create an excellent student experience.

Inform and inspire.

1.6.1 Do no harm

The cardinal rule of TAing: A TA shall not harm a student, or through inaction, allow a student to come to harm. Some things that fall under this rule include:

- Making sure your grading is consistent and accurate. Grades affect career outcomes, and one or two problems can make a surprisingly large difference to a student's final average.

- Immediately reporting any errors you find in course material, even if you are not sure that they are errors. Leaving errors uncaught confuses the students. It also embarrasses your fellow TAs, because many of them will only realize there is an error when students ask about it in office hours, and they may not be able to resolve it on their own.

- Immediately reporting any problems you encounter with the class, even if they create extra work for the course staff. (Remember, our highest duty is to the students – TAs come second!)

- Correcting yourself if you accidentally misinform a student. Posting on Piazza if you accidentally misinform a group of students. One misconception can stick with a student for life!

1.6.2 Reach every student

We must be mindful of all groups of students. This includes

- SCPD students.

- Students who are bad at math.

- Students who don't come to class/go to office hours/post on Piazza. (All important class announcements should be distributed through multiple channels.)

- Students who finish their work the night before the deadline. (This is most of the students, so the bulk of the office hours should be close to the deadline.)

- Students who need to finish their work three days before the deadline, so they can work on other work. (Last-minute changes to problem sets are frowned upon, and TAs should hold early office hours to accommodate these students.)

1.6.3 Creating an excellent student experience

We must strive to provide each student with the best possible CS 161 experience. This includes

- Responding to all student communications within 24 hours. This includes Piazza posts, personal emails, and regrade requests.

- Delivering high-quality course content.

- Being polite and cordial in student relations.

1.6.4 Inform and inspire

It is important to teach students algorithms. It is even more important to convince them that algorithms is worth learning.

Many students are very motivated to learn algorithms, especially since CS 161 is such an important class. However, there are other students who just take it because it is required, and are really not looking forward to it. Your attitude can make the difference between them phoning it in and them taking a lot of knowledge away from the class.

CS 161 is also a class that people take early in their career. If you inspire a student, you have produced a new computer scientist. If you don't, they might choose to go into some other field instead.

To inspire the students:

- Be prepared. Nothing turns off students more than a poorly prepared course staff.

- Convey enthusiasm. If you love dynamic programming, students are more likely to love it as well.

2 TA Roles and Responsibilities

2.1 Keeping up with course material

It's important to be caught up on lecture, even if you already know algorithms. Different algorithms classes often emphasize different things, and cover very different material. Even at Stanford, what is covered varies from professor to professor. If a student asks you about the details of an algorithm covered in class, you should either be able to answer the question, or point to the slide (or page in CLRS) where it is explained.

You do not have to physically come to class (unless you are the Lecture TA), but you should watch the lecture videos or read the lecture slides.

2.2 Office hours

You should either hold two or four hours of office hours a week, depending on your role. Office hours will be held on QueueStatus, and SCPD students will be able to join via Google Hangouts.

You should read the problem set and solution set thoroughly before office hours, as well as the lecture slides for that week. For context, this usually takes me about an hour, and if you try to do it in the ten minutes before your office hours, your performance in office hours will probably suffer.

After each office hours session, you should send all of the TAs a report on the Slack channel about

- How many people were at your office hours?

- Which questions did students have the most trouble with?

- Was this an easy problem set or a hard one?

- Were there any mistakes in the problem set or the solution set?

- Did students have any complaints about the assignment or the class?

- Were there any issues that other TAs should be on the lookout for?

- Are there any individual students that are either struggling or extremely talented? (We need to keep track of extremely talented students so it is easier for the instructor to write them letters of recommendation.)

If you think there are errors in the problem set or solution set, you have a duty to report them. Don't leave them for some other poor TA to find during their office hours. This applies even if you are not sure whether you have found an error or not.

If you cannot answer a question during your office hours, the protocol is to get the student's email address, and say "I'll ask around and get back to you." You should email the student

no later than 1 hour after your office hours have ended, when you have had a chance to coordinate with the other TAs.

You are encouraged to use the other TAs as a resource, by posting a message to the Slack channel. (For instance, if you find an error in the solution set during your office hours, one of the other TAs can google the right answer for you while you're still talking to the student, and then send it to you on Slack, whereas you might look silly if you googled the answer yourself.)

If this happens with a group of students, you may pass a piece of paper around and get everyone's email address.

Office hours will be held on QueueStatus, which is a system where students can put their names in an office hours queue. A good policy is to only allow students to put their name in the queue once every two hours, and to give students in the queue priority over students who are not in the queue. This makes it more likely that everyone gets to see a TA at least once.

If students are still in the queue at the end of your office hours, and there is no one doing office hours right after you, it leaves a good impression if you either (a) handle them, or (b) send them an email asking if they have any questions. You are not required to do this, but the students will think you are a better TA.

2.3 Grading

Every TA will do a roughly equal share of the grading. Your objective should be to grade in a way that is fair, consistent, and informative to the student. When you take off points, you should be specific about what you are taking off points for – for example, if you take points off for a "major error," you should say what the error was. This will both reduce regrade requests and improve the student experience.

Unless otherwise specified, you are expected to be done with grading by Friday at 3 pm the week after the assignments are turned in. You should send a message to the Slack channel when you have finished with all your grading. The order in which you finish your grading will determine the order in which you choose questions to grade next week. (This does not apply in quarters with weekly grading sessions.)

2.3.1 Regrade requests

Every TA will be responsible for their own regrade requests. You should not give back points unless you have made a clear error in grading. If you do give back points to a student, you must also give back points to all other students who made a similar error, even if they did not submit a regrade request. This is to prevent vocal students from gaining an unfair advantage over less vocal students.

All regrade requests should be addressed within 24 hours.

2.3.2   Advice

- Read the first twenty solutions carefully (running the code in an interpreter if necessary), and use them to determine the grading rubric. The first twenty solutions should contain most of the common mistakes. Your rubric should be specific enough that anyone who is also grading your problem should be able to follow it.

- Try not to give people zeros if they have made an effort on the problem. This is demoralizing and negatively impacts the student experience. Instead, give them 20% of the total points.

- Try to do your grading on a large computer monitor, over a fast Internet connection. This will speed you up.

- Always include a "no response" rubric item that specifically indicates that the person did not submit a solution. This makes it easier for the student to dispute a zero, if they actually did submit the assignment and it just didn't load on our end (which happens a lot when people submit images instead of a PDF).

- If you realize you have deducted points incorrectly, you may click the magnifying glass next to the rubric item to find all solutions you tagged with that item. This will substantially narrow your search space when you have to give back points to all the people you misgraded.

- Learn to use the Gradescope keyboard shortcuts (1, 2, 3 etc for rubric items 1, 2, and 3, right arrow for going to the next submission, j and k for moving between pages within a submission, "Save View")

- If you are not sure whether pseudocode does the right thing, you may convert it into Python code and try running it. If you do this, and the code is incorrect, you should leave a comment containing the exact code you ran and the test case that broke it.

2.4   Exam grading and proctoring

We will have two grading sessions: a midterm grading session and a final grading session. These grading sessions usually last 8 hours each, and will be scheduled at the start of the quarter.

For each exam, the tasks are as follows:

- Design the exams

- Preflight the exams (since exams are the most important, this will be done by everyone, not just the problem set TAs)

- Print the exams

- Proctor the main exam

- Proctor the OAE exams

We will assign these tasks to TAs the week before the exam.

2.5   TA meetings

Every week, there will be a meeting of the TAs. The main task will be designing problem sets and exams, but we will also discuss problems and logistics.

2.5.1   Designing problem sets

Every week, we will come up with problem ideas together, in a group. I recommend using problems from previous versions of CS 161, or pulling them from textbooks. These problems have been tested and are less likely to have errors in them. However, if you have new ideas for problems, that is great too.

When designing problems, try to avoid "double jeopardy" – that is, problems where solving part b relies on having a correct solution to part a. In particular, this means we should avoid asking people to prove the correctness of algorithms they come up with themselves. Instead, we prefer to test algorithm design and correctness proofs separately.

When designing problems, try to avoid problems with multiple correct solutions, especially if one solution is much easier than the others, or tests different algorithmic skills.

When designing exam questions, try to avoid problems where some students may feel compelled to write much more than others (e.g. "produce an English description of this algorithm"). We should also avoid ambiguous instructions, such as "write pseudocode" (if it is not clear which functions and data structures may be treated as black boxes).

3   Special roles

There are two categories of TAs: front-end TAs and back-end TAs.

As a front-end TA your job is to directly help other students. Your role will be more heavy on office hours and student interaction, so you should be a people person who cares about individual students and is good at responding tactfully and enthusiastically to student questions.

As a back-end TA your job is to help with lecture, problem set, and exam design. It is critical that you have a solid knowledge of algorithms, and that you complete your assigned deliverables in a timely fashion. It is also your job to give direct, extensive, and critical feedback to the professor and the other TAs. You will also do office hours and interact with students, but you will have fewer office hours than the front-end TAs.

Each of the TAs (both front-end and back-end TAs) will do an equal share of the grading.

3.1 Back-end roles

3.1.1 Head TA – 1 TA

The head TA takes on several roles.

Leader: The head TA should motivate and inspire the other TAs, and help them perform at their fullest potential. A great head TA

- Leads by example. You must show passion for the class, and model effective behavior, so that other TAs follow suit.

- Works strictly harder than the other TAs.

  - Good: Because I am head TA, and have the most experience, I will grade the hardest problem.

  - Bad: Because I am head TA, I do enough work already, so I shouldn't have to do any grading.

- Inspires the TAs, and continually reminds them why their role is important.

- Encourages TAs to feel a sense of ownership, e.g. by giving them total control over some part of the class. If you want a TA to do something, the task should clearly belong to them, and ideally be assigned at the beginning of the quarter.

  - Good: Alice, you are the official Solution Set Checker. You are in charge of finding errors in the solution sets for the entire quarter.

  - Bad: Can one of you look through these solution sets and find errors?

- Makes every TA feel like they are personally responsible for the success of the class.

- Encourages TAs to bond with their teammates, and help each other out.

- Insists on prioritizing the student experience, and does not encourage TAs to behave unethically towards students. Unethical leadership is a good way for TAs to become cynical and jaded.

Resource: The head TA should serve as a mentor to the other TAs, and the other TAs should be able to use the head TA as a resource if they are having trouble.

- If a TA needs help with their job, or is encountering problems, it is the head TA's job to help them.

- The head TA should be "oncall" during all office hours. It is their job to address issues that come up during any TA's office hours, and respond to the ping within 10-15 minutes.

- The head TA should be the secondary oncall for Piazza posts.

- The head TA is a mentor for new TAs (and experienced TAs who want to improve), and should teach them how to grade and conduct office hours effectively.

Resource: The head TA should be the main support person for the instructor. If the instructor needs help with something, it is the head TA's job to either help the instructor, or find someone who can. It is also the head TA's job to be the instructor's "partner," and make them feel like they are not alone.

Manager: The head TA should

- Explain clearly how TAs get evaluated at the end of the quarter.

- Set high expectations for TAs, and state them all at the beginning of the quarter, rather than adding new expectations as the class progresses.

- Before the start of the quarter, make a list of everything TAs should do, and think about how you would like the workload to be distributed.

- Reward TAs fairly for meeting or exceeding expectations, and not favor any TA over the others.

- Show appreciation whenever a TA goes above and beyond.

- Create a sense of psychological safety, so that all TAs feel comfortable in the staff room.

- Create open lines of communication between TAs and the instructor.

- Collect feedback, opinions, and observations from TAs, who are the eyes and ears of the course staff.

- Make TAs feel like their feedback is valued.

- Reward TAs for reporting problems with the class.

Administrator: The head TA should do administrative tasks, including

- Assigning roles and office hours slots to TAs based on their preferences. I recommend deciding which office hours slots the class needs ("Monday evening," "Thursday early afternoon," etc), and then matching TAs to the office hours slots, rather than allowing each TA to select their own office hours.

  - Almost all of the office hours should be in the afternoon and evening, since this is when students are most likely to be working on their problem sets.

  - Most of the office hours should be close to the assignment due dates.

  - If possible, try to assign the Problem Set TAs (and the Lecture TA) to the highest-traffic office hours, since they will usually be the most familiar with the problem set. Try to assign the Piazza TA to the earliest office hours, so that they do their office hours preparation before spending the week monitoring Piazza. You might also try to assign new TAs to lower-traffic office hours, so they don't have to deal with the pressure of the long queue.

- Keeping track of special exceptions, such as OAE students and students who need extensions.

- Setting up Piazza/Slack/Gradescope/QueueStatus at the beginning of the quarter, and constructing homework submission templates on Gradescope.

  - When setting up QueueStatus, you should set it up so that students can only put their name in the queue once every two hours, and that students in the queue are always seen before students who are not in the queue. This makes it more likely that everyone gets to see a TA at least once.

- Booking rooms for TA meetings and grading sessions.

- Coordinating with the SCPD office to set things up for remote students. Receiving and printing the SCPD exams.

- Aggregating final grades in a spreadsheet and sort the students in order of score.

- Taking notes at TA meetings and sending out assignments/action items to the TAs after the meeting is over.

Owner: The head TA is personally responsible for the success of the class.

- Everything that is not done by the instructor and the other TAs must be done by the head TA.

- The head TA must prioritize the student experience, and put students first in all of their decisions, even if that means TAs have to do a little more work.

The head TA should work strictly harder than the other TAs, since that is what good leaders do. The head TA should take on one supplementary role, and do the number of office hours associated with that role. The head TA should, of course, do an equal share of the grading.

3.1.2 Lecture TA – 1 TA

Wanted: Someone who can physically show up to all the lectures, who has a careful eye for detail and a good knowledge of algorithms. Someone who is not afraid to tell the professor she is wrong. This is a good job for someone who was planning to go to all the lectures anyway.

Before lecture

Before each lecture, the instructor will email you a deck of slides, and your job is to point out the errors in them. You should reply to her email with a response in the form

- Slide 1: Good

- Slide 2: Good

- Slide 3: Should the plus sign be a minus sign?

- ...

etc, for all the slides.

During lecture

You should come to every lecture (even if they are recorded online) and take notes, and help answer student questions after class. If the instructor needs assistance with anything during class, it is your job to help her (e.g. if her computer doesn?t work, you can let her borrow your computer).

You should sit in a place where it?s easy for students to find you, if they need to talk to you after class.

After lecture

Send the instructor a document with

- Every question that students asked or answered in class.

- How long the instructor spent on each of her slides.

- Anything you have noticed about student attentiveness or behavior.

- Comments on which explanations worked and which ones didn?t.

In addition, you should update the lecture notes to deal with any issues that got raised during class.

Piazza

It is your job to answer all questions on Piazza that are specifically about the material covered in lecture.

Timeline

- The instructor will post drafts of lecture materials a week ahead of time.

- The instructor wants comments back two days ahead of the lecture.

- The sorts of comments she wants are:

  - pointing out typos (obviously) in slides and lecture notes

  - anything in slides, lecture notes, or accompanying python notebooks, where the material is not clear

  - pointing out where the organization/content of the lecture differs from the of the lecture notes

  - pointing out anywhere where the slides say "More details in lecture notes" but there are not more details in lecture notes.

- By two days after the lecture, the instructor would like the lecture notes updated to deal with any such issues. (You don't need to remove materials in lecture notes if they are not covered in class, but at least flag them to say that we didn't cover them in class).

Office hours

You should hold two hours of office hours a week.

Advice

When you are critiquing the lecture slides, pay special attention to slides with lots of pseudocode or mathematical formulas, since those are the most likely to contain errors. Diagrams may also contain errors.

You should always operate under the assumption that there will be bugs in the slides, even if the slides have been used before in previous quarters.

If you don't understand something on the slides, be sure to tell the instructor. It might be wrong, and even if it is not wrong, it's very important for the instructor to make slides that are easy to understand, and intelligible even to people who have not heard the lecture. (If you are confused, students will be even more confused!)

3.1.3 Problem set TA – 2 TAs

Wanted: Someone (x2) who is good at solving algorithms problems, and is good at getting stuff done on time. Someone who is not afraid to give critical feedback to the professor.

The problem sets will be released on Friday at 3 pm. The instructor will send out an initial draft of the problem set. You should email the instructor privately with full solutions to all of the problems, along with the amount of time it took you to solve each problem, and comments/concerns about the problems. You should also help preflight the midterm and final exams (although other TAs will be doing this too).

All of your solutions should be at the same level of detail as a solution that you would submit if you were taking CS 161 as a student.

In addition, you should each check over the solution sets before they are released, and email the instructor a document of the form

- Problem 1a: Good
- Problem 1b: Good
- Problem 1c: This solution is incorrect because?

Office hours

You should hold two hours of office hours a week.

Advice

- These problem sets are supposed to be pretty easy. If it takes you more than 30 minutes to come up with the idea for any individual problem, you should leave the problem blank and say you spent more than 30 minutes thinking about it. That may be a signal that it is too hard for students.

- You should review the lecture slides before working on the problem set, even if you think you are already very familiar with algorithms. The instructor this quarter may have taught the class differently from how it was when you took it.

- You should express concerns if there are errors in the question, or the problem statement has multiple possible interpretations.

- You should express some concerns if your solution contains calculus, probabilistic arguments (such as the union bound or indicator random variables), significant amounts of algebraic manipulation, or relies on a clever trick. These are things that students are likely to have trouble with (which doesn't necessarily mean that we don't want to ask those questions, but we may want to limit the number of hard questions on a problem set).

- You should express concerns if you think a problem has multiple correct solutions, or will otherwise be annoying to grade.

3.2 Front-end roles

3.2.1 Piazza TA – 1 TA per 100 students

Wanted: Someone who is a "people person," who likes students, and is good at responding to emails promptly and tactfully.

Your job is to answer all of the Piazza questions in a timely fashion, except the ones that are covered by the Lecture TA. You should set your email settings so that you receive an email in real time every time a student question comes in. You should decide amongst yourselves how to split up Piazza duties.

All student questions should be responded to within 24 hours.

The instructor and the other TAs will help you with this, but you are the one who is ultimately responsible.

Office hours

You should hold two hours of office hours a week.

Advice

- Install the Piazza app on your phone, so you can respond right away to easy questions. This will lower our average response time, and increase overall student happiness.

- If you don't know how to answer a Piazza question, post it on Slack and we will weigh in.

3.2.2   Section TA (optional) – 1 TA

Wanted: Someone who likes teaching and is not afraid to speak in front of an audience, or be recorded while lecturing.

It is your job to hold a 1-hour weekly recitation section, covering all of the topics students are most confused about. You should also hold midterm and final review sessions during your recitation section, and take a survey beforehand so that the students determine what you cover.

In addition, you should send a report to the Slack channel every week saying what you covered in section and how it went.

Office hours

You should hold two hours of office hours a week.

Advice

You should prepare section notes beforehand, and release the notes online prior to teaching your section. Your section notes should be detailed enough that people can understand the important concepts by just reading the section notes. This helps people follow along during your section, and makes the material available to the 75% of students who don't go to section.

In general, nothing you teach should be improvised, especially pseudocode and correctness proofs. You shouldn't simply copy the section notes onto the blackboard, but it is important that you prepare beforehand so you don't make mistakes.

3.2.3   Extra Office Hours TAs – all other TAs

You should hold four hours of office hours a week, instead of two.